THE BODY WEIGHT OF WOMEN OF CHILDBEARING AGE LIVING IN MALAYSIA: QUANTITATIVE AND QUALITATIVE PERSPECTIVES

By Sook Choo

A thesis submitted in partial fulfilment of the requirements for the
degree
of Doctor of Philosophy in Health Sciences

University of Warwick, Warwick Medical School
September 2019

Contents

List of tables

List of figures

List of appendices

Dedicated to Wernshu, Dr. Natalie Robinson and Dr. Abdelazim Yousif

Acknowledgements

First and Foremost, I would like to thank the Ministry of Health Malaysia, especially Director-General of Health and Deputy Director-General of Health (Research and Technical Support) for granting permission to use the National Morbidity Survey data sets. A big thank you goes to the Director of the Institute for Public Health and his team for continuous support in helping me to analyse the related data sets. My gratitude goes to all interview participants who happily shared their experience and information with me.

I cannot thank my supervisors enough, Clare Blackburn and Wolfgang Markham for their valuable guidance in both PhD and life for which I am deeply appreciate. I have learned from you that ‘social determinants of health’ is not only an experience, it is also a practice. Apart from my supervisors, I would like to acknowledge stunning statistical guidance provided by Peter Kimani and Ola Uthman at Warwick Medical School, George Leckie and Christopher Charlton from Centre of Multilevel Modelling at Bristol, Johnathan Bartlett from The London School of Hygiene & Tropical Medicine throughout my PhD. I should give credit to Samatha Johnson for helping me with literature search, especially qualitative section.

Special thanks go to Thich Nan Hanh, Tsem Rinpoche, and my comrades: Lucy, Jessica, David, Alan, Jasmine, Ya Yao, Peigy, Mandy, Kriss, Michelle, Agnes, Kristy, Caroline, Oliver, Yvonne, Fern, Geeta, Bola, Hana, Julie and friends back home for standing by me particularly during turbulent times.

I could not have made this dream came true without my family members who are my light in the darkness. I am sorry for being so ambitious and adamant in pursuing this dream. I am also eternally grateful of having Wernshu in my life. Thank you for being so resilient and bringing countless joys to me in this long

and bumpy ride despite you having health issues. Knowing that you are there for me, makes me happy and embrace all challenges bravely.

This research would not be possible with you all. Your goodwill would be greatly treasured in my heart until my last breath.

Declaration

This thesis is submitted to the University of Warwick in support of my application for the degree of Doctor of Philosophy. It has been composed by myself and has not submitted in any previous application for any degree. The work presented (including data analysis) was carried out by the author with the advice from Dr. Wolfgang Markham, Dr. Clare Blackburn, Dr. Peter Kimani and Dr. Ola Uthman.

Abstract

Background

Ethnic inequalities in the body weight of childbearing aged women 18-49 years old in Malaysia, are not fully appreciated. The aims of this research were two. First, to identify the patterns of underweight, pre-overweight, overweight, obesity and the mean BMI of Malaysian Malay women, Malaysian Chinese women, Malaysian Indian women and women of Other Indigenous People Minority Groups and their associated socioeconomic factors. Second, to explore women's perspective as regards to the meanings of body weight and the factors associated with weight maintenance, gain or weight loss.

Methods

Drawing from the interpretivism and positivism realm and within the framework of Social Determinants of Health, a sequential mixed methods approach was used to address the above aims. In the first phase of the study, two secondary data analyses of 1996, 2006, 2011 and 2015 Malaysia National Health and Morbidity Survey data were conducted using multilevel and logistic modelling techniques. The findings generated from the first phase of the study informed the undertaking of semi-structured interviews in the second phase.

Results

The results of secondary data analyses found evidence on the presence of educational inequalities in mean BMI across women of four main ethnic groups. There was a negative education level-mean BMI gradient among Malaysian Chinese women in 1996, 2006 and 2011, respectively. The same pattern was observed among Malaysian Malay women in 2011. Hence, the better education, the lower mean BMI for these women. There was a shift in educational-mean BMI patterning from positive gradient in 2006 to negative gradient in 2015 for women of Other Indigenous Minority Ethnic Groups. Among Malaysian Indian women, there was no education level gradient in mean BMI. The 18 semi-structured interviews supported the findings of Malaysian Chinese women in secondary data analyses by emphasising how traditional and modern, as well as local culture interacted with contextual factors in influencing their body weight via eating and or exercise.

Conclusions

The findings provide an understanding of the educational patterning of mean BMI among women of four main ethnic groups, and how cultural and contextual factors potentially contributed to such patterning and the practice.

Abbreviations

BMI	Body Mass Index
MM	Malaysian Malay
MC	Malaysian Chinese
MI	Malaysian Indian
OIP	Other Indigenous People of Minority Groups
NHMS	National Health and Morbidity Survey
SES	Socioeconomic status
TEW	Proportion of tertiary educated women
FT	Federal territory
ICC(s)	Intraclass Correlation Coefficient(s)
OR	Odds ratio
ONS	Office for National Statistics
WHO	World Health Organization
ref.	reference
UNDP	United Nations Development Programme
UNESCO	The United Nations Educational, Scientific and Cultural Organization
JKKN	The National Department for Culture and Arts
EPU	Economic Planning Unit
IKU	Institut Kesihatan Umum (Institute for Public Health)
CPDS	The Centre for Political & Diplomatic Studies

INTRODUCTION

The effects of body weight on health outcomes are well established with underweight, overweight and obesity all associated with poor health outcomes (Harita et al., 2012; Bhattacharya et al., 2007; WHO Expert Consultation, 2014). Body Mass Index (BMI) is an index of weight-for-height, which is commonly used to classify the body as underweight, healthy weight, overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his height in metres (kg/m^2) (Keys et al., 1972). People with BMIs outside of the range are at increased risk of non-communicable diseases such as cardiovascular and musculoskeletal conditions and some cancers (WHO Expert Consultation, 2004). The World Health Organisation reports that low- and middle-income countries are facing a double burden of disease, with both underweight and overweight/obesity co-existing within households, communities and countries (WHO, 2018).

The idea for this study was conceived when I learned that underweight and overweight were prevalent among women in Malaysia. There are marked inequalities across ethnic groups in Malaysia, particularly in education and job opportunities and I was interested in how these were associated, if at all, with body weight inequalities among women of childbearing age. Moreover, there was a dearth of weight related studies in Malaysia. Existing studies had some shortcomings in relation to both methodological and theoretical perspectives (Azmi et al., 2009; Rampal et al., 2007; Sidik and Rampal, 2009; Tan et al., 2011a and 2011b; Dunn, Tan and Nagya, 2012; Ismail, 2002; Chang, Chang and Cheah, 2009; Tan, Yen and Feisul, 2011; Mariapun, Ng and Hairi, 2018; Chan et al., 2017). Few studies have examined the socio-economic patterning and determinants of BMI of women living in Malaysia, with previous studies focusing mainly on overweight and obesity.

On personal level, my interest grew when I volunteered as a weight management supporter for a group of disadvantaged people in West Midlands, England. Some participants voiced their concerns to me and made me realise how difficult life circumstances interconnect with weight over time, and are commonly mediated by craving and loneliness. Throughout my voluntary period, I also learnt that a few women under-reported their dietary record. For these women, keeping a food diary was not helpful as the information was inaccurate. It also did not identify the root causes of being obese either.

Considering the social and economic situation in Malaysia and shortcomings in the body weight related studies in Malaysia, and my personal interest and background as a Malaysian Chinese woman, I decided to undertake research pertaining to the social determinants of body weight among women of childbearing age. As Malaysia has an ethnically diverse population, it seemed important to examine the social patterning of body weight among women in the four main ethnic groups: Malaysian Malay, Malaysian Chinese, Malaysian Indian and other Minorities Indigenous People women. My study utilised a sequential mixed methods approach incorporating quantitative and qualitative elements. The quantitative part of the study aimed to answer the following research questions:

(1) What is the socio-patterning of women's mean BMI, underweight, pre-overweight, overweight and obesity for four main ethnic groups in Malaysia across 1996, 2006, 2011 and 2015?

(2) What are the relationships between education and mean BMI, underweight, pre-overweight, overweight and obesity for each ethnic group in Malaysia?

The quantitative element of the study highlighted important findings about the association between body weight, ethnicity and education, but could not offer any information on how Malaysian women understand body weight, seek to manage their body weight or the factors they perceive to influence their body weight. As Malaysian Chinese women had lower BMIs and were more likely to have healthier body weights than other Malaysian women. Lower educated Malaysian Chinese women were more likely to have a higher BMI and being overweight. Additionally, I am Malaysian Chinese woman. Therefore, a qualitative study was designed to understand how this group perceived and managed weight. The research questions for the qualitative element of the study were:

(1) How do Malaysian Chinese women understand body weight?

(2) How do Malaysian Chinese women perceive their own weight?

(3) What strategies do Malaysian Chinese women use for losing, gaining or maintaining body weight?

(4) What factors do Malaysian Chinese women perceive to be influencing their body weight and weight management?

Structure of my Thesis

My thesis is organised into eight chapters. Chapter 1 sets the scene for my study by describing the social and economic setting of Malaysia. Chapter 2 reviews the existing literature and identifies the main gaps. Chapter 3 outlines the sequential mixed methods strategy that I adopt to addressing my research questions. It comprises of two secondary data analyses of 1996, 2006, 2011 and 2015 Malaysia National Health and Morbidity Survey in the first phase and semi-structured interviews in the second phase. Chapter 4 presents the preliminary analysis of secondary data analyses, followed by the results of each secondary analysis in Chapter 5 and 6, respectively. Chapter 7 presents the qualitative findings from semi-structured interviews with 18 Malaysian Chinese women. Chapter 8 discusses the main findings from the first and second phases of my research by locating them within the existing literature and how these contribute to knowledge on inequalities in body weight among women in

Malaysia. It also highlights the strengths and limitations of the study, discusses some implications for policy and practice and makes some suggestions for future research.

Chapter 1

Background studies

Malaysia was chosen as the setting, as that is where I was born. Moreover, markers of health such as body weight in Malaysia are associated with variations in socioeconomic and demographic characteristics and are, therefore, socially patterned. The next section introduces the context of my research; the geographical location and socio-economic circumstances, together with disparities in health conditions in Malaysia.

1.1 Introduction

Malaysia is one of the commonwealth countries located in South East Asia, covering 328,550 square kilometres of land. It is approximately 1.3 times larger than the UK and is 241,930 square kilometres (The World Bank, 2015). For governance purposes, Malaysia is divided into 13 states and three federal territories. The three federal territories are Kuala Lumpur, Putrajaya and Labuan. Peninsular Malaysia shares its borders with Southern Thailand and Singapore, and is separated from the federal territory of Labuan, the Malaysian states of Sabah and Sarawak on Borneo (Economic Planning Unit, 2013) by the South China Sea (see Figure 1.1). Labuan, Sabah and Sarawak have borders with Brunei and Kalimantan, and are also known as East Malaysia.

Malaysia is governed by a constitutional monarchy and parliamentary democracy. The *Yang Dipertuan Agong* (the King) acts as the head of country and is elected from one the hereditary male rulers of the Malay states (Economic Planning Unit, 2013). The governance of the country is based on the Westminster system: The King is part of Parliament, and there is also a House of Representatives and a Senate. The head of government is the Prime Minister. The political structure at the state and federal territory level resembles the country level. A Sultan or Governor (for the Sabah, Sarawak, Penang and Malacca states only) is the head of a given state, and governance is administered by a Chief Minister within the state legislative assemblies (Ghani, 2014; Hamid and Ismail, 2012). The federal territories are the administration of the central government. The central and state governments share power in relation to exercising the legislative procedures and administration and are predominantly male (cabinet.gov.my, 2019).

Figure 1.1: The geographical location of Malaysia

(Source: http://www.google.co.uk/ 11/01/2013)

As a democratically elected nation, all Malaysian citizens are eligible to vote for their central and state government representatives every five years. The Malaysian Government is led by the Barisan National Alliance, which has won the majority of seats in every election since Malaysia's independence in 1957. The Barisan National Alliance is a right-wing group formed by 13 political parties. Of these parties, five are ethnically dominated parties: United Malays National Organisation (UMNO); Malaysian Chinese Association (MCA); Malaysian Indian Congress (MIC); The Parti Pesaka Bumiputera Bersatu (PBB); and the United Pasokmomogun Kadazan Dusun Murut Organisation (UPKO) (Parliament of Malaysia, 2015). These political cleavages have been interpreted by Haskell (2005) as indicating that Malaysians still believe their interests and welfare are best fought by ethnically monopolised political organisations.

According to the latest census (2010), there are 28.3 million people in Malaysia, with slightly more men (53.0%) than women (47.0%). Women of childbearing age (15 to 49 years-old) accounted for nearly a quarter of the total population (24.4%), and about half (51.8%) of the female population in 2010 (WHO Western Pacific Region, 2014). The majority (91.8%) of the total population of Malaysia is Malaysians. Non-Malaysian citizens (e.g. Indonesians, Filipinos, Bangladeshis, Vietnamese and Cambodians) constitute the minority (8.2%) (Department of Statistics Malaysia, 2014; Joseph, 2014a&b). Malaysian citizens are categorised into four main ethnic groups with the following distribution: Malaysian Malays (54.4%); Malaysian Chinese (25.0%); Malaysian Indian (7.5%); and other Bumiputera (11.7%) (Department of Statistics, 2015).

Malaysian Malay, the major ethnic group in Malaysia, are known as 'Bumiputera', which means sons and daughters of the soil (Andaya and Andaya, 2001; Lemiere, 2007). According to Nah (2008), the legal definition of Malay is not rigid. People of any ethnic group can become Malay if they adopt Islam, practice Malay customs and speak the Malay language.

Aside from the Malaysian Malay, Other Indigenous People, such as the natives of Sabah and Sarawak and the Orang Asli in Peninsular Malaysia, are also recognised as 'Bumiputera' (Amanah Saham National Berhad, 2019; Khor and Shariff, 2008). This group are referred to as 'other Bumiputera' or 'Other Indigenous People of Minority Groups' in English. The term 'Indigenous People' is shorthand for Malaysian Malay and Other Indigenous People. Malaysian Chinese and Malaysian Indian, whose ancestors migrated mainly from China and India during British colonisation, are classified as 'non-indigenous people' (Spiegel, 2010).

Malaysian Chinese encompass two identities: the Chinese ethnicity, and being a citizen of Malaysia (Tan, 2000). Malaysian Chinese have inherited some traditional cultural practices from China, which are rooted in the Confucian values of patriarchal, selflessness and adapted to Malaysia's diet, language and Malay dominancy (Tan, 2000; Heng, 1996). Another segment of the Malaysian Chinese has adopted western notions as well, in which young women in particular have a strong desire for being independent (Joseph, 2014a; Ng et al., 2009).

Other young women differentiate themselves from traditional Chinese women who comply with the patriarchal system. These women frame their identity as being contemporary, and entrenched in materialism, competitiveness, diligence and career-mindedness. Therefore, some heterogeneity in customs and religious practices (e.g. Buddhism, Taoism, Islam and Christianity) are present amongst the Malaysian Chinese community (Joseph, 2014a). The degree of evolution in relation to adaptation and tradition varies according to level of education, income, location of residence, the western culture movement, globalisation and time (Kamarudin, 1993; Joseph, 2014c&d).

In the traditional Chinese culture, polygamy and mistresses are prevalent. Men put their parents above everything, and married women are also expected to do the same for their parents-in-law. Marriages usually happen at a later age within the Malaysian Chinese culture than within the Malaysian Indian culture (Kamarudin, 1993). Malaysian Indian are mostly Tamils, and a large proportion of them are Hindu (Kamarudin, 1993; Joseph, 2014). As with the Malaysian Chinese, the patriarchal system is dominant. Pottu (a decoration on the forehead), long hair and compliance with parental wishes are the cultural practices of traditional Malaysian Indian women. However, these practices have been interpreted by some young Malaysian Indian women as stripping them of their freedom (Joseph, 2014). In the traditional Malaysian Indian society, it is also the married woman's responsibility to keep marital harmony, in addition to being a wife, a carer, a cook and a nurturer (Kamarudin, 1993; Devasahayam, 2005).

Research conducted in the state of Sabah indicated that alongside the Malaysian Chinese and the Malaysian Indian, men of Other Indigenous People commonly have a higher status than the women (Suratman, 2001; Hadi, 1986). Men not only have greater financial control, but also have better inheritance rights, as the largest portion of land is usually presented to the eldest son (Suratman, 2001). As for the Other Indigenous People in Peninsular Malaysia, there is a tendency to have more children, with smaller gaps between children, in addition to spending a longer time breastfeeding (Khor and Shariff, 2008). The Other Indigenous People consist of more than 70 ethnic groups with diverse religious beliefs (e.g. Pagan, Christian, Muslim, Agricultural God and Animism) and culture (Sim and Khan, 2014). The Iban ethnic group in the state of Sarawak believe in holism, where human beings, spirits and nature co-exist and interact in their day-to-day lives (Metom, 2013). See Figure 1.2 for a photo of Malaysian women who belong to the ethnic groups of Minangkabau, Malaysian Indian, Malaysian Malay, Malaysian Chinese and Kadazan.

Figure 1.2: Malaysian women in their traditional costume (From left to right: the ethnic groups of Minangkabau, Malaysian Indian, Malaysian Malay, Malaysian Chinese and Kadazan)

(Source: http://www.google.co.uk/imgres? 21/02/2015)

As discussed above, each ethnic group has its own unique culture, but the national culture is primarily drawn from the indigenous Malay culture, with Islam as the primary religion (JKKN, 2015). Islam influences every aspect of the Malaysian peoples' lives, especially among Malaysian Malay. The influences range from legislation, building design, educational system, politics, and economic and cultural practices. The Malaysian Malay women 'are Muslims at birth', but other ethnic groups are free to adopt any religion (Tong and Tunner, 2008). Praying five times a day and fasting are part of a Muslim's spiritual practice. Most Muslim women wear a veil, which was adopted in the 1970s as part of the Islamisation process (Ahmed, 1992). Donning the veil is seen as being devoted to Islam, and is commonly viewed as an aspect of identity and considered to be joyous, rather than restrictive (Tong and Tunner, 2008).

Muslim men, on the other hand, can have four wives if financially feasible and if they are capable of being fair among the wives. The legitimacy of polygamy has been questioned especially by some women, while some women consent to it as God's will and others concede that polygamy is better than adultery, prostitution or having children out of wedlock. Others support polygamy because they believe that pregnant wives are unable to carry out their sexual responsibility. Polygamy has been viewed as protecting women's well-being, particularly when unmarried women outnumber men (Tong and Tunner, 2008; Yasin and Jani, 2013). Muslim women and men are bound to dual justice systems: Sharia Law is used for custody rights, divorce, marriage, apostasy; and Secular Civil Law is used for things like crime (Loo, 2009). Non-Muslims comply with the latter justice system only (Lemiere, 2007).

The above discussion highlights the fact that Malaysia is a multi-racial and multi-cultural country composed of various ethnicities across states and federal territories. For instance, Malaysian Malay are the biggest ethnic group in Peninsular Malaysia, while the majority of Kadazan/Dusun are found in Sabah, and the Iban in Sarawak (Department of Statistics Malaysia, 2011; Sim and Khan, 2014). Within this multi-ethnic society, it is normal for a woman to play diversified social roles: a wife, a mother, a source of family happiness, or a caregiver for a sick and elderly family member. The practice of care provision may be attenuating as a consequence of moving towards the nuclear family system. It may also be influenced by proliferation of smaller houses (Arrifin, 1997). Nonetheless, it remains strong in rural areas, as the family is still the primary place for caring for the elderly (Aziz and Yusooff, 2012).

Regardless of a woman's ethnicity, patriarchal norms are always integrated into women's lives to varying degrees. The patriarchal values dominated in Malaysia's society before the 1990s, particularly in rural areas, as a result of different hierarchical structures based on gender (Arrifin, 1997). It could be perceived as an intangible form of social control that women conform to men, which in turn possibly influences their health and body weight (Germov and William, 1996). The next section describes how structural transformations within

Malaysia’s patriarchal society produce and reinforce socioeconomic inequalities among women.

Since it gained independence from the British in 1957, Malaysia’s economy has diversified from agriculture and mining to include the manufacturing and service industries (Ariffin, 1998). Prior to economic transformation, women were mainly housewives and caregivers. The shift of import substitution policies to the pursuit of export-oriented policies by end of the 1960s, along with trade liberalisation, attracted many women who moved to urban areas for manufacturing work, which resulted in the rapid growth of women in the labour market (Amir and Mahmud, 2014; Ahmad, 1998; Miles, 2014; Chen et al., 2005).

In 1970, the participation of women in the labour market accounted for 30.0%, which increased to 46.8% in 1996, when the Malaysian economy was one of the fastest growing countries in East Asia. However, Malaysia, which was known as one of the four Asian Tigers, was hit by financial crisis in mid-1997 (Neely, 1999; World Development Report 1998/1999 Table 11 in Hasan, 2002). Retrenchment occurred in the private sector rather than the public sector (Baharudin, 2004). Across the private sector, the likelihood of losing a job was higher among the unskilled and semi-skilled workforce in the service and manufacturing industries was greater for women than for men (Baharudin, 2004; Jones and Marsden, 2010). As some unskilled female workers were family breadwinners, being laid off would mean a fall in household income, which elevated their risk of living in poverty (Jones and Marsden, 2010).

1.2 Gender inequality

Malaysia’s economy expanded by 4.7% in 2013 which was 3.0% higher than the UK (at 1.7%) (The World Bank, 2015). Malaysia is classified as an upper-middle income country, and is aiming to be a high-income country by 2024 (The World Bank, 2019). However, the Malaysian female participation rate in the labour force is half that of male. According to the World Bank (2015) the female participation rate was 12.0% lower than the UK (56.0%) in 2013. A number of possible conditions may explain the under-representativeness of females in the Malaysia labour market. There is some evidence that young, unmarried and childless women's participation rate is higher than that of other women, but women are more likely to exit the labour market when they are aged between 25 and 39, which are the marriage and childbearing years (Economic Planning Unit, 2015; UNDP, 2008).

This tendency of discontinuing work after marriage or giving birth has been linked to compliance with traditional gender roles (Abdullah, Noor and Wok, 2008). Giving up paid employment by taking up roles at home appears to be a decision made by the husband or family on behalf of the woman (Frank, 2011; Ismail and Sulaiman, 2014). Some husbands are said to feel insecure about allowing their wives to work in the public sphere and to commute on their own (Frank, 2011).

The decision for a married woman to stay at or leave work is also influenced by other factors, including her religion and educational level (Amin and Alam, 2008; Ismail and Sulaiman, 2014). Married Muslim women in rural areas were the least likely to work in contrast to their counterparts who lived in urban areas. Women who completed at least their secondary education were likely to continue working even after getting married, as compared with those of only primary or no formal education (Ismail and Sulaiman, 2014).

While some women intend to return to work after giving birth, childcare is an unresolved issue. Lack of childcare facilities in urban areas influences a woman's decision to stay in a full-time position. The likelihood of a married woman forfeiting a full-time job increases with the number of children aged under seven (Amin and Alam, 2008). To encourage women to return to work, civil servants have been entitled to get RM180 per child as childcare allowance since 2007. The government also exempts 10.0% of employers' corporation tax for employers who setup childcare facilities (Economic Planning Unit, 2015). Yet, only a few corporations have responded to this offer. Therefore, it is unsurprising that Malaysia's labour market is dominated by men.

Social circumstances rather than education are the greatest influence on women's withdrawal from the labour market (Wye and Ismail, 2012). It is purported that better educational achievement is a doorway to a higher status occupation. Wye and Ismail (2012) asserted that Malaysian females were the exception, and The World Bank figures support this view where Malaysian tertiary educated females are more vulnerable to unemployment than their counterparts compared with other middle-income countries such as Thailand. Their unemployment rate increased from 13.6% in 1996 to 35.4% in 2006, before reaching 40.9% in 2012 (The World Bank, 2015).

As for working women, inequality at work, including wages and career advancement opportunities, prevail in Malaysia (Amir and Mahmud, 2014; Low and Goy, 2005; Ismail and Jajri, 2012; Ministry of Human Resources, 2008). As a case in point, the difference between a professional female's and male's average monthly pay was RM822, as reported by the Ministry of Human Resources in 2008 (Ismail, 2011). Within the manufacturing sector, female workers, particularly those with lower status occupations such as unskilled assemblers and operators, received lower wages than their male counterparts who had attained the same educational level (Karubi and Khalique, 2012; Wye and Ismail, 2012; Low and Goy, 2005).

Studies conducted by Amir and Mahmud (2014) revealed that gender discrimination occurs in senior positions in telecommunication companies. Female executives, supervisors and managers had limited promotion, mentoring and reward opportunities, which hindered them from progressing to higher positions. Nonetheless, their stress levels were low. Perhaps they were content with their current work or less eager to move up the occupation ladder. Fernandez (2009), Ismail and Jajri (2012) pointed out that inadequate skills, experience and lower educational levels, along with prioritising ‘home duties’ were seemingly driving women to earn less than men.

In Malaysia, a woman’s involvement in decision making has remained relatively rare in many instances. In the past, only three women have held the post of deputy minister in the cabinet (in 1994) and two as a minister (in 2006), despite more women becoming members of political parties (Ahmad, 1998; Ministry of Women, Family and Community Development, 2007). As for trade unions, women leaders comprised merely 7.0% in 2004; with the greatest proportion occurring in the banking sector-related unions (Crinis, 2008).

Ariffin (1988; 1998) argued that the participation of women in unions was still disproportionately low because production (goods and services) and reproduction (offspring) had been gendered. Production belongs to the male domain, while reproduction was purely a woman’s role. The masculine and patriarchal unions regarded women as wives and mothers instead of workers. As a result, male unionists neglected female workers’ issues, including childcare and harassment, until the end of 1980s (Ariffin, 1998; Crinis, 2004).

The additional obligations of being a trade unionist, for example attending meetings after working hours, is another reason that restricts a married woman’s involvement in trade unions (Crinis, 2008). In 2007, 56.8% of married working women in Malaysia were believed to be largely working ‘double shifts’ (Aziz, 2011), because, along with their formal paid job, they bear most of the child-minding, parenting and housework responsibilities. Hiring a domestic helper is impossible for them due to financial constraints (Arifin, 1997). Consequently, female unionists’ contributions usually only exist in the pre-marriage period. There were cases where two female unionists continued to fulfil their commitments to the union after marriage, but both women were eventually divorced from their husbands (Crinis, 2008).

Kumar, Lucio and Rose (2013) claimed that trade unions in Malaysia had little power in protecting workers' rights and interests. There are non-governmental organisations (NGOs) that aim to help low-paid and low-skilled female workers by empowering them to identify and respond to their issues. Miles (2014) found that empowerment among female factory workers in Malaysia was low for three reasons: they resigned themselves to their current life and job circumstances; and lacked confidence to challenge employers, or feared the consequences of raising concerns about injustice issues.

In contrast to wider gender inequality in employment, there is no primary education gap between boys and girls. At the secondary school level dropout is higher among boys, despite government initiatives in 1992 to prolong secondary education to 11 years by promoting all students of lower secondary education to upper secondary education, irrespective of their academic achievement (UNESCO, 2011). At the post-secondary level, girls outnumber boys. A similar pattern occurs at the tertiary education level, where the gender gap is present in most courses at the university level. Females prefer the arts rather than sciences and technical courses. Their preferences could plausibly be because of gender stereotypes towards technical personnel that exist in the labour market (Economic Planning Unit, 2015).

1.3 Ethnic inequality in Malaysia: education realm

The Malaysian national education system not only has significant effects on gender, but also unequally impacts on ethnic groups in terms of educational route, opportunity, funding and scholarship. Educational inequality has been rooted in Malaysian society since the British Colonisation. At that time, different education structures were provided: schools in rural areas usually offered four years of primary education as compared to six years in the Malaysian schools in which the teaching medium was English (Hirschman, 1972; Raman and Sua, 2010).

Apart from this, the three main ethnic groups in Malaysia were largely segregated in terms of educational systems, which created excessive social and economic inequalities that varied according to rural-urban areas. Hence, for example, Malay schools, which were largely located in rural areas, emphasised religious education and basic literacy skills. The Chinese schools were built near mines and urban areas funded by the Chinese community; and Indian schools were in the rubber estates (Joseph, 2014d; Tan, 2012a). Each education system was based on the native country of the students (Hirschman, 1972).

The English schools, which were concentrated in urban areas, had a mixture of Malay, urban Chinese and Indian students from elite families. The schools prepared these elite children for British administration (Puteh, 2012; Joseph, 2014d; Hirschman, 1972). The varying education structures, curricular and systems that were run by different stakeholders during the British Colonisation appeared to generate a social hierarchy between and within ethnic groups, which greatly impacted social mobility. The social position of the urban elite group was improved through education, but the non-elite groups dwelling in rural areas were neglected (Thimm, 2013; Joseph, 2014d).

Other Indigenous People Minority Groups, traditionally, they worked as slaves in 18^{th} and 19^{th} centuries and relied on hunting and forest produce. Their livelihood changed after Independence. Some worked in the public sector and enjoyed privileged rights. Some participated in the resettlement programme and had a better financial position. However, some still engaged in traditional life in remote areas (Lim, 2003). They mostly live in rural or sub urban areas, concentrating in states such as Perak, Pahang, Selangor and Kelantan in Peninsular Malaysia, Sabah and Sarawak on Borneo Island (Boon, 2010). Consequently, accessing facilities such as schools and clinics or hospitals was relatively arduous.

Other Indigenous People Minority Groups had a different primary educational system before 1996. Prior to 1996, they attended schools in the village for three years before continuing through to primary six (Kamarudin, 2008). However, the quality of this educational system was low because of untrained teachers, inadequate funding and understanding of the culture. So, the Malaysian government decided to end this educational system and integrated it with mainstream education in 1996 (Rosnon, 2016). Figure 1.3 shows children of Indigenous People Minority Groups who attended primary schools in Sarawak in 2015. Some of them went to school with bare feet or slippers.

Figure 1.3 Children of Indigenous People Minority Groups in one of the primary schools in the state of Sarawak

(Source: https://www.thestar.com.my, 2019)

Presently, there are five types of primary schools in Malaysia: national school; special education school; religious school; national-type Chinese school; and national-type Indian/Tamil school. In Malaysia, the national-type Chinese and -Indian primary schools receive partial funding from the government, unlike the national schools, which are fully funded (Lee, 2012; Joseph, 2014b). For example, only 3.6% of the total financial provision to primary schools was allocated to Chinese schools in the 9th Malaysia Plan (2006-2010) (Lee, 2012).

The mother-tongue of the main ethnic group is used as the language of instruction across national and national-type schools. More Chinese descendants are enrolled in national-type Chinese primary schools because these schools ‘transmit and preserve their language and culture’ (Lee, 2012, p.166).

Within the secondary education system, three different educational systems exist. The national school students continue their studies to Form 1, regardless of their Primary School Achievement Test (UPSR) results. The non-national school students, except those with straight A’s UPSR results, have to study a one-year transition class. However, this school system changed in October 2010. Since then, only those who did not attain a minimum grade of C in the Malay language need to attend the transition class before resuming secondary education of up to five years in private or national schools (Sugimura, 2007).

Academically bright indigenous students are eligible to enrol for the MARA Junior Science Colleges and Residential Science Secondary School after completing primary education before pursuing pre-university programmes. Unfortunately, 90.0% of the enrolment to these schools is reserved for indigenous people, with the remaining 10.0% allocated to non-indigenous people (Joseph, 2008). See Figure 1.4 for a brief description of the main educational pathways for four main ethnic groups in Malaysia.

Figure 1.4: Description of main educational paths in Malaysia

Type of Primary School (Language of Instruction)	National School (Mainly Malaysian Language)	National-Type Chinese School (Mandarin)	National-Type Indian/Tamil School (Tamil)
Standard	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
	6	6	6
	↓	↓	↓

Type of Secondary School (Language of Instruction)	National School/MARA Junior Science College/Residential Science Secondary Schools/Private School (Language of instruction can be Malaysia Language, English, Mandarin)		
Form	I	Remove Class	Remove Class
	II	I	I
	III	II	II
		III	III
	IV	IV	IV
	V	V	V

School leavers can go on to further education in sixth form for two years, matriculation programmes (one- to two-year pre-university programmes), colleges, foreign universities or work after completing Form V.

Note: The educational system in Malaysia is divided into four phases: pre-school, primary (6 years), secondary (lower secondary: 3 years; and upper secondary: 2 years) and post-secondary education (2 years). Children start their primary schooling at the age of seven and finish the secondary education by 17 years old.

(Source: Ministry of Education, Malaysia, 2013; Kamogawa, 2003).

Indigenous people not only benefit from positive action in relation to secondary education, but additionally are granted priority for entering pre-university (namely, matriculation) programmes, lasting one to two years, and university programmes (Ministry of Education Malaysia, 2015; Brown, 2007). In 2003, only 10.0% of enrolment to the matriculation programme was opened to non-indigenous people (Thimm, 2013). Subsequently, some non-Malay were forced to further their studies in either private colleges or by spending another two years in post-secondary education, sitting for the Sijil Tinggi Pelajaran Malaysia examination (STPM). The matriculation programme and STPM are two different post-secondary education systems. Students of the matriculation programme take an internal examination devised by each matriculation college, but the STPM examination is standardised throughout the country (Loo, 2009).

Inequality in tertiary educational opportunities is noticeable, particularly since the introduction of ethnic quotas in 1970. The ethnic quotas restrict non-indigenous people from gaining public university places, as well as scholarships for their studies. The quota meant that 80.0% of scholarships were awarded to Malaysian Malay up until 2008. However, it was reduced to 60.0% after 2008 as a result of receiving strong criticism, particularly from the Malaysian Chinese (Syed, 2008). Similarly, more indigenous people get scholarships for overseas studies than non-indigenous people (Lee, 2004).

As for enrolment to the university, this is capped at a ratio of 55:45 indigenous to non-indigenous ethnic groups by the National Economic Recovery Plan (Kamogawa, 2003; Brown, 2007; Singh and Mukherjee, 1993). The number of Malaysian Chinese admitted to public universities in Malaysia has dropped since the implementation of the ethnic quotas. For instance, in 1985 the enrolment of Malaysian Malay to public universities was 2.5 times greater than Malaysian Chinese, who had the highest admission in the 1970s (Thimm, 2013). The number of professionals (e.g. doctors, lawyers and engineers) is increasing among Malaysian Malay (Rahimah, 2012).

As opportunities to further their studies in public universities are limited, more Malaysian Chinese and Indian have been undertaken their tertiary education in private universities. Some of them who were not offered their preferred course also followed their studies at private universities. The private universities have higher tuition fees relative to public universities, and limited access to student financial assistance. Only 30.0% of student loans were provided to private universities between 2000 and 2009 by the government (Thimm, 2011; Joseph, 2014). As a result, the indigenous people and non-indigenous people (e.g. Malaysian Chinese and Malaysian Indian) are polarised by the type of university they tend to attend. Malaysian Chinese and Malaysian Indian who can afford to bear the higher tuition fees make up the majority of students in private universities. In contrast, a number of indigenous people constitute the public universities' entrants (Lee, 2012).

Educational inequality is not only evident in all levels of education across ethnic groups; it also takes place within ethnic groups. Although both Malay and Other Indigenous People Minority Groups have been conferred special privileges in education opportunities and scholarships, research highlights that Other Indigenous People Minority Groups living mainly in rural areas of Peninsular Malaysia have yet to fully benefit from these privileges. Abdullah et al. (2013) claimed that economic development programmes had not been accompanied by an improvement in the educational level of the indigenous people other than Malay who live in Peninsular Malaysia. Their academic accomplishments have not gone through drastic changes.

Despite the implementation of the 'no child left behind policy' by the Malaysian government, Other Indigenous People Minority Groups lived in rural areas in Peninsular Malaysia, Sabah and Sarawak tend to drop out after completing their primary education, and only 2.0% successfully pursued tertiary education (Ramli and Mohammad, 2013; Jantan and Ahmad, 2013; Abdullah et al., 2013; Khor and Shariff, 2008). The same trend has also occurred among Other Indigenous

People of East Malaysia (Sabah and Sarawak), for example the Penan and the Iban. This trend in East Malaysia is underpinned by language barriers, the location of the schools, poverty, and fear of being exposed to new culture through education (The Equal Rights Trust, 2012, Boon, 2010). Another reason for their low educational attainment level was some did not have an equal start in education as they did not have the opportunity to attend pre-school (Michael and Chuen, 2012).

As for the Malaysian Chinese, school dropout rates were higher in the new villages situated in rural areas (Lee, 2012). The dropout rate among Malaysian Indian is unknown, but Joseph (2014b&c) stated that the teaching quality of National-Type Indian/Tamil Schools was lower than in the National-Type Chinese Schools. Within the realm of tertiary education, poor Malaysian Chinese and Indian, for which a course at a private educational institution is unaffordable, are unable to reap this benefit (Lee, 2012). In summary, the education system in Malaysia is politicised, and ethnically and hierarchically divided into indigenous people and non-indigenous people. An uneven distribution of educational opportunities, funding, scholarships, and special constitutional rights affects the four main ethnic groups differently. Preferential policies in education as well as the existence of different educational pathways could segregate the multi-ethnic society and conceivably slow down the process of socialisation (Rahman and Sua, 2010).

1.4 Ethnic inequality in Malaysia: income distribution

Inequality in income in Malaysia is likely to be as profound as educational inequality. Apart from being segregated by education, the social structure of Malay, Chinese and Indian during British Colonisation was also stratified by occupation. A greater proportion of Malay and other minority indigenous groups worked within traditional agricultural industries and lived in rural areas (Watson, 2011; Koon, 1997; Moser, 2010). The Chinese were described as possessing more economic skills than the Malay and Indian. They were involved in mining, trade, retail and catering services, and hence had a larger share of economic power (Rahman and Sua, 2010). Urban living was more common among the Malaysian Chinese communities than among indigenous Malay communities prior to independence, but presently, more than half of the Malaysian Chinese and Malay population live in cities (Koon, 1997; Moser, 2010; Yeoh, 2006).

After gaining independence from the British in 1957, a series of economic transformations took place. The implementation of ‘The Constitution of Malaysia’, underpinned and supported these changes. One of the most far-reaching aspects of this constitution was the recognition of the different life trajectories and life experiences of the vast majority of Malay when compared with non-Malay. This recognition was accompanied by the granting of special rights to Malay in relation to job opportunities within the public sector. Majlis Amanah Rakyat (MARA) was also set up to restore the economic position of the indigenous people (Watson, 2011; Amanah Saham National, 2019). Furthermore, all indigenous people are eligible to purchase houses at a discounted rate (Nah, 2008).

Despite these efforts, income inequalities still existed between the rich and the poor within ethnic groups and across rural-urban areas in the 1960s (Ragayah, 2008). The biggest inequality gaps occurred in the Malaysian Indian communities, followed by the indigenous people and the Malaysian Chinese. It was reported that the Gini Coefficient differed by 0.139 between rural (0.363) and urban Malaysian Indian (0.502). This rural-urban intra-ethnic gap was wider than the inter-ethnic differences. The corporate equity of the indigenous people was 2.4% in 1970, while 63.3% was owned by foreigners (Economic Planning Unit, 2012).

Tension between the three main ethnic groups (Malay, Chinese and Indian) arose mainly because of the continued dissatisfaction of Malay with their disadvantaged socio-economic position, which had not noticeably improved during the period 1957-1969. Malaysian Chinese and Malaysian Indian were dissatisfied with the introduction of the Malaysian language as a teaching medium in Chinese and Tamil schools in 1957 (Kamogawa, 2003). Eventually, tension over these issues reached peak and ethnic riots broke out in Kuala Lumpur in May 1969 (Singh and Mukherjee, 1993).

Different policies that aimed to redress income inequality were implemented after the 1969 riots, including the New Economic Policy (1970-1990). The National Economic Policy (1991-2000) and the restriction of eligibility to invest in Amanah Saham Bumiputera (ASB) funds for indigenous people only, (Amanah Saham National, 2019). These funds provide investors with guaranteed returns on investment. Apart from these, additional new government agencies such as PERNAS (National Trading Corporation), RISDA (Rubber Industry Smallholders Development Authority) and UDA (Urban Development Authority) were established for encouraging the involvement of indigenous people in commercial and industrial projects (Roslan, 2001).

Other initiatives were also undertaken to reduce the income inequalities between rural and urban areas, including the provision of subsidies to small plantation owners, and provision of bus and taxi permits and licenses to indigenous people (Lee, 2010). It has been argued that some rural dwellers (e.g. the estate workers, mine workers, contract labourers and some poor people) in East Malaysia were being excluded from the benefits of these provisions (Jomo, 2004). Hatta and Ali (2013) agreed with Jomo (2004), and they further state that poverty eradication programmes have not fully reached the majority of rural populations in Sabah.

Additionally, small segments of indigenous people, especially elite groups, gained more from corporate ownership equity restructuring (Jomo, 2004). The goal of increasing indigenous people’s corporate share indirectly promotes interethnic business joint ventures. Commonly the Malaysian Malay provide access to the ethnic-prioritised business opportunities, while the Malaysian Chinese business partners offer capital and skills (Jomo, 2004). There emerged two contrasting standpoints regarding the effects of the New Economic Policy (NEP) policy on the redistribution of the income. Antagonists argued that the policy had elements of racial discrimination. In the supporters' eyes, the policy rectified some of the socioeconomical disadvantages of the indigenous people (Kenayathulla, 2014).

Overall, the implementation of the NEP (1970-1990) has had marked beneficial effects on poverty. Poverty reduction was approximately 60.0% for Malay and Other Indigenous People Minority Groups population, 25.4% for Malaysian Chinese and 36.7% for Malaysian Indian, during the period 1970-2009 (Economic Planning Unit, 2015). The corporate equity share-holding by indigenous people rose from 2.4% to 19.3% in 1990, albeit missing the target of 30.0% set by the NEP (Economic Planning Unit, 2015).

The overall Gini Coefficient, which aims to measure income inequality, declined from 0.513 in 1970 to 0.431 in 2012 and 0.401 in 2016, signifying successful implementation of the NEP in eradicating poverty in Malaysia (Economic Planning Unit, 2015). Despite the overall improvement, income inequality was found across ethnicities and between rural-urban areas from 1995 to 2016 (see Table 1.1 for details). It was noted that the highest Gini Coefficient was found in indigenous people in 1995 and 2004. This implied a wider income inequality within the indigenous people (Ragayan, 2012).

As discussed above, the indigenous people are classified into two ethnic groups: Malaysian Malay and Other Indigenous People Minority Groups. To identify whether discernible income inequality occurred in Malaysian Malay or Other Indigenous People Minority Groups proves challenging. This is because separate coefficients for Malaysian Malay and Other Indigenous People Minority Groups are not available. Therefore, the existing the Gini Coefficient for indigenous people could be masking the real inequality conditions faced by each ethnic group. Research showed that the poverty rate of Other Indigenous People Minority Groups in Peninsular Malaysia was 33.5%, which is 26.0% more than the national poverty level in 2006 (UNDP, 2015). Other small-scale studies have identified greater poverty among Other Indigenous People Minority Groups and integration problems with other ethnic groups in Peninsular Malaysia (Rosliza and Muhamad, 2011; Roddin et al., 2012).

Turning to the rural-urban Gini Coefficient, the urban areas had wider inequality, which is associated with a greater incidence of poverty experienced by immigrants in urban areas (Ragayan, 2012).

Table 1.1: Gini Coefficient by Ethnicity and Strata in Malaysia, 1970, 1995, 2004, 2014

Year Ethnicity	1970	1995	2004	2012	2016
Indigenous People	0.466	0.441	0.452	0.421	0.385
Malaysian Chinese	0.466	0.428	0.446	0.422	0.411
Malaysian Indian	0.472	0.404	0.425	0.443	0.382
Urban Areas	Not available	0.431	0.444	0.417	0.389
Rural Areas	Not available	0.41	0.397	0.382	0.364

(Source: Economic Planning Unit, 2015)

Along with ethnic preferential policies, income inequality continues to this day. Presently, urban households with monthly earnings of less than RM1,500, and rural households with an income of below RM1,000 are entitled to access financial support from the government (Ragayah, 2012). However, the preferential racially-based policies, and other economic plans might limit non-indigenous people's participation in the economy. It was reported that 80.0% of civil service positions were filled by Malaysian Malay (Jain, Sloane and Horwitz, 2003). Additionally, specific business loans, such as the Executive Franchise Scheme are offered to indigenous people only by the Perbadanan National Berhad (PNS, 2015).

Moreover, the cost of doing businesses might be higher for non-indigenous people (Economic Planning Unit, 2004). Emigration of highly skilled Malaysian Chinese and Malaysian Indian to overseas, and high unemployment among indigenous graduates in relation to graduates belonging to other ethnicities are another two issues faced by the government (Liang, 2014; Lim, Rich and Harris, 2008;). The next section describes a brief overview of the health status of Malaysia and how health conditions interplay with ethnic inequality.

1.5 Ethnic inequalities in Malaysia: health conditions and BMI

The healthcare system in Malaysia has a dual structure. One is funded by the collection of taxation and revenue by the government, another is paid for by the patients (WHO, 2013). The delivery of healthcare systems has improved since gaining independence from the British Empire (Ministry of Health, 2012). Both healthcare systems provide a range of services, including reproductive health services, yet such services focus more on married women than young and adolescent women (The Equal Rights Trust, 2012).

In tandem with the improvements in health services (the ratio of doctors to patients has increased), the health of the population has also improved (WHO, 2013). This includes reductions in maternal, infant and toddler mortality rates.

The Malaysian maternal mortality rate reached 31 per 100,000 live births in 2010, triple that of the UK for the same period (The World Bank, 2015). The infant, toddler and under five mortality rate was recorded at 8 per 1,000 live births for the same year, as compared with 6 for the UK (The World Bank, 2015).

Life expectancy in Malaysia has also increased over the years, with women outliving men. According to official figures published in 2016, Malaysian Chinese women had the longest life expectancy (79.9 years), even without any special rights in education or any particular economic opportunities. In contrast, indigenous women (Malaysia Malay and Other Indigenous People of Minority Groups) who are given priority in education along with economic opportunities had the shortest life expectancy, reaching only 76.0 years old. Malaysian Indian women who do not have privileges in education and employment opportunities like Malaysian Chinese women had the same life expectancy as Indigenous People (Department of Statistics Malaysia, 2016).

Despite the launching of a 70 million population plan by the government in 1982 which included legislation to offer maternal benefits up to the fifth child, along with raising child relief tax allowance, the fertility rate which reflects the average number of children born by women of each of the four main ethnic groups is decreasing. The fertility rate of both Malaysian Chinese and Malaysian Indian women aged 15 to 49 has slipped to 1.7 and 1.5 in 2012 respectively; and to 2.3 for Other Indigenous People of Minority Groups. The Malaysian Malay's fertility rate in 2012 was 2.7, almost half that of 1970 (5.0). However, it is still the highest compared to other ethnic groups (Mahari et al., 2011; Lim, Jones and Hirschman, 1987; Department of Statistics Malaysia, 2013).

Malaysia is experiencing demographic and epidemiological transitions simultaneously, where the increase of population aged at least 65-year-old is accompanied by a rising number of non-infectious diseases. In mitigating the increase of non-infectious diseases, the Ministry of Health has launched various types of healthy lifestyle programmes since 1991. Two of these were the establishment of 49 Healthy Community Kitchens around the country to promote healthy cooking/eating; and the 10,000 steps daily campaign (Ministry of Health, 2012).

The healthy lifestyle programmes appeared unlikely to halt the increase in Malaysian childbearing aged women's BMI. At the national level, the prevalence of those who are underweight improved from 14.0% in 1996 to 7.3% in 2015. Those having a healthy weight shrank from 41.6% to 26.5% in 2015. Overweight increased from 21.4% in 1996 to 28.1% in 2015. In contrast to the prevalence of underweight, obesity was on the rise and increased from 7.7% in 1996 to 24.0% in 2015 (unpublished data from 1996, 2006, 2011 and 2015 Malaysia National Health and Morbidity Surveys). Weight differences are also pronounced across childbearing aged women of four main ethnic groups over the same periods (see details in Chapter 4).

1.6 Conclusion

The Malaysian population has become increasingly urbanised to the point where its urbanisation level is only one place behind Singapore in South East Asia (WHO, 2013). Gender inequality has also emerged between Malaysian men and women. Women's' rights and obligations at home and work are largely influenced and possibly constrained by the interplay of different stakeholders and institutional forces (e.g. government, employers, family members, patriarchal cultures and globalisation). In Malaysia, the marriable age for women (16 years-old) is two years younger than that for men (18 years-old) (The Malaysian Bar, 2015). Higher educated and older married woman are believed to secure greater autonomy at home. This increased autonomy is reinforced when women live within a nuclear family, but is attenuated when women live within an extended family (Mason, 1997).

Gender inequality, together with ethnic polarisation, is perpetuated in the arenas of education, employment, business, earning opportunities and resources within Malaysian society (Economic Planning Unit, 2015). These inequalities are shaped, reproduced and plausibly reinforced by different institutions over time. As a result, the social hierarchy of women is divided to different degrees along the ethnic lines, and reflected in various socioeconomic positions. Specifically, such unequal conditions could be linked to differences in body weight of women of childbearing age around the nation. Literature has documented that body weight inequality emerges in women living in industrialised countries, such as the UK. It also underpins this inequality within the framework of Social Determinants of Health, which I will be detailing in Chapter 2.

Chapter 2
Literature review

This chapter outlines a review of literature that is relevant for my area of investigation in three sections. Section one reviews the three main theoretical frameworks that are most relevant for my research. In the second section, I evaluate the existing literature that is relevant to the first part of my research. It begins by providing the meaning of ethnicity, followed by defining the key measures of body weight and weight classifications (e.g. healthy and unhealthy weight). It discusses the impact of having an unhealthy body weight and the multiple pathways that influence body weight. This second section ends by summarising the empirical evidence regarding weight-related pathways that are related to socioeconomic position. It also recognises what has been done and identifies the gaps in the existing literature. The third section summarises women's lay definitions and perceptions of body weight, reasons for and ways of managing and monitoring weight, barriers to losing and maintaining weight and their associated strategies. It concludes by outlining the gaps in literature.

2.1 Frameworks put forward to account for inequalities in body weight

The three most common frameworks for understanding health inequalities focus on biomedical, psychological and social explanations. These explanations may be applied to understanding differences in body weight.

2.1.1 Biomedical framework

The biomedical perspective is derived from a Western understanding of health and illness and has its roots in natural science. The main focus is the application of biological and physiological principles and insights into the human body (Freund, McGuire and Podhurst, 2003; Cedar, 2008). These principles and insights are based on three main assumptions: the separation of body and mind, the body as a machine and the principle of normality (Switankowsky, 2000; Freund, McGuire and Podhurst, 2003; Marcum, 2004; Blaxter, 2010).

Specific medical treatments and medical conditions

This section illustrates how medical treatments and medical conditions may be used to explain differences in body weight.

Specific medical treatments and the use of drugs such as steroids, insulin, lithium and ß blockers may result in weight gain (Leslie, Hankey and Lean, 2007). Likewise, the use of Nicotine reduces susceptibility to weight gain. Certain illness, for instance Prader-Willi syndrome (PWS) and Bardet-Biedl syndrome (BBS) cause obesity. However, the risk of developing these disorders is very low: 1 in 25,000 births for the PWS, and 1 in 100,000 births for the BBS (Bell, Walley and Froquel, 2005; Mutch and Clement, 2006; O'Rahilly and Farooqi, 2006).

Energy imbalance

Energy imbalance is the prominent account within the bio-medical perspective for explaining the presence of a non-healthy weight amongst individuals (Chang and Christakis, 2002). The perspective defines the occurrence of non-healthy weight as a long-term state of imbalance between food consumption and the use of energy in performing daily activities (Cedar, 2008; Loos and Bouchard, 2003; Chang and Christakis, 2002). Healthy weight is achieved through a long-term balanced energy state. Over consumption of food, especially high fat and high calorie foods together with a sedentary lifestyle result in overweight or obesity (Cedar, 2008). In contrast to overweight and obesity, underweight is linked to inadequate food consumption. As a result of these classifications, people within society are simply divided dichotomously into 'normal' (healthy weights) or 'abnormal' (unhealthy weights) based on the principle of normality.

The bio-medical perspective points out that the mutations or deficiencies of certain hormones can influence energy balance and weight indirectly. Ghrelin and leptin, are two types of hormones that regulate energy balance and weight, with conflicting effects on weight (Klok, Jakobsdottir and Drent, 2007; Montague et al., 1997). Moreover, Farooqi and O'Rahily (2006) and Frayling et al. (2007) demonstrated that mutations of leptin account for less than 0.01% in the population. However, the contribution of genetic composition to variation in BMI at the population level is very small. Genetic factors such as single nucleotide polymorphisms have been estimated to account for two per cent or less of the variation in BMI at the population level (Swinburn, et al., 2011; Hebebrand, et al. 2010; Bogardus, 2009).

Hereditability

There is evidence that genetically inherited traits contribute to the variation in weight (Stunkard et al., 1986 &1990; Price and Gottesman, 1991; Allison et al., 1996; Maes, Neale and Eaves, 1997; Silventoinen et al., 2010; Whitaker et al., 2012). However, findings from twin studies produced inconsistent results. Stunkard et al. (1986) showed that the influence of hereditability was strong across the weight continuum. However, some studies found that obesity had a weaker association with hereditability than leanness (Lyon and Hirschhorn, 2005; Stunkard, 1990; Costanzo and Schiffman, 1989). The inconsistency of these results suggests that there might be other factors such as environmental conditions that influence the expression of genetically inherited traits, which in turn influence variations in weight.

In summary, the biomedical perspective views and treats non healthy weight objectively through the symptoms present in one's physical body. It has not addressed the issue of why some people over time eat more or less and/use different amounts of energy that result in variations in weight, although it recognises the role of physical and social environment in body weight outcomes.

2.1.2 Psychological framework

Eating behaviour: individual’s attitudes, beliefs and motivation

An individual’s eating behaviour and hence body weight is, according to commentators adopting a psychological perspective, shaped by an individual’s attitudes, beliefs, perceptions, motivations, experiences and food preferences. These cognitions, emotions, motivations and experiences are, in turn, influenced by people with whom the individual has close relationships and by the media (Naidoo and Wills, 2008; Vartanian, Herman and Wansink, 2008; Salvy et al., 2009; Birch and Fisher, 1998; Moskovich, Hunger and Mann, 2011a&b; Christakis and Fowler, 2007; Ogden, 2007; Povey et al., 2000; Sarafino and Smith, 2012). Research that examines the association between parenting style and children’s eating behaviour indicates that controlling styles provoked unhealthy eating behaviour (Birch and Fisher, 1998; Arredondo et al., 2006). Thus, using food as reward or punishment has subsequent impacts on eating behaviours such as the development of bulimia nervosa in their adulthood (Puhl, Moss-Racusin and Schwartz, 2007).

An individual’s perception may also play a role in her/his eating behaviour. Differences between self-perceived and actual body size can lead to body weight dissatisfaction which, in turn, may affect eating behaviour and subsequently body weight (Jaworowska and Bazylak, 2009). People with anorexia, for example, are commonly dissatisfied with their weight because they perceive their body size to be bigger than it should be and also bigger in relation to the body size of others. Perceptions of body weight have also been shown to associate with socio-economic position (SEP). Women with a high SEP were shown to prefer leanness because they perceive leanness to be as a sign of success (Striegel-Moore, Siberstein and Rodin, 1986; Ogden, 2007).

Self-motivation and external motivation have different influences on eating behaviour and body weight. Self-motivation has greater positive effects than external motivation (Pelletier et al., 2004; Kopp and Zimmer-Gembeck, 2011).

Thus, a 10-unit increase in self-motivation (self-regulation) to regulate eating behaviour was associated with a 2.0% decrease in the BMI of middle-aged women living in New Zealand, after controlling for socio demographic characteristics, lifestyle factors, eating habits, food preferences and illness. Conversely, the imposition of externally controlled regulation of eating behaviour raised BMI by 1.4% (Leong et al., 2012).

Commentators adopting a psychological perspective also emphasise perceived self-control as an important influence on eating behaviour. Higher levels of perceived self-control promote healthy eating behaviour and a stronger intention to lose weight (Schifter and Ajzen, 1985; Povey et al., 2000). However, perceived self-control as a factor that influences weight loss through healthy eating behaviour appears to more effective in short-term rather than the long-term (Teixeira et al., 2010 and 2006; Linde et al., 2006).

Eating behaviour: emotion

Emotion, which is considered to be a subjective feeling, may also influence cognition, eating behaviour, body systems and BMI (Sarafino and Smith, 2012; Strien, Herman and Verheijden, 2009). Emotion may trigger overeating or under eating, both of which may result in an unhealthy body weight (Liem et al., 2008; Granberg, 2011; Dallman, 2010; Wardle et al., 2010; Block et al., 2009; Tomiyama, Dallman and Epel, 2011). Cross-sectional and prospective research have demonstrated the presence of causal links between anxiety, depression, stress and obesity (Kokonyei et al.,2013; Torres and Nowson, 2007). Additionally, Geliebter and Aversa (2003) suggested that people who are underweight commonly under eat when they encounter negative emotions but commonly over ate when their mood was positive.

To sum up, differences in eating behaviours cannot be fully explained by differences in attitudes, emotions and beliefs.

Physical activity

Psychological factors, such as stress, motivation and self-efficacy not only influence eating behaviour but also influence levels of physical activity (Bauman et al., 2012; William and French, 2011; Sherwood and Jeffery, 2000; Poag-Du Charme and Brawley, 1993; Fox and Hillsdon, 2007). Being physically inactive, for example spending long hours watching television increases the risk of having an unhealthy weight (Suter, Schutz and Jequier, 1992; Tremblay et al., 1995; Mummery et al., 2005; Story et al., 2008; Harris, Bargh and Brownell, 2009). Evidence shows that physical inactivity is inversely linked to weight gain (Martinez-Gonzalez, 1999; Jebb and Moore, 1999; Duvigneaud et al., 2007) but its impact on weight gain was small (Wareham, 2007). In addition to this, Scheers, Philippaerts and Lefevre (2012) demonstrated that being overweight or obese was linked to lower levels of physical activity. Overweight and obese women expended 1.46 and 1.31 kcal/kilogramme/hour, respectively compared to 1.67 kcal/kilogramme/hour that was expended by women of healthy weight.

Stress has been shown by systematic reviews to be inversely linked with physical activity (Van Stralen et al., 2009; Koeneman et al., 2011). Additionally, Sternfeld, Ainsworth and Quesenberry (1999) found that women with high self-efficacy were 3.96 times more likely to undertake sports or exercises than women with low self-efficacy in Northern California. However, an association between self-efficacy and continued participation in physical activity has not been conclusively demonstrated (Brassington et al., 2002; McAuley et al., 2003).

On the whole, psychological explanations focus on eating behaviour and physical activity level and their influence on body weight. Differences in eating behaviour and physical activity level are also associated with differences in intra-personal factors, choices, satiety responsiveness, treating food as a source or re-enforcer of enjoyment, eating dis-inhibition levels (eg. over eating in social occasions and loneliness) and self-control (Bryant, King and Blundell, 2007; Bond, McDowell and Wilkinson, 2001; French et al., 2012; Blundell at al., 2005; Epstein, Leddy, Temple and Faith, 2007). However, an individual's behaviour and cognition are influenced by culture and other socio-economic conditions which interact with psychological factors to shape a person's diet and physical activity behaviour, and consequently her/his body weight (Booth and Booth, 2011).

The next section describes these interactions and highlights how an individual's behaviour occurs within a social context and is shaped by people's social environment and socio-economic resources.

2.1.3 Social framework

Introduction

This section focuses on social determinants of health. The value of applying insights pertaining to the social determinants of health to overweight/obesity has been highlighted by both Marmot and Bell (2010) and Bennett, Wolin and Duncan (2008). Definitions of health inequalities or weight inequalities are provided next, followed by a discussion of the concept of social determinants of health and its three main explanations.

The definition of 'health inequalities' or 'weight inequalities'

Differences in people's health (weight) can be described in two ways, which are particularly pertinent to my research. First, it refers to differences in health (weight) status between individuals, reflecting differences in access to resources. Second, it concerns the systematic health differences between identified segments of population and reflects social inequalities (Judge et al., 2006; Braveman, 2006, Graham, 2010). In this dimension, health differences are termed as health inequalities (or health inequality) within the social perspective. Some commentators have indicated that health inequalities are not about differences in health that are caused by natural physiological process (Townsend and Davidson, 1982). Instead, health inequalities are systematic social differences in health or health-related experience (Townsend and Davidson, 1982a&b; Graham, 2009).

To capture the relationship between health status and the explicitly stated sources of health inequalities, the term health inequalities is often used in conjunction with the source of variability, for example ‘socioeconomic or gender or ethnic inequalities in health’. Regardless of the source of variability in health status, as health inequalities do not occur randomly, they must be considered as morally unjust (Graham, 2010; Whitehead and Dahlgren, 2007; Warwick-Booth and Lowcock, 2012; Kawachi, Subramanian and Almeida-Filho, 2002).

In summary, the social perspective views health (weight) inequalities as resulting from unequal social conditions, which occur over time and within a place; and systematically determine health (weight) differences (Marmot, 2005).

Social determinants of health and its three main explanations: behavioural, materialist, neo-materialist and psychosocial

The concept of social determinants of health describes how people’s health is determined by the social conditions they encounter, in which the conditions are shaped by the allocation of a wide array of determinants including money, power and resources at global, national and local levels (WHO, 2013). The systematic unequal allocation of these determinants across social groups results in health inequalities and health inequities. The following section outlines the three main mechanisms, explaining how social position determines health inequalities. These mechanisms are based on: 1) behavioural/cultural 2) material and neo-material and 3) psychosocial explanations.

Behavioural explanations

Behavioural/cultural explanations focus on the negative impact of unhealthy behaviours such as sedentary lifestyles, having an unhealthy weight, unhealthy eating habits and smoking on a variety of health outcomes. It suggests that health inequalities (or weight differences) are caused by social differences in health-related behaviours (Stronks et al., 1996). This approach explains social differences in health-related behaviours in two major routes. First, it points out that differences in health-related behaviours are the outcome of individuals' irrational actions, unhealthy choices and lack of self-control (Fuchs, 1974; Warwick-Booth, Cross and Lowcock, 2012; Busfield, 2000). Consequently, individuals are viewed as primarily responsible for their own health in this context (Hubley and Copeman, 2008; Teixeira, Patrick and Mata, 2011).

Some commentators have further developed the concept of behavioural explanations and argued that health-related behaviours choices are influenced by culture, socioeconomic position and physical environmental conditions (Tones, 1986; Pill, Peters and Robling, 1995; Marmot, 1999; Kawachi, Subramanian and Almeida-Filho, 2002; Graham & Power, 2004; Lahelma et al., 2004). Hence, health related behaviours consequently mediate the associations between people's social conditions and health inequalities or weight inequalities (Borodulin et al., 2012). For example, culture determines whether fatter or thinner body shapes are perceived as attractive, high status or ideal size. A larger body size is perceived as attractive in some countries, including Senegal, Middle East and Pacific Island (Rguibi and Belahsen, 2006; Holdsworth et al., 2004). Contrasting this perception, thinner body shape is recognised as a sign of beauty for women in some western countries (Pollock, 1995). These perceptions then, in turn, potentially influence health beliefs, eating behaviour and exercise, hence health outcomes (Kanter and Caballero, 2012; Giddens, 2009; Rguibi and Belahsen, 2006; Jutel, 2006).

Research has shown that apart from the misperceptions concerning larger body size, food plays important roles in influencing the distribution of weight, in particular in the Pacific Islanders' social events (Yates, Edman and Aruguete, 2004). They perceive that those who eat small portions in social gatherings are ill, unsociable or have bad genetic composition (Becker, 1995). This cultural influence possibly explains weight differences between Pacific Islander women and Australian women (Wilkinson, Ben-Tovim and Walker, 1994). In common with the Pacific Islander women, Black women in the U.S. also prefer a larger body size (Allan et al., 1993; Celio et al., 2002). The preference for a larger body size indirectly shields them from developing eating disorders, but increases their likelihood of being overweight (Striegel-Moore et al. 2003; Flynn & Fitzgibbon, 1998).

As with perceptions regarding body size, eating habits and attitudes to food, culture also determines attitudes to leisure time physical activity, which, in turn, may potentially influence women's weight. The Jordanian culture, for example, does not favour women's participation in physical activity and sports in outdoor spaces and this may contribute to the relatively high mean BMI of women in Jordan (Hourani, Naffa and Fardous, 2011).

The notion that health-related behaviours alone mediate the associations between social conditions and a variety of health outcomes has, however, been widely challenged. It has been noted that the contribution of unhealthy health-related behaviours to the systematic variations in heath is much smaller than the contribution arising from, for example, variations in income (Graham, 2010; Scambler and Scambler, 2007). Hence, behavioural change itself will not adequately reduce the surging of obesity epidemic (Mowafi et al., 2012).

Materialist and neo-materialist explanations

Materialist explanations for inequalities in health causally attribute health inequalities to differences in income, wealth and various aspects of the environment including housing, the work place and neighbourhood (DHSS, 1980). Neo-materialist explanations extend materialist explanations by incorporating the impact on health outcomes of materially deprived environments that are caused by underinvestment in health services and the physical and social infrastructure (Lynch, 2000).

There is increasing research examining weight variation by focusing on the built environment and individual material possession such as car ownership (Lovasi et al., 2009; Papas et al., 2007). For instance, non-car owners who live close to fast food outlets in Los Angeles Country are 12lb (or approximately 5kg) heavier than their counterparts who live in fast food outlets free area (Inagami et al., 2009). Another example related to this is women's BMI is found to be more susceptible to the higher number of small grocery and convenience stores which sell limited fresh and healthy food and closeness to fast food outlets than men (Wang et al., 2007; Block et al., 2011). However, similar research has not been conducted in Malaysia.

According to Marmot (2002), there are at least two routes through which material conditions such as income affect health (weight): (1) individuals' income; (2) the total wealth of a nation which is commonly captured by Gross National Income (GNI) per capita. At the individual level, the degree to which income influences people's health depends on purchasing power and public provision in health care and other amenities (Marmot, 2002). At the country level, Dinsa et al (2012) concluded that in countries with a national income of over US$1000 per capita, obesity was more common among poor women than rich women. Additionally, material ownership and income were shown to be relatively more prominent in positively influencing the weight of women than educational factors in low- and medium- development countries by McLaren (2007).

Psychosocial explanations

The material perspective is challenged by the psychosocial perspective in explaining health differences in two respects. First, Marmot reported that material factors account for one third of the mortality gradient in the UK (Marmot, 2004). This highlights that other explanations may contribute to the gradients in health that are observed in high-income countries. Marmot (2004) highlighted psychosocial factors as potential contributor to these health gradients. Second, the population health (e.g. life expectancy) does not always improve proportionally with an increase in a nation's total wealth as measured in terms of average national income. This is again particularly evident in high-income countries (Wilkinson, 1994 and1996). In this context, health is possibly influenced by the unequal distribution of income within society in a country, and is linked to psychosocial factors (Wilkinson, 1996).

The psychosocial perspective proposes that health inequalities are the result of negative psychological emotions such as stress experienced by people residing in an unequal society (Barry and Yuill, 2008; Marmot and Wilkinson, 2001). It proposes that psychological emotion impairs health through two core routes: (1) directly through mind and body; (2) indirectly through unhealthy behaviours (Elstad, 1998). The psychosocial perspective focuses on differences in psychosocial factors that are linked to different people's perceptions regarding material conditions, standard of living or social position in society. These perceptions may cause individuals in disadvantaged positions to feel worse off than others in advantaged positions. These feelings, in turn, transform into various forms of unhealthy emotions such as stress, anger and fear or increase the risk of adopting unhealthy coping behaviour such as smoking and over eating which indirectly harm health (Wilkinson, 1996; Graham, 2000; Marmot, 2006).

Differences in other psychosocial factors which include the size and quality of social networks and level of trust held between people in a society have also been linked to health inequalities (Egan et al., 2008). Poor social networks and trust limit one's social support, exposing people to more negative circumstances and hence inducing negative psychological effects and damaging health (Putnam, 1995; Fukuyama, 1997; Bourdieu, 1986; Portes,1998). Findings by a study in Southern Sweden supports this proposal by demonstrating that young women (aged 18 to 34) with low emotional support were more likely to be underweight or overweight/obese (Ali and Lindstrom, 2005).

Other important psychosocial factors that influence health outcomes and contribute to health inequalities are low control at work- and within a familial context and family-environment (Marmot, 1999; Chandola et al., 2004). It is believed that people with high 'control' or more authority are more likely to gain better health. It protects them from frequent exposure to stressful events or lessens the stressful condition (Elstad, 1998). However, one's authority level or capability of self-control depends on social environment and one's social position. The Whitehall study findings support this assertion by highlighting that low control at home drives the risk of developing coronary heart disease to a greater extent in women than in men (Marmot, 2004; Bosma et al., 1997).

In summary, psychosocial determinants inter-relate with material and behavioural determinants in influencing health inequalities. Systematic social variation in health is purported to be related to absolute and relative income. In other words, income is more than a marker of absolute poverty (Marmot, 2002). It is also a proxy of relative poverty, capturing other social dimensions such as social trust and social participation and its conceptualisation varies by culture and standard of living (Carpenter and Dolan, 2001; Giddens, 2009). People who are in socio-economic disadvantaged positions often lack the capacity to buy things and perceive their social participation is limited in relation to those in advantaged positions (Sen, 1992; Bartley, 2012). This subsequently limits their networking and social support, increasing the risk of adopting unhealthy coping behaviours, eventually exposing them to adverse health conditions relatively more often compared with those in advantaged positions (Graham, 2000).

Conclusion

Of these competing standpoints, the social perspective comprises the framework of social determinants of health that is considered the most appropriate framework to be adopted in my research for two reasons.

First, unlike the conventional biomedical and psychological perspectives which tend to hold more individualistic stance, the social perspective interprets determinants of health (weight) in a wider perspective (Daykin and Jones, 2008; Stephens, 2008; Earle, 2007). In the social perspective, it integrates determinants at personal level (e.g. genes, age, gender) with other determinants that present at non-personal levels such as environment circumstances, culture, education systems and social structure in explaining health and health inequalities. Such integration illustrates how health (weight) is influenced by a collective of social factors – beyond the physical body and mind (Warwick-Booth, Cross and Lowcock, 2012). Different accessibility and possession of social factors shape people's health (weight) at varying degrees and hence cause differences in people's health (weight) within a society (Warwick-Booth, Cross and Lowcock, 2012).

Second, I agree with social perspective that the notion of normal (ideal) health (weight) status has its social connotations, unrestricted to the concept of normality (e.g. greater or smaller than a norm) as stated in the biomedical perspective. The notion of ideal weight is possibly varied by women's household roles at home, their social position, experience, culture, time and places (Fletcher and Fletcher, 2005; Pollock, 1995; Bourdieu, 1978). For example, a larger body size is perceived as ideal among Nauruan, Middle-East and American Sunni Muslim women and their interpretations tend to be grounded in culture, motherhood and religion rather than based on BMI values (Odoms-Young, 2008; Rguibi and Belahsen, 2006; Pollock, 1995). Alternatively, ideal health (weight) status could be how individuals feel about their own health (body size) or individuals' perceptions which draw on comparisons made with others in a society without associating it with biomedical-based knowledge (Warwick-Booth, Cross and Lowcock, 2012).

2.2 Literature review on the first part of my research

This section evaluates the existing literature on socioeconomic-weight related determinants in Malaysia, upper-middle income countries, the UK and the US. Before commencing the search, concepts of ethnicity, BMI and its implication on health were sought and identified as below.

2.2.1 Key concepts

Ethnicity

The meaning of 'ethnicity' refers to the commonalities in origins, language, culture (i.e. eating and dressing) and traditions that are practiced through generations (Bhopal, 2014; Barry, 2008). In Malaysia, ethnicity is also linked to differences in rights and privileges, particularly in the ownership of land and properties, employment and education opportunities, as discussed in chapter one. Moreover, Article 160 of the Constitution of Malaysia under clause 2 has defined Malaysian Malay since 1957. According to this article, Malay refers to a person who practices Malay culture, speaks Malay language and is Muslim (Tew, 2011). Despite this act, ethnicity information is self-identified in surveys such as Malaysia National Health and Morbidity Survey.

Body weight and its measurement

Definition of BMI

The BMI is assessed by the ratio of body weight in kilograms to the square of height in metres (Keys et al., 1972). There are two classifications of BMI, namely the International BMI Classification and the Asian Public Health Action

Cut-off Points which were developed by the WHO. Table 2.1 shows the distribution of body size defined by different cut-off points of BMI. The standard classification for underweight is classified as a BMI less than 18.5 kg/m^2. Healthy weight is defined as BMI values ranging between 18.5 to 24.9 kg/m^2. Overweight is defined as BMI values ranging between 25.0 and 29.9 kg/m^2 while obesity is denoted by BMI values that are greater than 30.0 kg/m^2.

The Asian Public Health Action Cut-off Points of 23.0, 27.5, 32.5 and 37.5 kg/m^2, respectively are reported in Table 2.1 (WHO Expert Consultation, 2004). The Asian Public Health Action Cut-off Points were introduced following evidence that indicated people from the Asian communities commonly have higher percentages of body fat than white people with the same weight and height and, thus BMI, after adjusting for age and gender (Wang et al., 1994; Deurenberg, Yap and Staveren, 1998; Deurenberg-Yap and Deurenberg, 2003; WHO Expert Consultation, 2004).

Table 2.1:
Standard BMI Classification and Asian Public Health Action Cut-off Points

		International Classification (in kg/m^2)	Asian Public Health Action Cut-off Points (in kg/m^2)
Underweight		<18.5	
	Severe thinness	<16.0	
	Moderate thinness	16.0 - 16.9	
	Mild thinness	17.0 - 18.4	
Healthy range		18.5 - 24.9	23.0
Overweight		≥25.0	25.0
	Pre-obese	25.0-29.9	27.5
Obese		≥30.0	30.0
	Obese class I	30.0 – 34.9	32.5
	Obese class II	35.0 – 39.9	
	Obese class III	≥40.0	

(Source: WHO, 2013 on http://apps.who.int/bmi/index.jsp?introPage=intro_3.html)

Strengths and limitations of BMI

BMI, which contains the element of body weight in it, is one of the key terms in this study for three reasons. First, BMI is derived from objective measurements using simple equipment and is easily replicated. Second, the calculation of BMI is relatively straight forward. Third, BMI identifies people who are underweight, have a healthy weight, are overweight and are obese in population-based studies at low cost (Prentice and Jebb, 2001; Hu, 2008) whereas other related measures are unable to do this (e.g. waist circumference). Waist-Hip Ratio (WHR) was excluded from the analysis as this indicator of people's weight was not measured as part of the Third National Health and Morbidity in Malaysia Survey (2006) (IKU, 2008).

Interpreting BMI needs to be undertaken cautiously for four main reasons. First, BMI may be influenced by its denominator which is standing height (Garn, Leonard and Hawthorne, 1986). Concerns have been raised regarding the use of standing height (stature). These concerns focus on 1) how closely standing height reflects body composition and 2) whether standing height may be universally applied to both genders and all adult age groups (WHO Regional Office for Europe, 2011). Changes in standing height may be associated with age. That is, as people get older, their standing height commonly becomes shorted. Thus, the BMI of postmenopausal women, for example, tends to increase as a consequence of a decrease of lean mass, increase of total fat mass and a decrease in standing height as age increases (Wing et al., 1991; WHO, 1995; Panotopoulos et al., 1997). Additionally, the BMI of people who have short leg length arising from stunted growth may be difficult to interpret (Seidell and Flegal, 1997).

Second, it is not possible to assess a person's body fat (body fat and lean mass) from her/his BMI or how a person's fat tissue is distributed. Women commonly have a higher percentage of body fat compared with men with an equivalent BMI (Hu, 2008; Choo, 2002). Additionally, athletes, armed forces personnel and individuals who undertake more resistance exercises are likely to have a different body build than individuals who adopt sedentary lifestyle. The muscle mass of people who undertake this type of exercise is likely to be higher than the muscle mass of physically inactive people. Thus, even though people who undertake a lot of resistance exercise may have the same BMI as people who are physically inactive, they are likely to have less body fat than people who are physically inactive (WHO, 1995; Prentice and Jebb, 2001; WHO Expert Consultation, 2004).

Third, BMI does not fully reflect the body fatness of Black women whose fat mass is commonly lower than white or Hispanic women who have the same BMI (Fernandez et al., 2003; Rahman and Bereson 2010). Despite these limitations, Flegal et al. (2009), who drew upon the National Health and Nutrition Examination Survey (NHANES) data, reported a stronger correlation between percentage body fat and BMI than percentage body fat and waist circumference (WC) in women. The percentage body fat for women was measured using dual x-ray absorptiometry and the correlation between percentage body fat and BMI, ranged from 0.72 to 0.84 depending on the age group who were examined (Flegal et al., 2009). A similarly high correlation between BMI and body fat composition was observed by Romero-Corral et al. too (2008).

Unhealthy weight, health and social consequences

Underweight, overweight and obesity are linked to many adverse health outcomes including poorer maternal health, poorer quality of life, illness such as cardiovascular morbidity, physical disability and premature death (Gesink Law, Maclehose and Longnecker, 2007; Bolumar et al., 2000; Grodstein, Goldman and Cramer, 1994; Helgstrand and Andersen, 2005; Bhattacharya et al, 2007; McDonald, et al., 2010). Underweight, overweight and obesity affect people’s quality of life through a number of physical conditions including limited physical functioning, bodily pain and/or poor mental well-being all of which affect a person’s ability to live a full life (Doll et al., 2000; Wadden and Phelan, 2002;

Hassan et al., 2003; Kolotkin, Meter and Williams, 2001; see Appendix A for details).

Women's health in relation to pregnancy, child birth and effect on children
Underweight, overweight and obesity are linked to poor maternal health through five main routes. First, the likelihood of becoming pregnancy in a single menstrual cycle is lower for women who are overweight or obese than for women who have a healthy weight or are underweight (Gesink Law, Maclehose and Longnecker, 2007).

Second, pre-pregnant women who are underweight are more likely to miscarry and be infertile than women who have a healthy weight (Bolumar et al., 2000; Grodstein, Goldman and Cramer, 1994; Helgstrand and Andersen, 2005). Helgstrand and Andersen (2005), for example, reported that the hazard risk of miscarriage for pre-pregnant underweight women was about 1.24 higher than for women of healthy weight.

Third, mothers who are underweight are at increased risk of having both low pregnancy weight gain and a low birth weight infant (Spinillo et al., 1998; Kodama, 2010; Harita et al., 2012; Bhattacharya et al., 2007). According to a systematic review and meta-analyses conducted by Han et al. (2011), underweight women have a higher risk of delivering a low birth weight infant regardless of whether their country of residence is an industrialised country (relative risk =1.48) or an economically developing country (relative risk =1.52).

Fourth, women who are overweight or obese are more likely to have preterm infant birth (less than 32 weeks) (Bhattacharya et al, 2007; McDonald, et al., 2010). Preterm infant birth is associated with higher risk of infant death during the first year of life (Baeten, Bukusi and Lambe, 2001).

Fifth, women who are overweight or obese are at greater risk of having a caesarean delivery before 37 weeks. The need for a caesarian section arises through a number of associated complications including increased risk of gestational diabetes, high blood pressure and perinatal complications (Baeten, Bukusi and Lambe, 2001; Villamor and Cnattingius, 2006; Poobalan et al, 2009; Mamun et al, 2011). These adverse outcomes were also observed in a sample of 29303 women who lived in China and had a baby during the period 1995 to 2005 (Leung et al, 2008).

Studies show the intergenerational transmission of overweight or obesity from parents to children. Children who live with overweight or obese parents are associated with a greater risk of having a higher body weight in both economically developed and economically developing countries (Fuemmeler, et al., 2013; Bahreynian et al., 2017; Jaaskelainen, et al. 2011; Wan et al., 2015). For example, boys aged 6-18 whose parents were obese were 2.79 times more likely to be obese compared to children whose parents were in the healthy weight range in Iran. In England, Whitaker et al. (2010) found that children's BMI was stronger and statistically positively associated with their mother's weight status rather than their father's weight status, after considering mother's occupation, ethnicity, children's age and gender. In Sweden, the risk of childhood obesity was greater among children who had an overweight mother who also had a low or medium education attainment level rather than a high education attainment level (Moraeus et al., 2012).

Deterioration in quality of life

It has been widely documented that having an unhealthy weight negatively affects people's quality of life even before the onset of chronic disease through a number of physical conditions including limited physical functioning, bodily pain and/or poor mental well-being all of which affect a person's ability to live a full live (Doll et al., 2000; Wadden and Phelan, 2002; Hassan et al., 2003; Kolotkin, Meter and Williams, 2001; Kushner and Foster, 2000; Kim and

Kawachi, 2008; SoltØft, Hammer and Kragh, 2009; Ford et al., 2001; Larson, Karlsson and Sullivan, 2002; Ali and Lindstrom, 2006; Onyike et al., 2003). People who have an unhealthy weight may experience stigmatization which has its roots within the individual and/or with others. This also diminishes quality of life through a number of routes including increased reluctance to participate in physical activity (Wright and Whitehead, 1987; Puhl and Brownell, 2006; Kim and Kawachi, 2008; Friedman et al, 2005; Carr and Friedman, 2005).

The severity of the negative effect of unhealthy weight may vary according to gender. Some studies have found that greater BMI values have a greater negative effect on health-related quality of life among women than among men. Conversely, lower BMI values have a greater negative impact on men's health-related quality of life (Lean et al., 1999; SoltØft, Hammer and Kragh, 2009; Keddie, 2011). Deterioration in quality of life also varies by weight status (Doll et al. 2000; Heo et al., 2003; Ma and Xiao, 2011). For instance, Heo et al. (2003) found that the likelihood of having poor health for an underweight or an obese individual was respectively 1.57 and 1.95 higher than an ideal weight individual. Other factors such as illness and socioeconomic circumstances also influence the association between quality of life and BMI. Thus, for example young and middle-age severely obese women who had either low or high educational status been more likely to have depression if they also had illnesses such as asthma and diabetes (Ma and Xiao, 2011).

Morbidity

It is well established that underweight is associated to recurrent infectious diseases (Pryer, 1990; Shetty and James, 1994; Kennedy, Nantel and Shetty, 2006). Adults who are overweight or obese are more likely to experience non-infectious diseases such as cardiovascular disease, type 2 diabetes, dyslipidemia and osteoarthritis that may cause disability (Must et al., 1999; WHO Consultation on Obesity, 2000; Visscher and Seidell, 2001; Moore et al., 2010; Alley and Chang, 2007). According to Allender and Rayner (2007), diabetes and cardiovascular disease are the two major illness associated with obesity. Cancers account for one-tenth of obesity-related disease. Having a BMI that indicates a person is either overweight or obese raises the risk of developing certain cancers such as endometrial cancer and gallbladder cancer (Calle and Kaaks, 2004; Reeves et al, 2007; Renehan et al, 2008; Yang et al, 2012).

The relationships between BMIs and co-morbidities do, however, vary according to ethnicity. For example, Asian people have increased susceptibility to cardiovascular disease and type 2 diabetes at BMI values that are lower than 25.0 kg/m^2 (WHO Expert Consultation, 2004). Younger aged Asian populations are also more vulnerable to type 2 diabetes compared with white populations (Ramachandran, Ma and Snehalatha, 2010; Yoon et al., 2006).

Premature death

Both relatively low BMI and relatively high BMI values contribute towards premature death (Flegal et al, 2005). However, according to the World Health Organization (WHO), excess weight and obesity-related mortality is more pervasive than underweight. The prevalence of overweight or obesity accounts for the premature death of no less than 2.8 million adults every year (WHO, 2012). The major routes through which underweight-related premature deaths arise are through respiratory diseases and lung cancer. The major causes of premature death that arise as a consequence of being overweight and obese have been shown to be diabetes and cardiovascular disease (Allison et al., 1999; Flegal et al., 2007; Prospective Studies Collaboration, 2009).

2.2.2 Aim and search strategy

This section presents my literature review. It critically examined studies that were undertaken on women's weight status issues in upper-middle income countries with the per capita gross national income (GNI) spread from US$11,080 to US$25,880, as classified by the World Bank in 2019 (The World Bank, 2019). The World Bank per capita GNI classification is preferred over the classification of countries derived from the Human Development Index (HDI) because the former is more regularly updated than the latter in 2016 (UNDP, 2016).

As Malaysia is one of the upper-middle income countries that aims to become an economically developed nation in 2024 (The World Bank, 2019), I decided to include high-income countries in my literature search to further facilitate comparisons between Malaysia and other countries in relation to the social patterning of BMI. My search also included studies from India again to further facilitate comparisons; as Malaysian Indian, as indicated by their stated ethnicity, originate from India. My discussion on my literature review findings will be separated into high, upper-middle and low-income countries using GNI per capita (the Atlas Method) following the presence of different socioeconomic patterns of women’s weight for high-, mid- and low- income countries (Sobal and Stunkard 1989; Marteroll et al., 2000; Monteiro et al., 2004; Subramanian et al., 2011; Dinsa et al., 2012). These findings reinforce the need to organise the study countries in my review into high-, mid- and low- income countries in order to gain greater insights into the social patterning of BMI.

Search terms

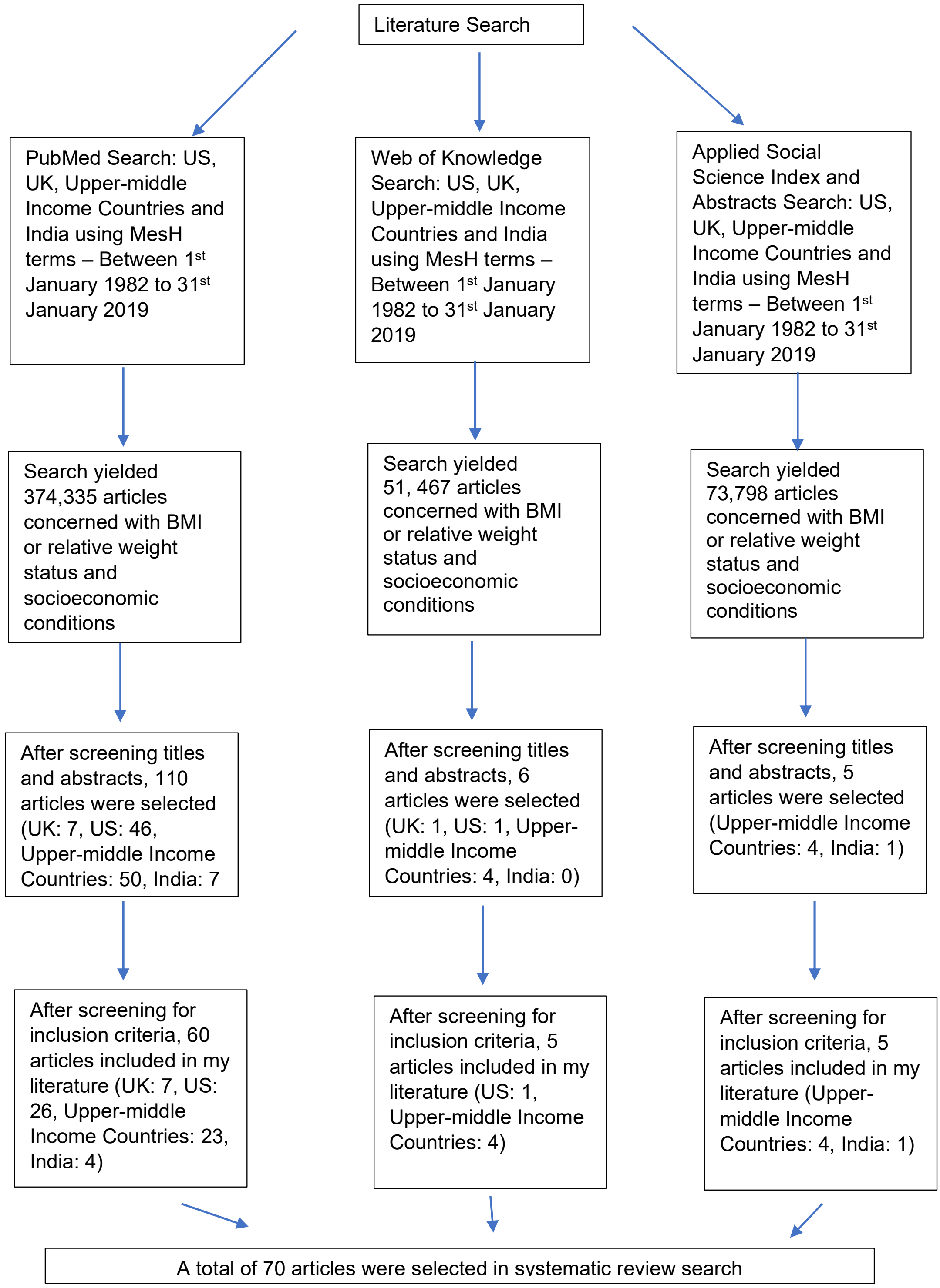
PubMed, Web of Knowledge and Applied Social Sciences Index and Abstract databases were used to in identify any relevant articles. These databases were selected because my proposed study includes a focus on public health as well as social science. PubMed is one of the key search databases as it holds more than 5400 journals. The advantage of Web of Knowledge and Applied Social Sciences Index and Abstract is that each of them is a multi-disciplinary online database (pubwash.lib.warwick.ac.uk, 2019). The search was also performed on references cited by main articles. The main search terms were BMI, Body Mass Index, body weight, body size, social class, educational status, ethnic groups and names of countries.

Inclusion criteria

To be included in the literature review, articles had to meet the following criteria. Articles showed the association between BMI or weight status or mean BMI with socioeconomic positions, using the WHO or Asian public health action cut-off points.

Articles published in English during the period between 1st January 1982 and 31st January 2019 using nationally representative cross-sectional survey or the first wave of a nationally representative longitudinal study that was conducted in a high- or, upper-middle income country or India. A total of 70 articles that met the inclusion criteria were identified and selected for my review (See Figure 2.1 for details).

Figure 2.1 Systematic review search strategy for association between socioeconomic status and relative weight or BMI or mean BMI in the US, the UK, Upper-middle income Countries and India, 1st January 1982 – 31st January 2019



2.3 The review findings for first part of research

Weight distribution varies greatly not only between and within countries, it also varies according to age, gender, and ethnic origin (Jones-Smith et al. (2011 and 2012); Finucane et al., 2011; http://www.who.int, 2012; Flegal et al., 2010; Flegal et al., 2012; Mendez, Monteiro and Popkin, 2005; Mascie-Taylor and Goto, 2007; Martorell et al., 2000). Hence, for example, on a global level the prevalence of obesity is generally more pronounced in women than in men (Kelly et al., 2008). However, the proportions of obese men and women are similar in high income countries (Mascie-Taylor and Goto, 2007). In low- and middle- income countries, obesity is more common among women (WHO, 2012). This section aims to provide a review of the associations between social position and relative weight specifically in the US and the UK, upper-middle income countries and India.

BMI and ethnicity

My review findings demonstrate the emergence of weight differences between and within ethnicity in the UK and the US. A US study of BMI among women from black and minority ethnic communities found that the prevalence of overweight/obesity was more pronounced among Hispanic Black, Native America and Mexican American women than among non-Hispanic White women. Meanwhile, Asian American women had the lowest prevalence of overweight /obesity (Denney et al., 2004; Wang and Beydoun, 2007, Barrington et al., 2010).

African American women, for example, had an average BMI that was 2.10 units higher than the average BMI for white women after adjusting age, education, income, marital status and physical activity (Robert and Reither, 2004). Differences in weight within Hispanic origin women aged 20 to 44 were examined by Vahratian (2009). According to her, non-Hispanic Black women were at the greatest risk of being overweight or obese, regardless of subscription of health insurance. In the UK, Indian and African Caribbean women were reported to be at greater risk of being overweight or obese than white women (Karlsen and Nazroo, 2010; Agyemang et al., 2011).

According to my review, only four studies have explored the associations between ethnicity and women's BMI or obesity in upper-middle income countries despite growing of interest in studying ethnic weight differences in the US and the UK. Three studies were conducted in Malaysia (Dunn, Tan and Nayga, 2012; Mariapun, Ng and Hairi, 2018; Chan et al., 2017) and one in South Africa (Puoane et al., 2002). Puoane et al. (2002) found that in South Africa, the BMIs of Indian and White women were 1.683 and 3.259 units lower than the BMIs of African women. Dunn, Tan and Nayga (2012) reported that Malaysian Malay women aged 18 to 65 were at greater risk of being obese than Malaysian Chinese.

BMI, age and ethnicity

My review indicates that the influence of age on BMI varies according to the age-strata of the study participants. Age is generally positively associated with BMI in studies that focused on women in the US and the UK (Lakdawalla and Philipson, 2002; Robert and Reither, 2004; Wang and Beydoun, 2007; Vahration, 2009; Guendelman et al., 2011; Wardle, Waller and Jarvis, 2002; Scarborough and Allender, 2008; Bruce et al., 2007, Xu and Wang, 2015). Guendelman et al. (2011) for example reported a one-year increase in age was associated with 0.1 unit increase in BMI of Mexican American women.

The relationships between age and BMI appear to vary after considering socioeconomic status, as shown in the study conducted by Zhang and Wang (2004a). They investigated the influence of age on the associations between socioeconomic status and BMI among men and women living in the US. They reported that socioeconomic status had the strongest association with obesity in women aged 40-49 (0.198). However, the strongest association between socioeconomic status and overweight occurred among women aged 30 to 39 (0.103) (Zhang and Wang, 2004a).

In upper-middle income countries such as China, Iran, Peru and Mexico, BMI is commonly cited as being positively related to age (Poterico et al., 2012). This increased risk of being overweight or obese with age has also been observed in Bostwana and Jordan (Letamo, 2011; Nsour, Kayyali and Naffa, 2013). Underweight is more prevalent in the youngest age group whereas the BMI is particularly high among people who are older than 40 years old (Bakhshi et al., 2008a; Janghorbani et al., 2007; Gomez et al., 2009; Reynolds et al., 2007; Letamo and Navaneetham, 2014). There was a significant change in the prevalence of obesity among Colombian women during the period 2005-2010, and this change was highest in the oldest group (Kasper et al., 2014).

BMI, marital status and ethnicity

With regards to the BMI-marital status association, it varies across ethnicity, types of relationships and residential areas in the US. For instance, Sobal, Hanson and Frongillo (2009) reported that married women were commonly at greater risk of being overweight than never married in the US. However, with exceptional case was found in White never married women's risk of being overweight was higher compared with married women of the same ethnic group. Moreover, White, Black and Hispanic women who were separated were identified to be more likely to have higher risk of overweight than married women. As for the influence of divorce on BMI, the risk of being overweight and obese increased in Black women but decreased in White women. Such risks were also lowest in White and Black women who lived with a partner, but not for Hispanic women.

By considering the impact of residential area on BMI which were not accounted for in the study of Sobal, Hanson and Frongillo's studies (2009), Lee et al. (2005) revealed that White and Black married women who resided in non-

Metropolitan areas had greater BMI than their unmarried counterparts in a similar geographical location. Opposite patterns were observed in Metropolitan areas where both Black and White married women who resided in these areas had a lower BMI compared to their unmarried counterparts. The negative relationship between marriage and BMI was also noted among both married African American (0.123) and married white women (0.719) by Bruce et al. (2007). Without considering the impact of residential area on BMI, their findings suggested that in the US, married African-American women and white women had lower BMIs than single women of their ethnic group.

Consistent with Sobal, Hanson and Frongillo's (2009) general finding about there being a higher risk of being overweight among married women than that of never married women, my review also shows that married women who live in upper-middle income countries appear to be at greater risk of being overweight. Additionally, they are more likely to be obese than never married women (Janghorbani et al., 2007; Janghorbani et al., 2008; Bakhshi et al., 2008a; Bakhshi et al., 2012; Navadeh et al., 2011; Beltaifa et al., 2008a&b; Letamo, 2011; Colchero and Sosa-Rubi, 2012). Aside from this, never married women who live in Iran, Tunisia and India are more likely to be underweight compared to other women (Janghorbani et al., 2007; Janghorbani et al., 2008; Bakhsi et al., 2008a; Wang et al., 2009).

In Brazil, women who had never been married had the lowest risk of being overweight or obese during the period 2006 and 2012. Differences in overweight and obesity between married and unmarried Brazilian women were also pronounced between 2006 and 2012. Married women were more likely to be overweight or obese in 2006. These observed trends changed in 2012 and during this period women who were separated or widowed had the highest risk of being overweight or obese (Quezada and Lozada-Tequeanes, 2015).

My review found that never married women tended to weigh less than their counterparts in these cross-sectional studies. The influence of being married and unmarried on weight is mixed for upper-middle income countries. Based on my review, only one of the selected studies linked marriage at an early age to the greatest risk of becoming overweight and obese and this occurred among Jordanian women (Nsour, Kayyali and Naffa, 2013). Although these studies have observed differences in the relationships between marital status among women in upper-middle income countries, none of them outline the possible underpinning mechanisms in detail. How marital status transitions (in-out of marriage) influence weight gain or weight loss throughout life course was not identified in these studies.

My review also found that Dunn, Tan and Nayga (2012) did not account for gender differences when they identified the association of BMI and marital status in their studies that were based in Malaysia. Chan et al. (2017) found married women had a greater overweight and obesity risk than never married women.

BMI, education and ethnicity

In high income countries (the US and the UK in my context), BMI is commonly negatively associated with educational attainment among women (Flegal, Harlan and Landis, 1988; Robert and Reither, 2004; Zhang and Wang, 2004b; Guendelman et al., 2011; El-Sayed, Scarborough and Galea, 2012; Devaux et al., 2011). For example, Leigh, Fries and Hubert (1992) provided confirmation of a negative association between BMI and educational level for White women during 1971-1975. Yun et al. (2006) drawing upon the Behavioural Risk Factor Surveillance System (BFRSS) also observed a negative association among non-Hispanic African American women in 1999-2000.

Although the above examinations offered evidence supporting the presence of a negative BMI-educational associations in the U.S., the negative association was not established for Black women during the 1971-1975 and 1997-2005 periods, nor among African American women in1986 (Leigh, Fries and Hubert, 1992; Bruce et al., 2007). An inverted ‘U’ shaped education-BMI association was observed among Black women by Leigh, Fries and Hubert (1992) during the period 1971-1975. Bruce et al., (2007) demonstrated that in 1986, the BMI of African-American women with 13 to 15 schooling years (2.04 kg/m^2) was lower than the BMI of women who had a college degree or higher (1.52 kg/m^2). Thus, the group that had reached the second highest educational level had the lowest risk of having increased BMI (Bruce et al., 2007).

In contrast to the findings of Bruce et al. (2007), Yun et al. (2006) found that obesity was most prevalent among Non-Hispanic Black and Non-Hispanic White women in the middle education group during the 1999-2000 year. In addition to this, Zhang and Wang (2004b) reported that the trend of weight differences between the most and least educated Black women in the U.S. had become weaker since 1988 and was not significant in 1999-2000. Ethnic education-related disparity in obesity between Non-Hispanic Whites and Black college-educated women became wider from 1971-1980 to 1999-2006 in the United States (Yu, 2011). Turning my attention to England, the prevalence of overweight rose significantly among lower educated women aged 18-75, when compared higher educated women during the period 1993-2008 (Howel et al., 2013). This increment was accompanied with a significant and widening of the education-related inequalities in obesity, across these two groups of women for the same period of time in England (Howel et al., 2013).

In relation to upper-middle income countries, a negative gradient was found between education and overweight in the studies that originated in Iran, Southeast Brazil, urban areas in Mexico, and Thailand (Janghorbani et al., 2007; Jitnarin et al., 2010; Monteiro, Conde and Popkin, 2001, Buttenheim et al, 2010). However, a negative gradient was only found for obesity class II for the period 1997-2004 in Thailand (Aekplakorn et al., 2007). In studies that were conducted in Mexico, Tunisia, and South Africa, obesity was most common among women in middle education groups (Gomez et al., 2009; Beltaïfa et al., 2008; Puoane et al., 2002).

A different association was found between obesity and education level in other studies that originated in upper-middle income countries. Eight studies conducted in Mexico, Tunisia, Iran, Thailand, Peru and South Africa found that the highest educated women had the lowest risk of being obese (Bakhsi et al., 2008b; Mohammad et al., 2009; Beltaïfa et al., 2008; Aekplakorn et al., 2007; Jitnarin et al., 2010; Colchero and Sosa-Rubi, 2012; Aitsi-Selmi et al., 2014, Ferrer et al., 2014). In contrast to these study findings, Turkish highly educated women were more prone to overweight than lower educated women (Ergin et al., 2011). When separating the 1988-2012 Mexican National Health and Nutrition Survey data according to urban and rural areas, primary educated or illiterate women of urban areas were most likely to be obese. Conversely, rural secondary educated women had the highest risk of being obese during the same period of time (Ferrer et al., 2014).

A positive education-related weight gradient was observed among women living in Bostwana: the greater the educational attainment level, the higher the chances of being overweight and obese (Letamo, 2011; Letamo and Navaneetham, 2014). The presence of a positive education-related BMI gradient was also observed among Indian women using the1998-1999 National Family Health Survey and a three-level linear model (Ackerson et al., 2008). This positive educational gradient remained in 2005-2006 (Sengupta et al., 2015). Neglecting the hierarchical data structure, Aitsi-Selmi et al. (2014) postulated that Indian women with secondary education and above were 2.23 times more likely than no/primary educated women of becoming obese.

In Malaysia, Chan et al. (2017) found that women without formal education had the lowest likelihood of being overweight and obese. In another study, Malaysian Malay women with post-secondary school qualifications and those without formal education had a lower BMI than women who had had a primary school education. However, among Malaysian Chinese women, those who attained secondary and tertiary education had lower BMIs compared to those with primary education and those without any formal education (Dunn, Tan and Nayga, 2012). The results emanating from these studies were subject to two limitations. First, the generalization of these results is challenging because the nested clustering nature of the data used in the analysis was not considered. Second, the weight-related pathways were not fully addressed by these studies.

Drawing from nationally representative cross-sectional data, my review suggests that a universal education-related-BMI or weight pattern is far from being universally established in upper-middle income countries. Only four studies from Iran, Brazil, Mexico and Thailand, respectively observed a negative education-related gradient for overweight (Janghorbani et al., 2007; Jitnarin et al., 2010; Monteiro, Conde and Popkin, 2001, Buttenheim et al, 2010). This result resembled the commonly observed relationships that are found in studies originating in the UK and the US. Other studies that were conducted in upper-middle income countries, however found a mixed education-related weight relationship for women.

BMI and place of residence

The location of where a person lives is one of the widely used contextual indicators in weight-related literature. Varying strengths and directions between BMI and place of residence have been reported in studies conducted in upper-middle income countries and India. Rural-urban differences in BMI were observed in Bostwana, Peru, Iran, Thailand, Malaysia, Colombia, Mexico and India (Letamo, 2011, Poterico et al., 2012; Kasper et al., 2014; Subramanian, Perkins and Khan, 2009; Subramanian and Smith, 2006; Ackerson et al., 2008; Ferrer et al., 2014; Dunn, Tan and Nayga, 2012; Aekplakorn et al., 2007;

Poterico et al., 2012; Bakshi et al., 2008a; Navadeh et al., 2011; Janghorbani et al., 2008).

For example, living in rural areas was reported to have weaker relation with overweight and obesity in Bostwana and Peru (Letamo, 2011, Poterico et al., 2012). Similarly, Iranian women who lived in rural communities were observed to have a lower risk of being overweight or obese but were at greater risk of being underweight than women who lived in urban communities (Janghorbani et al., 2008). In contrast, South African women living in rural areas had a much greater risk of being obese than urban women (Alaba and Chola, 2014) and more highly educated women in Mexico who lived in rural communities were also more likely to have a higher BMI (Fernald, 2007).

In two time point studies which analysed the associations between urban/rural living and women's' weight by adopting multilevel linear regression approach, a positive urban residence-BMI relation was found in Namibia between 1992-2007, after accounting for age, marital status, the overall wealth index, the amenities index and the household goods index. The opposite association was seen among female residents of urban areas in Kazakhstan. They experienced greater changes in BMI than their rural counterparts throughout 1995 -1999. This association shifted from 0.03 to 0.3 BMI units. With the same modelling technique, a more pronounced change in both direction and strength of association was found among Jordanian women between 1997 and 2007. In 1997, the mean BMI of female urbanites was recorded at 0.93 higher than the mean BMI of women living in rural areas. However, the direction and strength of this relationship changed in 2007. In 2007, the mean BMI of Jordanian women living in urban areas was 0.03 BMI units lower than the mean BMI of women living in rural areas. In India, the positive BMI-urbanicity association presented in 1998 and 2005, however the magnitude did not differ substantially between two point of times (0.63 in 1998; 0.68 in 2005) (Neuman et al., 2013).

Other study findings are consistent with those of Neuman et al. (2013) in relation to BMI of women living in India including Balarajan and Villamor (2009). They pointed out that overweight-obesity prevalence was greater among urban residents, after considering their socio-economic and life-style associated-factors. There was also evidence that focused on the influence of residential location (as measured by population density) on unhealthy weight in India. The prevalence of underweight varied across large city, small city, town and rural settings for Indian women in India. The higher the population density, the lower the risk of being underweight (Subramanian and Smith, 2006; Ackerson et al., 2008). In contrast, Indian women of urban areas in India were at greatest risk of having higher BMI (overweight and obesity) than those who resided in rural areas after considering the influence of age, caste, occupation, education, parity and diseases such as malaria and tuberculosis (Subramanian and Smith, 2006).

BMI and area-level education

Area-level education is another contextual BMI-related determinant that has been investigated in the previous studies. Area-level education was posited to affect women's weight for two reasons. Firstly, women spend more time with other women living in their residential areas than women who live outside of their residential area. Secondly, living in highly-educated areas could possibly be related to having greater access to better neighbourhood facilities, including health and sports facilities. Women who are more highly educated or who have a higher socioeconomic position tend to possess greater health-related knowledge, value thinness and engage in a healthy lifestyle (McLaren, 2007; Boing and Subramanian, 2015). Hence, there is a propensity for them to influence each other's weight.

My literature review did not identify associations between area-level education and women's BMI in upper-middle income countries that were based on nationally representative data. However, smaller scale investigations in Brazil and Egypt revealed a negative association between area-level education and

BMI or the risk of becoming obese. Lower education-level neighbourhoods were linked to higher BMI (Boing and Subramanian, 2015; Mowafi et al., 2011).

BMI, income inequality and ethnicity

Wider income inequality is associated with heavier body weight. These findings suggest that women who live in areas that have wider income inequality have limited access to appropriate health-related information and support. Using the 1986 Americans' Changing Lives (ACL) as their source of data, Robert and Reither (2004) found statistically non-significant positive relation for women's BMI and community level income inequality (as captured by the Gini coefficient at census tract level). Robert and Reither (2004) did not consider ethnic differences in BMI.

Studies that have taken women's ethnicities into account, reported that the greater the income inequality as measured by Gini coefficient, the lower BMI for White women who lived in metropolitan areas in the US. Similar pattern was observed among metropolitan Black women after adjusting for their household income, population density, age, education and region. Nevertheless, this negative association was weaker in Black women (-0.273) than in White women (-0.851) (Chang and Christakis, 2005). The high relative deprivation associated with wider income inequality may cause women to experience higher stress levels which, in turn negatively impact body weight (Chang and Christakis, 2005).

In contrast to Chang and Christakis (2005) who examined the income inequality-BMI relationship by concentrating only on metropolitan women in the United States, Fan, Wen and Kowaleski-Jones (2016) expanded their study to include the whole nation. Their findings were consistent with those of Chang and Christakis (2005) whereby the risk of being obese decreased with rising area-level income inequality and those of Chen and Crawford (2012) who examined the relationships between state-level income inequality in the US (state-level Gini Coefficient) and overweight/obesity.

My review indicates that while the number of studies that focus on the relationships between income inequality and obesity or BMI in the developed nations is growing, relatively few have been undertaken in upper-middle income countries. In India, wider state-income inequality as captured by Gini coefficient raised the likelihood of being underweight, overweight and obese (Subramanian, Kawachi and Smith, 2007). To my best knowledge, research examining the relationships between income inequality and women's BMI have not been examined in Malaysia.

Conclusion

My review has focused on the socioeconomic patterning of BMI for women in the US, UK, upper-middle income countries and India. In summary, mixed results are found concerning the associations between women's BMI and both compositional and contextual factors in upper-middle income countries. These study findings were obtained using different statistical methods that commonly did not adopt a multilevel modelling approach even though the predominantly cross-sectional nationally representative data that were used were hierarchical in nature. Additionally, social disparities in weight, especially educational disparity among women of differing ethnic groups in upper-middle income countries is still under researched. More importantly, explanations that focus on the mechanisms underpinning the associations between women's weight and the social and economic circumstances in which they live remain limited in upper-middle income countries.

Research on the BMI of women living in Malaysia is relatively sparse compared with research on the BMI of women living in high-income countries. In particular, research that focuses on inequalities in BMI among Malaysian women of childbearing age, across four main ethnic groups, after adjustment for indicators including the influence of residential areas, income inequality, and marital status has yet to be conducted. Moreover, studies on BMI among women living in Malaysia tend to adopt either a quantitative or qualitative perspective and emphasis on overweight and obesity (Azmi et al., 2009; Rampal et al., 2007; Tan et al., 2011a and 2011b; Ismail, 2002; Chang, Chang and Cheah, 2009; Tan, Yen and Feisul, 2011; Mariapun, Ng and Hairi, 2018).

My first part of research is restricted to the BMI of women of childbearing age (18-49 years) with the 1996, 2006, 2011 and 2015 nationwide health survey dataset. I have selected this sample for three reasons. First, although the world wide average age of women who experience menopause is 51 years, Malaysian women on average experience menopause at the age of 49.4 to 50.7 (Greendale, Lee and Arriola, 1999; Ismael, 1994). Menopause is associated with a change of body composition, weight gain and eventually a decrease in height, all of which influence women's BMI. Thus, by restricting my study to women age 49 or less, the effects associated with the menopause/post-menopause periods will be minimized (Hajikazemi et al., 2010; Panotopoulos et al., 1997; WHO, 1995; Wing et al., 1991).

The undertaking of this study is underpinned by the findings that women are at highest risk of putting on the most weight when they are 20 to 39 years old (William et al., 1994). Second, unhealthy body weight influences maternal and child health (Villamor and Cnattingius, 2006; Han et al., 2011). Third, to my knowledge, no previous research has been conducted that focuses on the association of socioeconomic status of childbearing age women and body weight status in Malaysia, explicitly considering the framework of social determinants of health.

2.4 Literature review for the second part of research

Women's perceptions of body weight, strategies for and barriers and facilitators to managing body weight

This section summarises previous studies, which have focused on women's lay definitions and perceptions of body weight, reasons for and ways of managing and monitoring weight, barriers to losing and maintaining weight and their associated strategies.

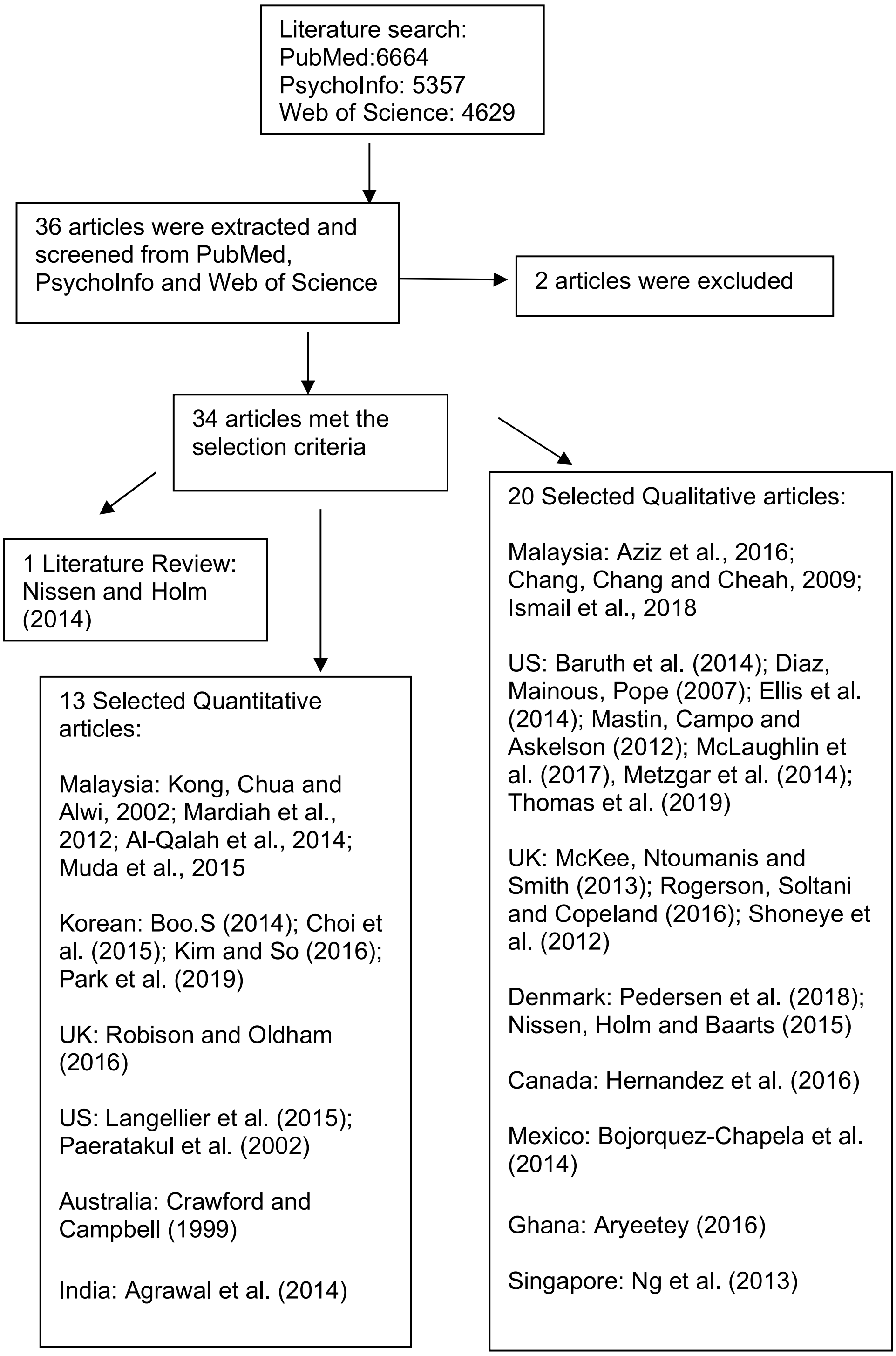
2.4.1 Search strategy

As stated in my methodology chapter, I used three electronic databases (PubMed, PsychoInfo and Web of Science) to search for papers reporting quantitative and qualitative studies pertaining to the meanings of weight status, weight perceptions, motivations for losing, gaining or maintaining weight, barriers and facilitators and strategies of weight management. Searches were conducted using the terms: weight loss, weight maintenance, weight gain, barriers, facilitators, strategies, overweight, normal weight. I restricted my search to non-pregnant women aged at least 18 years old, publishing between January 2000 to February 2019 in English language.

The following studies were excluded: (i) studies involved participants with health problems, students, and obese women (ii) Studies that focused on clinical interventions. The rationale for excluding these studies from my search was because their research questions, design and targeted samples were different to mine. Studies that did not segregate overweight and obese participants however, were included in my review. In total, there were 36 articles extracted from PubMed, PsychoInfo and Web of Science. Two were excluded from my review because the study participants were new mothers and information about body weight were not provided in their analysis.

As a result, 34 papers were included in the review. Of these, 13 papers described quantitative studies, 20 papers presented data from qualitative studies and one literature review. Only four quantitative papers (Kong, Chua and Alwi, 2002; Mardiah et al., 2012; Al-Qalah et al., 2014; Muda et al., 2015) and three qualitative papers (Aziz et al., 2016; Chang, Chang and Cheah, 2009; Ismail et al., 2018) presented data on women living in Malaysia. Of the quantitative papers, there were also four papers from Korea and two from the US, and one each from the UK, Australia and India. Of the papers presenting qualitative data, in addition to the three Malaysian papers, there were seven from the US, three from the UK, two from Denmark and one each from Ghana, Canada, Mexico and Singapore. A further paper reported on Malay women living in Singapore (see Figure 2.2).

Figure 2.2: Flowchart on articles selected for the second part of research



2.4.2 Lay definitions and perceptions of body weight

Of the studies reviewed, a number of qualitative and quantitative studies have reported on how women define healthy and unhealthy body weight and perceive their own body weight status. The qualitative studies provided data on women's perceptions and views about body weight in general and their own body weight. Of the three qualitative studies most pertinent to my study, that is, those reporting on women living in Malaysia, only two reported on women's perceptions of their own weight (Aziz et al., 2016; Chang et al., 2009).

Chang et al.'s study (2009) reported on the perceptions of overweight and obese women from indigenous ethnic groups in one Malaysian state only: rural Sarawak. The majority of women in these weight groups perceived themselves to be ugly and discussed feelings of shame about their body size. Some women reported finding it difficult to find clothing to fit and avoidance of some clothing styles. They also reported that their excess weight had physical impacts that made them less effective.

Aziz et al.'s qualitative study (2016) also focused on Malaysian women who had a BMI in the categories of overweight or obese. This study recruited Malaysian housewives (women staying at home for at least the previous 6 months) from Malay, Chinese and Indian ethnic groups. The majority of women in this study said they disliked their body size and described themselves using descriptors such as 'too fat' or 'too big' and reported gaining weight after they married or had children. This study did not report its findings by ethnic group. Bojorque-Chapela et al.'s study (2014) showed that some groups of women positively value 'thinness' and see it as a sign of beauty.

Only one quantitative paper has reported on Malaysian women's' self-perceptions of body weight. Muda et al.'s study (2015) was restricted to participants who were overweight or obese in rural households in one state (Kelantan). Two-thirds of participants considered themselves to be healthy although almost all intended to reduce their weight. Almost two thirds also described obesity positively, associating it with happiness, strength and affluence and thinness as a sign of unhappiness.

A number of qualitative papers have reported on females living in other countries and their perceptions of body weight. Several studies, like Muda's study, have also highlighted how being overweight is considered positively and more socially acceptable in some cultures and counties and by some ethnic groups (Aryeetey et al., 2016, Diaz 2007, Shoneye et al., 2012). For example, Aryeetey's study (2016) of women living in a suburb of Ghana's capital highlighted that being overweight was often viewed positively. Some weight gain was seen as expected by society and was associated with financial prosperity and being well cared for by a husband.

Shoneye et al.'s study (2012) also found that Black, but not White women, in the UK tended to view larger body sizes positively. Excessive overweight however, was perceived to be stigmatising and leading to poor self-image in a number of studies. Terms commonly used to describe unhealthy weight in medical/health circles and the research literature, such as obesity and overweight, in particular have been reported as unacceptable and offensive (Shoneye et al., 2012; Ellis et al., 2014).

A number of quantitative studies in countries other than Malaysia have also examined women's self-perception of their weight in relation to the objective BMI cuff offs set by health experts and health authorities (Agrawal et al., 2017; Crawford and Campbell, 1999). These studies indicate that women's self-perceptions of their own or ideal body weight were different from the cut-off points set by health experts/authorities. The only study (Kong et al., 2002) with quantitative data on Malaysian women identified that women both overestimated and underestimate their BMI: 41.0% of women had lower BMI than they perceived, 10.0% had a higher BMI than they perceived and 48.0% had an accurate perception of their own BMI. This study however, was carried out in shopping centres in urban areas using convenience sampling, thus the results are unlikely to be representative of the wider population of women in Malaysia.

Several quantitative studies have identified that overweight women are more likely than women of healthy/normal weight to misperceive their weight status, perceiving their weight to be ‘about right’ or ‘ideal’ (Robinson and Oldham 2016, Crawford and Campbell 1999, Paeratukal et al., 2001). Quantitative studies in Korea found younger women were more likely to overestimate their weight, with underestimation of body weight increasing with increased age (Kim and So, 2018, Park et al., 2019).

Age, marital status and ethnicity have been reported as factors associated with misperceptions of own body weight. In addition to the three Korean studies reported above, studies by Crawford and Campbell (1999) and Langellier et al., (2015) have also reported that underestimation of body weight increased as age increases. The role of marital status on women’s perceptions of body weight has been reported in several studies. Never married women in Korea (Boo, 2014; Park et al., 2019) and non-married women in the US (Langellier et al., 2015) have been reported as more likely to overestimate their weight than those who were married or living with a partner.

Few studies have examined ethnic differences in weight perceptions in relation to objective measures of BMI. Two quantitative studies from the US have reported ethnic differences with Black and Hispanic women (Langellier et al., 2015, Paeratukal et al., 2001) more likely to misperceive their weight (underestimate their weight) than other groups of women. In Malaysia, Kong, Chua and Alwi’s survey (2002) suggested that over-concern about weight was more common among Malaysian Chinese adults than among Malaysian Malay and Malaysian Indian adults. Despite being underweight, the Malaysian Chinese adults in this study commonly viewed themselves as being heavier than they actually were.

Socio-economic position has also been shown in some studies to be associated with self-perceptions of body weight. Secondary analyses of national survey data from Korea showed that lower socio-economic status was positively associated with underestimation of body weight among women when compared with measured BMI (Boo, 2014). Similar findings are reported in a study from India (Agarwal et al., 2017) and the US (Paeratakul et al., 2002). Although a small number of quantitative studies have examined socio-economic differences in perceptions of body weight, fewer have examined education as factor. Langellier et al. (2015) identified that women in higher educational attainment groups were more likely those in lower educational attainment groups to perceive themselves as overweight. Agarwal et al. (2017) showed that most illiterate Indian women perceived themselves had a normal weight.

2.4.3 Strategies for managing body weight

As my research included a small qualitative study exploring Malaysian Chinese women's perceptions of body weight and experiences of maintaining and managing this, it is important to review the literature on the strategy's women adopt for maintaining and managing their weight. According to the literature review undertaken by Nissen and Holm (2014), dieting was the most common weight control approach for overweight women and women with a healthy weight in the West. The least popular strategy that was adopted focused on physical activity.

The literature search identified on six studies (four quantitative and two qualitative) reporting on Malaysian women's strategies for managing weight. Kong, Chua and Alwi's (2002) survey data suggested that Malaysian women who lived around Kuala Lumpur commonly used both dieting and physical activity to lose or maintain their weight. As noted earlier, this study was carried out in shopping centres using convenience sampling therefore unlikely to have generated generalizable results.

Mardiah et al.'s cross sectional survey results (2012) focused on Malaysian female civil servants in Penang and found self-monitoring of diet was preferred. However, how these women monitored their diet in getting rid of unwanted weight was not discussed in this paper. Another cross-sectional survey also focused on Malaysian female civil servants but in Putrajaya, Kuala Lumpur (Al-Qalah et al.'s., 2014). The majority of participants were highly educated Malay women who had a healthy weight or were overweight and had at least one sustainable weight loss experience during the previous year. Almost half of the participants said they tried to lose weight by increasing their vegetables and fruits intake and also by reducing the size of their food portions. A slightly smaller proportion (42.5%) said they reduced consumption of fatty foods.

Aziz et al.'s (2016) and Ismail et al.'s (2018) qualitative studies both report on weight loss strategies. Aziz et al.'s study of 'housewives' (married/divorced/widowed/single women who were not working) highlighted that most participants had tried to lose weight, with cutting back on food intake, fasting, exercising and taking weight loss products identified as strategies for weight loss, although it wasn't clear how commonly used these strategies were. Ismail et al. (2018) found that overweight or obese female civil servants in Kota Bahru, in the state of Kelantan also most commonly attempted to lose weight through cutting back on food intake. Some female participants in this study said they dieted by stopping eating rice or by only having one meal per day. Undertaking physical activity, attending a private fitness centre (i.e. the use of steam machine) and consuming weight loss products were other weight loss strategies that are used. The results from this study, which focused on civil servants, are unlikely to be generalizable to the wider population.

This study and other studies carried out in Malaysia (Kong, Chua and Alwi, 2002), Al-Qalah et al., 2014) have highlighted that women also use diet products, including diet pills and attended weight loss programmes but the proportions reporting doing so were very small. For example, only a negligible proportion (1.7%) said they took pills and other types of slimming products to lose weight (Al-Qalah et al., 2014). Slimming pills were not viewed as an option for losing weight by some Singaporean Malay and Malaysian Malay women because they were considered to be expensive and it was unsustainable (Ng et al.,2013; Ismail et al., 2018). It also caused some side effects such as constipation, as pointed out by some Malaysian Malay women (Ismail et al., 2018).

None of the studies of Malaysian women examined whether different strategies are adopted by short-term and long-term weight loss maintainers although research elsewhere has shown the existence of differences between the two groups (Pedersen et al., 2018).

The literature review also identified a small number of relevant studies from other countries. Several qualitative studies reported on weight loss and weight maintenance strategies. Shoneye et al.'s (2011) UK studies explored attitudes and knowledge among Black and White women and noted that both groups had a high level of knowledge about weight loss strategies, including surgical procedures, medications and commercial weight loss products. It is not clear what strategies they commonly used.

Two other qualitative studies (Hernandez et al., 2016; Nissen, Holm and Baarts, 2015) focused on women with normal body weight or moderate overweight. These papers report how women in these studies perceive weight management as an ongoing process. Hernandez et al.'s US study of women with normal body weight reports that participants focused on themselves and their interests, and these took precedence over food. They tried to live a healthy lifestyle but had self-defined weight targets. They took action when their weight exceeded these, restricting snacks, sugary foods, keeping particular foods out of sight and sometimes not buying certain foods. Missing meals was reported as another way to manage weight in Nissen and Holm's literature review (2014)

In addition, two studies were identified that looked at different groups of women. Pedersen et al. (2018) examined differences between short-term and long-term weight loss maintainers. Short-term weight maintainers (maintained weight loss for 12 months without regaining weight) were described as having a 'weight loss' mind-set and had carried out detailed planning and avoided particular behaviours to maintain their weight. Long-term maintainers were able to be more flexible in terms of planning, habits and routines, and this in turn, helped them to maintain their weight in long-term. Reyes et al. (2012) explored differences between weight loss maintainers and regainers in the US. They reported that both groups shared some experiences, such as lapses but maintainers appeared to continue diet and exercise strategies, they used during their weight loss period whereas regainers found these more difficult to continue.

The Malay homemakers in Singapore preferred attending community-level weight management programmes. They were less comfortable with the clinical-based weight management programmes held in the hospitals because they were worried that participation in these programmes would result in them being stigmatised. In contrast, the weight management programmes held in the community enabled them to attend with friends, which prevented them from dropping out (Ng et al., 2013).

Eating mindfully was perceived as another strategy for losing or maintaining weight for some women in some countries. Being mindful about the presence and detaching from the failed past experience in losing weight could improve weight management (McKee et al.2013). This strategy increases women's awareness of the types and contents of food that they ate (Metzgar et al., 2014). Mindfulness additionally helped in making food decisions but practising mindfulness at all times appeared to be challenging (Rogerson, Soltani and Copeland, 2016).

2.4.4 Barriers and facilitators

There appear to be a wide array of barriers and facilitators to achieving and maintaining a desired body weight. However, previous studies appear to have focused more on weight loss and maintenance. My literature review suggested that social support from family and friends, cultural beliefs and attitudes of women and their families, internal factors such as motivation and perseverance, time, food planning, knowledge, social and economic circumstances may all acts as barriers and facilitators to weight management.

Of the studies carried out in Malaysia, only the two qualitative studies reported on facilitators and barriers to achieving and maintaining a desired body weight. Aziz et al.'s (2016) and Ismail et al.'s (2018) studies both identified social support and social networks as important. Social supports from varying stakeholders such as family members, friends, and colleagues were seen as essential in facilitating and promoting weight management, and assisting with initiating and continuing weight maintenance strategies and programmes. Family, friends and colleagues could also act as 'saboteurs' when they were discouraging (Ismail et al., 2018).

Studies beyond Malaysia have also identified how important family support and social networks are in facilitating and acting as barriers to gaining and maintaining a healthy weight. Singaporean Malay women stated that the influence of friends through the provision of various social supports such as calling each other and engaging in weight-related activities together reduced relapse, and facilitated weight loss (Ng et al., 2013). Some women recounted that they had been teased for having healthy food during mealtimes with their family or in other social settings (McLaughlin et al., 2016). Some had been provoked to discontinue their weight loss and others felt that their weight loss efforts were hindered by inadequate support from partner and friends (Metzgar et al., 2014; Baruth et al., 2014; Thomas et al., 2009). Some women stated they needed empathic supporters who had a close relationship with them and continuously encouraged them to lose weight (Thomas et al., 2009).

Several other studies have suggested that cultural beliefs and attitudes to body weight held by family members and friends can act as barriers. McLaughlin et al.'s study (2017) of US Mexican American women and Diaz et al.'s study (2007) of Latinos in the US have both highlighted how familial cultural acceptance of higher weights and family members' refusal to change to healthier diets could undermine women's attempts to reduce their weight.

Women in Malaysian studies have also identified self-motivation as a significant factor. Motivation often depended on support from family and friends (Aziz et al., 2016). Self-motivation has also been identified as a facilitator of weight loss and weight maintenance in studies in other countries (Baruth et al., 2014; Metzgar et al., 2014). Being able to renew motivation after diet violations could help weight loss (Metzgar et al., 2014). McKee, Ntoumanis and Smith (2013) suggested that goal regulation and self-control influenced weight maintenance, with the capability to integrate it as a permanent lifestyle change in daily life along with monitoring own weight and sensible dietary restrictions.

Having self-discipline in relation to eating and staying active has been cited by some women as vitally important in weight management. Singaporean Malay women and Malaysian Malay women had pointed this out (Ng et al., 2013; Aziz et al., 2016). Laziness was explicitly stated as one of the barriers in losing weight by one of the Malaysian Malay homemakers (Aziz et al., 2016). Malaysian women in Chang et al.'s study (2009) also identified lack of self-discipline in terms of not being able to resist eating, as a barrier. Nevertheless, self-discipline and staying active were affected by the nature of women's work and the weather (Welch et al., 2009).

Lack of time due to family circumstances and work have also been identified as a factor that can act as barrier to weight loss attempts by some Malaysian women. Women in Aziz et al.'s study (2016) discussed how looking after the house and children could act as time barriers, particularly when they didn't get support from anyone else. These family and household responsibilities also left women feeling too tired to take exercise as part of a weight loss or maintenance strategy.

Family circumstances have also been identified as barriers by women in other countries. Demanding family circumstances appeared to hinder socio-economically disadvantaged Australian women's ability to maintain their weight (Welch et al., 2009). Columbian women and Singaporean Malay women have also identified how a variety of responsibilities at home resulted in them having inadequate energy and time for exercising, which negatively influenced their weight (Baruth et al., 2014, Ng et al., 2013). Women's commitments to others, and the prioritisation of other family members (i.e. children) has been reported as resulting in women subsequently neglecting themselves and impeded their efforts to lose weight (Metzgar et al., 2014; McLaughlin et al., 2016; Bojorquez-Chapela et al., 2014; Mastin, Campo and Askelson, 2012). Other domestic commitments such as nursing the elderly and sick partners also hindered weight loss (Welch et al., 2009).

Welch et al. (2009) highlighted that, for Australian women, motherhood could facilitate the maintenance of a healthy weight among the least advantaged women who lived in rural areas in Australia. These women agreed that childminding children below five years old indirectly helped them to maintain their weight in at least two ways. They engaged in physical activities in some way when taking a baby out for a walk. Breastfeeding also helped them to monitor their weight.

Some women stated that cooking diet and non-diet meals (or high-calorie and low-calorie food) for themselves and other family members was impossible and that as a consequence, impeded their weight loss effort (Thomas et al., 2009). Some studies have also highlighted how limited food choices at social and family gatherings can hinder women's weight loss or maintenance when they were served with an array of high-calorie and high-fat food (McLaughlin et al., 2016; Thomas et al., 2009). These women commonly gave into the pressure to eat such foods as they believed that refusing to eat the food was socially offensive (McLaughlin et al., 2016).

Food planning appeared to ease weight maintenance among Australian socio-economically disadvantaged healthy weight women (Welch et al., 2009). Some women in Britain also stated meals planning helped them to maintain weight successfully (McKee et al., 2013).

A number of previous studies have highlighted the role of economic circumstances in supporting and hindering weight loss and maintenance. Finances have been identified as barriers in a number of studies. Of the studies carried out in Malaysia, women identified managing finances as a barrier. They felt inclined to spend money on family members rather than themselves. Some believed that losing weight required spending money on weight loss products (Aziz et al., 2016).

Studies from other countries have also highlighted how women perceive limited finances to be a barrier to achieving healthy weight. Expensive gym membership along with limited family earnings were other barriers to affordable weight loss through increased exercise (Baruth et al., 2014; Ng et al., 2013; Bojorquez-Chapela et al., 2014). Financial issues were also an obstacle faced by overweight women in Michigan when attempting to lose weight (Mastin, Campo and Askelson, 2012). These women stated that they could not afford healthy food and childcare, as well as gym membership in order to lose weight. Some traded off between price, quality of food and their body weight (Baruth et al., 2014).

Studies in Malaysia (Aziz et al., 2016; Ismail et al., 2018) and other countries (Shoneye et al., 2015; Baruth et al., 2014; Mastin, Campo and Askelson, 2012) have identified lack of knowledge about nutrition and exercise as hampering some women's attempts to eat and cook healthily and exercise. For example, some women recollected how misleading information portrayed by the media on healthy food confused them when making their food choices in England (Shoneye et al., 2015). Aziz et al. (2016) and Ismail et al (2018) have reported on how Malaysian women may have poor knowledge relating to particular foods including rice, a staple of their diet.

Some women felt exercising regularly was a single strategy that helped them to lose and maintain weight (Metzgar et al., 2014; Rogerson, Soltani and Copeland, 2016). Some revealed that exercises offered them at least two benefits. First, exercise increased their dietary compliance because non-compliance would have been interpreted as wasting the time that had been allocated for doing exercise. Second, it also promoted positive emotions, and helped women to counter negative emotions that arose from their weight loss journey.

A few women stated that weight loss and maintenance required a combination strategy of exercise and dietary control (Metzgar et al., 2014; Diaz, Mainous and Pope, 2007). A similar view was expressed by a Malaysian Malay woman (Aziz et al., 2016). Irregular exercise was a barrier for African American women trying to lose weight (Mastin, Campo and Askelson, 2012).

In addition to social support, environmental conditions surrounding women's living areas such as the weather, safety issues, dogs and traffic conditions negatively affected women's participation in exercise (Baruth et al., 2014). These external factors have been identified as acting as facilitators and barriers in studies of Malaysian women including feeling safe to exercise outside (Aziz et al., 2016) and time pressures due to family life (Aziz et al, 2016; Ismail et al., 2018).

Structural support such as unavailability of childcare services was noted as a barrier for engaging in physical activities, which in turn affected how women could manage their weight more effectively (Welch et al., 2009). Other studies reported that the availability of time and whether the physical activity itself was pleasurable influenced women's ability to stay active (Baruth et al., 2014; Welch et al., 2009; Aziz et al., 2016). In Malaysia, watching television was preferred to exercise (Aziz et al., 2016). Some preferred to have time for themselves (Welch et al., 2009).

Limitations in physical health have been identified as barriers by some women. Tiredness has been cited as a barrier to exercising in Malaysia (Ismail et al., 2018; Aziz et al., 2016; Chang, Chang, Cheah, 2009). Slow metabolism was pointed out as a reason for not losing weight (Mastin, Campo and Askelson, 2012). The fitness of the physical body (such as knee pain) to perform exercise is another obstacle that has been cited by a few women in Malaysia and in some countries such as the US (Baruth et al., 2014; Ismail et al., 2018).

In conclusion, the literature review provided in section 2.3 found a small number of research (four quantitative and two qualitative) studies explored weight-related perceptions, barriers and facilitators and weight management strategies in Malaysia. These studies focused on overweight and obese women who were civil servants, low income women, Malaysian Malay and Other Indigenous Minority Groups, housewives in the state of Kelantan, Sarawak, Federal

Territory of Kuala Lumpur and Putrajaya, Penang and Selangor. They are subject to some methodological drawbacks. For example, information about how the sample size of the focus groups was determined was not provided (Muda et al. 2015, Chang, Chang and Cheah, 2009).

Moreover, of the seven articles that focused on healthy weight or slightly overweight women, none drew on Malaysian Chinese women. Therefore, little is known about weight perceptions among Malaysian Chinese women and why they practise certain weight-related approaches despite them having the highest rate of underweight and healthy weight according to the National Health and Morbidity Surveys (1996-2015) (unpublished data from IKU, Malaysia, 2019). Considering the gap in existing literature, I have undertaken sequential mixed methods research and the next chapter details my research methodology.

Chapter 3
Methodology and methods

In chapter two, a review of the literature regarding social variations in body weight amongst women in the USA, UK, upper-middle income countries and India was presented. It was proposed that a consideration of the variation in body weight across ethnic groups was rare. Compared with the UK and the US there is a dearth of literature that focuses on how women in developing countries such as Malaysia manage their weight.

I have attempted to examine how multiple factors may influence the body weight of Malaysian women of childbearing age using sequential mixed methods, drawing on the framework of social determinants of health. This chapter outlines how I attempted to answer my research questions. It has four sections. In the first section, I outline the rationale for choosing my methodology and methods. In section two, I discuss my research design. For the final two sections, I explain how I undertook my research and data analyses.

3.1 The rationale underpinning my chosen methodology

This section introduces the methodological approach that I adopted for my research. In this section, I discuss the theoretical assumptions underpinning my research, both ontological and epistemological. Understanding these assumptions guided me when framing my research questions, and when choosing my research design and research methods, in order to enable me to answer my research questions (Green and Thorogood, 2010).

Ontology is concerned with what exists and social ontology focuses on what kind of social world exists; i.e. the nature of social reality (Bryman 2012). Epistemology is the study of knowing and how we make sense of the world in which we live, which also encompasses notions of what knowledge may be considered to be valid. For example, a positivist approach assumes that the social world can be examined in the same way that the natural world can be examined through experiments and hypothesis testing. When a positivist approach is adopted the knowledge that is generated is assumed to be objective and value free (Bryman, 2016). In contrast, an interpretivist approach focuses on the social construction of knowledge and how people make sense of their social world and how this making sense of the world may change depending on the social context. When this type of approach is adopted the notion that inquiry may be value-free and objective is rejected, it is also reasoned that the generated knowledge is socially produced and reproduced between the researcher and the participants throughout the research process (Broom and Willis, 2007). The generated knowledge is consequently driven by people's interpretations (Green and Thorogood, 2010), is dynamic and has subjective elements that are underpinned by multiple truths.

To understand the social reality pertaining to socioeconomic variation in body weight among Malaysian women aged 18-49 years old, I adopted both a positivist and an interpretivist approach. Although these approaches may appear to have differing features, it is possible to adopt both paradigms at the same time. Such integration is vital and stressed by Lin:

'..without establishing a causal relationship, one does not know which factors should be addressed by policy; without establishing the mechanism, one will not understand how to address those factors….the combination of positivist and interpretivist approaches in policies studies thus provides both the causal "what" and the causal "how" – something neither approach can provide alone…' (p.165 and p.168)

Having reasoned that integrating positivist and interpretivist approaches is plausible for my research, the following section discusses how these approaches interweave with the choice of my research methodology and research methods.

3.2 Research design: sequential mixed methods

To address my research aims and identified research questions relating to weight issues among Malaysian women of childbearing-aged, I proposed a mixed methods research design. It combines quantitative and qualitative strategies within a single research project (Bryman, 2012; Creswell & Plano Clark, 2007). This type of research design is termed multi-methods (Brannen, 1992), multi-strategy (Bryman, 2004) or mixed methodology research (Tashakkori and Teddlie, 1998). Of these, mixed methods is the most commonly used term (Bryman, 2012).

Among the varying types of mixed methods research designs, I have chosen a sequential mixed methods research design for two reasons. First, it has the capacity to provide a fuller explanation of the factors that may influence the body weight of Malaysian women of childbearing age (Curry, Nembhard and Bradley, 2009; Morse, 1991; Patton, 1990; Bryman, 2006). A fuller account can be established in two stages. In the first stage, various patterns of weight and drivers of unhealthy weight among women of childbearing age was identified using quantitative data analysis. In the second stage, additional explanations for the social patterning of BMI was provided by accessing women's lived experience of body weight issues, using qualitative interviews. Thus, the sequential mixed methods design provides diverse views by integrating data from both a quantitative and qualitative perspective. Second, adding a qualitative dimension addressed some of the methodological shortcomings of previous studies that took place in Malaysia, which have been predominantly quantitative in design.

According to Bryman (2012), quantitative research is a research strategy that comprises three common key features. First, it is commonly linked to the use of a deductive approach. The use of a deductive approach in research involves the specification of the theory and generation of a set of hypotheses from a predetermined theory. The predetermined theory functions as an input into the research and guides data collection and theory-testing (Bryman, 2012). The process of deductive research commonly appears to occur in a linear sequence, connecting each main step with another. However, this may not always be the case. A departure from this sequence may occur when the relevance of the predetermined theory is found to be negligible upon the completion of data analysis.

Although a quantitative research strategy is widely linked to a deductive approach it may also adopt an inductive approach. This occurs when the findings add value to the existing pool of knowledge and theories (Bryman, 2012). For my research, the ‘social determinants of health’ was chosen as the theoretical framework, acting as an input for guiding the formulation of the research questions, driving the data collection and theory-testing.

The second general feature of quantitative research is it usually involves practices that are linked to the natural sciences, which adopt epistemological and ontological positions for understanding social phenomena that are associated with a positivistic paradigm. Thus, quantitative research approaches tend to involve the use of different types of measurements in order to examine associations of cause and effect and patterns of prevalence and (Naidoo and Wills, 2008). Underpinned by the first and second features, I examined how socio-economic factors are associated with the BMI, of women of childbearing-age using the framework of social determinants of health.

The third common feature of a quantitative strategy is grounded in the positivist ontological assumption that social reality is ‘out there’, i.e. it can be accessed using appropriate research methods (Creswell, 2007; Crossan, 2003). Thus, claims are commonly made that phenomena are measurable and observable in an objective way (Green and Thorogood, 2010). Measurement bias, participant selection bias and the interaction between the researcher and the researched consequently need to be kept to a minimum in quantitative-positivist research.

The knowledge that is produced through the adoption of a quantitative process of enquiry is commonly assumed to be valid, objective, free from values such as subjective feelings; and hence is generalisable and recognisable as a truth (Bryman, 2012).

The ontological notion of objectivity in producing value-free research has been contested however. Commentators argue that participants' subjective experiences, perceptions/interpretations and feelings are crucial for understanding human experience (Green and Thorogood, 2010). Additionally, the application of practices from the natural sciences to the social world neglects the distinctions between the social and the natural worlds (Smith, 1998; Crossan, 2003). For example, public health related surveys, which apply the practices of natural science, commonly include fixed-choice answers that are predominantly predetermined by researchers. Participants' varying interpretations of the questions set by researchers have often been neglected. Hence, respondents' answers may neither fully reflect their stance nor connect to the specific context of their daily lives (Cicourel, 1964; Bryman, 2012).

Additionally, although research may identify associations between certain factors such as SES indicators and various health outcomes particularly in high-income countries, factors such as SES indicators alone do not fully capture the role of culture in society which may also influence health outcomes such as body weight (Ulijaszek, 2012).

Although the limitations described above apply to my public health related surveys (see methods section), I chose a quantitative methodology as part of my research design because this enabled me to describe patterns of women's BMI, specifically how these patterns vary amongst four ethnic groups. This approach can be described as reductionist as it reduces the complexity of a situation to a set of factors. However, it also facilitated the identification of weight differences (or weight inequalities) of women between and within the four ethnic groups. Additionally, it allowed me to estimate the associations between key socio-economic factors and women's BMI at the national level, and offered a national picture of the prevalence of unhealthy weight in Malaysia (Sweet and Grace-Martin, 2010). The strength and direction of the influence of each socio-economic factor on the BMI of women from each ethnic group could also be identified. The identification of disadvantaged groups would allow me to contribute to the development of future healthy weight policies and strategies (Harper et al., 2010).

Qualitative research also has its own set of general features and is often described as inductive, interpretive and constructive. In contrast to a deductive approach, an inductive approach is linked to research in which theory is generated from the collected data/observations. Thus, theory is the output of the research in this context. However, the association between theory and research that is incorporated within an inductive approach also leans towards tendencies rather than definiteness (Bryman, 2012).

In relation to an epistemological stance, qualitative research emphasises the interpretations of participants in order to understand social phenomena such as health and body weight issues within the context they occur. Ontologically, it holds that social phenomena and illness experiences are socially constructed between people rather than being 'out there' (Snape and Spencer, 2003). Knowledge that is produced through qualitative enquiry is consequently not considered to be value free, and instead contains multiple truths and is considered to be circumstantial and subjective. In this regard, it has been critiqued as more subjective relative to quantitative research (Bryman, 2012).

The features of an interpretivist approach, stated above, are congruent with a view that links individuals' health and illness experiences such as unhealthy body weight to wider dimensions (Wainwright and Forbes, 2000). This type of research seeks to link lay experience or knowledge with multiple determinants, including the psychosocial and material contexts, in which inequalities are embedded (Popay et al. 1998). It consequently facilitates the emergence of a detailed understanding of health inequalities between and within groups that is consistent with the framework of the social determinants of health (Popay et al., 1998; Putland, Bauman & Ziersch, 2011). An interpretivist approach which was adopted in the qualitative aspect of my research is consequently appropriate and is key to understanding Malaysian women's subjective experiences, perceptions and feelings in relation to their body weight. Specifically, this aspect of my research sought to explore how women's body weight is influenced by multiple factors in daily life.

In conclusion, the above discussion describes the general tendencies regarding the nature of quantitative and qualitative strategies. This discussion did not aim to polarise quantitative and qualitative research strategies and badge the approaches as very distinctive because there are clear similarities between them (Hardy and Bryman, 2004). These similarities include the intention of both strategies to explore variation between people and associated-factors. Numerical analysis such as frequency is also utilised by both strategies (Silverman, 1984 and 1985).

Furthermore, not all key features in either the quantitative or qualitative research strategies are reflected within an individual study. A piece of research that employs a qualitative research strategy does not always have interpretivist features and does not always generate theory (Adler and Adler, 1987; Bryman, 2012). Equally, research that adopts a quantitative research strategy may contain interpretivist features (Brown and Harris, 1978). This indicates that quantitative and qualitative research strategies have some connections in terms of their epistemological and ontological stances, but these connections are not rigid (Bryman, 2012). Therefore, integrating quantitative and qualitative research strategies within a single research is plausible.

Process of conducting mixed methods research

The methodology section has been presented prior to the method section; i.e. it is structured in a way consistent with the view of Wilson (2002) who maintained that the research methodology offers the philosophical foundation for choosing the research methods. However, the link between philosophical assumptions underpinning the research methodology and the choice of research methods should not be considered rigid (Bryman, 2012).

In this section, I outline the two different interactive phases embedded in my sequential mixed methods research design. In the first phase, two secondary analyses of existing quantitative data sets were carried out. The second phase consisted of a qualitative component (Creswell and Clark, 2011). The research questions for the qualitative component were defined and generated from the results of the secondary analysis found in phase-I of my study. In other words, aspects of the qualitative design emerged after the quantitative analysis was completed. For example, the findings that emerged from my quantitative analysis were used to select the research participants for the qualitative arm of my study (Tashakkori and Teddlie, 1998; Creswell and Clark, 2011).

3.3 Details of phase 1 research process

The aim of my phase-I, quantitative secondary analyses was to identify the social patterning of BMI and weight categories among women aged 18 to 49 from four main ethnic groups namely Malaysian Malay, Malaysian Chinese, Malaysian Indian and Other Indigenous Minority Groups. Therefore, my phase-I research had two analyses with the use of: (a) random intercept three-level linear regression model and (b) single-level logistic regression model.

Identification of data sources

The data for the first phase of my analyses came from the nationally representative 1996, 2006, 2011 and 2015 Malaysia National Health and Morbidity Surveys (hereafter, NHMS). The surveys are repeated cross-sectional private households' surveys, which have been conducted by the Institute for Public Health, Malaysia, since 1986 on a ten-year basis. However, it changed to five-year basis after 2011 to provide timely information for policy making (NHMS 2015).

Each of these surveys obtained ethical approval from the Malaysian Medical and Research Ethics Committee, Ministry of Health Malaysia. They covered 18 health topics including nutrition, diabetes, physical activities, and smoking. Information was collected through structured questionnaire and/or clinical examination by trained nurses (IKU, 1996 and 2006). Participants' height and weight (except pregnant women), were measured using a SECA portable body meter and a Tanita digital lithium weighing scale during the interview. The measurements complied with the standard procedures set by the World Health Organization (WHO). Weight and height were measured with participants wearing light indoor clothing and in bare feet (IKU, 2006, Kee et al., 2008).

All surveys adopted a two-stage stratified random sampling design, drawing geographical area units and private households only from the 1995 and 2004 labour force survey sampling frame, respectively, the sampling frames for the 2010 Census and the 2014 sampling frame were provided by the Department of Statistics. These sampling frames were chosen because they were based on the most up to date information about the population (IKU, 2011 and 2015). At the first stage of the sampling procedure, area units within the corresponding state or federal territory were selected from the sampling frame. The private households who lived in a selected geographical area unit were randomly chosen at the second stage. Next, all members of a selected household who had lived there for at least two weeks were selected (IKU, 1996).

I chose Malaysia National Health and Morbidity Surveys over three other available health-related surveys that had been carried out in Malaysia (World Health Survey (2002), National Study on Cardiovascular Disease Risk Factor (2004), and My NCD Surveillance-1 (2005/2006), for three reasons. First, the chosen surveys were nationally representative surveys that contained large sub-samples of people belonging to the four main ethnic groups. Second, the chosen surveys used an updated sampling frame in their design. Third, compared with the other three main health-related surveys as mentioned above, Malaysia National Health and Morbidity Surveys yielded a very high response rate from the public, (IKU, 1996 and 2006; Rampal et al., 2008; Disease Control Division, 2006; Pampel, Denney, and Krueger, 2012). As a result, the 1996-2015 Malaysia National Health and Morbidity Surveys provided wider coverage of participants and areas, better quality data for my study and could facilitate comparisons across four main ethnic groups over four points in time. Table 3.1 compares the Malaysia National Health and Morbidity Surveys with the other available surveys (Rampal et al., 2008; IKU, 2008; Disease Control Division, 2006; Pampel, Denney and Krueger, 2012; IKU, 1996-2015).

Once I had identified the data source, I requested permission to use the 1996-2015 Malaysia National Health and Morbidity Surveys data sets from the Institute of Public Health (IKU) of the Malaysian Ministry of Health. My data request was restricted to women aged 18-49 only. The restriction was consistent with the aim of my research, which focused on women of childbearing age, ranging from 18 to 49 years old.

Two safety measures were adopted after permission to use the data sets was granted by Institute for Public Health (IKU), Malaysia: the creation of strong passwords and duplicated copies as backups. When the survey was carried out by IKU, participants were given an information sheet and consent form prior to the survey and their participation was completely voluntary (IKU, 1996, 2006, 2011 and 2015). While I was not there to observe the process, this suggests a process was in place to gain informed consent, although the processes themselves did not guarantee informed consent.

Ethical approval for the qualitative part of my study which focused on interviews with Malaysian Chinese women and the use of the 2006 Malaysia National Health and Morbidity Survey (NHMS) data set for my analyses was obtained from BSREC (Reference: REGO-2013-553, see Appendix A.2.2).

Approval to conduct the 1996, 2006, 2011 and 2015 National Health and Morbidity Surveys was granted by “the Malaysian Medical Research and Ethics Committee, Ministry of Health”, respectively (referenced in Noor Ani et al., 2018 pp.107; Fadhli et al., 2013 pp.26; Institute for Public Health, 2015 pp.282).

Approval to conduct my analyses using the 1996, 2006, 2011 and 2015 National Health and Morbidity Survey data sets was granted by the Ministry of Health, Malaysia on 26 November 2010 for the 2006 survey data set, on 15 November 2013 for the 1996 survey data set, on 11 October 2018 for the 2015 data set and on 25 November 2018 for the 2011 data set (see Appendix A.2.1, A.2.3 - A.2.5 for the correspondence, approval letter or the signed data use agreements). The 2011 and 2015 data sets were requested for additional analyses as my initial analyses based on the 1996 and 2006 data sets were undertaken before undertaking my qualitative investigations among Malaysian Chinese women and had identified interesting body weight trends that varied according to the ethnicity of the women who were recruited to these surveys.

Table 3.1 Comparisons of Seven Main Health Surveys in Malaysia

Summary of findings	World Health Survey (2002)	National Study on Cardiovascular Disease Risk Factor (2004)	My NCD Surveillance (2005/2006)	The 1996 National Health and Morbidity survey	The 2006 National Health and Morbidity survey	The 2011 National Health and Morbidity survey	The 2015 National Health and Morbidity survey
Types of survey	Cross sectional	Cross sectional	Cross sectional	Cross sectional	Cross sectional	Cross sectional	Cross sectional
Year of data collection	2002	2004	09/2005-02/2006	1996	2006	2011	2015
Valid measure (weight and height)	Self-reported	Measured	Measured	Measured	Measured	Measured	Measured
Definition of weight status	WHO	WHO	WHO	WHO	WHO	WHO	WHO
Total respondents	6038	18805	3040	59903 (all health related modules)	33465 (for all health related modules)	30806 (for all health related modules)	30548 (for all health related modules)
Eligible respondents	6038	16127	2572	33342 adults aged 18 and above answered nutritional module	33055 adults aged 18 and above answered nutritional module	28650 adults aged 18 and above answered nutritional module	29806 adults aged 18 and above answered nutritional module
Response rate	81.0%	85.8%	84.6%	86.9%	90.0%	88.2%	86.4%
Sampling frame	Designed by WHO	Derived by DoS	Used the 2000 National Household Sampling Frame	Used the 1995 Labour Force Survey Sampling Frame	Used the 2004 Labour Force Survey Sampling Frame	the National Population and Housing Census 2010	Update sampling frame from DoS
Sampling technique	Stratified multistage cluster sampling	Stratified two-stage cluster sampling	Stratified two-stage cluster sampling	Stratified two-stage cluster sampling	Stratified two-stage cluster sampling	Stratified two-stage cluster sampling	Stratified two-stage cluster sampling
Coverage	Institutions (hospital, nursing home, hospice and others) and private households	Private households in 13 states and Kuala Lumpur	Private households in 13 states and Kuala Lumpur	Private households in 13 states and Kuala Lumpur	Private households in 13 states, Kuala Lumpur and Labuan	Private households in 13 states, Kuala Lumpur and Labuan	Private households in 13 states, Kuala Lumpur and Labuan

Study population and sample size

The National Health and Morbidity Surveys had an overall response rate of 86.9% (1996), 90.0% (2006), 88.2% (2011) and 86.4% (2015). Various factors contributed to the lower response rates. These included (1) loss of completed questionnaires during shipment, which occurred in the states of Sabah and Sarawak; (2) demolished residences; and (3) safety threats in certain areas (IKU, 1996, 2006, 2011, 2015). The Malaysian NHMSs successfully interviewed the following participants (IKU, 1996, 2006, 2011 and 2015): 59,903 (1996); 56,710 (2006); 30,806 (2011) and 30,548 (2015).

Outcome variable of interest

My main outcome response for part (A) analysis which used the random intercept three-level linear regression model was continuous BMI. BMI was obtained by dividing body weight in kilograms by height in metres squared (WHO, 1995). In the 1996-2015 surveys, participants' height and weight were taken by trained nurses (IKU, 1996, 2006, 2011 and 2015). The measuring procedures complied with the standard procedures set by the World Health Organization (WHO). Weight and height were measured with participants wearing light indoor clothing and in bare feet (IKU, 1996, 2006, 2011 and 2015, Kee et al., 2008). Bedridden, physically impaired or pregnant women were excluded from the weight and height measurements (IKU, 1996).

I converted continuous BMI data into a five categorical variable based on WHO Asian Cut-Off Points: underweight, healthy weight, pre-overweight, overweight and obesity for the part (B) of my secondary analysis. The five weight categories were the outcome of part (B) analysis which used the single-level logistic regression model. These outcomes were: underweight (BMI<18.5 kg/m^2), healthy weight (18.5-22.9 kg/m^2), pre-overweight (23.0-24.9 kg/m^2), overweight (25.0-29.9 kg/m^2) and obesity (≥30.0 kg/m^2).

Independent variables of interest

This section describes the independent variables of interest. Selected independent variables for my statistical analyses of the data sets for women aged 18-49 years were age, marital status, educational background, place of residence, state-level proportion of women educated to tertiary level and state income inequality as measured by the Gini coefficient. In my analyses, the geographical area-level was used interchangeably with the enumeration-block level, as they carried the same meaning. I selected these variables to capture how socioeconomic circumstances measured at the individual, area- and state-level were linked to women's BMI, within a hierarchically structured society in Malaysia.

Age, marital status and educational attainment level were included in my analyses as three independent variables. These variables represented the individual-level social and economic conditions. The geographical area-level independent variable comprised the degree of urbanization of the geographical area in which each woman's residence was located. The income inequality measured by Gini coefficient and the proportion of women educated at the tertiary-level were two state-level independent variables I incorporated into my first secondary data analysis.

Variables that capture how socioeconomic circumstances measured at the individual-, area-, and state-level were linked to women's BMI, within a hierarchically structured society in Malaysia were selected from the data sets. The following section describes the selected independent variables:

Age: categorised in years as 18-25, 26-33, 34-41, 42-49 with 7-year intervals. The reference category was the 42-49 years age group.

Marital status - categorised as never married, married, and unmarried. The unmarried subcategory was created for women who reported they were divorcees, widows or separated. Married women were chosen as the reference category in my analyses.

Educational status - categorised as never attended any formal education; attended primary education only; attended secondary level education; attended tertiary education. Tertiary education was used as the reference category. This variable was selected as studies demonstrate that increased education is protective for women's Body Mass Index through varying mechanisms, including employment prospects, income, responsiveness to health information, accessibility to health service, and through protective health behaviours such as exercise and healthy diet (Devaux et al., 2011; Zimmerman, Woolf and Haley, 2014). Poor diet and a sedentary lifestyle are risk factors for a higher BMI among Finnish women of lower education and income (Borodulin et al., 2012). Moreover, education is relatively more reliable than income, as it captures women's socioeconomic position, empowerment level, controllability and it links to health behaviour and it is relatively more stable than income variable (Cohen et al., 2013).

Level of urbanization was classified according to the geographical location of a woman's residence within a given enumeration block (or the primary sample unit). Consistent with the Department of Statistics Malaysia, the 1996, 2006, 2011 and 2015 surveys defined a unit enumeration block as a geographical area that contained 80 to 120 private residences, which was equivalent to 600 residents (IKU, 2008). These enumeration blocks were grouped together according to the population density - metropolitan (75,000 population and above), large urban areas/cities (10,000 to 74,999 population), urban areas (1,000 to 9,999 population) and rural areas (less than 1,000 population) (IKU, 2008; Department of Statistics Malaysia, 2015). Level of urbanisation is a proxy variable for neighbourhood environment as it reflects the varying levels of urbanization, socio- and physical environment in which women lived.

Residential location is of importance to my analyses for two main reasons. First, disparities exist in Malaysia between rural and urban areas in relation to the proportion of tertiary educated women and average household income (Department of Statistics, 2015; Hassan and Rasiah, 2011). Second, the availability of resources and access to resources that may be important in maintaining a healthy weight vary across locations. Water and electricity supplies and road transportation are less readily available in the rural areas of Sarawak and Sabah compared with Peninsular Malaysia (EPU, 2006; Lee, 2011,). The number of sports facilities, food price and wages are generally lower in rural areas than in urban areas (Department of Statistics Malaysia, 2016; Barghchi, Omar and Aman, 2010; Asra, 1999).

Share of tertiary educated women at the state-level was identified by comparing the number of tertiary educated women residents to all women residents within a state or federal territory, measured as a percentage. I divided the proportion of tertiary educated women at the state-level into three groups – 0.0% (lowest), less than 20.0% (middle) and 20.0% or more (highest). Mowafi et al. (2011), Boing and Subramanian (2015) reasoned that women who resided in the lower education areas were more likely to have a higher BMI than woman who lived in higher education areas in Cairo and southern Brazil. However, this association has yet to be examined in Malaysia.

Income inequality – measured using the Gini Coefficient for each state and federal territory of Kuala Lumpur, Labuan and Putrajaya in Malaysia. I collapsed the state's Gini Index into three categories: high (0.430 and above), medium (0.408 to 0.429) and low (0.359 to 0.398). Along the scale, the zero Gini Coefficient value indicates everyone has the same level of earnings (De Maoi, 2007) and income is equally distributed among individuals of a given state or federal territory. In contrast, a Gini Coefficient value of one denotes the occurrence of the highest level of inequality in a state. Lower Gini Coefficient values reflect more equal income distribution within a state. Hence, the income disparities between the poor and the rich is relatively narrow compared to the income disparities that are observed in states with a higher value of Gini Coefficient (De Maoi, 2007).

To my knowledge, Gini Coefficient is the only income inequality-related indicator available at the state-level in Malaysia. Therefore, despite its shortcomings such as insensitivity to the top and bottom groups in the population, and fluid interpretation of income distribution for the same value of Gini Coefficient, I adopted it as it was the only state-level measure available (Subramanian and Kawachi, 2004, Wilkinson and Pickett, 2006). In Malaysia, the Gini Coefficient was not available for the Federal Territory of Labuan at these two time points. As Labuan was once under the governance of Sabah, her Gini Coefficient was used as the proxy for Labuan.

It has been hypothesised that wider income distribution differences harm health (Wilkinson, 1996, Pickett and Wilkinson, 2015). Volland (2012) found a positive association between state-level income inequality and BMI in the US. In India, the risk of having unhealthy weight rose with the state income inequality level (Subramanian, Kawachi and Smith, 2007; Pickett et. al., 2005). However, these studies did not stratify participants according to their ethnic origin.

Independent variables representing women's individual-level social and economic conditions were: age, marital status, educational attainment level was included in my analyses as three independent variables. In my analyses, the geographical area-level equated to the enumeration-block level. The area-level independent variable was urbanicity. The state-level independent variables I incorporated into my first secondary data analysis were the income inequality Gini coefficient and the proportion women educated at the tertiary-level.

I excluded the occupation variable from the first phase of my analyses because it was inadequately operationalised. A broad array of occupations described by survey participants had been constructed as managerial and administrative, professional and technical, clerical and related workers, sales and services, agricultural, fishery production, craft, operators and assembly workers, housewives, unemployed and still studying. However, none of these classifications explicitly reflected the hierarchical structure. The existing classification grouped all related workers solely on the basis of the nature of industry rather that the nature of the job within the industry. Hence, for example, the manager of a plantation and a rubber tapper were placed in the same occupation group even through their jobs and income are very different.

Household income has been cited as a determinant for BMI which influences possession of material resources and social participation (Marmot, 2002, Mariapun, Ng and Hairi, 2018). I decided to exclude it from my analysis although the average monthly household income information was available in my survey data. The rationale for excluding this information that approximately 40.0% of these data were missing in the 1996 survey and it would not have been possible to conduct multiple imputation for missing average monthly household income for three-level linear regression models when the missing case rate was so high.

Moreover, the definition of income takes various forms, it ranges from wages, allowance to yield of investment (OECD, 2016). However, the income variable in the surveyed data that I used was derived from a single question. Women were asked to specify their average household income without any supportive information on what constituted income. So, the question could be ambiguously constructed. Additionally, the average household income itself was less accurate in reflecting the material well-being condition because it did not take into account the number of economic dependents. Given the drawbacks of the construction of income variable in the surveys that I used, its measurement validity and reliability were questionable.

Differences in obesity could be influenced by ethnicities and religions, as suggested by Higgins (2017). Religion had been excluded from my secondary analysis because it was not available in 2006-2015 data sets. Furthermore, 99.9% of Malaysian Malay women in my analysis which drew on the 1996 Malaysia National Health and Morbidity Survey were Muslim. More than 80.0% of Malaysian Chinese women were Buddhist and Malaysian Indian women were Hindus (see Table 3.2).

Table 3.2 Distribution of Ethnicities and Religions for Malaysian Malay, Malaysian Chinese, Malaysian Indian and Other Indigenous Minority Ethnic Groups in 1996

	Ethnicity	Malay	Chinese	Indian	Other Indigenous People
Religion	Islam	6916 (99.9)	25 (1.1)	57 (5.1)	787 (49.4)
	Christian	4 (0.1)	306 (13.7)	108 (9.7)	674 (42.3)
	Buddhist	0 (0.0)	1837 (82.4)	25 (2.3)	21 (1.3)
	Hindu	0 (0.0)	9 (0.4)	902 (81.3)	1 (0.1)
	Others	0 (0.0)	53 (2.4)	18 (1.6)	109 (6.8)
	Total	6920 (100.0)	2230 (100.0)	1110 (100.0)	1592 (100.0)

(Source: unpublished data, extracted from the 1996 Malaysia National Health and Morbidity Survey. The first figure in each column represents the total number of women and its percentage (%) in parentheses)

Data screening and cleaning

After taking safety measures to protect the data, I began to extract the variables of interest from the 1996 survey data files, which comprised of the nutritional and exercise and demographic modules, and merged these two modules into a single dataset using an unique identifier for each person with Statistical Package for the Social Sciences Software (SPSS). The same procedure was undertaken for the 2006, 2011 and 2015 survey data files, which consisted of nutritional and demographic modules.

The focus of my research was BMI among non-pregnant healthy women aged 18 to 49 who belonged to the main ethnic groups (Malaysian Malay, Malaysian Chinese, Malaysian Indian and Other Indigenous Minority Ethnic Groups). After women who did not belong to the four ethnic groups of interest to this study were excluded (n=729 for the 1996 data set; n=785 for the 2006 data set), this yielded sample of 12,839 and 11,887 non-pregnant and physically healthy women aged 18 to 49 in 1996 and 2006 respectively. As for the 2011 and 2015 data sets, the sample did not have women who did not belonged to the four ethnic groups of interest. Therefore, 5,568 women and 6530 women were respectively retained in 2011 and 2015 data sets.

A further n= 686 and n=24 women were removed from my 1996 and 2006 samples for two reasons. First, these women appeared to have erroneous height (i.e. negative height values, less than 100cm) and or body weight (i.e. less than 20 kilograms) values. Second, some of them had implausible BMI values which fell below 12.00 kg/m^2 or over 70.00 kg/m^2 (Neuman et al., 2011) and it was not possible to cross check their height and body weight. Additionally, excluding these participants is consistent with the approach adopted by Lebel et al. (2014). Therefore, the final number of participants for my 1996 and 2006 analyses were respectively n=12,153 and n=11,863. The final number of participants for my 2011 and 2015 analyses were respectively n=5,568 and n=6,530 because the BMI values were within the acceptable range (12.77 kg/m^2 and 59.67 kg/m^2 for 2011; 12.72 kg/m^2 and 55.66 kg/m^2 for 2015). Figure 3.1 illustrates the process of deriving final samples for my statistical analyses.

Figure 3.1: Flowchart illustrating data cleaning process of the 1996 BMI and the 2006 BMI data

After merging the data files, the number of cases in the

- 1996: n=13,568
- 2006: n= 12,672

- 729 cases belonged to ethnic group other than the four main ethic groups in Malaysia were removed from the 1996 subsample.
- 785 cases were excluded from the 2006 subsample for the same reason.

Data sets contained Malaysian Malays, Malaysian Chinese, Malaysian Indians and Malaysian Other Indigenous People only

- 1996: n= 12,839
- 2006: n= 11,887

- A total of 686 cases with implausible values were removed from the 1996 subsample. These included:
  *309 cases with negative height values,
  *350 cases with negative weight values,
  *22 cases whose height was recorded as less than 100cm,
  *3 cases that weighed 14kg to 18kg
  *1 case whose standing height was 555cm,
  *1 case had potential reporting error in height, weight or BMI
- A total of 24 cases which appeared to have reporting errors were removed from the 2006 subsample. These included:
  *deletion of 14 cases whose height was less than 100cm,
  * 4 cases who weighed 9kg to 19kg were removed,
  *exclusion of 1 case whose height and weight was identical
  *5 cases had potential reporting errors in height, weight or BMI.

Final sample with implausible cases removed:

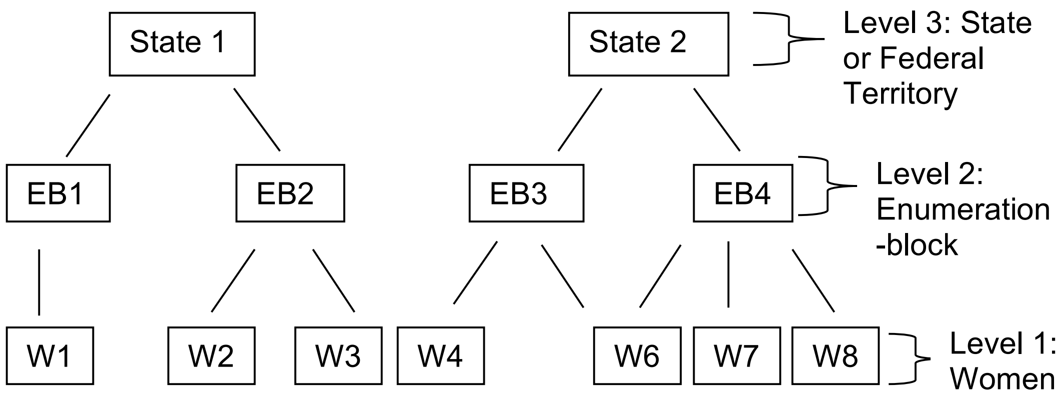
- 1996: n=12,153
- 2006: n=11,863

Secondary quantitative analysis for Part A: random intercept three-level linear regression Analysis

Secondary analysis occurs when new analyses are conducted using existing original data which were initially collected for other purposes (Dale, Arber and Procter, 1988; Kiecolot and Nathan, 1985; Boslaugh, 2007). There are some advantages to undertaking a secondary analysis. First, generalisability is improved through the use of existing nationally representative data (De Vaus, 2002; Dale, Wathan and Higgins, 2008). Second, the large nationally representative data sets facilitate the analysis of subgroups within the population (Dale, Wathan and Higgins, 2008; Bryman, 2012). However, careful consideration needs to be made regarding the adoption of a theoretical framework for analysing the existing data. This is because embedded values within the theoretical framework may not be measured by the variables that exist within the data set. Additionally, the sampling design does not involve the secondary analysts. If detailed information regarding the sampling design and data collection process are not made available, secondary data analysts have an incomplete understanding of the data (Boslaugh, 2007; Dale, Arber and Procter, 1988).

After deciding the variables that I needed to incorporate in my models, I summarised their characteristics using descriptive statistics with the support of SPSS. This was followed by developing my substantive models which were a series of random intercept three-level linear models that were constructed for four main ethnic groups: Malaysian Malay, Malaysian Chinese, Malaysian Indian and Other Indigenous Minority Ethnic Groups using the 1996-2015 Malaysian National Health and Morbidity Survey data sets and STATAIC 13 software package. The structure of the data was hierarchical, in which individual women were clustered within a selected geographical area or enumeration-block and the enumeration blocks were clustered within a state or federal territory (see Figure 3.2).

Figure 3.2 Three-level structure: women clustered within an enumeration-block within a state or federal territory



The three-level linear random intercept model aimed to examine the effects of state, enumeration block and individuals' socio-demographic characteristics on BMI (CMM, 2014) for each stratified set. They also help to identify and disentangle sources of BMI variation into these three distinct levels rather than assume it as constant (Lebel et al., 2014).

Three reasons support the use of random intercept three-level linear models in my secondary analysis.

First, multilevel models acknowledge the presence of hierarchical structure in my survey data sets. In each three-level random intercept linear model, an individual woman is assumed to be linked in more ways to other women who live within her residential area, and possibly within her state than to other women from another enumeration block or another state. Women who were clustered in this way were more likely to share similar living and working circumstances such as social positions, lifestyles and neighbourhood conditions than women who lived in other areas (Merlo et al., 2005; Stride, 2008; Hox and Kreft, 1994). Similarly, women who lived in state 1 were likely to differ from women who lived in state 2 in terms of social attributes and physical environment. The similarities and dissimilarities that were observed among women within as well as across geographical areas or enumeration-blocks and states exemplify the presence of connections within-and between-clusters. This connection implied the shared influences among women of a particular enumeration-block and state (see Figure 3.2).

Throughout my discussion regarding the three-level random intercept linear model, state-level represents observations located at ‘the highest level of hierarchy’. It was recognised as the top-level. The enumeration-block level captured the neighbourhood influence of women’s residential area. This second level established the middle- or intermediate-level of my models. Level-1 constituted individual woman and corresponded to the lowest level of hierarchy.

Second, three-level linear random intercept multilevel models allow me to simultaneously identify patterns of weight and the associated drivers of these patterns at individual-, enumeration-block and state-levels. Intra Class Correlations associated with these models additionally, allowed me to identify BMI variations that were present within- and between- individual women, enumeration-blocks and state(s) or federal territories. These models also enabled me to identify the influence of each socioeconomic independent variable on the BMI outcome variable through the values of the associated coefficients. However, standard linear regression model cannot do this with clustered data.

Third, the three-level linear random intercept multilevel model offers an appropriate analysis for my theoretical framework, namely the social determinants of health, which was put forward earlier in my literature review. This framework emphasises that health (BMI) is associated with multiple determinants at both individual and structural levels. These multiple determinants at both levels explain weight differences in populations. An individual’s weight is influenced simultaneously by her social characteristics such as age, education, number of children and occupation. At the same time her weight is potentially shaped by characteristics at a wider level such as the influence of family members, peers, where she lives and the social environments that surround her (Corsi, Kyu and Subramanian, 2011; Wang, Xie and Fisher, 2012). Thus, constructing multilevel models enables the prediction of both direction and strength of the individual-, household- and area-level conditions on the BMI for each ethnic group of women and this is done simultaneously. Moreover, it provides relative BMI variation for individual-, household- and area-level (Arcaya et al., 2012). Neuman et al. (2013) and Corsi, Finlay & Subramanian (2012) are two examples of studies that adopted a linear multilevel analytical approach to identify the geographical and individual variability in BMI.

I did not fit a standard linear regression model in my nested data as this type of analysis can generate biased results because attributes of all three levels are treated as a single level. Multiple linear regression analysis is consequently less suitable because it ignores 1) relationships between women within enumeration blocks and states and 2) ignores the social and physical influences that women experience as a consequence of where they live (Wang, Xie and Fisher, 2012). Thus, the influences at each level cannot be estimated and the standard errors would be inaccurate (Pillinger, 2016).

Another pitfall of applying the standard linear regression analysis to clustered data is that I would have needed to create more than 100 dummy variables to represent a group of enumeration-blocks and another 15 dummy variables for states and federal territories. The estimation of the enumeration-block effects would have become arduous when the number of enumeration blocks is large, i.e. more than 100. Moreover, each of these dummy variables would have had to be treated as an independent observation, which would be misleading (Subramanian, Blakely and Kawachi, 2003). Hence, measuring the BMI variation between-enumeration-block or –state/federal territory would not have been possible had I adopted the standard linear regression approach.

Additionally, unlike logistic regression, multilevel linear regression models can accommodate a continuous dependent variable. A strength of using a continuous BMI variable rather than a categorical BMI variable is that it reflects the entire weight continuum of women in a country (Subramanian et al., 2011). Following the decision to use a random intercept linear model, I have selected a subset of variables from those available in the full dataset, specific to the research questions which I generated for my research. At the outset of carrying out the multilevel analysis, I determined the outcome response and covariates that corresponded to level-1, level-2 and level-3 based on the findings of previous studies, my theoretical position, and the availability of the relevant data.

The uniqueness of three-level model versus other statistical techniques makes it a more suitable tool for studying health aetiology which fits my first secondary analysis (Bingenheimer and Raudenbush, 2004). It contributes to empirical and methodological understandings of the BMI X SES interactions among women. To the best of my knowledge, individual-enumeration-block-state-BMI associations remain underexplored in Malaysia. None of previous work which studied weight issues in Malaysia has applied the multilevel modelling approach. Dunn, Tan and Nayga (2012) used quantile regression rather than multilevel quantile regression and consequently did not explicitly consider the clustering nature of the NHMS III dataset in their research.

The following subsection documents the steps that were required in order to build a series of three-level random intercept models for my four main ethnic groups: Malaysian Malay, Malaysian Chinese, Malaysian Indian and Other Indigenous Minority Ethnic Groups.

These models allowed me to

(1) identify the individual-, enumeration-block- and state-level sources of variation in BMI

(2) examine the association of individual woman's BMI who lived in an i-th household within jth neighbourhood or area by considering SES characteristics

My outcome measure was continuous BMI. An individual woman's socio-demographic characteristics (educational attainment level, age and marital status and her residential location) were entered as level-1 covariates. These variables were all categorical. A woman's neighbourhood was represented by the level-2 covariate: urbanicity (rural, small urban, large urban and metropolitan). At the state-level, which was the level-3, the proportion of women educated to the tertiary and the Gini Coefficient level were used to represent the state's income distribution condition, ranging from low to high.

Below is the list of response outcome and independent variables that I included in the first phase of my analyses (See Table 3.3).

Table 3.3 List of Variables of Interest

Name of Variable	Characteristic of Variable of Interest
Outcome Response:	
BMI	Continuous
Independent Variables:	
Level-1 (Individual-level)	
Age group	18-25 26-33 34-41 42-49 (reference category)
Marital Status	Never Married Unmarried Married and co-habiting (reference category)
Educational Status	None Primary Secondary Tertiary (reference category)
Level-2 (Enumeration-block-level)	
Location of Dwelling Area	Rural Areas Small Urban Areas Large Urban Areas Metropolitan (reference category
Level-3 (State-level)	
Share of tertiary education	0.0% Less than 20.0% 20.0% and above (reference category)

Gini Index	Highly Unequal (Gini Index 0.430 and above) Moderately Unequal (Gini Index 0.408-0.429) Least Unequal (Gini Index 0.359-0.398) (reference category)

Null Model

The first step for analysing my data using three-level random intercept models focussed on constructing null models or empty models. The null model is also known as unconditional model or variance components model. It was built without adding any independent variables, but constituted the outcome response, an intercept, state or federal territory, enumeration-block random effects and individual level residual error term. There was one main assumption that I needed to fulfil when constructing the null model. The estimated residuals at each level were required to be normally distributed with zero means and constant variances. This was tested by observing a quantile-quantile plot. When the estimated residuals appear to be lying along the 45-degree line, the random effect of the examined level is taken to have a normal distribution (CMM, 2014).

Null models enabled me to assess the random effect of three levels only. My null models distinguish total variation of BMI into three components: individual-, enumeration-block- and state-level. It was run by excluding observations with missing values, and can be expressed as follows

$BMI_{ijk} = \beta_{0ijk}cons$

$\beta_{0ijk} = \beta_0 + v_{0k} + \mu_{0jk} + e_{0ijk}$

BMI_{ijk} = Body Mass Index of an i^{th} woman lived in j^{th} enumeration block within k^{th} state

β_{0ijk} = intercept

v_{0k} = between-state- variance

μ_{0jk} = within-state - between-enumeration block variance

e_{0ijk} = within-state-within-enumeration block-between-women variance

In my empty model, the proportion of variance at each level was captured by its variance partition coefficient (VPC) where its computation was shown below.

The state level VPC:

$VPCv = \sigma_v^2 / (\sigma_v^2 + \sigma_\mu^2 + \sigma_e^2)$

The enumeration block level VPC:

$VPC\mu = \sigma_u^2 / (\sigma_v^2 + \sigma_\mu^2 + \sigma_e^2)$

The individual level VPC:

$VPC = \sigma_e^2 / (\sigma_v^2 + \sigma_\mu^2 + \sigma_e^2)$

Without considering the influence of independent variables, the null model produced three components of total BMI variation, namely variation at state/federal territory, enumeration-block and individual-level separately. This information was essential for examining Intraclass Correlation Coefficients (alternatively referred to as ICCs) for state/federal territory and enumeration-block levels. The ICC demonstrated the degree of similarity or correlation of women's BMI within a state or enumeration-block. This tertiary level ICC was obtained by dividing the BMI variation at state/federal territory level with the total variation in BMI. State-level variation (tertiary-level variation) measures the differences between women living in the state but in different enumeration-block. To yield the ICC of enumeration-block, the state and enumeration-block's BMI variance was compared over total variation in BMI.

In other words, the ICCs explained the variation of BMI, which was attributable to observed differences at the state/federal territory and enumeration-block levels (Robson and Pevalin, 2016). Lower values of ICC indicate a relatively small differences in BMI within a given state or enumeration-block. They also indicate weak clustering in the structure of the data. However, zero state-level ICC does not necessarily suggest the absence of BMI variation between-state/federal territory (Bingenheimer and Raudenbush, 2004). Nor does it indicate that a single-level model such as linear regression model would be the preferred option. A multilevel linear regression model was still adopted as it is underpinned by my selected theoretical framework, literature review and the data structure (CMM, 2014).

Full Model

I created my full model by expanding my null model with the inclusion of a set of independent variables (as specified in Table 3.4). I estimated the variability of BMI at three levels: individual, enumeration blocks and state by adding all covariates to the existing empty model. I excluded observations with missing values in this extended model, which has been named as random intercept model. There were two components in my random intercept model: fixed part, and random part. The fixed part consisted of the estimated coefficients of covariates of interest whilst variances of three levels: individual-, enumeration block- and state-level were defined as the random part.

Unlike the single-level linear regression, which assumes the intercept remains the same for all women by producing a single estimated intercept value, the random intercept model provides two estimated intercept values: overall intercept (β_{0ijk}), and group intercept (β_0). The overall intercept provides the estimates intercept value for all women. It is commonly known as the grand mean. Conversely, the group intercept represents the intercept value for women in each enumeration-block in a state (Snijders and Bosker, 2012; Leckie, 2013; Leckie and French, 2015). I outlined my random intercept model as below.

$$BMI_{ijk} = \beta_{0ijk} + \beta_n X_{ijk} + v_{0k} + \mu_{0jk} + e_{0ijk}$$

$$\beta_{0ijk} = \beta_0 + v_{0k} + \mu_{0jk} + e_{0ijk}$$

where

i represents individual-level, j for household-level and k is neighbourhood-level

β_{0ijk} refers to overall intercept

β_0 defines as group intercept

X_{ijk} denotes covariates of interest from three levels

$B_n X_{ijk}$ indicates coefficient for each covariate of interest

Within my three-level random intercept model, the significance of each element of the fixed part (i.e. β0ijk, βn) was evaluated by its p-value. If the p-value is less than 5.0%, then the covariate is statistically significant.

Next, I examined the magnitude of BMI variation that existed at state- or federal territory-, enumeration-block- and individual-level, respectively. I then computed the adjusted ICCs for the higher levels: the state- or federal territory and the enumeration-block using the same procedure as mentioned in the null model for depicting the unadjusted ICCs. The adjusted ICCs referred to the Intra Correlation Coefficients that generated after taking into account the BMI-associated factors.

After completing the calculation for the adjusted ICCs, I moved onto interpreting the influence of each variable of interest on BMI. The values of the coefficients in my three-level random intercept model would have been equal to the value of the coefficients in a single-level linear regression model. But the intercept value and its interpretation would be different to that obtained in a single-level linear regression model. In my three-level random intercept model, coefficient values may be used to identify the magnitude and direction of the influence of the SES independent variables on BMI. As for its intercept, its interpretation was dissimilar to the single-level linear regression model. It signified the average BMI of a well-off married woman aged around 42-49 years old, who lived in a metropolitan area of a highly equal state where at least 20.0% of the female residents attained tertiary education, after considering the unexplained differences at enumeration-block and state levels. As with the null model, I checked the assumption of normality for each level's residual errors using Quantile-quantile plot.

Before repeating these steps for another three ethnic groups, normality which is required for linear multilevel models, were tested. Inspection of the distribution of residuals was conducted using a Quantile-quantile plot to test the presence of normality (Fox, 1991; Berry and Feldman, 1985).

3.3.2 Secondary analysis for Part B: a single-level logistic regression

Upon completing the estimation of the random intercept three-level linear regression models, I fitted a series of single-level logistic regression models to examine the likelihood of the occurrence of each weight category (underweight, pre-overweight, overweight and obese) in relation to 'healthy weight', drawing on the following five explanatory variables: age, marital status, urbanicity, ethnicity and education. The healthy weight was treated as the reference category in all instances of logistic regression analysis. I adopted Asian Cut-Off Points for each weight category: underweight (18.5 kg/m^2), healthy weight (18.5-22.9 kg/m^2), pre-overweight (23.0-24.9 kg/m^2), overweight (25.0-29.9 kg/m^2) and obesity (30.0 kg/m^2 and above).

The logistic regression strategy proved better than the three-level linear regression model in three ways. Firstly, some states do not have a grouping of Malaysian Indian women or women of Other Minority Indigenous Groups (see details in Chapter 4). Secondly, unlike the binary outcome linear regression model, the estimated value (or likelihood) of the logistic model is unrestricted to the values of zero and one. The logistic model is unbound by such restriction because its predicted outcome probability is transformed with odds and logarithm (Alison, 2009). Thirdly, when compared to the linear regression model, the errors of the logistic model are not bound to a normal distribution (Alison, 2009).

I had four sets of contrast outcomes in my logistic regression analysis: underweight versus healthy weight; pre-overweight versus healthy weight; overweight versus healthy weight; and obesity versus healthy weight. Each of these contrast outcomes were fitted separately into the logistic regression model, along with five independent variables and an interaction term of ethnicity and education.

I excluded the state-level variables: income inequality and proportion of tertiary education from my logistic regression analysis. This was because my focus was the influence of individual-level socioeconomic positions on the unhealthy weight category in relation to healthy weight; this subsequently informed my phase-II research.

All classifications of explanatory variables remained the same as the three-level linear regression model, except for education, age and ethnicity. I reclassified the education variable into three levels: never attended formal education and primary education; secondary education; and tertiary education. For each of analysis, I combined ‘never attended formal education and primary education’ as a single subcategory to represent the lowest education group because of the fewer instances of non-educated women in each weight category. Additionally, I changed the age group reference to 18–25 years to facilitate easier interpretation of results.

Generally, the logit equation is expressed as below:

logit (underweight/healthy weight) = intercept + $\beta 1$Age + $\beta 2$Marital Status + $\beta 3$ Urbanicity + $\beta 4$Ethnicity + $\beta 5$Education + $\beta 6$Ethnicity.Education

I used STATAIC 13 to run a series of single-level logistic regression models with the outcomes of being underweight versus healthy weight and aforementioned independent variables and interaction terms. I repeated the same estimation for other outcomes: pre-overweight versus healthy weight; overweight versus healthy weight; obesity versus healthy weight using the same data set. Upon completion of this analysis, which drew on the 1996 Malaysia National Health and Morbidity Survey data set, I replicated the same estimation procedure to the 2006, 2011 and 2015 data sets.

The estimated parameters of the logistic regression models were measured in odds ratios; for instance, in the model, which measures the odds of being underweight, the value of the estimated parameter of being greater than one was interpreted as the higher likelihood of falling in the underweight category than in the healthy weight category. It also indicates the presence of positive relationship between the independent variable and the corresponding odds ratio. The opposite interpretation was held for the value of the estimated parameter of being less than one. If the value of the estimated parameter is equivalent to one, indicating the odds ratios for the outcome of being underweight is identical with the outcome of being healthy weight. Therefore, it suggests the presence of no relationship between the corresponding independent variable and the odds of being underweight (Jaccard, 2001; Liu, 2016; Long and Freese, 2014).

For instance, the odds ratio (OR) = 1.20 was reported for marital status (never married and married) and the risk of being underweight and where ‘women in the marriage relationship’ was treated as a reference category. It implies that the odds of being ‘underweight’ were higher in never married women than married women when assuming other factors remained constant. The odds of being ‘underweight’ for the married are 1.20 times the odds of being in the healthy weight category. Hence, married women were more likely to be underweight than never married women (Liu, 2016).

The significance of each parameter was assessed with the Wald z statistic and its p-value. A p-value that is less or equal to 0.05 signified the individual independent variable had a significant influence on the related weight outcome. The overall significance of the model was accessed by the χ^2 (chi-square) test and its p-value. Any p-value up to 0.05 indicated that the model was a good fit (Liu, 2016; Long and Freese, 2014).

3.4 Details of phase II research process

Semi-structured interviews and sites of fieldwork

Phase-II of my research entailed face-to-face semi-structured interviews which were undertaken after the completion of the first part of my research. Semi-structured interviews engage both the researcher and the interviewee in producing knowledge (Carter and Little, 2007). Their use involves the use of a set of open-ended questions to guide the interviewing. As the interviews progress, follow-up questions may be made in response to participant’s replies. Also, semi-structured interviews provide some flexibility for the researchers. Questions may be asked in a different sequence and/or different words may be used during the interviews, but the essence of the questions remains largely the same (Brinkmann and Kvale, 2015, Bryman, 2016). Hence, it is possible to compare participants' responses (Bryman, 2016).

Face-to-face semi structured interviews were thought to be suitable for four reasons. First, I anticipated that gathering women of childbearing age together in one place in order to conduct focus groups would be difficult because of transportation problems. Additionally, there is a dearth of community facilities such as community halls in Malaysia. Second, Malaysia has a strong local oral tradition which may potentially be more supportive of one-to-one semi-structured interviews rather than focus groups. Third, it is possible that some women may feel uncomfortable talking about their weight in front of their peers within focus groups particularly if they are underweight or overweight or obese. Fourth, qualitative interviewing is one method for gathering multiple truths from participants (King and Horrocks, 2010).

The face-to-face interviews were informed by the study findings of phase-I of my sequential mixed-methods research. The first part of my study found that age, marital status and education were three main determinants that influenced the mean BMI and weight statuses of women of childbearing age in the four main ethnic groups living in Malaysia over 1996-2015. Malaysian Chinese had a lower mean body weight than women from the three other main ethnic groups and were more likely to have a healthy weight. Higher educated Malaysian Chinese women were more likely to be underweight relatively to lower educated Malaysian Chinese women. On the other hand, the lower educated Malaysian Chinese women were more likely to be overweight. Additionally, educational gradients in body weight were significant in Malaysian Chinese women: the higher the educational level, the lower the mean body weight in 1996, 2006 and 2011.

These findings are particularly interesting as there are a number of factors that may potentially influence the socio-economic status of Malaysian Chinese including Malaysian Chinese women do not have enhanced access to education, business opportunities, and are less likely to be employed in the public sector and I am a Chinese woman from Malaysia (Joseph, 2018; The Equal Rights Trust, 2012). I decided to choose my home town: the state of Kedah to recruit my study participants and conduct the interviews.

X and Y neighbourhoods in Kedah were selected as fieldwork sites in Phase II, X neighbourhood is rural and Y neighbourhood is urban. X neighbourhood has fewer physical amenities than Y neighbourhood and has no retail or leisure parks, secondary schools, markets, public transportation or hospitals. Old wooden buildings and muddy roads were the most obvious physical aspects of X neighbourhood.

These two neighbourhoods were selected for two reasons. One, the 2006 NHMS reported that more highly educated women more were likely to live in urban rather than suburban areas (see Table 3.4). Thus, these areas fitted my phase-II research, which focused on exploring educational variation in weight among Kedahan Malaysian Chinese women. Two, I lived a few miles away from both neighbourhoods during my childhood and felt this might help when recruiting interviewees.

Table 3.4: Distribution of educational attainment level (measured in percentage, %) for Malaysian Chinese women in urban and rural areas across the state of Kedah, 2006.

Educational Level	Primary	Secondary	Tertiary
Urban Areas	68.4	68.8	69.2
Rural Areas	31.6	31.2	30.8

(Source: Unpublished data from the 2006 Malaysia National Health and Morbidity Survey)

Preparation of interview guide

I started to devise my interview guide after deciding on the sites for my fieldwork. The Malaysian Prime Minister's Department required that I submit my topic guide as part of the essential documents for ethical approval and the issuing of a research pass. I would not have been allowed to access interviews without having obtained ethnical approval and a research pass.

My interview guide was comprised of a set of questions that loosely covered my research topic areas (see Appendix A 3.1). These questions were based on findings from my literature review and linked to an interpretivist approach (Bryman, 2016). The topic guide was also relatively lightly linked to my research questions, which I redefined after completing the data collection and analysis in Phase I (Bryman, 2016). Following Denscombe's advice (2014), my topic guide consisted of easy opening questions first which were followed by the difficult questions, such as stress-related questions.

Ethical approval from the Malaysian Government

Upon the completion of my topic guide, I submitted my topic guide, research proposal, ethical approval letter from Warwick Medical School's Biomedical and Scientific Research Ethnical Committee (BSREC) and a soft copy of my passport to the Director of Research at the Prime Minister's Department for ethnical review and application.

The ethical review took about six months to complete. Initially, I planned to recruit my potential participants in local government clinics and hospitals however I decided against this because the hospital director told me that recruitment at hospitals and clinics required cross-departmental ethical approval. This could have taken years to gain as my ethical approval application would have had to be passed to various government departments. Additionally, I am not medical trained and this may have hindered by application for cross-departmental ethical approval.

Negotiating access

I approached the leaders of the churches, Buddhist temples and charities in July 2013 in order to negotiate access to potential interviewees. During my conversations with these leaders, I showed them my topic guide and outlined the purpose of my research, time and financial constraints and the reasons I had selected this area to conduct my research. I also assured these leaders that the likelihood of harm arising from voluntarily participating in my interviews was small and participants could seek counselling help at the nearby hospitals if they were distressed as a consequence of participating in my interviews.

My gatekeepers verbally agreed for me to approach potential participants in their premises and allowed me to put flyers on their notice boards. One of my gatekeepers was helpful and enthusiastic about my research. She immediately rang four women and arranged for me to meet them. She then introduced me to these women at a local social event Kedah in July, 2013. I tried to build rapport with them by joining other social or worship activities. All four women kindly agreed to be participants in my pilot qualitative interviews.

Piloting of qualitative interviews

The pilot interviews were helpful for two reasons. First, they helped me to identify any potential problems with my interview schedule. Problems included inappropriate wordings in my interview guide or interview protocol that clashed with local context (Kvale, 2008). Second, they provided me with an opportunity to familiarise myself with the flow of interview and recording equipment, which was important for me.

I made the appointments for the pilot interviews by phone three days before I reached the study areas in Kedah. Four women had initially agreed to undertake pilot interviews in 2013 but one woman had moved away from Kedah. During the pilot interview phase I also made myself known to local people in two ways. I attended social events that were held in churches, temples and local communities. I also used a number of local small business services, posted flyers of my research on the notice boards of churches and temples, and helped my gatekeepers' children to do their homework.

Pilot interview process

Three Malaysian Chinese women aged between 20 to 49 were interviewed in their homes as part of my phase II pilot study during the period February to April 2014. In the days leading up to the pilot interviews, I talked to my interviewees about the interview procedure and gave them a consent form and an information sheet (Plowright, 2011, Appendix A 3.2-3.3). These documents outlined:

(1) the aim of my study

(2) justification of why the participant was selected

(3) clarification of the meaning of voluntary engagement with an emphasis on the right to disengage from the research at any time

(4) the retention of anonymity throughout the research process

(5) the use of the provided information for scientific purposes and publication

(6) how the information was to be recorded and managed

This information, which was presented in both Mandarin and English and proofread by two language teachers, provided my participants with a clearer picture about their rights. Their signature on the consent form signified their agreement to voluntarily participate in the research and indicated they understood the information provided. A copy of the signed written consent form was returned to my interviewee and I kept the original copy (Peel, 2004).

After the interviewees returned their signed written consent forms, I asked if they had any concerns about my research. I also arranged a place and time for interview. On the day of my interview, for my own safety I informed my sister about the interview place and estimated interview duration.

At the beginning of each pilot interview, I thanked my participant for her participation. We then had a casual conversation, talking about her day or journey to our meet up point. I also shared my positive experiences during my stay in X or Y area, to create a relaxed atmosphere for interviewing. Before I briefly told the participant about my research, I talked about my experience regarding weight change and work as a voluntary weight buster to build rapport with them. I recounted the importance of understanding their weight-related viewpoints, as I needed these views in order to deepen my understanding and thanked each interviewee for her help with my research. I then sought written consent to participate in the interview and record the interview and reiterated that the interview was conducted on a voluntary basis.

I also stressed that talking about weight-related issues can be a sensitive subject for some women and that negative emotions may arise during and after the interview for example related to stigmatization. I subsequently gently reminded them that they could decide not to answer all or any questions during the interview or stop participating in the interview altogether if they felt uncomfortable or unhappy talking about the issues I raised in the interview. I also provided participants with information on local support services (e.g. counselling services at health centres) to those who felt that they required support about their weight. Each interviewee was also reminded of her right to withdraw her data up to three months after the interview was conducted and I would destroy her data. I additionally reassured my participants that their anonymity would be maintained and that their real names would be replaced with a pseudonym when I stored, transcribed, and published the data. Finally, I asked the interviewees if they had any concerns about my research or interview.

At the start of each pilot interview I gathered background information from each participant and asked questions about weight perceptions, weight-related barriers as well as weight management strategies. While listening to their responses I tried to observe their non-verbal reaction too. I felt non-verbal observation helped me to better understand their viewpoints and gauge if the interview was distressing which may have required that I stopped the interview. I also encouraged my participants to link the daily life experiences that influenced their weight related viewpoints by probing asking for some examples such as how motherhood influenced their weight. I also asked some participants to further explain when I did not understand the information that they shared.

When my interviewees seemed to struggle answering my questions, I remained silent for a while. One of my usual prompts was related to the question ‘what do you eat at end of a month?’ when I would talk about how I struggled to make ends meet when I worked and studied full-time for a Master’s degree in Malaysia. While talking about these experiences I would highlight that by end of every month for a year my food budget was restricted to RM3 a day, which was equivalent to less than a pound a day. I did not have money to attend my graduation day too. I explained that paying the monthly house and car instalments during this time left me with little money. As a result, I weighed less at that time than I did when I moved out of my parents’ home.

At the end, I asked my participants if they had other information that they would like to share with me. I emphasised that they could contact me at any time within three months of their participation if they encountered any negative feelings after the interviews. Some of them laughed and shook their heads. Fortunately, none of my participants felt uncomfortable during the interviewing. I thanked the interviewees for participating and gave each one 25 Malaysian Ringgit (equivalent to five pounds sterling) and two pencils or pens with the Warwick University logo for their children.

After each pilot interview, I recorded as soon as I could my field notes which included an evaluation of the interview process, the interview venue and its surroundings and extra information related to the interview (Bryman, 2016; Denscombe, 2014). I then transferred these notes to a word document and saved them on my computer. I reviewed my interviews again when I transcribed my interview data. Below are reflections about my pilot interviews.

Findings of pilot interviews

Prior to the interview, my pilot study participants highlighted two concerns. These concerns may have arisen because they had not been interviewed before as part of a research study. First, they wondered what the interview would entail. To which I responded that the interview would be a conversation that focused on their personal weight-related viewpoints and experiences. To alleviate fear, I compared this type of interview with a job interview. I reassured them that no test was required as part of the interview. I emphasised that my role would focus on listening as I was very keen to learn from their weight-related stories.

Second, two of my lower educated pilot study participants raised concerns about accuracy of information that they shared with me. I reassured them that there was no right or wrong views/experiences and that as far as I was concerned their views/experiences were valid and that these interviews would help to deepen my understanding of weight-related issues and barriers.

Three main issues were raised during my pilot interviews that needed to be addressed before I could embark on my main study.

1. Once one participant discovered that I was a student from a medical school, she asked if I would identify the causes of her weight gain. As a consequence, I decided to explain to my main study interviewees before the interviews that I was not a trained medical doctor or nutritionist but was instead a university research student who sought their help to complete my studies. This adjustment stifled subsequent questions pertaining to illness, nutrition or causes of weight gain.

2. The second issue related to the wording I used in my interview guide. I noted that one secondary school educated woman struggled to understand the concept of ‘stressful times.’ She asked me the meaning of ‘stress’. After discussing this problem with my supervisor, I replaced the term stressful times with difficult or tough times in subsequent interviews.

3. After replaying my first recording, I found out that I talked too fast during the interview. I asked one question after another to my first participant, and seemed to race through the time she had allocated for the interview. I did not probe and focused solely on my interview guide and interviewee responses. After I had reflected on this interview style, I decided to do a few mock interviews at home before conducting another two pilot interviews. I reminded myself that I needed to stay calm before I left home for the interview.

Main study: face-to-face semi-structured interviews

The determination of the number of semi-structured interviewees in qualitative inquiry with the purposive sampling strategy was different from the probabilistic sampling strategy, which is widely adopted in quantitative research. In such quantitative research, adequacy of research participants generally depends on the population size, margin of error, the nature of the survey, and confidence intervals (Bonde, 2013; Garvin, 2015; Bryman, 2016). Conversely, the answer pertains to how many interviews are appropriate for qualitative research, in which purposively sampled participants remain less definitive (fluid). It involves an array of considerations, including data saturation, the methodological choices, and conditions such as the availability of resources (Baker, 2012; Bryman, 2012).

A common guideline for deciding sample size in qualitative research is data saturation (Hagaman and Wutich, 2016). Ragin (2012) and Mason (2010) recommended that data saturation determines the number of interviews. According to them, the number of interviews was sufficient once the interviewing data no longer provided new insight. At this point, the data were saturated, where additional interviews only generate repetitive information or themes (Guest, Bunce and Johnson, 2006). However, interviewing until reaching saturation depends on other circumstances. When and how the data saturated are more likely to interweave with the methodological choice, the scope of the research, the participants' selection criteria, quality of data, the availability of resources (time, energy, money, participants), and the researcher's experience (Mason, 2010; Bonde, 2013; Green and Thorogood, 2009; Flick, 2011; Bryman, 2012).

According to some writers, the chosen methodological perspective (i.e. epistemological position, methods, research questions) influences the number of interviews requires for qualitative research. For example, Passerini and Sandino (2012) believed that one interview was considered to be enough for oral history research as it could provide depth and breadth accounts. Bryman (2012) who pointed out that a study drew on Interpretive Phenomenological analysis was more likely to have a much smaller number of interviewees also agreed with Passerini and Sandino (2012). Similarly, Charmaz (2012) and Bonde, 2013) purported that a small number of interviews were acceptable for a research that adopted multimethods or mixed methods strategy.

Apart from these, the determination of the number of research participants relied on the nature of research questions (Charmaz, 2012). Both Becker (2012) and Brannen (2012) commented that a single interview is inadequate if the research aims to make comparison across groups. Their view aligned with Hagaman and Wutich's (2016) comparable study, which focused on researching perceived local water problems and solutions in four semirural areas located in Bolivia, Fiji, New Zealand and Arizona. Interviewees of these four settings shared two commonalities: two different levels of water supply and development status. Based on the interviews data of 41 in Bolivia, 57 in Fiji, 24 in New Zealand and 30 in Arizona, they found that three main themes emerged at least once after the conduct of five interviews.

Guest, Bunce and Johnson (2006) who studied the shared perceptions of being infected by HIV among sexually active Nigerian and Ghanian females aged 18 observed that their themes remained invariant after the twelfth interviews. Drawing from this study, they concluded that given that the characteristics of interviewees were more alike, fewer participants were needed for redressing a narrowly defined research question by experienced researchers. Their conclusion was echoed by Bonde (2013). She added that the more diverse character the potential interviewees, an inexperienced researcher, inadequate resources, the more interviews appeared to be needed to be conducted in order to achieve data saturation.

Considering the rigid guidelines on deriving an ideal sample size for qualitative interviews and the notion of data saturation are still debatable alongside the above views, 18 interviews should suffice for my second part of research (Baker, 2012). There are two main reasons behind this ‘stopping criterion’ which were interconnected. The first reason centred on my methodological stance. I felt my research question pertaining to the interviews was simple. I aimed to explore weight perceptions and weight-related barriers between lower and higher educated Malaysian Chinese women who lived in the state of Kedah. These women shared many commonalities, except educational attainment level and dwelling location. Moreover, successive transcripts were mostly linked to my existing themes. I felt my interviews were concerned more on how women constructed their reality based on their experiences rather than a generalised hypothesis statement. Hence, a larger sample size (i.e. more than 18 women) was unnecessary. My second point was that given my qualitative interviews were informed by the first part of my research, a larger number of interviews than needed would have strained resources. Also as explained by Francis et al. (2010), it was an ethical issue as more interviews may have wasted participants’ time.

I used purposive and snowballing sampling techniques for recruiting potential participants in the field. Two criteria were required to be met for participation. First participants were required to be non-pregnant Malaysian Chinese women aged 18 to 49 years who had secondary school or post-secondary education and did not have a baby who was aged between zero and six months. Second, participants were required to live in Kedah in either neighbourhood X or neighbourhood Y.

Participants were recruited in three ways: through gatekeepers from the local church or Buddhist temple, through referral from pilot study participants and through local social events. Arranging and undertaking the main study interviews with some participants was challenging for me as some of them had busy lives. In some cases, I spent up to two hours waiting for them because of delays on the road or to finish their cooking and house chores and sometimes helped them with some light housework in order to reduce the waiting time.

I repeated all the procedures of my pilot study interviews with my main study interviews including the procedure for obtaining verbal consent and my interview guide. Additionally, I asked spontaneous follow-up questions. These interviews lasted between 25 minutes and 90 minutes with verbal consent been taken from all participants. Occasionally, my interviews were interrupted by walk-in customers.

On two occasions, my interviews were interrupted because young children sought their mother's attention or needed their nappies changed. I attempted to distract children from interrupting our interviews in two ways. First, I sketched a rat and a lion before telling the young children a story about these animals. Second, having previously sought permission from my interviewee, I rewarded children with sweets for playing alone while I interviewed their mother. Having reflected on this I believe that when interviewing mothers with young children, I should have provided accompanying children with toys, storybooks or finger food in order to facilitate the interview process. One interview was cut short and only lasted 25 minutes because my interviewee's parents-in-law came home earlier than expected. I sensed that my interviewee was uncomfortable sharing information with me when her parents-in-law were present.

I encountered two other challenges while doing my qualitative fieldwork in Kedah. First, I noticed that an obese family lived in X area. However, whenever I met a member of this family in a public area, she/he did not smile back at me and avoided direct eye contact with me. Even though I was keen to recruit the mother to my research study, I felt their response indicated that they did not want to participate. Second, dengue fever was widespread at that time in Kedah so I took the extra precaution of spraying mosquitoes repellent all over my body while I was there. The outbreak of dengue fever affected my social hours with other potential participants as the mosquitos' peak activity occurs in the evening (WHO, 2016).

Four women who were educated to secondary school level only refused to be audio recorded because of personal reasons, including they felt they had a funny voice or were embarrassed. Some of the other participants hesitated when answering the stress-related questions and refused to elaborate further. I noticed a change in the tone of their voice and facial expressions and decided not to probe further. Additionally, two interviewees decided to skip those questions.

Transcription

The interview data were transcribed verbatim by translating the local dialect (Hokkien) or Mandarin into English. Pauses, sighs, silence, changes of tone and laugher were enclosed in brackets, e.g. (laugh). After discussing with my supervisors, a few local dialects and Mandarin phrases such as 'neng chi shi fu' (meaning to be able to eat is a blessing') were transcribed directly and retained with inverted commas. This is because a direct translation to English appeared to be meaningless. Annotation, for example [she was smaller than me] was shown in a squared bracket.

Each participant was given a pseudonym as an identifier during data transcription. Their personal data were stored separately from interview data so that the interviewees could not be easily matched to pseudonyms. For security reasons I saved all transcripts in Microsoft Word files that were password protected and kept paper copies of transcripts and backup files in a locked cupboard. I spent between 6 and 12 hours transcribing the interviews. My transcription speed was affected by the length of the interview and the quality of the recording as some interview recordings had external noise from passing vehicles and/or children screaming. After transcribing, my supervisors checked the transcription with me to reduce mistranslation and misinterpretation of interview data. This improved the quality of transcription and the credibility of my second phase of research.

Thematic analysis

Thematic analysis was used to analyse my qualitative interview data. After I had familiarised myself with each interview, I coded the transcription manually. I then discussed this with my supervisors who also coded the same transcription. We compared the themes and decided which themes were more suitable. As a novice, this boosted my confidence in proceeding with the second stage of thematic analysis and improved the quality of my research.

Coding is a process in which 1) a word or a phrase is extracted from the transcript and assigned to a relevant quote or 2) a new and different word or phrase is used to summarise the relevant quote (Saldana, 2010). For example, a theme of perceived weight with a subtheme of fatness was created and assigned to the following extracts:

'*I am 53kg… I still feel I am fat'*.

'*My weight? ….(silent)….. I feel my bones and hips are bigger after giving birth…, I am heavier.'*

'my ideal weight is 58kg…I am 62kg…I look fat….' .

In the second phase of thematic analysis, I reread the same transcript and identified additional quotes or any mismatches between the themes or sub-themes and the assigned quotes. I then exported my transcripts to NVIVO which is suitable for thematic analysis (Zamawe, 2015). Employing NVIVO software in addition to manual coding has two advantages. First, employing NVIVO allowed me to extract, gather and organise all the relevant transcript excerpts in one place and consequently facilitated the comparison of relevant quotes within- and between-participants. Second, an audit trail is produced when NVIVO is employed as each extracted excerpt that is presented in a node is given a reference link that connects directly to the relevant transcript. The audit trail helped me to keep a record on the research process.

I created the main themes by using the tree node function in NVIVO and child nodes for its subthemes, according to those that I had identified manually. This process was iterative.

In the third phase of my thematic analysis, I compared themes within and between transcripts. These comparisons enabled me to identify and categorise common and uncommon themes emerging from my interview data (Bryman, 2012). Following this phase, I refined and reorganised a few subthemes, which had one or two quotes by combining them under one broad sub-theme, or renamed them. For example, in the main theme of factors associated with weight loss strategies, the subtheme of ‘believe in zodiac’, which contained one excerpt only. After discussing with my supervisors and conducted my literature search, this subtheme was moved to ‘personal attitudes and beliefs’.

Like other qualitative research, the nature of the second phase of my research was also prone to comments such as lack of validity, less reliable and limited generalization (Noble and Smith, 2015). However, some commentators reasoned that these can be improved in qualitative research through methodological and methods (i.e. research design, data collection, analysis) and reporting (Green and Thorogood, 2009; Brinkmann and Kvale, 2015; Bryman, 2016). These commentators outlined a set of criteria for assessing the validity, reliability and generalisability in qualitative inquiry. However, a fixed assessment standard for assessing the quality of qualitative work has yet to be developed and yet to reach consensus (Noble and Smith, 2015).

In the second phase of my research, I improved the trustfulness of my analyses by considering practices suggested by Noble and Smith (2015); Brinkmann and Kvale (2015) and Green and Thorogood (2009). I recognised how common particular themes or subthemes were in my transcripts and attempted to include relevant context in my writing. I also kept a record on how the decisions were made at every stage of research process, for instance data analysis and transcripts management. I reflected on the effect of my personal experience, methodological stance as well as limitations such as sampling bias on my studies.

Reflexivity and positionality

Following the interpretivist approach, participants and I interact to construct knowledge together through semi-structured interviews (Kvale, 1996; Bryman, 2016). This implies that instead of neutrality, partiality is achieved in my research, particularly in interviewing because of the reciprocal researcher-participant relationship that I had in the field (Finlay, 2003). As an interviewer, I influenced the interviewing by bringing in my values, assumptions, position, identity and preconceived knowledge. Meanwhile, observation and interaction with interviewees throughout the research process also influenced these elements (Hand, 2003). Hence, recognising these influences through reflexivity is vital in promoting rigorous qualitative research, which is part-II of my research (Lamb and Huttlinger, 1989). Although I have been doing reflection throughout my research process, the following section focuses on reflexivity on the interview data collection, analysis and reporting, followed by my positionality as a researcher.

Researcher role

I believed that the explanation about my research interest, confidentiality, participant’s rights along with my desire to learn reduced the distance between the participants and me, encouraging them to open up and share their weight-related experiences with me. In the field, I always introduced myself as a research student whenever I met anyone. As for my participants, I additionally also explained why I decided to choose the state of Kedah as my study location. I assured them that anything that they shared with me would remain confidential and anonymous.

Apart from the right to withdraw that was reiterated during the interviews, I reminded participants that they had the same right to do so within three months from their interview dates. They could contact me if they experienced uncomfortable feelings following the interviews. Furthermore, I convinced them that their personal account was valid knowledge albeit subjective. I stressed that I had limited knowledge about weight-determinants in Kedah and was keen to listen and learn from them. All the participants were happy to support me in data collection after listening to my explanations. I was overwhelmed with their positive response and recorded this in one of my field notes:

I realise that social trust is high in this place in Kedah. Everyone that I met so far is friendly, humble and helpful despite their educational background or income level. I can join their activities and get along with them. They accepted me without questioning my role as a researcher. They agreed to help me immediately when I asked them to be a participant in my research. [Field note 1]

However, in one instance I failed to gather my interview data. This difficulty arose with a participant and related to active participation in an interview. As a researcher, I was thrilled when I successfully recruited a participant with a weight problem. I knew this participant through my morning walks. I thought this interview would go well. After the first few minutes of the interview where her personal background had been taken, I started to feel it was difficult talking to her. Despite my attempts to prompt, she continuously decided to skip some questions or simply said she knew nothing about the questions. I terminated the interview after about ten minutes, as she seemed to reluctant to share her perspective:

I felt discomfort and confused after talking to her. What went wrong? The location was private enough for her to talk, but she refused to open up. She *kept declining to answer my questions by either requesting me to skip them or telling me that she did not have any knowledge about it. I felt I have been pushed to the wall. Were the questions too tough for her or she just simply refused to answer? Or this was just a case that was linked to unanticipated interviewee's behaviour, as pointed out by Bryman (2012)? [Field note 2]*

Ethical practice

It was challenging to strike the balance between building and maintaining good relationship with everyone while adhering to ethical practice in the field. In the second week of my fieldwork, a pregnant woman who was keen to participate in my research approached me. She persuaded me to interview her by justifying that she had weight change experience. In her mind, I could interview her seeing that nobody would know that she was a pregnant participant, except the two of us.

According to the ethnical procedure stated in The Biomedical and Scientific Research Ethics Committee (BSREC) Warwick Medical School, pregnant women should be excluded from my research. I immediately resolved this ethical dilemma without consulting my academic supervisors. My action in resolving this dilemma spontaneously was aligned with the suggestion made by Punch (1994). I informed her about the ethical procedure as well as justifying that the decision was made mainly to protect her and her baby's well-being. I apologised to her for not being able to include her as a participant.

On a further occasion, one of my participants seemed to struggle to answer my question regarding to 'what do you eat at end of a month?'. She remained silent after some time. I did not ask further questions as I sensed that this could be a sensitive question for her. I was empathetic with her, I gentle checked on her and reminded her that she had the right to discontinue the interview. She smiled and insisted on continuing our interview. At the end of the interview, I informed her again about the availability of counselling service, which she could use if she had uncomfortable feelings after the interview.

Positionality

I am aware of how difficult it is to talk about personal experiences concerning weight-related issues as it was a sensitive topic for some women. So, I shared my weight change experiences briefly and my voluntary experience as a weight buster in England with my participants to encourage them to open up and talk to me. Meanwhile, I also told them that I lived in those areas for a while when I was young. I emphasised that talking about their own weight-related issues not only deepened my knowledge and understanding, but also might benefit other women.

Sharing my background and experiences with participants influenced my research in two ways. First, it indicated that my research process was not value free. Second, it influenced how participants perceived me, either as an outsider or insider. During the fieldwork, I positioned myself as an outsider for two main reasons. First, although I am still familiar with local dialect, Mandarin and culture, I have lived in England for ten years. Most of my knowledge about weight-related issues was from the literature as well as personal experience and exposure in England. Second, I was a childless married woman who studied at Warwick. None of my participants had the same social position as me.

To minimise the differences between my position and theirs, I dressed like them and used local dialect or Mandarin when communicating with them. I also kept a non-judgmental mind when talking to them and observing. A few participants were curious about my social position. They wanted to know why I still studied and stayed childlessness. I smiled and explained that it was linked to medical reasons that I stayed childlessness.

Conclusion

In sum, this chapter details the methodology and methods used in my research. The next chapter presents the description of data from the 1996, 2006, 2011 and 2015 Malaysian National Health and Morbidity Surveys.

Chapter 4
Descriptive statistics

Drawing on interpretivism, this chapter explores and provides a brief insight into the features of my phase 1 data patterns. The data in this chapter is descriptive and therefore differences in the patterns (the strength or direction) are not statistically significant. Thus, it should be noted that where parameters are identified as higher or lower, this does not mean that differences are statistically significant, as no statistical tests were carried out. It also helps in triangulating two advanced methods that are adopted in Chapter 5 and 6 to deriving a robust conclusion (Babones, 2016). My phase 1 data came from the 1996, 2006, 2011, and 2015 nationally representative cross-sectional Malaysia Health and Morbidity Surveys. To align with my research interest, I restricted my study sample to women between the ages of 18 and 49 who were Malaysian Malay, Malaysian Chinese, Malaysian Indian, and or from Other Indigenous Minority Ethnic Groups (n=12,513 in 1996; n=11,683 in 2006; n=5,568 in 2011; and n=6,530 in 2015). In 1996, 2006, 2011 and 2015, these women lived in 2,207, 2,126, 780 and 868 enumeration blocks, respectively, that spanned 13 states and three federal territories (Kuala Lumpur, Labuan, and Putrajaya) (see Table 4.1).

The structure of this chapter is outlined as follows: the first section describes socio-demographic profiles of participants. It explores socio demographic patterns of mean BMI over the period 1996 to 2015. The second section interprets changes of women's mean BMI and their differences based on age, marital status, education, ethnicity, levels of urbanisation, and state-level share of tertiary education. The third section focuses on prevalence of underweight, healthy weight, pre-overweight, overweight and obesity and their variations across four ethnic groups. The last section highlights educational differences in mean BMI or relative weight status in the context of Malaysian childbearing age women of the four main ethnic groups over two decades.

4.1 The profile of survey participants

The profiles of the participants in the 1996, 2006, 2011, and 2015 NMHS surveys that constituted my samples, including missing cases at the variable level, are described using SPSS and presented in Table 4.1. The first figure in the second column in Table 4.1 represents the total number of complete observations and its percentage (%) in parentheses. This is followed by the total number of missing cases and the missing rate, indicated in parentheses in the third column of Table 4.1.

4.1.1 Age and marital status

As shown in Table 4.1, the participants' profile is summarised by six socio-demographic determinants. These determinants are age, marital status, education, ethnicity at the individual-level, levels of urbanisation at enumeration-block-level and share of tertiary education and income inequality at the state-level. Although the number of women with measured BMI in the 1996 (n=11,974) and 2006 (n=11,755) surveys was almost doubled those in the 2011 (n=5,451) and 2015 (n=5,939) surveys, the age and marital status distribution were fairly alike for 1996-2015. The only exception was the share of the oldest age group (42-49 years old) which increased from by 4.7%, from 19.4 % to 24.1% during 1996-2015.

The percentage of married Malaysian women within the 18-49 age range remained around 70.0% over four time points. This marriage rate was slightly lower than British women (75.0%) of similar age group in 1979 (ONS, 2002). The percentage of never married women and unmarried women was always below 30.0% and 5.0%, as evidenced at each time point.

4.1.2 Education and ethnicity

Unlike the distribution of age and marital status, there were some notable changes in educational attainment levels across four surveys, which were conducted between 1996 and 2015. As illustrated in Figure 4.1, the proportion of women with no formal education declined dramatically over the last two decades. A similar declining trend was observed for the proportion of women who completed up to primary education (see Table 4.1). These declining trends were not a surprise as 99.0% of girls completed their primary school education in 1990, contributing to the achievement of the second United Nations Millennium Development Goal earlier than 2015 (United Nations and Economic Planning Unit, 2019).

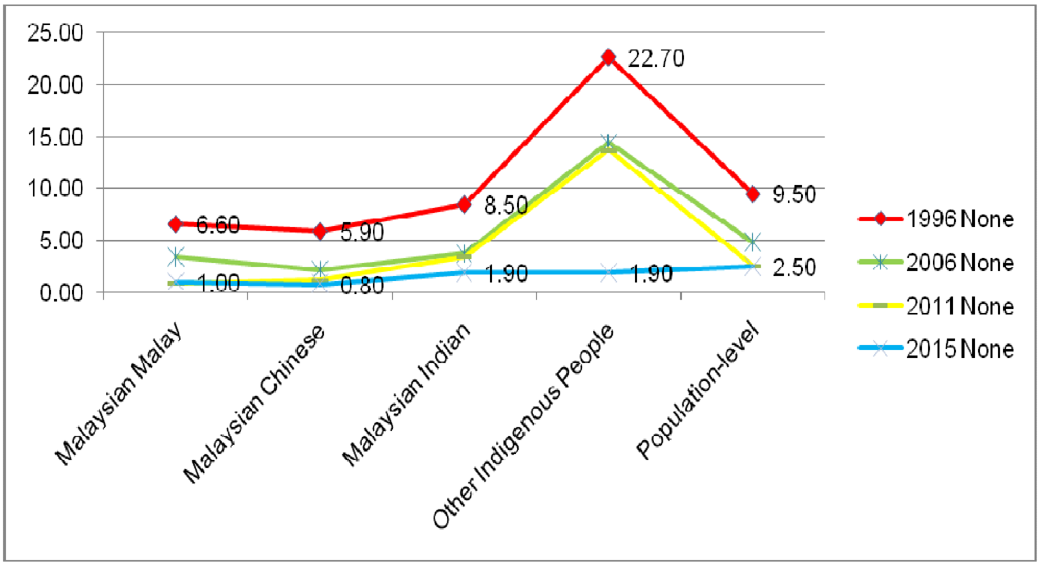
The rapidly declining trends in women with no formal education and no primary education could be attributable to higher public spending on education and other government policies. The Malaysian government spent approximately 4.4% to 6.0% of its national budget on education in 1980-2012. These rates were higher than those of Great Britain except for years 2006, 2007, and 2008 (UNDP, 2019). Implementation of Malaysia Plans and the National Policy for Women, which are designed to eradicate illiteracy among women and address parents' perception of education contributed to the declining trend too (EPU, 2018).

Table 4.1
Profile of Participants in the 1996, 2006, 2011, and 2015 NHMS Data Sets

Year	1996		2006		2011		2015	
Characteristics of participants	**Frequency n (%)**	**Missing Cases n (%)**	**Frequency n (%)**	**Missing Cases n (%)**	**Frequency n (%)**	**Missing Cases n (%)**	**Frequency n (%)**	**Missing Cases n (%)**
BMI	11974 (98.5)	179 (1.5)	11755 (99.1)	108 (0.9)	5451 (97.9)	117(2.1)	5939 (90.9)	591 (9.1)
Age	12153 (100.0)	0 (0.0)	11709 (98.7)	154 (1.3)	5568 (100.0)	0 (0.0)	6530 (100.0)	0 (0.0)
18-25	3281 (27.0)		2948 (24.9)		1455 (26.1)		1527 (23.4)	
26-33	3331 (27.4)		2686 (22.6)		1316 (23.6)		1798 (27.5)	
34-41	3189 (26.2)		2961 (25.0)		1382 (24.8)		1630 (25.0)	
42-49	2352 (19.4)		3114 (26.6)		1415 (25.4)		1575 (24.1)	
Education	11958 (98.4)	195 (1.6)	11789 (99.4)	74 (0.6)	5509 (98.9)	59 (1.1)	6447 (98.7)	83 (1.3)
None	1133 (9.3)		572 (4.8)		145 (2.6)		162 (2.5)	
Primary	3209 (26.4)		2410 (20.3)		653 (11.7)		803 (12.3)	
Secondary	6397 (52.6)		7320 (61.7)		3038 (54.6)		3384 (51.8)	
Tertiary	1219 (10.0)		1487 (12.5)		1673 (30.0)		2098 (32.1)	
Marital Status	12095 (99.5)	58 (0.5)	11826 (99.7)	37 (0.3)	5566 (100)	2 (0.0)	6527 (100.0)	3 (0.00)
Never Married	2987 (24.6)		3040 (25.6)		1633(29.3)		1671 (25.6)	
Married	8734 (71.9)		8318(70.34)		3755 (67.4)		4554 (69.7)	
Unmarried (Widow, Divorced, Co-habit)	374 (3.1)		468 (3.96)		178 (3.2)		302 (4.6)	
Ethnicity	11996 (98.7)	157 (1.3)	11863 (100.0)	0 (0.0)	5568 (100)	0 (0.0)	6055 (92.8)	475 (7.2)
Malay	5730 (47.1)		6923 (58.4)		3479 (62.5)		4039 (61.9)	
Chinese	3161 (26.0)		2233 (18.8)		974 (17.5)		879 (13.5)	
Indian	917 (7.5)		1111 (9.4)		487 (8.7)		471 (7.2)	
Other Indigenous People	2188 (18.0)		1596 (13.5)		628 (11.3)		666 (10.2)	
Enumeration blocks	2027 (100.0)	0 (0.0)	2126 (100.0)	0 (0.0)	780 (100.0)	0 (0.0)	868 (100.0)	
***see Table 4.2 for details**								
Urbanicity of enumeration block	12153 (100.0)	0 (0.0)	11863 (100.0)	0 (0.0)	5487 (98.6)	81 (1.4)	6530 (100.0)	0 (0.0)
Metropolitan areas (75000 and above population)	5197 (42.8)		5667 (47.8)		2869 (51.5)		2989 (45.8)	
Urban large areas (10000 to 74999 population)	1851 (15.2)		1746 (14.7)		540 (9.7)		1007 (15.4)	
Urban small areas (1000 to 9999 population)	438 (3.6)		512 (4.3)		371 (6.7)		354 (5.4)	
Rural areas (the rest of the country)	4667 (38.4)		3938 (33.2)		1707 (30.7)		2180 (33.4)	
Share of Tertiary Education at State level	12153 (100.0)	0 (0.0)	11863 (100.0)	0 (0.0)	5568 (100.0)	0 (0.0)	6530 (100.0)	0 (0.0)
Low	4834 (39.8)		5567 (46.9)		1386 (24.9)		2078 (31.8)	
Middle	4577 (37.7)		3331 (28.1)		2879 (51.7)		2064 (31.6)	
High	2742 (22.6)		2965 (25.0)		1303 (23.4)		2388 (36.6)	

Although the illiteracy rate declined sharply over 20 years at the national level, different levels of illiteracy prevailed across the four main ethnic groups (see Figure 4.1).

Figure 4.1 The Proportion of Women Who Never Attended School (in percentage), 1996-2015



Over the period of 1996-2015, the greatest decrease in the number of women who did not receive a formal education was among women from Other Indigenous Minority Ethnic Groups (91.6%); nearly one in four (22.7%) did not receive a formal education in 1996. That rate declined to one in 10 (13.7%) in 2011 and further decrease to two in 100 (1.9%) in 2015. These declining trends happened mainly among women from Other Indigenous Minority Ethnic Groups from the states of Sabah and Sarawak. They comprised approximately 85.0% of the total sample size of women from Other Indigenous Minority Ethnic Groups from 1996 to 2015.

The decrease in the proportion of women from Other Indigenous People Minority Ethnic Groups with no education in Sarawak could potentially be linked to children in Sarawak enjoying going to schools because of waterlogged living conditions at home. Schools were seen as a better place for them to do different activities as they provided facilities and space for them (Nor et al., 2011). The introduction of a formal primary school education system where the mother tongue of Other Indigenous People's is used as one of the teaching languages could possibly encourage more children to enrol to schools too. For people from Other Indigenous Minority Ethnic Groups, the Semai Language, has become the official teaching language at the primary school level in Peninsula Malaysia since 1998 (Nor et al., 2011; Ting and Rose, 2014; Ghani, 2015; Kamaruddin, 2008); the Kadazan Dusun language is the official teaching language for Sabah since 1997; and the official teaching language is the Iban language for Sarawak since 1988 (Smith, 2003).

Switching our focus to the decrease in the number of women who did not receive any formal education again, the second-largest decrease was among Malaysian Chinese women (86.4%) and the third-largest was among Malaysian Malay women (84.8%). Among Malaysian Chinese women, the rate plunged from 5.9% in 1996 to 2.2% in 2006 and 1.2% in 2011, then further decreased to 0.8% in 2015. The Malaysian Malay women who had no formal education accounted for 6.6% in 1996, decreased to 3.5% in 2006, and plateaued at approximately 1.0% in 2011 (0.9 %) and in 2015 (1.0%), respectively.

Conversely, the smallest decline in the number of women with no formal education was among Malaysian Indian. One potential explanation is that Malaysian Indian aged15-19 had the highest illiteracy rate (13.0%) in 1970 compared with Malaysian Chinese (6.0%) and Indigenous People (9.0%) (UNDP, 2019). As a whole, the proportion of Malaysian Indian women with no formal education declined by 77.6% over the past two decades (1996-2015). The proportion of Malaysian Indian women without formal education was 8.5% in 1996; it dropped by almost half to 3.8% in 2006 and 3.5% in

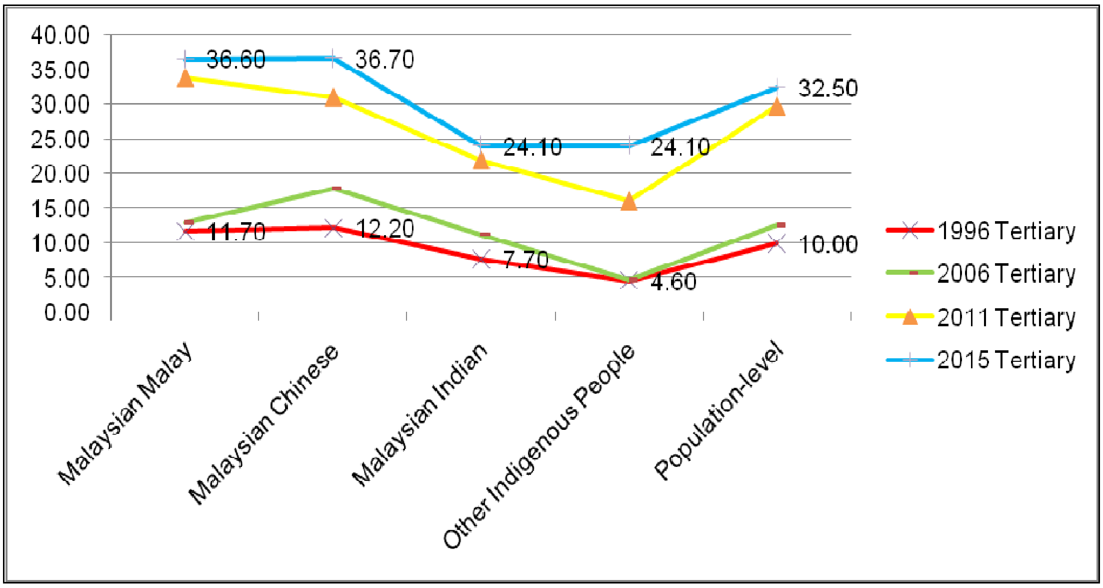
2011. In 2015, it plunged to 1.9%, about four times smaller than in 1996. The decline in the number of women who did not receive formal education was offset by an increase in the proportion of women with tertiary education for the same periods.

At the national level, the proportion of tertiary educated women has tripled in size since 2006 (see Table 4.1). It increased gradually by 2.5%, from 10.0% in 1996 to 12.5% in 2006, but escalated to 30.0% and 32.1%, respectively in 2011 and 2015. A number of factors contributed to the increment in female graduates. Existing research indicates that outperformance among girls and a higher drop-out rate among boys at secondary education level resulted in increased female access to higher education institutions (Yong, 2017; Jelas and Dahan, 2010). Other factors such as the establishment of more private and public universities, the provision of study loans with low interest through the National Higher Education Fund (PTPTN), and encouragement for young people (17-23 years old) to pursue higher education also increased female access to tertiary institutions (Mukherjee, 201; Garcia et al., 2015).

Varying patterns in the proportion of tertiary educated women were observed for women from each ethnic group for the same study period (Figure 4.2). The greatest increase was observed among women from Other Indigenous Minority Ethnic Groups. Their proportion grew from nearly five in 100 (4.6%) in 1996 to one in four (24.1%) in 2015. This was followed by a sharp increase in the proportion of tertiary educated Malaysian Malay women, from 11.7% to 36.6% over the period 1996-2015.

A greater proportion of Malaysian Chinese women achieved the highest education level in most years of the study period and increased from 12.2% to 36.7% between 1996 and 2015. Although the number of Malaysian Indian women with tertiary education also increased during the same period, their gains were less than those of the other three main ethnic groups. The proportion of Malaysian Indian women with tertiary education increased from 7.7% in 1996 to 24.1% in 2015.

Figure 4.2 The Proportion of Tertiary Educated Women (in percentage), 1996-2015



4.1.3 The distribution of sample sizes by ethnicity and states

Table 4.1 also shows that the distribution of the sample sizes of women from the four main ethnic groups. The sample size of Malaysian Malay women increased by 14.8%, from 47.1% in 1996 to 61.9% in 2015. In contrast, Malaysian Chinese women and women from Other Indigenous Minority Ethnic Groups had a reduced sample size for the same periods. For example, Malaysian Chinese fell by 12.5% from 26.0% in 1996 to 13.5% in 2011. There was a decrease of 7.8% of sample size for women from Other Indigenous Minority Ethnic Groups for the period between 1996 and 2015. According to the 2010 Census, the composition of the population for each of the three main ethnic groups was as follows: Malaysian Malay and Other Indigenous Minority Ethnic Groups (67.4%), Malaysian Chinese (24.6%), and Malaysian Indian (7.3%) (Department of Statistics, 2018). The question of whether the sample size of each ethnic group represented the actual population with a similar age range remains unanswered for two main reasons. Firstly, the definition of ethnicity is complex and a complete guideline has not been established was consequently not given to respondents. As a result, the surveys relied on self-reported ethnic origin, which could lead to some inaccuracy issues. Secondly, the official statistics on age distribution for women ages 18-49 from the four main ethnic groups were not yet available.

Apart from the above limitations, my study samples did not contain any female respondents ages 18-49 among who were from Other Indigenous Minority Ethnic Groups in the state of Terengganu in 1996 and 2006. In 2011, no female respondents from Other Indigenous Minority Ethnic Groups were recruited in the states of Terengganu and Kelantan. In 2015, three states -Terengganu, Kelantan, and Perlis - did not have any female respondents aged 18-49 from Other Indigenous Minority Ethnic Groups (see Appendix B 4.1-B 4.4).

My study samples also did not have any Malaysian Indian female respondents aged 18-49 from the states of Terengganu and Sabah in 1996. Moreover, no Malaysian Indian female respondents were recruited from the states of Terengganu, Kelantan, and the Federal Territory of Labuan in my 2011 study sample. In 2015, Kelantan, Terengganu, Sarawak, and the Federal Territory of Labuan did not have any Malaysia Indian female respondents for the corresponding age range (see Appendix B 4.1- B 4.4).

As for Malaysian Chinese women, none were found in the Federal Territory of Putrajaya in 2015. Additionally, fewer numbers of Malaysian Chinese aged 18-49 were recruited in the Federal Territory of Labuan (1) and Putrajaya (2) in the 2011 sample (see Appendix B. 4.1 – B 4.4).

As discussed above, fewer than 10 Malaysian Indian women or women from Other Indigenous Minority Ethnic Groups lived in states such as Perlis, Sabah, Sarawak, and the Federal Territory of Putrajaya. Consequently, not all enumeration blocks in my analyses had at least one respondent from the Malaysian Indian community or at least one respondent from the Other Indigenous Minority Ethnic Groups. Thus, my data can only be fitted to particular advanced statistical analyses although there was n=2,027, n=2,126, n=780 and n=868 enumeration blocks in my sample (see Table 4.1).

4.1.4 Urbanicity

Turning my attention to the distribution of women's residential areas according to four levels of urbanisation, there was a move towards a greater proportion of women living in urbanised areas, away from the country, for the years 1996, 2006, 2011, and 2015. More women lived in urban areas compared to rural areas over the four time points. Female residents in urban areas accounted for 66.6% in 2015 compared with 61.6% in 1996. This trend aligns with the national-level urbanised population growth. Migration to more urbanised areas could be linked to higher employment and educational opportunities (Department of Statistics, 2015).

4.1.5 Proportion of tertiary educated women

Table 4.1 also illustrates differing proportions of tertiary educated women living in states and federal territories across Malaysia in 1996, 2006, 2011, and 2015. An upward trend was found in the proportion of tertiary educated women living in states and federal territories. Approximately one in four (25.0%) women in my study originated from states with a high proportion of female tertiary education graduates between 1996 and 2011. This proportion increased to four in 10 (40.0%) in 2015. The growing share of women living in a state with a high proportion of tertiary educated women could imply that more women increasingly attained tertiary education.

In contrast, the proportion of women living in a state with a middle proportion of tertiary educated women increased by 14.0% between 1996 and 2011. It accounted for 37.7% in 1996, increasing to 51.7% in 2011 but decreasing to 31.6% in 2015. There were around 39.8% of women from the four main ethnic groups who lived in a state with a low proportion of tertiary educated women in 1996. This proportion, however, declined to 24.9% in 2011 before increasing to 31.8% in 2015.

Table 4.2

The Scale of Income Inequality across States and Federal Territories in Malaysia during 1996, 2006, 2011, and 2015 as captured by Gini Coefficient

State/Federal Territory	1996	2006	2011	2015
Johor	0.397	0.368	0.383	0.354
Kedah	0.429	0.392	0.391	0.393
Kelantan	0.442	0.368	0.410	0.389
Melaka	0.371	0.380	0.355	0.337
Negeri Sembilan	0.408	0.385	0.382	0.380
Pahang	0.359	0.380	0.354	0.324
Pulau Pinang	0.398	0.411	0.370	0.356
Perak	0.381	0.399	0.418	0.362
Perlis	0.412	0.454	0.455	0.327
Selangor	0.409	0.418	0.396	0.372
Terengganu	0.466	0.399	0.426	0.328
Sabah	0.454	0.450	0.428	0.404
Sarawak	0.447	0.442	0.440	0.386
FT Kuala Lumpur	0.417	0.446	0.442	0.378
FT of Labuan	0.454	0.450	0.428	0.404
FT of Putrajaya			0.305	0.369
Mean (Average)	0.416	0.409	0.405	0.366
Median	0.412	0.399	0.410	0.371
Range	0.107	0.086	0.150	0.080

(Source: www.edu.gov/my, 2019)
Note: The Gini Coefficient is not available for Federal Territory (FT) of Putrajaya in 1996 and 2006

4.1.6 Income distribution: Gini Coefficient

Income distribution in Malaysia, determined by the Gini coefficient, varied marginally across states and federal territories in 1996, 2006, 2011, and 2015 (see Table 4.2). A smaller value of Gini coefficient is associated with a lower income inequality level for a given state or federal territory. It also implies that the income gap between the rich and the poor is narrower. If the income is distributed evenly in a state, the Gini value is equivalent to zero.

The Malaysian government applied the Gini coefficient only for years 1997, 2007, 2012, and 2016. Thus, they were adopted in my first part of my analysis. The extent of income inequality in 13 states and two federal territories (FT) from 1996 to 2006 and 13 states and three federal territories from 2011 to 2015 is presented in Table 4.2. It is measured by the Gini coefficient, on a scale of zero to one.

As can be seen in Table 4.2, the median Gini coefficient was 0.412 (1996), 0.399 (2006), 0.410 (2010), and 0.371 (2015). At each time point, the difference in income inequality between states was 0.107 (1996), 0.086 (2006), 0.150 (2011), and 0.080 (2015), respectively. In 1996, income equality was greatest in Terengganu and smallest in Pahang.

The states of Terengganu and Pahang are both located on the east coast of the Malaysian peninsula. Pahang is among the states in Malaysia with a low level of urbanisation; Terengganu is more urbanised (Department of Statistics, 2011). In 1995, Terengganu had the highest poverty incidence (23.4%) in Malaysia; in 1997 that figure was the second-highest (17.3%). The incidence of poverty in Pahang was about three times lower than Terengganu over the same years (1995: 4.4%, 1997: 1.7%) (CPDS, 2016). In 2006, the highest income inequality was in Perlis and the lowest income inequality was in Johor and Kelantan. In 2011, Perlis again experienced the most unequal income distribution, while the least was in the Federal Territory of Putrajaya. Perlis is a state on the north end of the Malaysian peninsula, sharing borders with the state of Kedah and southern Thailand. Wider income inequality in Perlis is plausibly associated with its higher unemployment rate among women, and higher incidence of poverty compared to Johor and Kelantan.

In 2006 and 2011, the economy of Perlis relied heavily on agriculture and service industries. These two components contributed less than 2.0% to Malaysia's GDP during the same years. Unlike Perlis, the state of Johor is located next to the island of Singapore. Johor is the most southern state in Peninsula Malaysia. It is surrounded by the by Malacca Straits in the west and South China Sea in the east. Johor was the third highest economy growth state in 2010 and 2016 in Malaysia (Department of Statistics, 2018). Johor's economy is led by manufacturing and service industries. In 2006, both industries accounted for 14.0% and 8.6% of Malaysia's GDP, respectively (Department of Statistics, 2018).

Similar to Perlis, agriculture and service industries in the state of Kelantan were the top contributors to Malaysia's GDP in 2006 and 2011. However, Kelantan's contributions to the national GDP were larger than Perlis, registering 9.2% and 2.3%, respectively, in 2006; and 9.1% and 2.2%, respectively, in 2011 (Department of Statistics, 2018).

The unemployment rate among women aged 15 to 64 in Perlis was higher than unemployment among the same age-group women in Johor and Kelantan. Women's unemployment rate in Perlis increased from 2.5% in 1996 to 3.5% in 2006 and rose to 4.4% in 2011. Both Johor and Kelantan saw female unemployment rate of 3.0% and below in 1996, 2006, and 2011. Moreover, Perlis had a greater poverty incidence rate between 2007 and 2012 compared with Johor (Department of Statistics, 2018) at 7.0% in 2007 and 1.9% in 2012 whilst Kelantan's poverty incidence was reported at 7.2% and 2.7% over the same years (EPU, 2012). The Federal Territory of Putrajaya saw a relatively more equal income distribution, possibly because most residents are civil servants.

Over 1996-2015, income inequality decreased in Negeri Sembilan, Sabah, Sarawak and the Federal Territory of Labuan. The income gap among the Malaysian Malay and people from the Other Indigenous Minority Ethnic Groups in these states and federal territory decreased for the same periods (EPU, 2016).

4.2 Changes in mean BMI

Table 4.3 provides an overview of mean BMI distribution for 13 states and three federal territories in Malaysia across the four main ethnic groups of women aged 18-49 in 1996, 2006, 2011, and 2015. However, mean BMI information was not made available for Federal Territory of Putrajaya before 2011. As my BMI data were assumed to be roughly normally distributed, parametric measures such as mean were used in my statistical analyses.

Table 4.3
The Mean BMI of Malaysian Women at the State- and Federal Territory- (FT) level in 1996, 2006, 2011, and 2015

State/Federal Territory (FT)	Mean BMI by state/FT1996	Mean BMI by state/FT 2006	Difference in mean BMI 1996-2006	Mean BMI by state/FT2011	Difference in mean BMI 2006-2011	Mean BMI by state/FT2015	Difference in mean BMI 2011-2015
Johor	22.97	25.15	2.18	25.31	0.16	25.97	0.66
Kedah	23.19	25.72	2.53	25.92	0.20	26.76	0.84
Kelantan	22.91	25.39	2.48	25.45	0.06	25.77	0.32
Melaka	23.34	25.59	2.25	24.88	-0.71	26.71	1.83
Negeri Sembilan	23.32	25.94	2.62	25.15	-0.79	27.03	1.88
Pahang	24.03	25.41	1.38	25.34	-0.07	26.70	1.36
Penang	22.77	24.61	1.84	25.58	0.97	25.30	-0.28
Perak	23.14	25.05	1.91	25.50	0.45	26.13	0.63
Perlis	24.23	25.09	0.86	27.38	2.29	26.97	-0.41
Selangor	22.84	25.24	2.40	25.66	0.42	25.83	0.17
Terengganu	23.34	25.04	1.70	25.55	0.51	25.92	0.37
Sabah	22.72	23.96	1.24	24.83	0.87	25.74	0.91
Sarawak	22.92	24.66	1.74	25.34	0.68	25.99	0.65
FT Kuala Lumpur	23.09	24.23	1.14	24.79	0.56	24.78	-0.01
FT Labuan	23.13	25.63	2.50	24.82	-0.81	26.39	1.57
FT Putrajaya				24.82		26.97	2.15
National level	23.07	24.97	1.90	25.44	0.47	26.12	0.68

Table 4.3 shows that mean BMI varies across the states and federal territories. In 1996, the state with the highest mean BMI (24.23 kg/m^2) was Perlis, and the state with the lowest mean BMI (22.72 kg/m^2) was Sabah. The difference between the mean BMI of these two states was n=1.51 kg/m^2. Perlis is located in the northern part of the Malaysian peninsula, sharing her

borders with southern Thailand and Kedah (https://www.royalark.net, 2019). It is the smallest state in Malaysia, with a population of about 248,500. The predominant ethnic group in Perlis is Malaysian Malay (Department of Statistics, 2013a). Sabah lies on the island of Borneo and has a population of 3,720,500. It is primarily rural; the largest city is Kota Kinabalu (Department of Statistics, 2018). Unlike other states in Malaysia, the largest ethnic group in Sabah is Other Indigenous Minority Ethnic Groups, and one in three people (29.4%) in Sabah is a foreign immigrant. Sabah has the highest number of foreign immigrants in Malaysia, about 10 times higher than the state of Perlis (3.4%) (Department of Statistics, 2018).

In 2006, the state with the highest mean BMI (25.94 kg/m^2) was Negeri Sembilan; the state with the lowest was again Sabah (23.96 kg/m^2). The difference between the mean BMI of these two states was n=1.98 kg/m^2. Negeri Sembilan is located on the Malaysia peninsula and shares borders with Malacca, Pahang, Selangor, and Johor. Malaysian Malay is the largest ethnic group in Negeri Sembilan, which had a lower poverty incidence than the state of Sabah in 2007 and 2011. The poverty incidence in Negeri Sembilan was 1.3% in 2007 and 0.5% in 2011. Additionally, Negeri Sembilan is more urbanised than Sabah, which had the highest poverty incidence in Malaysia in 2007 and 2011. Unlike Negeri Sembilan, the main ethnic groups in Sabah are the Kadazan and Dusun and both ethic groups form part of the Other Indigenous Minority Ethnic Group (Department of Statistics, 2011). The poverty incidence in Sabah was 16.0% in 2007 and 7.8% in 2011 (CPDS, 2016).

As can be seen in Table 4.3, in 2011, the state with the greatest mean BMI was Perlis (27.38 kg/m^2). Perlis had the widest income inequality in Malaysia in the same year. The lowest mean BMI was in Kuala Lumpur (24.79 kg/m^2). Although Malaysian Malay comprises the majority in both states, Kuala Lumpur is exclusively an urban area. In 2015, the highest mean BMI was observed in Negeri Sembilan whilst the lowest mean BMI was in Kuala Lumpur.

Table 4.3 also shows that nationally, the mean BMI rose during the period between 1996 and 2015. It rose by 1.90 kg/m^2 over the first decade, from 23.07 kg/m^2 in1996 to 24.97 kg/m^2 in 2006. Then, it increased by 0.47 kg/m^2 to 25.44 kg/m^2 in 2011 and subsequently to 26.12 kg/m^2 in 2015. The mean BMI also rose in every state in the period of 1996-2006. In 1996 and 2006, the increase in BMI varied between states and ranged from 0.86 kg/m^2 to 2.62 kg/m^2. Between 2006 and 2011, a decline in mean BMI was observed in Negeri Sembilan, Melaka, Labuan, and Pahang. The mean BMI increased in all of the other states and federal territories in 2015, with the exception of Penang, Perlis, and Kuala Lumpur.

Table 4.4 shows the mean BMI at the national-level for four main ethnic groups of Malaysian women aged 18 to 49 for the years of 1996, 2006, 2011, and 2015. At the national level, mean BMI increased by 1.90 kg/m^2, from 23.07 kg/m^2 in 1996 to 24.97 kg/m^2 in 2006. It further increased to 25.44 kg/m^2 in 2011 and to 26.12 kg/m^2 in 2015. Table 4.4 shows that the mean BMI of the four main ethnic groups rose during 1996-2015 and that the upward trend was consistent with the rising trends at the national level. However, the smallest changes in mean BMI were among Malaysian Chinese women throughout the study period. In contrast, the largest changes in mean BMI were among Malaysian Indian women. Therefore, variations in mean BMI occurred across the four main ethnic groups.

Table 4.4
The Mean BMI at the National-level and for Four Main Ethnic Groups of Women in Malaysia: 1996 – 2015

Ethnicity	1996	2006	2011	2015
Malaysian Malay	23.40	25.47	25.97	26.64
Malaysian Chinese	22.45	23.31	23.31	23.67
Malaysia Indian	23.50	25.83	26.32	26.98
Other Indigenous People of Minority Groups	22.88	24.52	25.01	26.30
National-level	23.06	24.97	25.44	26.21

4.3 Changes in weight categories

Two sets of BMI cut-off points: the WHO Asian cut-off points for underweight, overweight, and obese are the same as the international cut-off points. The only difference between the two is that a public health action point - also known as pre-overweight - is introduced. The public health action point covers the BMI of 23.0 kg/m^2 to 24.9 kg/m^2. With the introduction of pre-overweight, the healthy weight band as defined by the Asian cut-off points is reduced to 18.5 kg/m^2 to 22.9 kg/m^2.

The prevalence of underweight, healthy weight, pre-overweight, overweight, and obesity among Malaysian Malay, Malaysian Chinese, Malaysian Indian, and women from Other Indigenous Minority Ethnic Groups aged 18 to 49 at the national level is shown in Table 4.5 and Figure 4.3 - 4.7. The table also shows the changes in the proportion of women from the four ethnic groups in each of the five weight categories over the four time points. Turning to the WHO international weight classification, the pre-overweight group is a fraction of the healthy weight range. Hence, the size of healthy weight women (as classified by WHO international) is equivalent to the sum of the Asian pre-overweight and healthy weight categories. However, as my study ample study comprised an Asian population only, the explanations of the trend were mainly drawn from the Asian cut-off points.

At the national level, the prevalence of those who are underweight improved from 14.0% in 1996 and 9.4% in 2006 to 8.3% in 2011 and 7.3% in 2015 (see Table 4.5). Those having a healthy weight shrank by 9.3% from 41.6% to 32.3% between 1996 and 2006. However, it further decreased to 30.6% in year 2011 and to 26.5% in 2015. Overweight increased from 21.4% to 26.8% between 1996 and 2006 and subsequently increased to 27.0% in 2011 with a slight rise to 28.1% in 2015. In contrast to the prevalence of underweight, obesity was on the rise and increased from 7.7% in 1996, to 17.2% in 2006, 19.5% in 2011 and 24.0% in 2015.

Table 4.5
The Prevalence of Underweight, Healthy weight, Pre-overweight, Overweight, Obesity among Four Main Ethnic Groups women: 1996-2015

	1996					2006				
International: Weight status		Healthy weight					Healthy weight			
Asian: Weight status/	Under-weight	Healthy weight	Pre-overweight	Over-weight	Obesity	Under-weight	Healthy weight	Pre-overweight	Over-weight	Obesity
Ethnicity										
Malay	14.00	38.40	14.80	23.60	9.30	8.80	29.70	13.60	28.00	19.90
Chinese	14.50	47.80	15.30	17.60	4.90	11.60	43.00	15.90	21.20	8.30
Indian	13.70	36.90	15.90	23.90	9.70	9.10	26.20	14.30	28.00	22.40
OIP	13.70	43.30	16.20	20.10	6.70	9.60	33.20	14.70	28.40	14.20
National-level	14.00	41.60	15.20	21.40	7.70	9.40	32.30	14.20	26.80	17.20

	2011					2015				
International: Weight status		Healthy weight					Healthy weight			
Asian: Weight status/	Under-weight	Healthy weight	Pre-overweight	Over-weight	Obesity	Under-weight	Healthy weight	Pre-overweight	Over-weight	Obesity
Ethnicity										
Malay	7.20	28.00	14.30	28.20	22.20	6.70	24.40	13.90	28.50	26.40
Chinese	12.50	43.50	15.90	18.20	9.90	11.20	41.30	15.70	21.80	10.10
Indian	7.80	23.90	12.40	31.90	24.10	8.70	20.00	10.90	31.70	28.70
OIP	8.00	31.20	16.00	29.60	15.20	4.90	24.60	15.90	31.10	23.60
National-level	8.30	30.60	14.60	27.00	19.50	7.30	26.50	14.10	28.10	24.00

Note: The WHO International BMI cut-off points were used to define the weight status in the second row. Underweight is defined as BMI below 18.5 kg/m^2, 18.5 kg/m^2 to 24.9 kg/m^2 for healthy weight, overweight (25.0 kg/m^2 – 29.9 kg/m^2) and obesity if the BMI is 30.0 kg/m^2 and above.

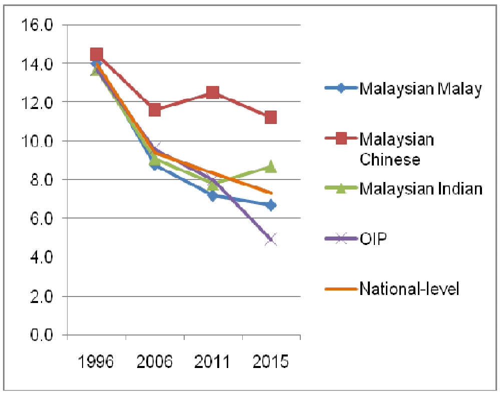
Malaysian Chinese of childbearing-aged women (18-49 years old) were more likely to have a healthy weight compared with women from the three major ethnic groups over the years of 1996, 2006, 2011 and 2015. The 1996, 2006, 2011 and 2015 Malaysia National Health and Morbidity Surveys indicated that more than four in ten Malaysian Chinese women stayed in the healthy weight band. As for prevalence of pre-overweight, the differences were small between the different ethnic groups, except in 2015. In 2015, Malaysian Indian women had the lowest prevalence of pre-overweight (10.9%) whereas the highest was observed among Other Minority Indigenous groups (15.9%) (Table 4.5 and Figure 4.5).

The surveys also highlighted that one in four Malaysian Malay and Malaysian Indian women were overweight in 1996. But, one in three Malaysian Malay and Malaysian Indian women were overweight in 2006, 2011 and 2015. Similar weight trends were observed among women from Malaysian Other Minority Indigenous groups.

As shown in Table 4.5, the prevalence of obesity was lowest among Malaysian Chinese women (4.9%) and highest among Malaysian Indian women (9.7%) in 1996. Similar patterns persisted over the period 2006-2015. The prevalence of obesity for Malaysian Malay women was slightly above the national-level. Although the prevalence of obesity for Other Minority Indigenous groups was slightly below the national-level, it rose by 16.9%, from 6.7% to 23.6% over the last two decades.

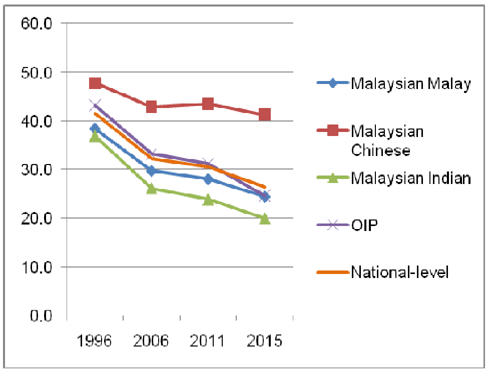
In sum, differences in body weight status emerged among Malaysians of childbearing age (18 to 49), across 1996, 2006, 2011 and 2015. These women were trapped under the double burden of malnutrition (underweight and obesity). As can be seen in Figures 4.3 and 4.4, underweight and healthy weight were most prevalent among Malaysian Chinese women over four time points. Of the four groups, Malaysian Chinese women had the lowest overweight and obesity rate (see Figures 4.6 and 4.7). Malaysian Indian experienced a decrease in pre-overweight prevalence but an increase in obesity prevalence (see Figures 4.5 and 4.7). Increasing obesity prevalence was also marked among Malaysian Malay women and women from Other Indigenous Minority groups for 1996-2015 (see Figure 4.7).

Figure 4.3 Prevalence of Underweight for Malaysian Malay, Malaysian Chinese, Malaysian Indian and Other Indigenous People Minority Groups (OIP) (in percentage): 1996-2015



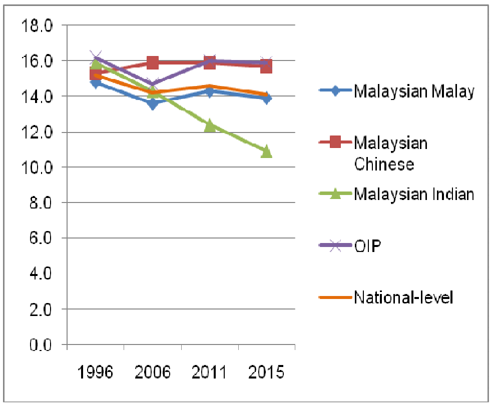
Note: y-axis refers to prevalence of underweight (%)

Figure 4.4 Prevalence of Healthy Weight for Malaysian Malay, Malaysian Chinese, Malaysian Indian and Other Indigenous People Minority Groups (OIP) (in percentage): 1996-2015



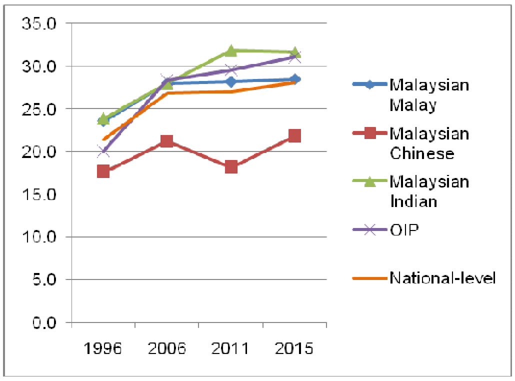
Note: y-axis refers to prevalence of healthy weight

Figure 4.5 Prevalence of Pre-overweight for Malaysian Malay, Malaysian Chinese, Malaysian Indian and Other Indigenous People Minority Groups (OIP) (in percentage): 1996-2015



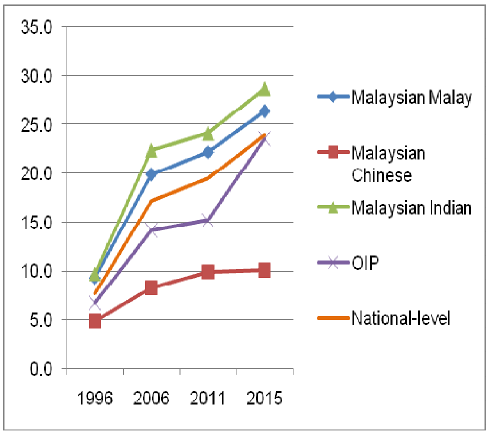
Note: y-axis refers to prevalence of pre-overweight

Figure 4.6 Prevalence of Overweight for Malaysian Malay, Malaysian Chinese, Malaysian Indian and Other Indigenous People Minority Groups (OIP) (in percentage): 1996-2015



Note: y-axis refers to prevalence of overweight

Figure 4.7 Prevalence of Obesity for Malaysian Malay, Malaysian Chinese, Malaysian Indian and Other Indigenous People Minority Groups (OIP) (in percentage): 1996-2015



Note: y-axis refers to prevalence of obesity

4.4 Comparison of body weight and education across four ethnic groups: 1996-2015

One of the limitations of the data presented in Tables 4.1 - 4.5 was that these data did not consider women's socioeconomic status (SES). In Figure 4.8, I attempted to graphically examined the influence of SES by comparing women's mean BMI (on the Y-axis) with their educational attainment levels (X-axis) for each of the four main ethnic groups. The solid lines denote the weight status of each ethnic group in 1996, 2006, 2011, and 2015 (see Table 4.6 for mean BMI at each education level for each ethnic group in the same periods).

4.4.1 Comparison of mean BMI and education across four ethnic groups: 1996-2015

Table 4.6 indicates that a negative educational gradient occurred among Malaysian Chinese in 1996, 2006, and 2011. It also shows the presence of an educational gradient among Malaysian Indian women in 2011 and women from the Other Indigenous Minority Groups in 2015. If women with no formal education are omitted then, the mean BMI of Malaysian Malay, Malaysian Chinese, and Malaysian Indian women declined with a higher educational level over the four time points. Similar patterns were observed among women who belonged to Other Indigenous Minority Ethnic Groups in1996 and 2015.

At each educational level, the mean BMI of women from all four ethnic groups always increased over four time points, except in five observations (see Table 4.8). Malaysian Chinese women with primary education had a lower mean BMI in 2011 than in 2006. In 2015, Malaysian Malay, Malaysian Chinese, and Malaysian Indian women who never attended school had a lower mean BMI than in 2011. The primary educated Malaysian Indian women also weighed less in 2015 (28.56 kg/m^2) than in 2011 (28.70 kg/m^2).

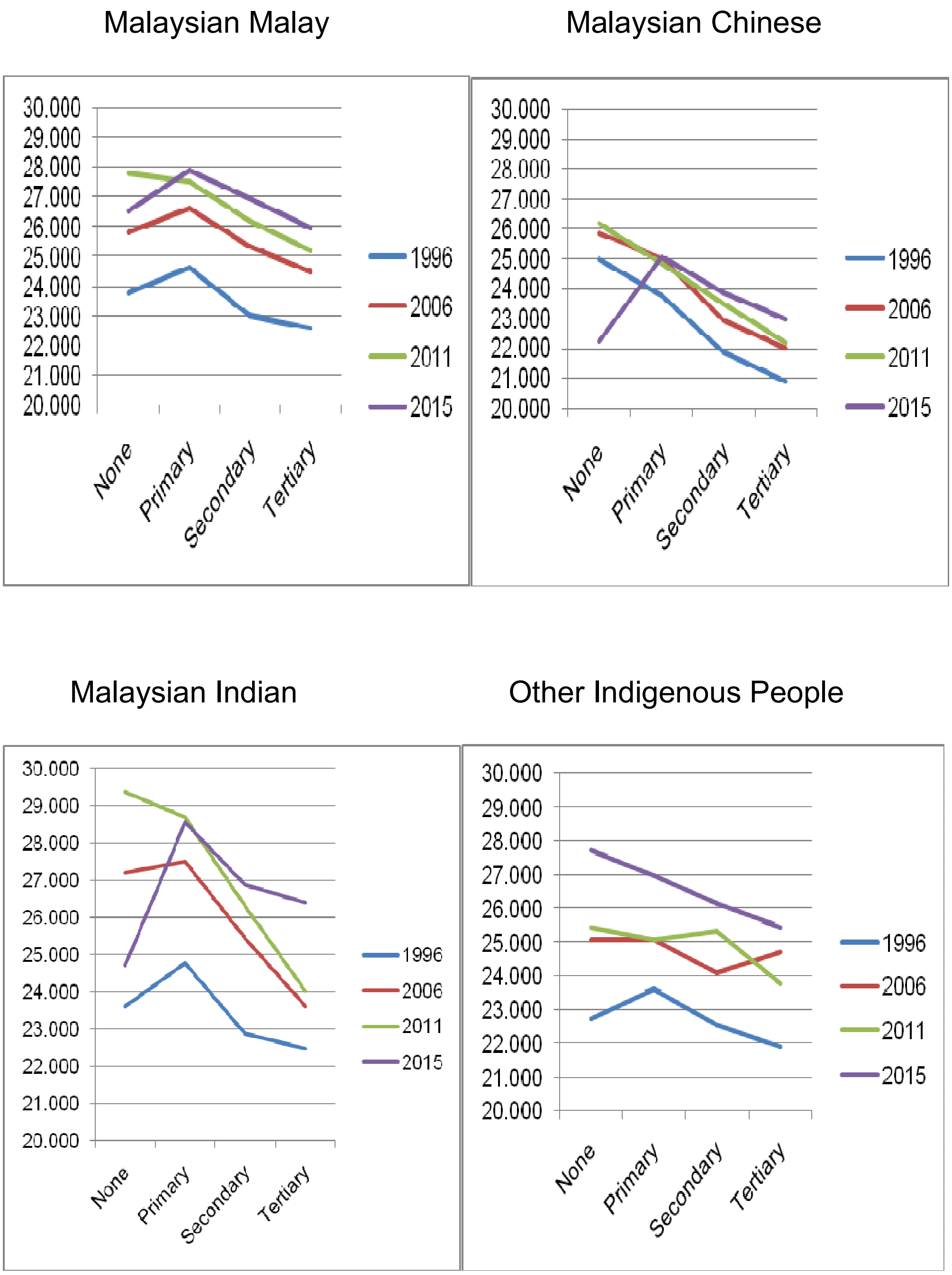
The mean BMI was lowest among Malaysian Chinese women who completed tertiary education in 1996, 2006, 2011, and 2015. In 1996, the least-educated Malaysian Chinese women had the highest mean BMI. By

2006 and 2011, the highest mean BMI was observed among the Malaysian Indian women without a formal education. However, in 2015 the highest mean BMI was observed among the primary educated Malaysian Indian women.

Table 4.6
Comparison of mean BMI of Women from the Four Main Ethnic Groups at Different Educational Levels over Years 1996-2015

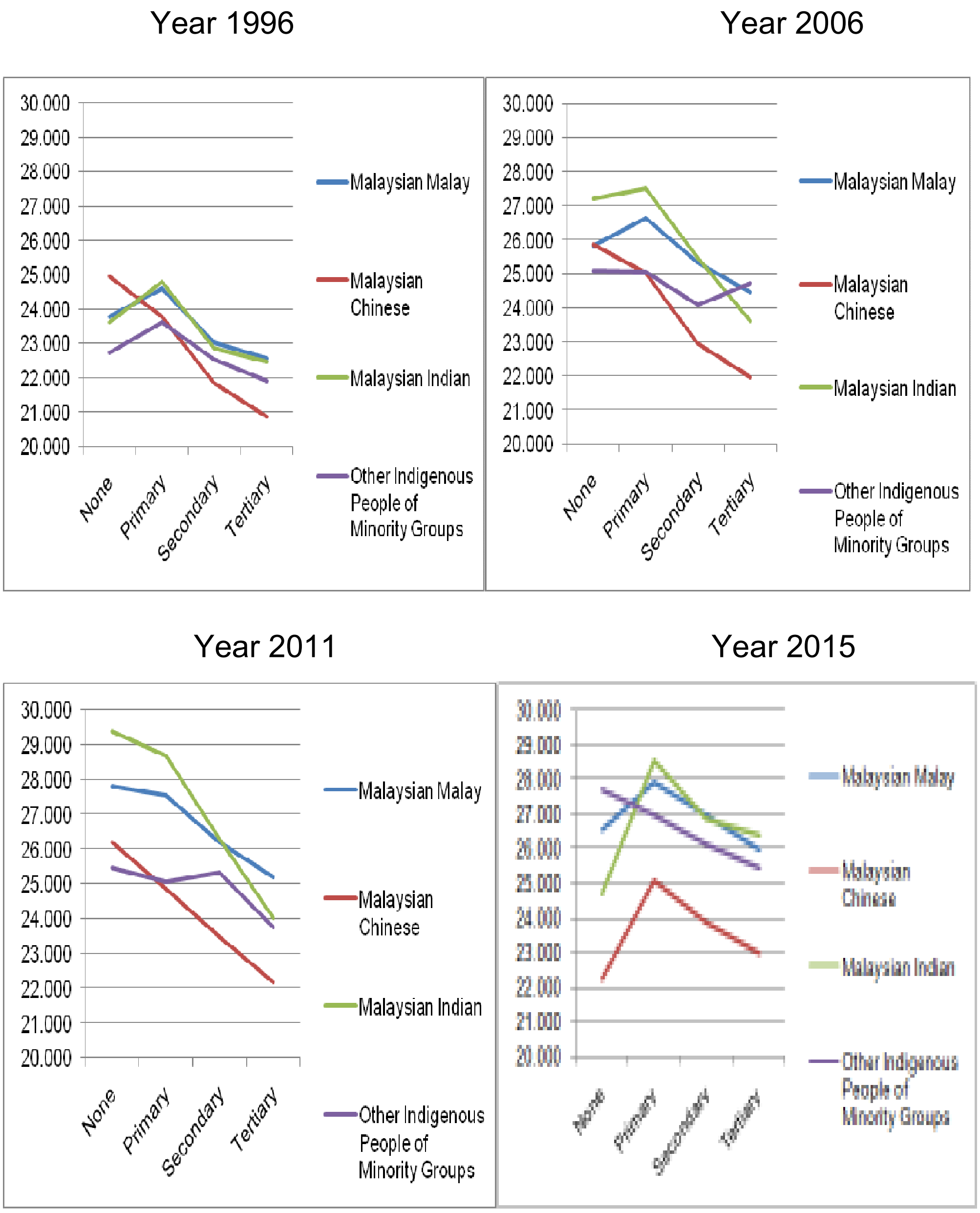
Educational Attainment Levels	Years			
Ethnicity	1996	2006	2011	2015
Malaysian Malay				
None	23.77	25.82	27.81	26.54
Primary	24.62	26.65	27.54	27.89
Secondary	23.02	25.32	26.21	26.95
Tertiary	22.57	24.47	25.21	25.97
Malaysian Chinese				
None	24.97	25.87	26.21	22.25
Primary	23.79	25.03	24.86	25.06
Secondary	21.87	22.94	23.48	23.86
Tertiary	20.89	21.99	22.17	22.98
Malaysian Indian				
None	23.62	27.20	29.38	24.72
Primary	24.79	27.52	28.70	28.56
Secondary	22.88	25.46	26.32	26.88
Tertiary	22.47	23.63	24.03	26.40
Other Indigenous People of Minority Groups				
None	22.74	25.09	25.47	27.72
Primary	23.62	25.08	25.07	26.99
Secondary	22.56	24.09	25.33	26.13
Tertiary	21.91	24.72	23.76	25.45

Figure 4.8 Comparison of mean BMI of Women from the Four Main Ethnic Groups at Different Educational Levels over Years 1996-2015



Note: y-axis refers to BMI (kg/m^2) of a woman

Figure 4.9 Comparison of mean BMI between Ethnic Groups of Different Educational Levels over Years 1996-2015



Note: y-axis refers to BMI (kg/m^2) of a woman

Figures 4.8 and 4.9 illustrate that the only clear BMI-education gradient that occurred was a negative BMI gradient across the four different educational levels for Malaysian Chinese women in1996, 2006, and 2011. Inspection of the graph in both Figures 4.3 and 4.4 also show a negative educational gradient among women from Other Indigenous People Minority Groups in 2015.

4.4.2 Comparison of weight categories and education across four ethnic groups: 1996–2015

This section describes the distribution of underweight, healthy weight, pre-overweight, overweight and obese women aged 18–49 years, according to their ethnicity and education levels. I combined participants without a formal education and those with primary education into a single group, because the number of the former decreased substantially, from 1,133 in 1996 to 162 in 2015. This led to some cells in the cross-tabulation table having few or no observations when stratified by weight category, education level and ethnicity.

As Table 4.7 demonstrates, within the lowest educated group, Other Indigenous People Minority Groups showed the greatest prevalence of being underweight between 1996 and 2006; however, 2011 to 2015 saw this shift to Malaysian Chinese women. As for the secondary educated group, differences in the prevalence of being underweight were not substantial across all four ethnic groups, with the disparity across this grouping being less than 5.0% across each of the main ethnicities, every one of the four times they were analysed. Variances in underweight prevalence were widest in the tertiary educated group, ranging from 7.5% to 9.2%. Additionally, tertiary educated Malaysian Chinese women were most susceptible to being underweight at any of the four time points.

Table 4.7
Distribution of Underweight According to Ethnic Groups and Educational Levels: 1996–2015

	Underweight BMI <18.5kg/m^2				
Education	Ethnicity	1996	2006	2011	2015
None and Primary	Malaysian Malay	160 (9.1)	70 (4.8)	9 (2.8)	15 (4.7)
	Malaysian Chinese	83 (8.2)	24 (4.4)	9 (6.4)	7 (8.2)
	Malaysian Indian	30 (8.8)	14 (4.4)	2 (2.0)	1 (1.5)
	Other Indigenous People	132 (11.8)	42 (6.5)	14 (6.3)	6 (3.3)
Secondary	Malaysian Malay	505 (15.9)	448 (9.9)	137 (7.1)	133 (6.6)
	Malaysian Chinese	283 (16.9)	156 (12.6)	57 (11.6)	43 (10.3)
	Malaysian Indian	83 (17.0)	71 (10.9)	22 (8.2)	28 (10.7)
	Other Indigenous People	146 (16.1)	103 (11.9)	24 (8.1)	18 (6.3)
Tertiary	Malaysian Malay	115 (17.5)	83 (9.4)	94 (8.2)	94 (7.2)
	Malaysian Chinese	77 (20.8)	71 (18.2)	47 (16.8)	37 (13.4)
	Malaysian Indian	11 (15.7)	14 (11.3)	12 (11.5)	9 (8.5)
	Other Indigenous People	13 (13.3)	7 (9.6)	10 (10.0)	6 (4.2)

Note:
The first figure in each column represents the total number of complete observations and its percentage (%) in parentheses.

Table 4.8 reveals that the number of those exhibiting a healthy weight decreased sharply at each education level between 1996 and 2015, except for three observations. Among the lowest educated women, Malaysian Indian women were least likely to be having a healthy weight when compared to the other three ethnic groups. Conversely, the lowest educated Malaysian Chinese women were more likely to be in a healthy weight range, except for in 1996, when Other Indigenous People Minority Groups had the highest proportion of those at a healthy weight (40.7%). Similar patterns were observed among the secondary educated group, aside from in 2015. That year, secondary educated Malaysian Malay women were least probable to be at a healthy weight. Meanwhile, among the tertiary educated group, Malaysian Chinese women were most likely to be within a healthy weight range.

Table 4.8
Distribution of Healthy Weight According to Ethnic Groups and Educational Levels: 1996–2015

	Healthy Weight BMI 18.5–22.9kg/m^2				
Education	Ethnicity	1996	2006	2011	2015
None and Primary	Malaysian Malay	588 (33.5)	350 (24.2)	58 (18.2)	60 (18.8)
	Malaysian Chinese	379 (37.4)	185 (33.6)	49 (34.8)	30 (35.3)
	Malaysian Indian	110 (32.3)	60 (19.0)	11 (10.9)	7 (10.8)
	Other Indigenous People	455 (40.7)	199 (30.9)	68 (30.6)	37 (20.2)
Secondary	Malaysian Malay	1267 (40.0)	1347 (29.9)	510 (26.4)	447 (22.3)
	Malaysian Chinese	859 (51.3)	560 (45.2)	208 (42.2)	167 (40.0)
	Malaysian Indian	191 (39.1)	178 (27.2)	59 (22.1)	59 (22.5)
	Other Indigenous People	411 (45.2)	301 (34.8)	82 (27.8)	70 (24.3)
Tertiary	Malaysian Malay	280 (42.6)	329 (37.3)	381 (33.2)	376 (28.7)
	Malaysian Chinese	217 (58.6)	192 (49.2)	142 (50.9)	126 (45.7)
	Malaysian Indian	31 (44.3)	49 (39.5)	42 (40.4)	21 (19.8)
	Other Indigenous People	54 (55.1)	24 (32.9)	44 (44.0)	45 (31.3)

Note:
The first figure in each column represents the total number of complete observations and its percentage (%) in parentheses.

Table 4.9 establishes that the lowest educated Malaysian Chinese women had the highest pre-overweight prevalence, from 1996 to 2011. Amid the secondary educated group, Malaysian Indian (15.3%) were more likely to be pre-overweight than the other three ethnicities in 1996, while the greatest pre-overweight prevalence observed was among secondary educated Malaysian Chinese women (16.2%) in 2006. Between 2011 and 2015, those in the secondary educated Other Indigenous People Minority Groups were the most prone to being pre-overweight.

Table 4.9
Distribution of Pre-overweight According to Ethnic Groups and Educational Levels: 1996–2015

	Pre-overweight BMI 23.0–24.9kg/m^2				
Education	Ethnicity	1996	2006	2011	2015
None and Primary	Malaysian Malay	285 (16.2)	184 (12.7)	43 (13.5)	40 (12.5)
	Malaysian Chinese	192 (18.9)	97 (17.6)	26 (18.4)	7 (8.2)
	Malaysian Indian	57 (16.7)	49 (15.5)	13 (12.9)	11 (16.9)
	Other Indigenous People	194 (17.3)	92 (14.3)	33 (14.9)	25 (13.7)
Secondary	Malaysian Malay	446 (14.1)	604 (13.4)	265 (13.7)	265 (13.2)
	Malaysian Chinese	241 (14.4)	201 (16.2)	86 (17.4)	70 (16.8)
	Malaysian Indian	75 (15.3)	86 (13.1)	30 (11.2)	23 (8.8)
	Other Indigenous People	138 (15.2)	132 (15.2)	52 (17.6)	52 (18.1)
Tertiary	Malaysian Malay	96 (14.6)	139 (15.8)	174 (15.2)	199 (15.2)
	Malaysian Chinese	40 (10.8)	50 (12.8)	33 (11.8)	45 (16.3)
	Malaysian Indian	11 (15.7)	22 (17.7)	16 (15.4)	14 (13.2)
	Other Indigenous People	14 (14.3)	9 (12.3)	13 (13.0)	20 (13.9)

Note:
The first figure in each column represents the total number of complete observations and its percentage (%) in parentheses.

As seen in Table 4.10, secondary and tertiary educated Malaysian Chinese women were the least likely to be overweight when compared to the other three ethnic groups at any of the four specified points in time. Yet, among the lowest educated group, Malaysian Indian women were more likely to be overweight than Malaysian Malay, Malaysian Chinese and Other Indigenous People Minorities in 1996, 2011 and 2015.

Table 4.10
Distribution of Overweight According to Ethnic Groups and Educational Levels: 1996–2015

	Overweight BMI 25.0 - 29.9kg/m²				
Education	Ethnicity	1996	2006	2011	2015
None and Primary	Malaysian Malay	493 (28.1)	497 (34.4)	111 (34.9)	98 (30.7)
	Malaysian Chinese	269 (26.5)	167 (30.4)	34 (24.1)	28 (32.9)
	Malaysian Indian	97 (28.4)	93 (29.4)	36 (35.6)	27 (41.5)
	Other Indigenous People	255 (22.8)	206 (32.0)	71 (32.0)	64 (35.0)
Secondary	Malaysian Malay	700 (22.1)	1206 (26.8)	558 (28.9)	597 (29.8)
	Malaysian Chinese	236 (14.1)	241 (19.5)	89 (18.1)	96 (23.0)
	Malaysian Indian	105 (21.5)	185 (28.3)	94 (35.2)	69 (26.3)
	Other Indigenous People	156 (17.2)	220 (25.4)	87 (29.5)	85 (29.5)
Tertiary	Malaysian Malay	127 (19.3)	208 (23.6)	294 (25.6)	342 (26.1)
	Malaysian Chinese	33 (8.9)	54 (13.8)	42 (15.1)	45 (16.3)
	Malaysian Indian	14 (20.0)	27 (21.8)	20 (19.2)	39 (36.8)
	Other Indigenous People	15 (15.3)	23 (31.5)	24 (24.0)	42 (29.2)

Note:
The first figure in each column represents the total number of complete observations and its percentage (%) in parentheses.

Table 4.11 indicates increasing differences in terms of obesity levels at each stage of educational attainment across Malaysian Malay, Malaysian Chinese, Malaysian Indian and Other Indigenous People of Minority Groups. Within each education level, Malaysian Chinese women exhibited lower rates of obesity than Malaysian Malay women, Malaysian Indian women and women of Other Indigenous People Minority Groups, except in 2011, as that year women of Other Indigenous People Minority Groups with the lowest educational level had the lowest rate of obesity (16.2%).

Table 4.11
Distribution of Obesity According to Ethnic Groups and Educational Levels: 1996–2015

	Obesity BMI ≥ 30.0kg/m²				
Education	Ethnicity	1996	2006	2011	2015
None and Primary	Malaysian Malay	230 (13.1)	344 (23.8)	97 (30.5)	106 (33.2)
	Malaysian Chinese	91 (9.0)	77 (14.0)	23 (16.3)	13 (15.3)
	Malaysian Indian	47 (13.8)	100 (31.6)	39 (38.6)	19 (29.2)
	Other Indigenous People	83 (7.4)	104 (16.2)	36 (16.2)	51 (27.9)
Secondary	Malaysian Malay	251 (7.9)	898 (19.9)	459 (23.8)	562 (28.0)
	Malaysian Chinese	54 (3.2)	81 (6.5)	53 (10.8)	41 (9.8)
	Malaysian Indian	35 (7.2)	134 (20.5)	62 (23.2)	83 (31.7)
	Other Indigenous People	58 (6.4)	110 (12.7)	50 (16.9)	63 (21.9)
Tertiary	Malaysian Malay	39 (5.9)	122 (13.8)	204 (17.8)	297 (22.7)
	Malaysian Chinese	3 (0.8)	23 (5.9)	15 (5.4)	23 (8.3)
	Malaysian Indian	3 (4.3)	12 (9.7)	14 (13.5)	23 (21.7)
	Other Indigenous People	2 (2.0)	10 (13.7)	9 (9.0)	31 (21.5)

Note:
The first figure in each column represents the total number of complete observations and its percentage (%) in parentheses.

Tables 4.7– 4.11 suggest ethnicity and educational level might be associated with weight categories, because there were differences in each weight category across each of the ethnic groups. When comparing the five weight categories, the variances were more pronounced among those maintaining a healthy weight and those considered obese than among the underweight, pre-overweight and overweight groupings. However, these differences did not indicate the strength and direction of relationships across ethnicity, education level and weight category.

To summarise, differences in the mean BMI and rates of being underweight, a healthy weight, pre-overweight, overweight and obese were presented across the four ethnic groups of women in Malaysia between 1996 and 2015.

These findings warrant further investigation, the results of which are detailed in Chapters 5 and 6.

Chapter 5
Results of three-level random intercept linear regression analyses

Chapter five focuses on the analyses of three-level linear regression models using the 1996, 2006, 2011 and 2015 Malaysia National Health and Morbidity Survey data with mean BMI as the outcome. As discussed in my literature chapter, existing research regarding socioeconomic influences on BMI predominantly focuses on patterns that are observed in industrialised countries rather than patterns that are observed in economically developing countries.

My particular focus in this chapter is the associations between mean BMI and socioeconomic status among women of childbearing age belonging to four main ethnic groups in Malaysia. In order to do this, I examined weight differences and distributions for the years 1996, 2006, 2011 and 2015 through the creation of adopting three-level linear models.

This chapter has been divided into three sections. The first section focuses on inter-ethnic group differences in mean BMI for the years 1996, 2006, 2011 and 2015. The second section presents the findings of ethnic inequalities in BMI and education, drawing on Wald Test results. The third section is the conclusion.

5.1 Social patterning of mean BMI for Women of Four Main Ethnic Groups over 1996, 2006, 2011 and 2015

This section focuses on social patterning of mean BMI for women of four main ethnic groups over 1996, 2006, 2011 and 2015 because of variation in mean BMI presented across ethnic groups at the population-level (see Appendix C for details).

5.1.1 Social patterning of mean BMI for Malaysian Malay women over 1996, 2006, 2011 and 2015

Table 5.1 presents the results of the fixed parts of my full models for Malaysian Malay women in 1996, 2006, 2011 and 2015. This subsection highlights the results of the full models only because they are theoretically driven and to facilitate comparisons between the four data sets.

The overall mean BMI for Malaysian Malay women was 27.261 kg/m^2 in 1996 and increased to 30.770 kg/m^2 in 2006. However, the mean BMI decreased to 25.132 kg/m^2 in 2011 and then increased to 30.723 kg/m^2 in 2015. Age was positively associated with mean BMI among Malaysian Malay women for the years of 1996, 2006, 2011 and 2015. Although mean BMI was positively associated with each increase in the age category, these associations were not always significant. The mean BMI of women aged 42-49 years was not significantly different to the mean BMI of women aged 34-41 years in 1996, 2011 and 2015.

Never married Malaysian Malay women had a significantly lower mean BMI than married Malaysian Malay women except in 2015. Unmarried Malaysian Malay women, also had a lower mean BMI than married Malaysian Malay women and these differences were significant in 1996 and 2006 but were not significant in 2011 and 2015.

The mean BMI of Malaysian Malay women was not always significantly associated with every education attainment level. Consistent patterns of mean BMI appeared in primary and secondary education groups over the four time points. Their mean BMIs were relatively higher than the tertiary education group. Primary educated women had a significantly higher mean BMI than tertiary educated women in 1996, 2006, 2011 and 2015. The mean BMI was also significantly higher when secondary educated Malaysian Malay women were compared with tertiary educated Malaysian Malay women.

The mean BMI of Malaysian Malay women who did not receive formal education was not significantly different to mean BMI of tertiary educated women at any of the four time points. They had a lower mean BMI than tertiary educated Malaysian Malay women in 1996, 2006 and 2015. There also appeared to be a negative education-mean BMI gradient among Malaysian Malay women in year 2011. This indicated that as education increased mean BMI decreased.

At the enumeration-block-level, metropolitan Malaysian Malay women had a lower mean BMI than Malaysian Malay women who lived in small and large urban areas but these differences in mean BMI were not significant in 1996 and 2015. The mean BMI of Malaysian Malay women living in rural areas was lower than the mean BMI of Malaysian Malay women living in metropolitan areas in 1996 and 2006 but these differences in mean BMI were not significant. However, in 2011 Malaysian Malay women living in rural areas had a significantly higher mean BMI than Malaysian Malay women living in metropolitan areas. There were no significant differences between these two groups women in 2015 although similar mean BMI patterns persisted.

The associations between the proportion of tertiary educated women in a state or federal territory and mean BMI did not vary substantially over years 1996-2015. Moreover, the proportion of tertiary educated women at the state-level was not significantly associated with mean BMI among Malaysian Malay women in 1996, 2006, 2011 or 2015 except for one observation. In 2015, Malaysian Malay women from the middle proportion of tertiary educated women states had a significantly lower mean BMI (0.608 kg/m^2) than Malaysian Malay women from the high proportion of tertiary educated women state.

Income inequality was also not significantly associated with mean BMI among Malaysian Malay women in 1996, 2006, 2011 and 2015. However, a one unit increase in income inequality, as measured by Gini Coefficient, was associated with large decreases in mean BMI in 1996 (5.713 kg/m^2) in 2006 (8.206 kg/m^2) and in 2015 (7.563 kg/m^2). In contrast, a one unit increase in income inequality contributed to an increase in mean BMI in 2011 (5.388

kg/m^2). That these differences were not significant may be partially due to the small number of states and federal territories and a small variation in Gini Coefficients across the states and federal territories, which resulted in the relatively large standard errors.

Table 5.1
Results of the fixed parts of Full Models for Malaysian Malay women in 1996, 2006, 2011 and 2015

Fixed Part	Malaysian Malay 1996			Malaysian Malay 2006			Malaysian Malay 2011			Malaysian Malay 2015		
BMI	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value
Intercept	27.261	1.654	0.000	30.770	2.607	0.000	25.132	1.724	0.000	30.723	2.483	0.000
Age												
18-25	-2.890	0.230	0.000	-3.675	0.239	0.000	-2.977	0.370	0.000	-3.426	0.372	0.000
26-33	-1.724	0.200	0.000	-2.138	0.198	0.000	-1.207	0.295	0.000	-1.651	0.295	0.000
34-41	-0.217	0.191	0.129	-1.027	0.192	0.000	-0.327	0.290	0.123	-0.375	0.291	0.101
42-49 (ref.)												
Marital Status												
Never Married	-1.016	0.186	0.000	-1.337	0.206	0.000	-0.866	0.315	0.003	-0.431	0.314	0.086
Unmarried	-0.661	0.342	0.026	-0.742	0.343	0.016	-0.191	0.599	0.367	-0.412	0.495	0.202
Married (ref.)												
Education												
None	-0.187	0.316	0.280	-0.193	0.425	0.319	1.059	1.100	0.170	-0.329	1.078	0.381
Primary	0.721	0.234	0.000	0.686	0.260	0.003	1.020	0.403	0.005	0.920	0.417	0.013
Secondary	0.246	0.197	0.109	0.320	0.203	0.058	0.402	0.227	0.040	0.590	0.234	0.006
Tertiary (ref.)												
Enumeration Block urbanicity												
Rural	-0.140	0.159	0.191	-0.091	0.168	0.294	0.474	0.237	0.022	0.266	0.265	0.155
Small urban	0.253	0.379	0.250	0.054	0.369	0.439	-0.049	0.472	0.457	0.186	0.502	0.356
Large urban	0.074	0.215	0.366	-0.083	0.222	0.349	0.313	0.381	0.211	0.226	0.329	0.236
Metropolitan (ref.)												
Proportion of TEW												
Low	-0.281	0.303	0.166	-0.383	0.457	0.193	-0.607	0.529	0.119	-0.407	0.439	0.167
Mid	-0.159	0.273	0.260	-0.068	0.501	0.435	-0.507	0.390	0.098	-0.608	0.344	0.039
High (ref.)												
Income Inequalit	-5.713	3.781	0.065	-8.206	6.031	0.083	5.388	4.510	0.106	-7.563	6.517	0.106
Sample size												
Women	5565			6747			3390			3636		
Enumeration-blo	1284			1628			599			671		
States	15			15			16			16		

Notes:
1) ref. refers to base category
2) TEW refers to tertiary educated women in a given state or federal territory

Table 5.2 shows the results of the random part of my full models for Malaysian Malay women in 1996, 2006, 2011 and 2015. The mean BMI variance from the four sources changed during the period 1996 to 2015. However, the greatest variability in mean BMI continued to be found at the individual level and therefore was due to differences between women. At the individual-level, the variability rose from 20.381 in 1996 to 29.209 in 2006, 33.800 in 2011 and 37.925 in 2015. At the state-level, the variability increased from 0.083 to 0.187 between 1996 and 2011 but declined to 0.070

in 2015. These fluctuating trends in BMI variance were also observed at the enumeration-block level, which declined dramatically (from 0.815 to 0.033) over the years of 1996, 2006 and 2011 but increased in 2015 (0.567). In sum, the variation in mean BMI arising from differences between states became progressively weaker on Malaysian Malay women's mean BMI since 2006.

The ICCs reported at the state-level and enumeration-block-level suggested similarities for women who lived in different enumeration-blocks were not as strong as women who lived in the same enumeration-blocks within a state or federal territory. As with previous analyses, the assumptions of normality were assessed using Quantile-quantile plots and being met (see Appendix D, Figures D.5.1 – D.5.12).

Table 5.2
Results of Random Parts of Full Models for Malaysian Malay women in 1996, 2006, 2011 and 2015

	Malaysian Malay 1996		Malaysian Malay 2006		Malaysian Malay 2011		Malaysian Malay 2015	
Parameter	Estimate	Std. Err.	Estimate	Std. Err.	Estimate	Std. Err.	Estimate	Std. Err.
State-level variance	0.083	0.085	0.253	0.198	0.187	0.197	0.070	0.127
Enumeration-block-level v	0.815	0.254	0.257	0.221	0.033	0.125	0.567	0.330
Individual-level variance	20.381	0.438	29.209	0.561	33.800	0.821	37.925	0.946
Intraclass Correlation Coefficients (ICCs)								
State-level	0.004		0.009		0.005		0.002	
Enumeration-block-level	0.042		0.017		0.006		0.017	

5.1.2 Social patterning of mean BMI for Malaysian Chinese women over the years of 1996, 2006, 2011 and 2015

Table 5.3 presents the results of fixed parts of full model for Malaysian Chinese women over the years of 1996, 2006, 2011 and 2015. The overall mean BMI for Malaysian Chinese women was the lowest among the four ethnic groups. It was 22.935 kg/m^2 in 1996 and reduced to 21.428 kg/m^2 in 2006. However, it increased to 22.077 kg/m^2 in 2011 and 24.042 in 2015. There was a positive BMI-age association across the years of 1996, 2006, 2011 and 2015 for Malaysian Chinese women. Although the impact of age on mean BMI was consistent and positive over 19-year period, its impact was not significant for women aged 34-41-year-old in 2011 and 2015.

Unlike the findings that were observed for Malaysian Malay women, the mean BMI of never married Malaysian Chinese women was not always significantly lower than the mean BMI of married Malaysian Chinese women. The non-significant differences in mean BMI occurred in 2006 and in 2015. There were no significant differences in the BMI of unmarried and married Malaysian Chinese women in the years of 1996, 2006, 2011 and 2015. In 2015, both never married and unmarried Malaysian Chinese women had non-significantly higher mean BMI than married Malaysian Chinese women.

There was a negative and significant educational mean BMI stepwise gradient among Malaysian Chinese women that persisted over the three time points (1996, 2006, 2011). Thus, the higher the education level the lower the mean BMI. However, the education/mean BMI gradient was not present in 2015, possibly because fewer none educated Malaysian Chinese women (n=7) were included in the study sample. In 2015, the differences in mean BMI between Malaysian Chinese women who did not receive a formal education and those who had tertiary education was not significant. Their mean BMI was 1.635 kg/m^2 lower than the mean BMI of tertiary educated Malaysian Chinese women.

I reran the model with the same procedure but excluded Malaysian Chinese women who did not have a formal education from the analysis. The mean BMI/education gradient presented in year 2015 if the none educated Malaysian Chinese women were excluded from the analysis.

As shown in Table 5.3, in 2015 the primary and secondary educated Malaysian Chinese women had a higher mean BMI than the tertiary educated Malaysian Chinese women but none of these differences were statistically significant.

The influence of urbanicity on mean BMI varied. For example, the mean BMI of Malaysian Chinese women living in rural areas were significantly higher than the mean BMI of Malaysian Chinese women living in metropolitan areas in 1996 only. The mean BMI of Malaysian Chinese women living in small urban areas was also significantly higher than the mean BMI of Malaysian Chinese women living in metropolitan areas in 2006, 2011 and 2015. These significant differences increased from 0.731 in year 2006 to 1.760 in year 2015. The mean BMI of Malaysian Chinese women living in large urban areas was also significantly higher than the mean BMI of Malaysian Chinese women living in metropolitan areas in 1996 and 2006.

At the state-level, the proportion of tertiary educated women and income inequality were not significantly associated with the mean BMI of Malaysian Chinese at any time point, except for one observation in 2015. In 2015, the differences in mean BMI of Malaysian Chinese women who lived in low proportion of tertiary educated women states was significantly higher (1.096 kg/m^2) than the mean BMI of Malaysian Chinese women who lived in states with a high proportion of tertiary educated women. A negative association between mean BMI and the proportion of educated women at the state level was observed in 1996, 2011 ad 2015 but a positive association was observed in 2006.

A one unit increase in income equality was associated with a decrease in mean BMI of 1.899 kg/m^2 in 1996 and 1.520 kg/m^2 in 2015 but with an increase in mean BMI in 2006 (4.359 kg/m^2) and 2011 (1.892 kg/m^2). None of the associations between income inequality which was captured by Gini Coefficient and mean BMI was significant.

The normality assumptions were checked with Quantile-quantile plots. Each plot showed some residuals dots scattered along some parts of a diagonal line and within the acceptable range of +2.000 and -2.000, hence the assumption of normality in all models was appropriate (see Appendix D, Figures D.5.13 – D.5.24).

Table 5.4 presents the random part of the full models across 1996, 2006, 2011 and 2015. The BMI variance varied across the individual-, enumeration-block- and state-level in 1996, 2006 and 2011. The major source of variability was due to differences between Malaysian Chinese women at the individual-level. The individual-level variability increased over four time points. Variability at the enumeration-block-level was larger than variability at the state level at each of the four time points. But, it weakened progressively over time. The ICC statistics also indicated that Malaysian Chinese women living in the same enumeration-block had greater similarities than Malaysian Chinese women living in different enumeration-block within a state.

Table 5.3
Results of the fixed parts of Full Models for Malaysian Chinese Women in 1996, 2006, 2011 and 2015

Fixed Part	Malaysian Chinese 1996			Malaysian Chinese 2006			Malaysian Chinese 2011			Malaysian Chinese 2015		
BMI	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value
Intercept	22.935	2.015	0.000	21.428	1.999	0.000	22.077	3.137	0.000	24.042	4.930	0.000
Age												
18-25	-1.347	0.265	0.000	-2.516	0.340	0.000	-1.580	0.601	0.006	-2.262	0.659	0.000
26-33	-1.115	0.224	0.000	-0.831	0.280	0.001	-0.795	0.457	0.041	-1.307	0.545	0.008
34-41	-0.611	0.207	0.002	-0.456	0.244	0.031	-0.435	0.418	0.148	-0.343	0.475	0.241
42-49 (ref.)												
Marital Status												
Never Married	-0.954	0.210	0.000	-0.286	0.279	0.154	-0.997	0.462	0.017	0.042	0.509	0.466
Unmarried	-0.281	0.584	0.311	-0.036	0.556	0.476	0.281	0.976	0.387	0.271	0.958	0.396
Married (ref.)												
Education												
None	2.956	0.382	0.000	2.600	0.678	0.000	3.242	1.448	0.013	-1.635	2.071	0.213
Primary	1.844	0.268	0.000	1.985	0.324	0.000	1.522	0.532	0.003	1.021	0.672	0.065
Secondary	0.676	0.233	0.002	0.610	0.261	0.009	0.758	0.363	0.020	0.453	0.401	0.130
Tertiary (ref.)												
Enumeration Block Urbanicity												
Rural	0.551	0.241	0.009	0.172	0.274	0.262	0.363	0.490	0.231	0.538	0.623	0.198
Small urban	0.237	0.394	0.274	0.731	0.410	0.038	1.266	0.592	0.017	1.760	0.742	0.008
Large urban	0.468	0.214	0.015	1.357	0.371	0.000	-0.045	0.584	0.468	0.756	0.536	0.076
Metropolitan (ref.)												
Proportion of TEW												
Low	0.314	0.346	0.159	-0.167	0.302	0.275	0.827	0.652	0.087	1.096	0.621	0.032
Mid	0.153	0.361	0.332	-0.071	0.353	0.414	0.755	0.573	0.075	0.045	0.651	0.486
High (ref.)												
Income Inequality	-1.899	4.672	0.336	4.359	4.586	0.164	1.892	7.888	0.392	-1.520	12.988	0.445
Sample size												
Women	3045			2141			904			779		
Enumeration-block	905			822			310			274		
States	15			15			16			15		

Notes:
1) ref. refers to base category
2) TEW refers to tertiary educated women in a given state or federal territory

Table 5.4
Results of the Random Parts of Full Models for Malaysian Chinese Women in 1996, 2006, 2011 and 2015

	Malaysian Chinese 1996		Malaysian Chinese 2006		Malaysian Chinese 2011		Malaysian Chinese 2015	
Parameter	Estimate	Std. Err.	Estimate	Std. Err.	Estimate	Std. Err.	Estimate	Std. Err.
State-level variance	0.095	0.117	0.040	0.069	0.344	0.435	0.234	0.337
Enumeration-block-level b	0.846	0.352	0.594	0.452	0.030	0.058	0.149	0.377
Individual-level variance	14.988	0.476	17.491	0.669	21.435	1.041	23.731	1.287
Intraclass Correlation Coefficients (ICCs)								
State-level	0.006		0.002		0.016		0.010	
Enumeration-block-level	0.059		0.035		0.017		0.016	

5.1.3 Social patterning of mean BMI for Malaysian Indian women over the years of 1996, 2006, 2011 and 2015

Table 5.5 shows the results of the fixed part of my full models for Malaysian Indian women in 1996, 2006, 2011 and 2015. The overall mean BMI for Malaysian Indian women was 27.916 kg/m^2 in 1996, decreasing to 25.179 kg/m^2 in 2006 and to 14.527 kg/m^2 in 2011 before peaked at 28.825 kg/m^2. The extreme value of mean BMI in 2011 could possibly cause by a small number of states and less variance of income inequality at the state-level. I replicated the same procedure on the 2011 Malaysian Indian data set but without considering the influence of income inequality. The overall mean BMI was reported at 25.638 kg/m^2.

A positive BMI-age gradient was observed across 1996, 2006 and 2011. The positive associations between age groups and mean BMI were all significant in 1996 and 2006. However, in 2011 only Malaysian Indian women who were aged 18-25 years old had a significantly lower mean BMI than Malaysian Indian women who were aged 42-49 years old.

The associations between mean BMI and the four age groups for Malaysian Indian women differed in 2015. Thus, the positive BMI-age gradient disappeared in 2015. However, Malaysian Indian women aged 18-25 years old continued to have a significantly lower mean BMI than Malaysian Indian women aged 42-49 years old. A major difference was observed among Malaysian Indian women aged 34-41 years old when compared to Malaysian

Indian women aged 42-49 years old as women aged 34-41 years old had a significantly higher mean BMI.

Married Malaysian Indian women had a significantly higher mean BMI than never married Malaysian Indian women in 1996 and 2006 but not in 2011 and 2015. The mean BMI of unmarried Malaysian Indian women was not significantly different to the mean BMI of married Malaysian Indian women at any of the four time points. Moreover, in both 2011 and 2015 there were no significant differences in mean BMI among never married, married, unmarried or married Malaysian Indian women.

The associations between education level and mean BMI among Malaysian Indian women varied over the three time points (1996, 2006, 2011). There appeared to be a negative relationship between education level and mean BMI among Malaysian Indian women who were educated to the primary, secondary and tertiary levels in 1996, 2006 and 2011 and these associations were significant in 2006 and 2011 but not always significant in 1996. Moreover, these differences in mean BMI were greater in 2011 than in 2006. However, Malaysian Indian women who were educated to the primary level had a higher mean BMI than Malaysian Indian women who had no formal education at each of the three time points and additionally also in 2015. Malaysian Indian women who had no formal education in 1996 were the only Malaysian Indian women who had a lower mean BMI than Malaysian Indian women who had tertiary education but this association was not significant.

In 2015, Malaysian Indian women’s mean BMI was associated non-significantly with four educational attainment levels. The none educated and primary educated Malaysian Indian women had a higher mean BMI compared with the tertiary educated Malaysian Indian women. The opposite association was suggested when the secondary educated Malaysian Indian women were compared to the tertiary educated women.

At the enumeration-block level, the mean BMI of Malaysian Indian women living in metropolitan areas was higher than the mean BMI of Malaysian

Indian women living rural areas, small urban areas and large urban areas in 1996. The reverse trends were true in 2011 and 2015. The majority of differences in mean BMI across four levels of urbanicity was not significant. Two significant differences were observed for Malaysian Indian women living in rural areas and large urban areas in 1996.

At the state-level, the associations between mean BMI and the proportion of tertiary educated Malaysian Indian women were not significant. The associations between mean BMI and state-level income inequality among Malaysian Indian women were relatively large but variable and only significant in 2011. Thus, a one unit increase in income inequality was associated with a very large decrease in mean BMI (5.149 kg/m^2) in 1996 and a large increase in mean BMI in 2006 (1.119 kg/m^2).

In 2011 an increase in income inequality by one unit was associated with a significant increase in mean BMI (27.322 kg/m^2). In 2015, a one unit increase in income inequality was associated with a reduction in the mean BMI of Malaysian Indian women by 2.451 kg/m^2. A small number of states and federal territories (n=13), large standard deviations and less varied Gini values across states and federal territories could possibly underpin the less precise estimate for this association in both 2011 and 2015 (Du Prel et al., 2009).

Table 5.5
Results of the fixed parts of Full Models for Malaysian Indian Women in 1996, 2006, 2011 and 2015 Analyses

Fixed Part	Malaysian Indian 1996			Malaysian Indian 2006			Malaysian Indian 2011			Malaysian Indian 2015		
BMI	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value
Intercept	27.916	5.104	0.000	25.179	6.470	0.000	14.527	5.780	0.011	28.825	13.347	0.017
Age												
18-25	-3.507	0.561	0.000	-3.176	0.642	0.000	-2.344	1.035	0.013	-4.885	1.018	0.000
26-33	-2.421	0.502	0.000	-1.302	0.521	0.006	-1.115	0.811	0.082	-0.730	0.822	0.192
34-41	-1.151	0.478	0.007	-1.100	0.492	0.013	-0.300	0.734	0.337	1.293	0.797	0.050
42-49 (ref.)												
Marital Status												
Never Married	-1.457	0.428	0.000	-1.361	0.525	0.005	-0.253	0.882	0.390	-0.477	0.847	0.284
Unmarried	-1.111	0.814	0.085	-0.276	0.806	0.369	0.440	1.157	0.356	1.322	1.271	0.144
Married (ref.)												
Education												
None	-0.410	0.822	0.308	2.164	1.074	0.022	3.655	1.643	0.014	0.056	0.713	0.464
Primary	0.911	0.669	0.086	2.624	0.673	0.000	3.801	0.930	0.000	0.499	1.040	0.323
Secondary	0.231	0.608	0.355	1.561	0.577	0.003	1.955	0.703	0.004	-3.663	2.500	0.068
Tertiary (ref.)												
Enumeration Block Urbanicity												
Rural	-0.791	0.445	0.036	-0.107	0.531	0.424	0.083	0.800	0.465	0.715	0.880	0.206
Small urban	-0.601	0.916	0.250	1.007	1.100	0.177	0.024	0.908	0.488	1.462	1.516	0.163
Large urban	-0.807	0.439	0.037	-0.340	0.616	0.289	0.782	1.130	0.250	1.329	0.981	0.084
Metropolitan (ref.)												
Proportion of TEW												
Low	0.264	0.678	0.344	0.376	0.744	0.304	0.119	1.179	0.481	0.677	1.466	0.296
Mid	-0.169	0.461	0.358	0.860	0.706	0.108	0.031	0.862	0.472	-2.426	1.862	0.078
High (ref.)												
Income Inequality	-5.149	12.225	0.332	1.119	14.971	0.472	27.322	14.487	0.023	-2.451	35.236	0.472
Sample size												
Women	898			1075			471			433		
Enumeration-block	352			503			198			192		
States	13			15			13			12		

Notes:
1) ref. refers to base category
2) TEW refers to tertiary educated women in a given state or federal territory
3) The state of Terengganu and Federal Territory of Labuan were not included in the 1996 analysis because female Malaysian Indian respondents were not found in these state and federal territory. The state of Perlis and Federal Territory of Putrajaya were not included in the 2011 analysis because of a very small number of Malaysian Indian women who resided in large urban areas or metropolitan areas only.

Table 5.6
Results of the Random Parts of Full Models for Malaysian Indian Women in 1996, 2006, 2011 and 2015

	Malaysian Indian 1996		Malaysian Indian 2006		Malaysian Indian 2011		Malaysian Indian 2015	
	Estimate	Std. Err.	Estimate	Std. Err.	Estimate	Std. Err.	Estimate	Std. Err.
State-level variance	0.083	0.160	0.058	0.146	0.645	1.415	2.730	3.537
Enumeration-block-level variance	0.952	0.799	4.023	1.157	0.233	0.327	3.168	2.333
Individual-level variance	20.619	1.217	28.521	1.503	33.296	2.226	32.043	2.849
Intraclass Correlation Coefficients (ICCs)								
State-level	0.004		0.002		0.019		0.072	
Enumeration-block-level	0.048		0.125		0.026		0.155	

Table 5.6 shows the random part of the full models for Malaysian Indian women for 1996, 2006, 2011 and 2015. The BMI variance of Malaysian Indian women varied across the individual-, enumeration-block- and state-

level for the years of 1996, 2006, 2011 and 2015. As in previous analyses, the major source of variability in mean BMI occurred at the individual level between Malaysian Indian women. The variability in mean BMI at the enumeration-block-level was larger than the variability in mean BMI at the state-level for four time points. ICC statistics again indicated a higher correlation between Malaysian Indian women living in the same enumeration-block than between Malaysian Indian women living in different enumeration-blocks within the same state.

The normality assumption of all models was assessed by inspecting the Quantile-quantile plots. All plots indicated that the assumption of normality was appropriate (see Appendix D, Figures D.5.25 – D.5.36).

5.1.4 Social patterning of mean BMI for women from Other Indigenous Minority Ethnic Groups in 1996, 2006, 2011 and 2015

Table 5.7 highlights the results of the fixed part of my full models for women from Other Indigenous Minority Ethnic Groups in 1996, 2006, 2011 and 2015. The overall mean BMI for women from Other Indigenous Minority Ethnic Groups was 21.410 kg/m^2 in 1996 and it increased to 31.042 kg/m^2 in 2006. In 2011, it decreased to 26.915 kg/m^2 in 2011 and then increased to 32.926 kg/m^2 in 2015.

A positive age mean BMI gradient was observed across 2006 and 2011. The mean BMI was positively and significantly associated with each increase in the age category, except for the difference in 1996 and in 2015 between the mean BMI of the 34-41 years age group and the mean BMI of the 42-49 years age group which was not significantly different.

Women from Other Indigenous Minority Ethnic Groups who were married had a significantly higher mean BMI than women who had never married during periods of 1996 - 2015. There was no significant difference in the mean BMI of unmarried women and the mean BMI of married women at any of the four time points.

Among women from Other Indigenous Minority Ethnic Groups, the associations between mean BMI and education level were not significant at each education level with the exception of one observation in 2006. In 2006, women who had no formal education had a significantly lower mean BMI than tertiary educated women (1.197 kg/m^2). The analyses of the 2006 data indicated that there was a positive association between mean BMI and education level.

In contrast, the BMI-education association for women from Other Indigenous Minority Ethnic Groups was negative in the subsequent surveys which were conducted in 2011 and 2015. In both years, tertiary educated women from Other Indigenous Minority Ethnic Groups had a lower mean BMI than women from Other Indigenous Minority Ethnic Groups without formal education, those who had primary education and those who had secondary education.

Most of the associations between mean BMI and four classifications of urbanicity of enumeration-block varied among women from Other Indigenous Minority Ethnic Groups and were not significant. The only significant association occurred in 2011. In 2011, women from Other Indigenous Minority Ethnic Groups who lived in rural areas had a significantly lower mean BMI than women who lived in metropolitan areas and this difference was relatively large (1.744 kg/m^2). Women from Other Indigenous Minority Ethnic Groups who resided in metropolitan areas had a greater mean BMI than women from Other Indigenous Minority Ethnic Groups of rural, small urban and large urban areas in 2006, 2011 and 2015. However, such differences in mean BMI were not significant.

At the state-level, living in a state with a high proportion of tertiary educated women was associated with a lower mean BMI over the years of 1996, 2006, 2011 and 2015. These associations were largely not significant except for two observations in 2015. In 2015, women from Other Indigenous Minority Ethnic Groups living in states with a high proportion of tertiary educated women had a significant lower mean BMI than women from Other

Indigenous Minority Ethnic Groups living in states with a low and middle proportion of tertiary educated women.

State-level income equality was also not significantly associated with mean BMI. A unit increase in income inequality was non-significantly associated with a very large decrease in mean BMI in 2006 (9.019 kg/m^2) and in 2015 (20.728 kg/m^2). This could possibly be attributable to large standard deviations and less varied Gini values across states and federal territories in both 2011 and 2015.

Table 5.7
Results of the fixed parts of Full Models for Women from Other Indigenous Minority Ethnic Groups in 1996, 2006 and 2011 Analyses

	OIP1996			OIP 2006			OIP 2011			OIP 2015		
BMI	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value
Intercept	21.410	3.994	0.000	31.042	4.320	0.000	26.915	8.892	0.002	32.926	7.046	0.000
Age												
18-25	-2.032	0.316	0.000	-4.011	0.412	0.000	-3.182	0.678	0.000	-3.178	0.759	0.000
26-33	-0.879	0.293	0.002	-1.256	0.373	0.001	-1.279	0.623	0.022	-0.884	0.631	0.080
34-41	0.192	0.295	0.256	-0.626	0.360	0.040	-1.016	0.619	0.046	0.009	0.633	0.492
42-49 (ref.)												
Marital Status												
Never Married	-1.493	0.254	0.000	-1.074	0.351	0.001	-2.365	0.590	0.000	-1.069	0.610	0.042
Unmarried	-0.668	0.480	0.081	0.204	0.656	0.366	-0.775	1.163	0.257	-0.360	0.909	0.339
Married (ref.)												
Education												
None	-0.375	0.481	0.212	-1.197	0.672	0.036	0.196	0.870	0.416	0.905	0.942	0.163
Primary	0.709	0.464	0.063	-0.741	0.629	0.122	0.449	0.704	0.258	0.350	0.689	0.308
Secondary	0.407	0.439	0.181	-0.637	0.592	0.136	0.814	0.624	0.094	0.239	0.558	0.332
Tertiary (ref.)												
Enumeration Block Urbanicity												
Rural	-0.349	0.224	0.065	-0.174	0.308	0.284	-1.744	0.579	0.001	-0.036	0.489	0.471
Small urban	0.935	0.614	0.063	-0.164	0.734	0.412	-0.050	0.845	0.472	-1.050	1.255	0.203
Large urban	-0.126	0.373	0.363	-0.279	0.489	0.285	-0.287	1.017	0.388	-0.281	0.849	0.371
Metropolitan (ref.)												
Proportion of TEW												
Low	0.474	0.724	0.251	0.205	0.820	0.409	0.008	2.198	0.523	2.643	1.328	0.020
Mid	0.086	0.804	0.445	0.441	0.930	0.324	2.255	2.217	0.129	3.284	1.573	0.016
High (ref.)												
Income Inequality	4.705	9.242	0.308	-9.019	9.847	0.176	1.556	23.926	0.452	-20.728	18.388	0.101
Sample size												
Women	2121			1556			554			616		
Enumeration-bloc	571			419			128			137		
States	15			14			14			12		

Table 5.8
Results of the Random Parts of Full Models for Women from Other Indigenous Minority Ethnic Groups (OIP) in 1996, 2006, 2011 and 2015 Analyses

	OIP 1996		OIP 2006		OIP 2011		OIP 2015	
Parameter	Estimate	Std. Err.	Estimate	Std. Err.	Estimate	Std. Err.	Estimate	Std. Err.
State-level variance	0.072	0.190	0.233	0.409	3.554	5.820	0.983	2.387
Enumeration-block-level v	0.703	0.411	0.999	0.478	1.660	1.103	0.174	0.360
Individual-level variance	16.120	0.621	21.519	0.865	21.628	1.486	27.101	1.620
Intraclass Correlation Coefficients (ICCs)								
State-level	0.004		0.01		0.132		0.035	
Enumeration-block-level	0.046		0.054		0.194		0.041	

Table 5.8 presents the breakdown of the random part of the full models for the years of 1996, 2006, 2011 and 2015 for women from Other Indigenous Minority Ethnic Groups. The largest variation in mean BMI among women from Other Indigenous Minority Ethnic Groups was due to differences between women at the individual level at all four time points. The state variance still accounted for the smallest differences in mean BMI for women from Other Indigenous Minority Ethnic Groups in 1996 and 2006. These results are similar to the results for Malaysian Chinese women but different to the results for Malaysian Malay women and Malaysian Indian women. State level variance was higher than enumeration block variance for Malaysian Malay women and Malaysian Indian women in 2011 but not in 1996, 2006 and 2015.

All ICCs at the state- and enumeration-block-level increased over three time points (1996, 2006 and 2011) but then decreased in 2015. All state-level ICCs were weaker than the enumeration-block ICC at any four time points. These results suggested a stronger commonality among women from Other Indigenous Minority Ethnic Groups who lived in the same enumeration-block-level of a state as opposed to women from who lived in the same state but in different enumeration blocks.

Quantile-quantile plots found that most residual dots moved along with the diagonal lines which indicated that all models complied with the assumption of normality (see Appendix D, Figures D.5.37 – D.5.48 for the plots).

The socio-demographic characteristics appeared to have different influences on the mean BMI of Malaysian Malay women, Malaysian Chinese women, Malaysian Indian women and women from Other Indigenous Minority Ethnic Groups. For example, a positive age gradient emerged among Malaysian Malay women in year 2006, Malaysian Chinese women and Malaysian Indian women in 1996 and 2006 and women from Other Indigenous Minority Ethnic Groups in 2006 and 2011. Irrespective of ethnicity, there were mixed associations between unmarried women and married women over four time points. An education-mean BMI gradient was observed among Malaysian Malay women in 2011; Malaysian Chinese women in 1996, 2006 and 2011; and women from Other Indigenous Minority Ethnic Groups in 2006 and 2015.

In all adjusted models, the main source of variability in mean BMI centred at the individual-level. The enumeration-block-level ICC was consistently greater than the state-level ICC. Therefore, the shared commonalities were greater among two women from the same enumeration block than two women from different enumeration blocks within a state.

5.2 BMI-education level gradient for four main ethnic groups, from 1996 to 2015

This section aims to evaluate the impact of education on the mean BMI among women who belonged to four main ethnic groups in Malaysia.

Two test statistics were adopted to achieve this aim. First, the t-test or Z-test was used to assess the impact of a single parameter of educational attainment level on mean BMI. Second, the Z-test or Wald Test was used to assess the overall effect of education on mean BMI. The t-test or Wald Test indicated a significant impact of education on mean BMI if the corresponding p-value was less than 0.05 or five percent. Neither was used to examine the causal effect of education on mean BMI as it was beyond the scope of my studies.

5.2.1 BMI-education level gradients for Malaysian Malay women

Table 5.9 and Figure 5.1 show varying educational-patterning of mean BMI for Malaysian Malay women over the years of 1996, 2006, 2011 and 2015. Malaysian Malay women who completed education up to tertiary level consistently had a significantly lower mean BMI than Malaysian Malay women who completed education up to primary level from 1996 to 2015. Although the mean BMI of tertiary educated Malaysian Malay was also lower than the mean BMI of secondary educated Malaysian Malay women, significant differences were only observed in year 2011 and 2015.

Turning to the analyses drawing on the Wald Tests, the results of the Wald Tests highlighted a strong and significant influence of education on mean BMI of Malaysian Malay women for years 1996, 2006 and 2015. In 2011, a significant education-BMI-gradient was not established among Malaysian Malay women. Perhaps, marginal differences in mean BMI that occurred between none educated and primary educated Malaysian Malay women contributed to the absence of significant negative gradient in 2011.

As Malaysian Malay are the largest ethnic group in Malaysia and consequently constituted the largest group of participants in the surveys, it was not surprising that their BMI-educational gradients resembled the ones at the population-level. As shown in Figure 5.1, the mean BMI-education gradients of Malaysian Malay women followed the ‘inverted U shape’ for the years 1996, 2006 and 2015. The gradients show that none educated and primary educated Malaysian Malay women had a higher mean BMI than tertiary educated Malaysian Malay women and over-nutrition might contribute to the finding that relate to the mean BMI of none educated and primary educated Malaysian Malay women. Malaysian Malay women without a formal education had the lowest mean BMI in years 1996, 2006 and 2015, but the highest in 2011 (not significant). Meanwhile, primary educated Malaysian Malay women had a significantly higher mean BMI than tertiary educated Malaysian Malay women at all four time points.

Figure 5.1 BMI-educational gradients for Malaysian Malay Women, 1996 to 2015

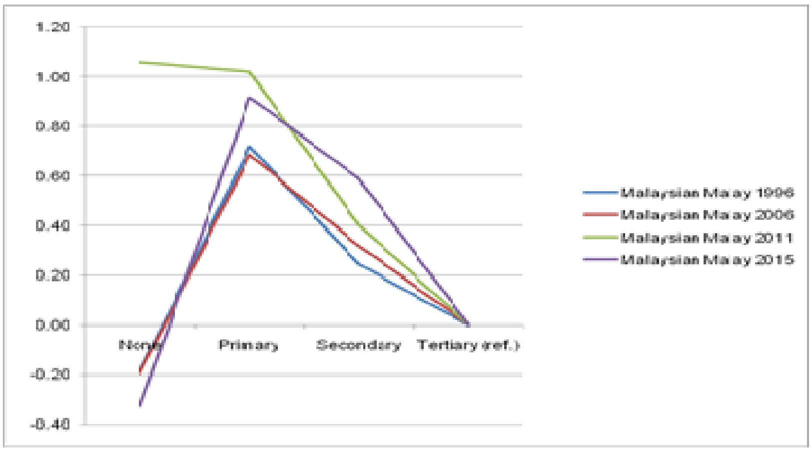


Table 5.9
The Significance of Educational Levels on Mean BMI of Malaysian Malay Women, 1996-2015

Fixed Part	Malaysian Malay 1996			Malaysian Malay 2006			Malaysian Malay 2011			Malaysian Malay 2015		
BMI	Mean	S.E.	P-value	Mean	S.E.	P-value	Mean	S.E.	P-value	Mean	S.E.	P-value
Education												
None	-0.187	0.316	0.280	-0.193	0.425	0.319	1.059	1.100	0.170	-0.329	1.078	0.381
Primary	0.721	0.234	0.000	0.686	0.260	0.003	1.020	0.403	0.005	0.920	0.417	0.013
Secondary	0.246	0.197	0.109	0.320	0.203	0.058	0.402	0.227	0.040	0.590	0.234	0.006
Tertiary (ref.)												
Wald Test	17.560 (0.001)			10.000 (0.019)			6.810 (0.078)			8.810 (0.032)		

Note: The figure in each parenthesis represent the p-value

5.2.2 BMI-education level gradients for Malaysian Chinese women

Table 5.10 shows that education level significantly influenced the mean BMI of Malaysian Chinese women in 1996, 2006 and 2011. The education-mean BMI associations for Malaysian Chinese women differed from the other three main ethnic groups women in three ways. First, there was a consistent and significant education-BMI gradient among Malaysian Chinese women which persisted over the years 1996, 2006 and 2011. Such underlying findings underlined by the smaller p-value as reported by the t-test and Wald-test. The stepwise gradients were displayed in Figure 5.2.

Some changes in education level patterning of mean BMI occurred in 2015 for Malaysian Chinese women. First, the negative education level gradient disappeared because Malaysian Chinese women with tertiary education had a higher mean BMI than Malaysian Chinese without formal education.

Second, each educational attainment level did not associate significantly with Malaysian Chinese women's mean BMI in 2015. These changes could possibly be caused by the relatively small number of Malaysian Chinese women who had no formal education along with a small number of states and federal territories, as discussed in section 5.5.

Figure 5.2 BMI-educational gradients for Malaysian Chinese Women, 1996 to 2015

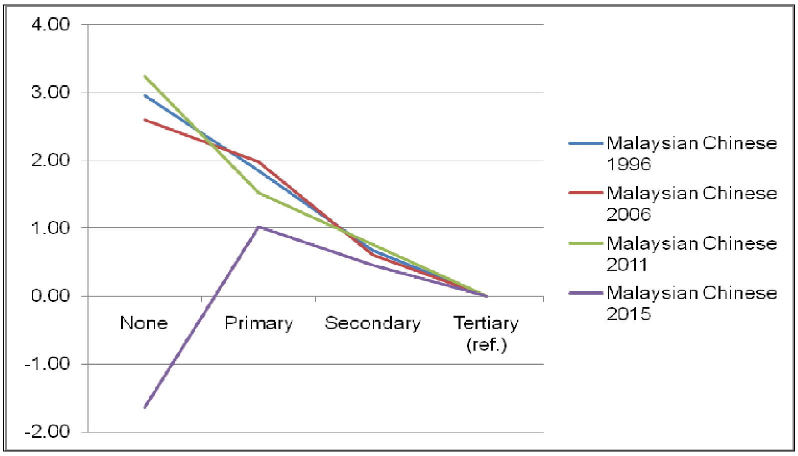


Table 5.10
The Significance of Educational Levels on Mean BMI of Malaysian Chinese Women, 1996-2015

Fixed Part	Malaysian Chinese 1996			Malaysian Chinese 2006			Malaysian Chinese 2011			Malaysian Chinese 2015		
Education	Mean	S.E.	p-value	Mean	S.E.	p-value	Mean	S.E.	p-value	Mean	S.E.	p-value
None	2.956	0.382	0.000	2.600	0.678	0.000	3.242	1.448	0.013	-1.635	2.071	0.213
Primary	1.844	0.268	0.000	1.985	0.324	0.000	1.522	0.532	0.003	1.021	0.672	0.065
Secondary	0.676	0.233	0.002	0.610	0.261	0.009	0.758	0.363	0.020	0.453	0.401	0.130
Tertiary (ref.)												
Wald Test	88.800 (0.000)			48.840 (0.000)			17.370 (0.001)			3.810 (0.283)		

Note: The figure in each parenthesis represents the p-value

5.2.3 BMI-education level gradients for Malaysian Indian women

Table 5.11 shows the output for the t-tests and Wald Tests for Malaysian Indian women, from year 1996 to 2015. There were mixed education-mean BMI associations for Malaysian Indian women (see Figure 5.3). In 1996, tertiary educated Malaysian Indian women had a lower mean BMI than none educated Malaysian Indian women but a higher mean BMI than primary educated and secondary educated Malaysian Indian women. In 2006 and 2011, tertiary educated Malaysian Indian women had a lower mean BMI than none educated, primary educated and secondary educated Malaysian Indian women. These differences in mean BMI were all significant. The association for each education level became stronger and significant in 2006 and 2011 than it was in 1996.

In 2015, none of the test statistics provided significant results in relation to the relationships between mean-BMI and education level for Malaysian Indian women. Malaysian Indian women with tertiary education still had a lower but non-significant mean BMI relative to Malaysian Indian women with no formal education or primary education. However, Malaysian Indian women with tertiary education had a non-significant lower mean BMI than Malaysian Indian women with secondary education.

The education level-mean BMI gradients of Malaysian Indian women are shown in Figure 5.3. In 1996, 2006 and 2011 the highest of mean BMI occurred among primary educated group. However, the gradient became slightly steeper in 2006 and 2011. In both years, differences in mean BMI between primary and tertiary educated women were more pronounced than in year 1996.

Figure 5.3 BMI-educational gradients for Malaysian Indian Women, 1996 to 2015

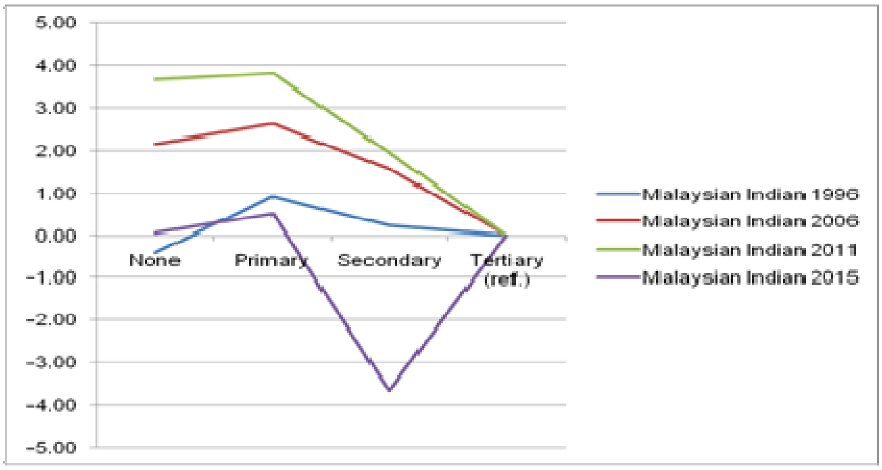


Table 5.11
The Significance of Educational Levels on Mean BMI of Malaysian Indian Women, 1996-2015

Fixed Part	Malaysian Indian 1996			Malaysian Indian 2006			Malaysian Indian 2011			Malaysian Indian 2015		
Education	Mean	S.E.	p-value	Mean	S.E.	p-value	Mean	S.E.	p-value	Mean	S.E.	p-value
None	-0.410	0.822	0.308	2.164	1.074	0.022	3.655	1.643	0.014	0.056	0.713	0.464
Primary	0.911	0.669	0.086	2.624	0.673	0.000	3.801	0.930	0.000	0.499	1.040	0.323
Secondary	0.231	0.608	0.355	1.561	0.577	0.003	1.955	0.703	0.004	-3.663	2.500	0.068
Tertiary (ref.)												
Wald Test	5.890 (0.117)			15.510 (0.001)			17.940 (0.001)			2.640 (0.451)		

Note: The figure in each parenthesis represents the p-value

5.2.4 BMI-education level gradients for Women from Other Indigenous People Minority Groups

Table 5.12 shows the results for the t-tests and Wald Tests for women from Other Indigenous Minority Ethnic Groups in years 1996, 2006, 2011 and 2015. In 1996, there was a mixed education level-BMI pattern. Overall, education had a significant impact on the mean BMI of women from Other Indigenous Minority Ethnic Groups in 1996. The mixed trend shifted to an upward trend in 2006 where a positive but non-significant education level-BMI gradient was found in 2006. Hence, tertiary educated women had the highest mean BMI relative to none educated, primary educated and secondary educated women.

In 2011, a different trend was found where tertiary educated women had the lowest mean BMI relative to none educated, primary educated and secondary educated women. The trends observed between 2006 and 2011 could possibly have indicated the shift of undernutrition (lower mean BMI) to overnutrition (higher mean BMI) among lower education groups (see Figure 5.4). In 2015, a negative educational gradient was found among women from Other Indigenous Minority Ethnic Groups. Although it was not significant, it resembled the education level-BMI gradient in industrialised nations.

Figure 5.4 BMI-educational gradients for Women from Other Indigenous People Minority Groups, 1996 to 2015

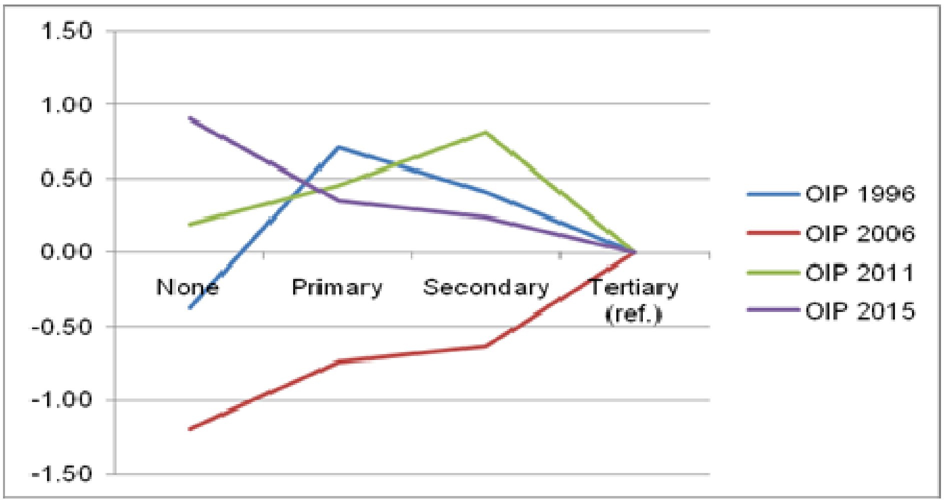


Table 5.12
The Significance of Educational Levels on Mean BMI of Women from Other Indigenous People Minority Groups, 1996-2015

Fixed Part	OIP 1996			OIP 2006			OIP 2011			OIP 2015		
Education	Mean	S.E.	p-value	Mean	S.E.	p-value	Mean	S.E.	p-value	Mean	S.E.	p-value
None	-0.375	0.481	0.212	-1.197	0.672	0.036	0.196	0.87	0.416	0.905	0.942	0.163
Primary	0.709	0.464	0.063	-0.741	0.629	0.122	0.449	0.704	0.258	0.35	0.689	0.308
Secondary	0.407	0.439	0.181	-0.637	0.592	0.136	0.814	0.624	0.094	0.239	0.558	0.332
Tertiary (ref.)												
Wald Test	18.450 (0.000)			3.580 (0.311)			2.220 (0.528)			0.940 (0.817)		

Note: The figure in each parenthesis represents the p-value

5.3 Conclusion

Age, marital status and education, urbanicity, proportion of tertiary educated women in a state and income inequality influenced mean BMI differently across women from the four main ethnic groups in Malaysia over the years of 1996, 2006, 2011 and 2015. Their impacts on mean BMI, however, were not always significant. For example, in 1996 a significant gradient occurred across all age groups for Malaysian Chinese women only. In 2006, a significant age-mean BMI gradient was observed among Malaysian Malay women, Malaysian Chinese women and women from Other Indigenous Minority Ethnic Groups. In 2011, the only significant age-mean BMI gradient occurred among Other Indigenous Minority Ethnic Groups.

Apart from age, differences in mean BMI were also observed in relation to marital status across the four main ethnic groups. The mean BMI of married Malaysian Chinese women, Malaysian Indian women and women from Other Indigenous Minority Ethnic Groups did not differ significantly from unmarried women from the same ethnic group at any of the four time points. However, significant differences in mean BMI were observed between married Malaysian Malay women and unmarried Malaysian Malay women in 1996 and 2006.

Regardless of ethnicity, all married women had a greater mean BMI than never married women except among Malaysian Chinese women in 2015. The differences in mean BMI between married and never married Malaysian Malay women, Malaysian Chinese women and Malaysian Indian women were not always significant during the period of 1996-2015. In contrast, all mean differences between married women and never married women from Other Indigenous Minority Ethnic Groups were significant over years 1996-2015.

In contrast, in 2015 the mean BMI of married women was not significantly different to the mean BMI of never married women among the Malaysian Malay, Malaysian Chinese and Malaysian Indian communities.

Education level significantly influenced Mean BMI particularly among Malaysian Chinese women in 1996-2011. A steep negative education level-mean BMI gradient was observed for Malaysian Chinese in 1996, 2006 and 2011. Education level also appeared to be related to the mean BMI of Malaysian Malay women in 2011 and women from Other Indigenous Minority Ethnic Groups in 2015.

A clear nutritional transition was observed among women from Other Indigenous Minority Ethnic Groups during the period 2006 to 2015 as the education level-mean BMI gradient shifted from a positive gradient to a negative gradient. As for Malaysian Indian women, the education level-mean BMI gradient was absent between 1996 and 2015. Primary educated Malaysian Indian women had the highest mean BMI at all four time points. It is interesting to note the emergence of different mean BMI-socio-demographic patterns among Malaysian Chinese women, Malaysian Indian women, Malaysian Malay women and women from Other Indigenous Minority Ethnic Groups who had unequal access and opportunities to education and businesses.

To sum up, Chapter 5 of my studies focused on socio-demographic patterning of mean BMI only. Differences in relative body weight, that could be useful for clinical intervention was not investigated. This led to a further investigation of differences in underweight, pre-overweight, overweight and obesity using the same data sets. The related results are presented in Chapter 6.

Chapter 6
Results of logistic regression analyses

This chapter presents the results of logistic regression models. It comprises five sections. Sections one to four focus on the results of the associations between underweight, pre-overweight, overweight or obesity, in relation to five socioeconomic measures. Section five presents the conclusion.

6.1 Underweight (BMI<18.5 kg/m^2): 1996-2015

This section explains the results of logistic regression models which are fitted based on final sample of n=6460 in 1996, n=4815 in 2006, n=2091 in 2011 and n=1842 in 2015. The results suggested that the likelihood of being underweight was significantly associated with each age group across 1996-2015, apart from the age group of 26-33 in 1996 (see Table 6.1). With the exception of 1996, age had a negative effect on underweight. Older women thus were less likely to be underweight than younger women. The risk of being underweight, then, decreased systematically with an increase in age, between 2006 and 2015; further, there appeared to be an underweight age gradient for the same periods (see Table 6.1).

Compared to never-married women, married women were less likely to be underweight; and this relationship proved consistent over the four time periods, but was only significant in 1996, 2006 and 2015. For example, never-married women were 1.57 times (57.0%) more likely to be underweight than married women in 1996. In contrast, married women were not significantly associated with a lower risk of being underweight when compared to unmarried women in 1996 (OR=1.23, 95% CI: 0.86, 1.76). This association reversed in 2006, and attenuated in 2011, and 2015. Between 2006 and 2015, though, married women had a higher risk of being underweight than unmarried women; but these associations were, again, not statistically significant (see Table 6.1).

Table 6.1
Results of Logistic Regression Analysis: Odds Ratio (OR) of Underweight versus Healthy Weight for Age, Marital Status and Urbanicity: 1996-2015

	1996				2006				2011				2015			
Underweight	OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.	
Age																
42-49	0.61	0.00	1.32	2.08	0.39	0.00	0.29	0.52	0.33	0.00	0.21	0.52	0.28	0.00	0.17	0.46
34-41	0.54	0.02	1.05	1.61	0.48	0.00	0.38	0.61	0.52	0.00	0.36	0.75	0.51	0.00	0.34	0.77
26-33	0.78	0.34	0.72	1.12	0.77	0.01	0.63	0.94	0.66	0.01	0.48	0.90	0.72	0.04	0.53	0.98
18-25 (ref.)	1.00				1.00				1.00				1.00			
Marital Status																
Never Married	1.57	0.00	1.36	1.81	1.45	0.00	1.21	1.74	1.28	0.09	0.96	1.71	1.56	0.00	1.17	2.10
Unmarried	1.23	0.25	0.86	1.76	0.91	0.68	0.57	1.44	0.79	0.59	0.33	1.90	0.78	0.50	0.37	1.62
Married (ref.)	1.00				1.00				1.00				1.00			
Urbanicity																
Rural	1.22	0.01	1.06	1.40	1.22	0.02	1.03	1.45	0.98	0.85	0.75	1.26	1.23	0.15	0.93	1.63
Small Urban	0.97	0.86	0.69	1.36	1.44	0.03	1.03	2.02	1.57	0.03	1.04	2.35	1.73	0.02	1.08	2.77
Large Urban	1.26	0.01	1.06	1.49	1.23	0.04	1.01	1.51	0.66	0.07	0.42	1.04	0.96	0.80	0.68	1.35
Metropolitan (ref.)	1.00				1.00				1.00				1.00			
Final Sample	6460				4815				2091				1842			
Total Sample Size	6668				4909				2120				2021			

Table 6.1 indicates the presence of mixed-patterns of risk related to being underweight, among women across the four categories of urbanicity, from 1996 to 2015. In 1996, women living in metropolitan areas proved significantly less likely to be underweight than women living in rural areas (OR=1.22, 95% CI: 1.06, 1.40) and large urban (OR=1.26, 95% CI: 1.06, 1.49) areas. However, no significant differences were detectable in the risk of being underweight between women living in metropolitan areas, and women living in small urban areas (OR=0.97, 95% CI: 0.69, 1.36) in 1996.

In 2006, women living in metropolitan areas had a significantly lower risk of being underweight, in relation to women living in rural areas (OR=1.22, 95% CI: 1.03, 1.45), small urban areas (OR=1.44, 95% CI: 1.03, 2.02), and large urban areas (OR=1.23, 95% CI: 1.01, 1.51). Women living in metropolitan areas also showed a significantly increased risk of being underweight than women living in small urban areas in 2011 (OR=1.57, 95% CI: 1.04, 2.35) and 2015 (OR=1.73, 95% CI: 1.08, 2.77). These increased odds ratios imply that women living in metropolitan areas had a significantly lower risk of being underweight than women living in small urban areas in 2011 and 2015.

Table 6.2 shows that, among Malaysian Malay women only, the tertiary educated were less likely to be underweight than the secondary educated groups, at all four time points; however, this association was only significant in 2006. The tertiary educated group were also non-significantly less likely to be underweight when compared to the none/primary educated group in 2006, 2011 and 2015. In 2015, the results suggested a decreasing risk of being underweight as education level increased. This observation was not supported by the Wald Tests and hence, equated to a non-significant negative education-underweight gradient among Malaysian Malay women.

Among Malaysian Chinese women, those who were educated to the tertiary level proved consistently more likely to be underweight than Malaysian Chinese women with none/primary education and secondary education over the time period 1996-2011. Only one of these associations was significant: the difference in risk of being underweight between none/primary educated women and tertiary educated women in 2006 (OR=0.59, CI: 0.35, 1.00). Moreover, tertiary educated women were less likely to be underweight compared with none/primary educated women in 2015 (OR=1.61, CI: 0.63, 4.13). The change demonstrated in this association is potentially explicable *vis-a-vis* a small number of none/primary educated Malaysian Chinese women (n=7) in the analysis. The results also suggested the presence of a positive education-underweight gradient among Malaysian Chinese women in 1996, 2006 and 2011. None of these gradients was significant, as identified by Wald Tests.

Table 6.2
Results of Logistic Regression Analysis: Odds Ratio (OR) of Underweight versus Healthy Weight for Education and Within-Ethnic Group: 1996-2015

Underweight	1996				2006				2011				2015			
Education (Malaysian Malay)	OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.	
NonePrimary	0.94	0.66	0.70	1.26	1.15	0.48	0.79	1.66	1.03	0.94	0.48	2.21	1.48	0.23	0.78	2.80
Secondary	1.02	0.87	0.80	1.30	1.36	0.03	1.04	1.78	1.31	0.09	0.96	1.77	1.24	0.17	0.91	1.70
Tertiary (ref.)	1.00				1.00				1.00				1.00			
Wald test (p-value)	0.60 (0.74)				5.68 (0.06)				3.08 (0.21)				2.58 (0.27)			
Education (Malaysian Chinese)																
NonePrimary	0.90	0.58	0.62	1.30	0.59	0.05	0.35	1.00	0.87	0.74	0.39	1.96	1.61	0.32	0.63	4.13
Secondary	0.99	0.97	0.74	1.34	0.87	0.42	0.62	1.22	0.93	0.75	0.59	1.46	0.98	0.95	0.59	1.65
Tertiary (ref.)	1.00				1.00				1.00				1.00			
Wald test (p-value)	0.47 (0.79)				3.85 (0.15)				0.16 (0.93)				1.14 (0.57)			
Education (Malaysian Indian)																
NonePrimary	1.08	0.85	0.48	2.44	1.07	0.88	0.45	2.55	1.03	0.97	0.19	5.53	0.38	0.41	0.04	3.78
Secondary	1.30	0.49	0.62	2.74	1.26	0.49	0.65	2.47	1.51	0.33	0.66	3.46	1.13	0.79	0.45	2.88
Tertiary (ref.)	1.00				1.00				1.00				1.00			
Wald test (p-value)	0.86 (0.65)				0.61 (0.74)				1.05 (0.60)				0.97 (0.62)			
Education (OIP)																
NonePrimary	1.70	0.11	0.89	3.25	0.94	0.90	0.37	2.38	1.29	0.58	0.52	3.22	1.55	0.48	0.45	5.34
Secondary	1.60	0.15	0.84	3.04	1.13	0.79	0.47	2.74	1.35	0.48	0.58	3.12	1.92	0.21	0.70	5.30
Tertiary (ref.)	1.00				1.00				1.00				1.00			
Wald test (p-value)	2.58 (0.28)				0.75 (0.69)				0.51 (0.78)				1.60 (0.45)			

Among Malaysian Indian women, the tertiary educated group possessed a lower likelihood of being underweight than the none/primary educated group, and the secondary educated group during 1996-2015, except for one instance. In 2015, an increased risk of being underweight was in evidence for Malaysian Indian women with tertiary education, when compared with Malaysian Indian women with none/primary education. None of these associations were significant, however. A similar pattern was evident among women from Other Indigenous Minority Ethnic Groups, with one exception. This occurred in 2006, where the tertiary educated group had a higher likelihood than none/primary educated group of being underweight (see Table 6.2). Once again, however, Wald Tests suggested that these associations were non-significant. To summarise, then, age represented a significant negative effect on the risk of being underweight from 2006 to 2015. Only never-married women showed significant divergence from married women, concerning the risk connected to underweight. Mixed patterns of associations between urbanicity and underweight were identified across women from the different ethnic groups, over four time points. The effect of lowest, middle or highest education level on the risk of being underweight was mostly non-significant for each ethnic group.

The above results highlight the presence of a positive educational-underweight gradient for Malaysian Chinese women over the time period 1996-2011. Consequently, the higher the educational attainment level in play, the greater the likelihood is of being underweight. A negative education-underweight gradient was found regarding Malaysian Malay women in 2015. Unlike Malaysian Chinese women, Malaysian Indian women and women from Other Indigenous Minority Ethnic Groups with tertiary-level education level, showed a decreased risk of being underweight, in most years – except in 2006 (for women from Other Indigenous Minority Ethnic Groups) and in 2015 (for Malaysian Indian women).

Table 6.3 indicates that the influence of ethnicity and education on the risk of being underweight was not significant in 1996 (see the results of interaction terms). For example, the effect of secondary education was on average decreased the risk of being underweight in Malaysian Chinese by 3.0% (0.97-1/100). The effect of secondary education was (on average) to greatly increase the risk of being underweight in Other Indigenous People Minority Groups by (1.57-1)/100 = 57.0%. The effect of none/primary education and being women of Other Indigenous People Minority Groups linked to the increase risk of being underweight by 82.0%, compared with other women. Because most interaction terms did not yield significant results, the focus was directed toward interpreting the main effects.

In regard to the main effects, tertiary educated Malaysian Malay women were more likely than tertiary educated Malaysian Chinese women (OR=0.94, 95% CI: 0.66, 1.33) to be underweight in 1996. Similarly, non-significant results, concerning the risk of being underweight, were found for the lowest educated group and middle educated group. In 1996, tertiary educated Malaysian Malay women were associated with a greater risk of being underweight compared to Malaysian Indian women (OR=0.84, 95% CI: 0.40, 1.75); and women of Other Indigenous People Minority Ethnic Groups (OR=0.53, 95% CI: 0.28, 1.02).

In 2006, the influence of ethnicity and education on the risk of being underweight was mostly not significant, except for two observations (see the results of interaction terms). These two observations were observed among none/primary educated and secondary educated Malaysian Chinese groups. The effect of none/primary education on average significantly decreased the risk of being underweight in Malaysian Chinese by 48.0% (0.52-1/100). The effect of secondary education was on average significantly decreased the risk of being underweight by 36.0%.

Between 2006 and 2015, tertiary educated Malaysian Malay women were less likely to be underweight compared to tertiary educated Malaysian Chinese (OR=1.66, 95% CI: 1.14, 2.41 in 2006; OR=1.63, 95% CI: 1.08, 2.46 in 2011 and OR=1.42, 95% CI: 0.91, 2.24). Similar relationships were observed for Malaysian Indian women. Between 2011 and 2015, tertiary educated Malaysian Malay women reflected a higher risk of being underweight than tertiary educated women of Other Indigenous Minority Ethnic Groups (OR=0.86, 95% CI: 0.41, 1.78 in 2011; OR=0.53, 95% CI: 0.22, 1.29 in 2015). Overall, Wald Tests suggested that the association between the risk of being underweight and tertiary education did not significantly vary across ethnicity.

Table 6.3
Results of Logistic Regression Analysis: Odds Ratio (OR) of Underweight versus Healthy Weight for Education and Between-Ethnic Group: 1996-2015

Underweight	1996				2006				2011				2015			
Ethnicity (Tertiary educated)	OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.	
Malaysian Chinese	0.94	0.72	0.66	1.33	1.66	0.01	1.14	2.41	1.63	0.02	1.08	2.46	1.42	0.13	0.91	2.24
Malaysian Indians	0.84	0.65	0.40	1.75	1.30	0.44	0.67	2.50	1.15	0.69	0.58	2.31	1.72	0.20	0.75	3.99
Other Indigenous People	0.53	0.06	0.28	1.02	1.14	0.77	0.47	2.78	0.86	0.68	0.41	1.78	0.53	0.16	0.22	1.29
Malaysian Malay (ref.)	1.00				1.00				1.00				1.00			
Wald test (p-value)	7.58 (0.37)				7.04 (0.07)				6.03 (0.11)				6.22 (0.10)			
Ethnicity (Secondary educated)																
Malaysian Chinese	0.91	0.32	0.77	1.09	1.06	0.60	0.85	1.32	1.16	0.43	0.80	1.67	1.12	0.57	0.75	1.70
Malaysian Indian	1.07	0.62	0.81	1.43	1.21	0.23	0.89	1.64	1.34	0.30	0.78	2.31	1.57	0.09	0.94	2.62
Other Indigenous People	0.84	0.12	0.67	1.04	0.95	0.70	0.74	1.23	0.89	0.64	0.53	1.47	0.82	0.48	0.46	1.44
Malaysian Malay (ref.)	1.00				1.00				1.00				1.00			
Wald test (p-value)	8.83 (0.64)				1.90 (0.59)				1.93 (0.59)				3.93 (0.27)			
Ethnicity (NonePrimary educated)																
Malaysian Chinese	0.91	0.53	0.67	1.23	0.86	0.55	0.51	1.43	1.38	0.54	0.50	3.84	1.55	0.41	0.55	4.35
Malaysian Indians	0.97	0.90	0.62	1.52	1.21	0.57	0.62	2.36	1.16	0.87	0.21	6.34	0.44	0.47	0.05	4.11
Other Indigenous People	0.97	0.82	0.74	1.26	0.94	0.79	0.61	1.45	1.08	0.87	0.43	2.71	0.55	0.27	0.19	1.59
Malaysian Malay (ref.)	1.00				1.00				1.00				1.00			
Wald test (p-value)	0.40 (0.94)				0.90 (0.82)				0.42 (0.94)				3.18 (0.37)			
Interaction terms																
MalaysianChinese# NonePrimary	0.96	0.88	0.61	1.52	0.52	0.04	0.28	0.97	0.85	0.77	0.28	2.54	1.09	0.88	0.36	3.32
Malaysian Chinese# Secondary	0.97	0.89	0.66	1.43	0.64	0.04	0.42	0.98	0.71	0.22	0.41	1.22	0.79	0.44	0.43	1.44
MalaysianIndian# NonePrimary	1.15	0.75	0.49	2.72	0.93	0.89	0.37	2.38	1.00	1.00	0.16	6.28	0.26	0.26	0.02	2.78
Malaysian #Indian Secondary	1.27	0.54	0.58	2.79	0.93	0.84	0.45	1.91	1.16	0.74	0.48	2.79	0.91	0.85	0.34	2.42
OIP# NonePrimary	1.82	0.10	0.90	3.66	0.82	0.70	0.31	2.21	1.26	0.71	0.39	4.07	1.05	0.95	0.26	4.19
OIP#Secondary	1.57	0.20	0.79	3.12	0.83	0.70	0.33	2.10	1.03	0.94	0.42	2.51	1.54	0.42	0.54	4.45

6.2 Pre-overweight (BMI 23.0-24.9 kg/m^2): 1996-2015

The results of the logistic regression models for pre-overweight are shown in Table 6.4. These models were fitted based on n=6610 in 1996, n=5374 in 2006, n=2348 in 2011 and n=2464 in 2015. The output suggested that women from the older age groups were significantly more likely to be pre-overweight compared to women in the youngest age group (18-25 years old). There also appeared to be a positive age gradient in the pre-overweight category during 1996-2015.

Persistently and significantly, married women had an increased risk of being pre-overweight than never-married equivalents, across the four time points. Although they had a higher risk of being pre-overweight than unmarried women, these differences were significant in 1996. Across the four categories of urbanicity, there were varying degrees of risk of being pre-overweight during 1996-2015. Still, no substantial differences in the risk of being pre-overweight appeared between women from metropolitan areas and women from rural areas, small urban areas and large urban areas, in 1996, 2006 and 2015.

Table 6.4
Results of Logistic Regression Analysis: Odds Ratio (OR) of Pre-overweight versus Healthy Weight for Age, Marital Status and Urbanicity: 1996-2015

	1996				2006				2011				2015			
Pre-overweight	OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.	
Age																
42-49	2.21	0.00	1.80	2.72	2.59	0.00	2.08	3.21	2.47	0.00	1.79	3.40	2.50	0.00	1.81	3.46
34-41	1.77	0.00	1.47	2.13	1.94	0.00	1.58	2.39	1.92	0.00	1.41	2.61	1.82	0.00	1.33	2.48
26-33	1.40	0.00	1.18	1.67	1.62	0.00	1.33	1.97	1.42	0.02	1.07	1.90	1.20	0.21	0.90	1.60
18-25 (ref.)	1.00				1.00				1.00				1.00			
Marital Status																
Never Married	0.64	0.00	0.54	0.75	0.69	0.00	0.58	0.83	0.64	0.00	0.49	0.83	0.78	0.06	0.60	1.01
Unmarried	0.71	0.04	0.52	0.99	0.74	0.06	0.55	1.01	0.61	0.07	0.36	1.05	0.78	0.27	0.50	1.22
Married (ref.)	1.00				1.00				1.00				1.00			
Urbanicity																
Rural	0.96	0.51	0.84	1.09	0.90	0.16	0.78	1.04	0.73	0.01	0.59	0.91	0.94	0.57	0.75	1.17
Small Urban	1.09	0.57	0.81	1.47	0.80	0.18	0.57	1.11	0.88	0.50	0.59	1.29	1.04	0.84	0.68	1.59
Large Urban	1.06	0.51	0.90	1.25	1.02	0.82	0.85	1.22	1.28	0.10	0.96	1.72	0.96	0.73	0.74	1.24
Metropolitan (ref.)	1.00				1.00				1.00				1.00			
Final Sample	6610				5374				2348				2464			
Total Sample Size	6818				5470				2466				2464			

Among Malaysian Malay women exclusively, a positive gradient between education level and risk of pre-overweight appeared in 2006 and 2015. Differences in the risk of being pre-overweight across each educational level were, though, not substantial for Malaysian Malay women. For example, the tertiary educated Malaysian Malay women represented a decreased risk of being pre-overweight than none/primary educated Malaysian Malay women by 7.0% (OR=0.93, 95% CI: 0.59, 1.47) in 2015. Overall, education did not significantly influence the risk of pre-overweight for Malaysian Malay women, as identified by Wald Tests.

Table 6.5
Results of Logistic Regression Analysis: Odds Ratio (OR) of Pre-overweight versus Healthy Weight for Education and Ethnicity: 1996-2015

Pre-overweight	1996				2006				2011				2015			
Education (Malaysian Malay)	OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.	
NonePrimary	0.99	0.95	0.75	1.32	0.87	0.34	0.65	1.16	1.16	0.53	0.73	1.83	0.93	0.76	0.59	1.47
Secondary	0.98	0.90	0.76	1.27	0.96	0.75	0.77	1.21	0.97	0.84	0.76	1.25	0.98	0.89	0.77	1.25
Tertiary (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	0.02 (0.99)				1.14 (0.57)				0.60 (0.74)				0.10 (0.95)			
Education (Malaysian Chinese)																
NonePrimary	1.85	0.00	1.25	2.73	1.37	0.14	0.90	2.06	1.56	0.16	0.84	2.91	0.45	0.09	0.18	1.12
Secondary	1.36	0.11	0.94	1.97	1.19	0.35	0.83	1.71	1.57	0.06	0.98	2.49	1.02	0.92	0.65	1.61
Tertiary (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	11.90 (0.00)				2.21 (0.33)				3.81 (0.15)				3.36 (0.19)			
Education (Malaysian Indian)																
NonePrimary	1.01	0.98	0.47	2.20	1.40	0.31	0.73	2.69	1.99	0.18	0.72	5.49	1.71	0.38	0.52	5.61
Secondary	1.06	0.88	0.50	2.25	1.08	0.80	0.60	1.93	1.12	0.77	0.53	2.35	0.50	0.11	0.21	1.18
Tertiary (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	0.06 (0.97)				1.49 (0.47)				1.92 (0.38)				5.94 (0.05)			
Education (OIP)																
NonePrimary	1.19	0.58	0.64	2.22	0.91	0.82	0.40	2.08	1.25	0.58	0.58	2.68	1.27	0.54	0.60	2.69
Secondary	1.26	0.48	0.67	2.35	1.17	0.70	0.52	2.64	1.90	0.08	0.92	3.94	1.59	0.16	0.83	3.05
Tertiary (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	0.55 (0.76)				2.27 (0.32)				3.98 (0.14)				2.01 (0.37)			

Among Malaysian Chinese women, a negative gradient was found between education level and the risk of being pre-overweight for Malaysian Chinese women in 1996 and 2006. The negative educational gradient in pre-overweight disappeared in 2011. In 2015, tertiary educated Malaysian Chinese women had an increased non-significant risk of being pre-overweight, compared to none and primary educated Malaysian Chinese women (OR=0.45, 95% CI: 0.18, 1.12). Overall, education had significant influence on the risk of pre-overweight for Malaysian Chinese women in 1996, as identified by Wald Test (see Table 6.5).

Among the Malaysian Indian women, the tertiary educated group tended to show a lower risk of being pre-overweight, compared to the none/primary-educated group and the secondary educated group from 1996-2011. Still, none of these differences were significant. In 2015, the tertiary educated group had a higher risk of being pre-overweight than the secondary educated group (OR=0.50, 95% CI: 0.21, 1.18), but a lower risk of being pre-overweight than the none/primary educated group (OR=1.71, 95% CI: 0.21, 1.18). Overall, the effect of education on the risk of pre-overweight for Malaysian Indian women was significant in 2015, as suggested by Wald Test (see Table 6.5).

Among women from Other Indigenous Minority Ethnic Groups, the tertiary educated exhibited a lower risk of being pre-overweight than none/primary educated women and secondary educated women - except in 2006. In 2006, the tertiary educated women from Other Indigenous Minority Ethnic Groups signalled a higher risk of being pre-overweight (OR=0.91, 95% CI: 0.40, 2.08). Nevertheless, none of the associations between education level and pre-overweight were significant among women from Other Indigenous Minority Ethnic Groups.

As Table 6.6 shows, most interaction terms did not yield significant results. So, the focus was directed toward interpreting the main effects. The tertiary-educated Malaysian Malay women were consistently and significantly more likely to be pre-overweight than tertiary educated Malaysian Chinese women, across the four time points. The risk of being pre-overweight among Malaysian Malay women was not significantly different from that of the Malaysian Indian women or women from Other Indigenous Minority Ethnic Groups, at any of the four time points. Overall, the results of Wald tests suggested that the effect of tertiary education on the risk of pre-overweight was significant over 1996-2015.

Table 6.6
Results of Logistic Regression Analysis: Odds Ratio (OR) of Pre-overweight versus Healthy Weight for Education and Between-Ethnic Group: 1996-2015

Pre-overweight	1996				2006				2011				2015			
Ethnicity (Tertiary educated)	OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.	
Malaysian Chinese	0.52	0.00	0.34	0.78	0.53	0.00	0.36	0.78	0.40	0.00	0.26	0.62	0.57	0.01	0.39	0.85
Malaysian Indians	1.06	0.87	0.51	2.23	0.94	0.82	0.54	1.63	0.77	0.42	0.42	1.43	1.25	0.54	0.61	2.56
Other Indigenous People	0.82	0.54	0.43	1.55	0.90	0.80	0.40	2.02	0.71	0.31	0.37	1.38	0.84	0.53	0.48	1.47
Malaysian Malay (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	10.19 (0.02)				10.86 (0.01)				17.25 (0.00)				8.51 (0.04)			
Ethnicity (Secondary educated)																
Malaysian Chinese	0.72	0.00	0.59	0.86	0.66	0.00	0.54	0.80	0.65	0.01	0.48	0.88	0.60	0.00	0.43	0.83
Malaysian Indian	1.15	0.36	0.85	1.54	1.05	0.74	0.79	1.40	0.89	0.63	0.55	1.44	0.64	0.09	0.38	1.07
Other Indigenous People	1.05	0.69	0.84	1.31	1.10	0.43	0.87	1.39	1.39	0.10	0.94	2.06	1.35	0.14	0.91	2.01
Malaysian Malay (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	17.05 (0.00)				20.81 (0.00)				12.31 (0.01)				15.24 (0.00)			
Ethnicity (NonePrimary educated)																
Malaysian Chinese	0.96	0.76	0.76	1.22	0.84	0.27	0.61	1.15	0.54	0.06	0.29	1.03	0.28	0.01	0.11	0.71
Malaysian Indians	1.08	0.66	0.76	1.54	1.52	0.06	0.99	2.33	1.33	0.54	0.54	3.32	2.29	0.12	0.80	6.54
Other Indigenous People	0.99	0.91	0.79	1.23	0.95	0.73	0.69	1.29	0.77	0.37	0.43	1.38	1.14	0.70	0.59	2.21
Malaysian Malay (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	0.40 (0.94)				6.51 (0.09)				5.08 (0.17)				12.03 (0.01)			
Interaction terms																
MalaysianChinese# NonePrimary	1.86	0.01	1.16	3.00	1.57	0.07	0.96	2.57	1.35	0.44	0.63	2.89	0.49	0.16	0.18	1.33
Malaysian Chinese# Secondary	1.38	0.16	0.88	2.18	1.23	0.33	0.81	1.89	1.61	0.08	0.95	2.71	1.04	0.88	0.63	1.73
MalaysianIndian# NonePrimary	1.02	0.96	0.45	2.32	1.62	0.18	0.80	3.26	1.72	0.33	0.57	5.18	1.83	0.35	0.52	6.52
Malaysian #Indian Secondary	1.08	0.85	0.49	2.39	1.12	0.72	0.60	2.09	1.15	0.73	0.53	2.50	0.51	0.14	0.21	1.23
OIP# NonePrimary	1.20	0.59	0.61	2.37	1.05	0.92	0.44	2.49	1.08	0.87	0.45	2.60	1.36	0.49	0.57	3.25
OIP#Secondary	1.28	0.48	0.65	2.52	1.22	0.65	0.53	2.82	1.95	0.09	0.91	4.20	1.62	0.17	0.81	3.22

A significantly higher likelihood of being pre-overweight was identified among secondary educated Malaysian Malay women, compared to secondary educated Malaysian Chinese women, across 1996-2015. That notwithstanding, the secondary educated Malaysian Malay women had a lower non-significant likelihood of being pre-overweight compared to secondary educated women from Other Indigenous Minority Ethnic Groups over 1996-2015. Unlike the comparisons of risk for being pre-overweight between secondary educated Malaysian Malay women and women from the other two ethnic groups, there was no clear pattern in risk of being pre-overweight among secondary educated Malaysian Indian women when they were compared with secondary educated Malaysian Malay women. Overall, the results of Wald tests suggested that secondary education influenced the risk of pre-overweight significantly over 1996-2015.

The results of logistic regression analysis in Table 6.4-6.6 indicated three distinctive but associations in relation to the risk of being pre-overweight among the lowest education group (no formal education and primary education). First, Malaysian Malay women of the lowest education group proved more likely to be pre-overweight than Malaysian Chinese women of the lowest education group, across 1996-2015. Second, the risk of being pre-overweight among the lowest education group was greatest for Malaysian Indian women across 1996-2015. Third, among the lowest education group, a change was apparent in the direction of risk association of being pre-overweight, between Malaysian Malay and women from Other Indigenous Minority Ethnic Groups. Malaysian Malay women (with the lowest education) evidence increased risk of being pre-overweight, when compared Women from Other Indigenous Minority Ethnic Groups with from the lowest education group during 1996-2011. That said, the association direction shifted in 2015; thus, Malaysian Malay women with the lowest education had a lower risk of being pre-overweight than women from Other Indigenous Minority Ethnic Groups from the same education group. Moreover, the effect of lowest education on the risk of being pre-overweight was significant in 2015, as suggested by Wald Test (12.03, p-value=0.01).

In summary, age had positive and significant effects on the risk of being pre-overweight. Married women consistently displayed an increased risk of being pre-overweight, compared to never married and unmarried women, across the four time points. Tertiary educated Malaysian Malay women had a significantly greater risk of being pre-overweight than tertiary educated Malaysian Chinese women during 1996-2015. A positive education level-pre overweight gradient was apparent for Malaysian Malay women in 2006 and 2015. In contrast, a negative education level-pre overweight gradient was evident for Malaysian Chinese women in 1996 and 2006. The effect of the secondary or tertiary education levels on the risk of being pre-overweight was, then, mostly significant for four main ethnic groups across 1996-2015.

6.3 Overweight (BMI 25.0-29.9 kg/m^2): 1996-2015

As Table 6.7 shows, the risk of being overweight was significant for each age group of women across 1996-2015. Married women displayed a significantly increased risk of being overweight compared to never married women, at all four time points. Similar patterns were evident when married women were compared with unmarried women. However, they only differed significantly in 1996 and 2006 (Table 6.7). A mixed patterning of the associations between overweight and urbanicity was observed (Table 6.7). Women living in metropolitan areas consistently had a lower risk of being overweight than women living in small urban areas (OR=1.05, 95% CI: 0.80, 1.39 in 1996; OR=1.37, 95% CI: 1.06, 1.77 in 2006; OR=1.27, 95% CI: 0.93, 1.74 in 2011; OR=1.07, 95% CI: 0.74, 1.54 in 2015). None of the associations between urbanicity and overweight were significant at any of the four time points.

Table 6.7
Results of Logistic Regression Analysis: Odds Ratio (OR) of Overweight versus Healthy Weight for Age, Marital Status and Urbanicity: 1996-2015

	1996				2006				2011				2015			
Overweight versus Healthy Weight	OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.	
Age																
42-49	3.16	0.00	2.62	3.82	4.87	0.00	4.04	5.86	2.99	0.00	2.27	3.93	4.63	0.00	3.50	6.12
34-41	2.36	0.00	1.99	2.81	2.94	0.00	2.46	3.51	2.31	0.00	1.77	3.02	3.59	0.00	2.74	4.69
26-33	1.64	0.00	1.39	1.94	1.95	0.00	1.63	2.32	1.37	0.01	1.07	1.76	1.77	0.00	1.38	2.27
18-25 (ref.)	1.00				1.00				1.00				1.00			
Marital Status																
Never Married	0.58	0.00	0.49	0.68	0.62	0.00	0.53	0.72	0.58	0.00	0.46	0.72	0.75	0.01	0.60	0.94
Unmarried	0.70	0.01	0.53	0.93	0.64	0.00	0.49	0.82	0.93	0.74	0.62	1.40	0.77	0.15	0.54	1.10
Married (ref.)	1.00				1.00				1.00				1.00			
Urbanicity																
Rural	0.92	0.21	0.82	1.04	1.08	0.23	0.95	1.22	1.03	0.72	0.87	1.23	1.06	0.57	0.88	1.27
Small Urban	1.05	0.71	0.80	1.39	1.37	0.02	1.06	1.77	1.27	0.13	0.93	1.74	1.07	0.73	0.74	1.54
Large Urban	1.08	0.32	0.93	1.26	1.12	0.14	0.96	1.31	1.18	0.22	0.91	1.55	0.97	0.81	0.78	1.22
Metropolitan (ref.)	1.00				1.00				1.00				1.00			

In Table 6.8, a negative education-level overweight gradient was clear among Malaysian Malay women in 2006 and 2011; Malaysian Chinese in 1996, 2006, 2011 and 2015; Malaysian Indian in 1996 and 2011; women from Other Indigenous Minority Ethnic Groups in 1996 (Table 6.8). A positive education-level overweight gradient was, conversely, observed among women from Other Indigenous Minority Ethnic Groups in 2006; as was the flattening of the educational-level overweight gradient among women from Other Indigenous Minority Ethnic Groups in 2015.

Table 6.8 also details the results of logistic regression analysis considering the influence of ethnicity on the association of education and the risk of being overweight (as captured by the interaction terms) for Malaysian women aged 18-49, across the years 1996-2015. Most of the output shows that the impact of education on the risk of being overweight did not vary by ethnicity significantly. There were four exceptions observed among lowest educated Malaysian Chinese in 1996 (none and primary educated); lowest educated Other Indigenous People Minority Groups in 2006; and secondary educated Malaysian Indian in 2011 and 2015. Tertiary educated Malaysian Malay women exhibited a significantly increased risk of being overweight when compared with tertiary educated Malaysian Chinese women, over the 20-year period.

Similar patterns were observed when comparisons were drawn between Malaysian Malay women and Malaysian Chinese women with no formal education/primary education and secondary education. These differences in risk were significant throughout the 20 years period. Accordingly, secondary educated Malaysian Malay women presented a significantly increased risk (57.0%) of being overweight, compared to secondary educated Malaysian Chinese women (OR=0.47, 95% CI: 0.36, 0.52), in 1996. Similar patterns were identified in 2015, where secondary educated Malaysian Malay women had a significantly higher risk of being overweight of 64.0%, when compared with secondary educated Malaysian Chinese women (OR=0.36, 95% CI: 0.27, 0.49).

Table 6.8
Results of Logistic Regression Analysis: Odds Ratio (OR) of Overweight versus Healthy Weight for Education and Ethnicities across 1996-2015

Overweight	1996				2006				2011				2015			
Education (Malaysian Malay)	OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.	
NonePrimary	1.17	0.23	0.91	1.52	1.17	0.20	0.92	1.50	1.35	0.12	0.92	1.96	1.08	0.67	0.74	1.58
Secondary	1.18	0.18	0.93	1.49	1.15	0.18	0.94	1.41	1.05	0.63	0.85	1.30	1.21	0.07	0.98	1.49
Tertiary (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	1.87 (0.39)				1.99 (0.37)				2.42 (0.30)				3.28 (0.19)			
Education (Malaysian Chinese)																
NonePrimary	2.88	0.00	1.91	4.33	1.64	0.01	1.11	2.41	1.48	0.18	0.83	2.63	1.52	0.20	0.80	2.87
Secondary	1.61	0.02	1.08	2.41	1.16	0.40	0.82	1.66	1.16	0.50	0.75	1.80	1.36	0.17	0.87	2.12
Tertiary (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	39.80 (0.00)				8.35 (0.02)				1.78 (0.41)				2.42 (0.30)			
Education (Malaysian Indian)																
NonePrimary	1.09	0.82	0.53	2.22	1.69	0.09	0.92	3.09	4.28	0.00	1.77	10.37	1.29	0.63	0.46	3.57
Secondary	1.05	0.88	0.52	2.11	1.73	0.05	1.01	2.97	2.56	0.00	1.34	4.91	0.49	0.04	0.25	0.97
Tertiary (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	0.07 (0.97)				4.03 (0.13)				12.13 (0.00)				6.83 (0.03)			
Education (OIP)																
NonePrimary	1.32	0.38	0.71	2.43	0.57	0.09	0.30	1.09	1.12	0.72	0.60	2.10	1.09	0.79	0.59	2.01
Secondary	1.28	0.43	0.69	2.38	0.71	0.28	0.38	1.33	1.42	0.26	0.77	2.60	1.13	0.66	0.65	1.97
Tertiary (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	0.79 (0.68)				4.05 (0.13)				1.65 (0.44)				0.20 (0.91)			
Overweight	1996				2006				2011				2015			
Ethnicity (Tertiary educated)	OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.	
Malaysian Chinese	0.32	0.00	0.20	0.49	0.38	0.00	0.26	0.55	0.30	0.00	0.20	0.45	0.32	0.00	0.22	0.48
Malaysian Indians	1.15	0.68	0.58	2.29	0.80	0.42	0.47	1.36	0.56	0.05	0.31	0.99	2.07	0.01	1.16	3.71
Other Indigenous People	0.71	0.29	0.38	1.34	1.54	0.18	0.82	2.89	0.77	0.36	0.45	1.33	1.12	0.64	0.70	1.78
Malaysian Malay (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	29.02 (0.00)				31.16 (0.00)				37.57 (0.00)				42.89 (0.00)			
Ethnicity (Secondary educated)																
Malaysian Chinese	0.43	0.00	0.36	0.52	0.38	0.00	0.32	0.46	0.33	0.00	0.25	0.45	0.36	0.00	0.27	0.49
Malaysian Indian	1.03	0.81	0.79	1.35	1.21	0.12	0.95	1.53	1.36	0.10	0.94	1.95	0.85	0.41	0.57	1.26
Other Indigenous People	0.78	0.02	0.63	0.96	0.95	0.60	0.77	1.16	1.04	0.81	0.74	1.47	1.05	0.79	0.73	1.50
Malaysian Malay (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	88.63 (0.00)				115.19 (0.00)				64.16 (0.00)				45.98 (0.00)			
Ethnicity (NonePrimary educated)																
Malaysian Chinese	0.77	0.02	0.63	0.95	0.53	0.00	0.41	0.69	0.33	0.00	0.19	0.58	0.45	0.01	0.24	0.84
Malaysian Indians	1.07	0.65	0.79	1.46	1.16	0.44	0.80	1.68	1.77	0.14	0.82	3.80	2.46	0.05	0.99	6.13
Other Indigenous People	0.80	0.03	0.66	0.98	0.75	0.03	0.59	0.97	0.65	0.07	0.40	1.04	1.12	0.68	0.66	1.92
Malaysian Malay (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	9.68 (0.02)				26.73 (0.00)				22.23 (0.01)				13.35 (0.00)			
Interaction term																
MalaysianChinese# NonePrimary	2.46	0.00	1.52	3.96	0.72	0.15	0.46	1.12	1.10	0.79	0.56	2.17	1.40	0.37	0.68	2.90
Malaysian Chinese# Secondary	1.37	0.19	0.86	2.18	0.99	0.95	0.66	1.48	1.10	0.69	0.68	1.79	1.13	0.63	0.69	1.83
MalaysianIndian# NonePrimary	0.93	0.85	0.44	1.97	1.03	0.93	0.51	2.11	3.18	0.02	1.22	8.28	1.19	0.76	0.40	3.50
Malaysian #Indian Secondary	0.89	0.77	0.43	1.87	1.48	0.23	0.78	2.83	2.44	0.01	1.23	4.81	0.41	0.01	0.20	0.82
OIP# NonePrimary	1.12	0.73	0.58	2.17	0.35	0.01	0.17	0.74	0.83	0.62	0.41	1.71	1.00	1.00	0.49	2.04
OIP#Secondary	1.09	0.81	0.56	2.11	0.61	0.17	0.29	1.25	1.35	0.36	0.71	2.55	0.94	0.83	0.52	1.69

Compared to tertiary educated Malaysian Malay women, tertiary educated Malaysian Indian women had a significantly lower risk of being overweight in 2011 (OR=0.56, 95% CI: 0.31, 0.99). But, they had a significantly higher risk of being overweight compared to Malaysian Malay women with tertiary education in 2015 (OR= 2.07, 95% CI: 1.16, 3.71). Secondary educated Indian women had a higher risk of being overweight than secondary educated Malaysian Malay women in 1996, 2006 and 2011. However, none of these differences was statistically significant. In spite of this, they had a lower, non-significant risk in 2015. Additionally, none/primary educated Indian women only had a significantly increased risk of being overweight when compared with none/primary educated Malaysian Malay women in 2015 (OR=2.46, 95% CI: 0.99, 6.13).

Tertiary educated Malaysian Malay women had a non-significant but higher risk of being overweight when compared to tertiary educated women from Other Indigenous Minority Ethnic Groups in 1996 (OR= 0.71, 95% CI: 0.38, 1.34) and in 2011 (OR= 0.77, 95% CI: 0.45, 1.33). The opposite was observed in 2006 (OR= 1.54, 95% CI: 0.82, 2.89) and 2015 (OR=1.22, 95% CI: 0.70, 1.78). Secondary educated women from Other Indigenous Minority Ethnic Groups showed a significantly lower risk of being overweight, in comparison to secondary educated Malaysia Malay women in 1996 (OR= 0.78, 95% CI: 0.63, 0.96). However, none/primary educated women from Other Indigenous Minority Ethnic Groups had a significantly lower risk of being overweight than none/primary educated Malaysian Malay women in both 1996 (OR= 0.80, 95% CI: 0.66, 0.98) and 2006 (OR= 0.75, 95% CI: 0.59, 0.97).

Breaking down the above, age was shown positively to influence the risk of overweight. So, married women had a significantly increased risk of being overweight compared to never married women, for each represented time point. Ethnicity and education, further, influenced overweight –, particularly for Malaysian Chinese women. Significantly increased risk of being overweight was evinced by none/primary educated Malaysian Malay women, compared with none/primary educated Malaysian Chinese women, across 1996-2015. Also, similar associations were apparent when secondary and tertiary educated Malaysian Malay women were compared to Malaysian Chinese women of similar educational attainment levels over the same period. Compared to women from the other ethnic groups, Malaysian Indian women, with the lowest education, were most vulnerable to overweight: because they had increased odds ratios relative to Malaysian Malay women with the lowest education. However, such associations did not differ significantly at any of the time points.

Within ethnic groups, a negative education level-overweight gradient was consistently in evidence among Malaysian Chinese throughout 1996-2015. Yet differences in the risk of being overweight across Malaysian Chinese women with three education levels became smaller over the first three time points. Negative education level-overweight gradients emerged, also, in the other three ethnic groups. Two negative gradients were presented among Malaysian Malay women in 2006 and 2011. A negative education level-overweight gradient, moreover, appeared in 1996 and 2011 for Malaysian Indian women and in 1996 for women from Other Indigenous Minority Ethnic Groups; but, in contrast, a positive education level-overweight gradient was observed among women from Other Indigenous Minority Ethnic Groups in 2006.

Finally, the logistic regression analysis suggested that overweight had the highest prevalence among the lowest education (none/primary educated) group in 1996 for Malaysian Chinese women (OR=2.88, 95% CI: 1.91, 4.33); Malaysian Indian women (OR=1.09, 95% CI: 0.53, 2.22); and women from Other Indigenous Minority Ethnic Groups (OR=1.32, CI: 0.71, 2.43). This could imply transition of overweight to lowest education group among women in these ethnic groups took place prior to 1996.

6.4 Obesity (BMI 30.0 kg/m^2 and above): 1996-2015

The results of logistic regression analysis (Table 6.9) indicated that age significantly and positively influenced the risk of being obese for women from the four main ethnic groups, across 1996-2015. Resultantly, older age was associated with an increased risk of being obese. Married women, indeed, proved of significantly higher risk of obesity than never married women, except in 2015. Similar relationships were observed between married women and unmarried women in each survey year; but these differences were significant only in 2006. On top of this, the differences in the risk of being obese across marital status were small in 2015. There was a consistently lower risk of obesity among women living in metropolitan areas compared with women living in rural areas, small urban areas, and large urban areas across 1996-2015. None of these differences were statistically significant, however.

Table 6.9
Results of Logistic Regression Analysis: Odds Ratio (OR) of Obesity versus Healthy Weight for Age, Marital Status and Urbanicity across 1996-2015

	1996				2006				2011				2015			
Obesity versus Healthy Weight	OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.	
Age																
42-49	3.51	0.00	2.64	4.68	4.78	0.00	3.84	5.94	2.80	0.00	2.06	3.79	3.73	0.00	2.79	5.00
34-41	2.90	0.00	2.22	3.78	2.97	0.00	2.41	3.67	2.13	0.00	1.58	2.87	2.93	0.00	2.21	3.87
26-33	1.52	0.00	1.17	1.98	2.19	0.00	1.79	2.70	1.70	0.00	1.30	2.24	1.93	0.00	1.50	2.49
18-25 (ref.)	1.00				1.00				1.00				1.00			
Marital Status																
Never Married	0.76	0.03	0.60	0.97	0.69	0.00	0.57	0.83	0.63	0.00	0.49	0.81	0.91	0.41	0.72	1.14
Unmarried	0.77	0.18	0.52	1.13	0.72	0.02	0.55	0.96	0.69	0.12	0.44	1.10	0.91	0.63	0.63	1.32
Married (ref.)	1.00				1.00				1.00				1.00			
Urbanicity																
Rural	1.01	0.91	0.85	1.20	1.04	0.56	0.91	1.20	1.04	0.69	0.86	1.26	1.18	0.10	0.97	1.42
Small Urban	1.19	0.38	0.81	1.75	1.35	0.05	1.01	1.81	1.21	0.29	0.85	1.72	1.30	0.17	0.89	1.88
Large Urban	1.01	0.96	0.80	1.26	1.15	0.13	0.96	1.37	1.20	0.22	0.90	1.61	1.19	0.14	0.94	1.50
Metropolitan (ref.)	1.00				1.00				1.00				1.00			

Table 6.10 shows the odds ratios of being obese within each ethnic group. Among Malaysian Malay women, the tertiary educated group had the lowest risk of being obese throughout 1996-2015. Tertiary educated Malaysian Malay women had a significantly lower risk of being obese than none/primary educated Malaysian Malay women and secondary educated Malaysian Malay women with one exception. There was no significant difference in the risk of being obese between tertiary educated Malaysian Malay women and secondary educated Malaysian Malay women in 1996.

Among Malaysian Chinese women only, the tertiary educated group always had a significantly lower risk of being obese than none/primary and secondary educated Malaysian Chinese women, except for in 2006 and

2015. In 2006, Malaysian Chinese with tertiary education had a decreased risk of being obese compared to Malaysian Chinese with secondary education (OR=0.90, 95% CI: 0.54, 1.50). Besides, the odds ratio for the lowest educated Malaysian Chinese women was 10.90 (95% CI: 3.39, 35.07) when compared to Malaysian Chinese women with tertiary education in 1996. In 2015, there were no significant differences in the risk of being obese when tertiary educated Malaysian Chinese women were compared to either none/primary educated Malaysian Chinese women, or secondary educated Malaysian Chinese women. A smaller number of Malaysian Chinese women (n=9) (with the lowest education) may have resulted in the logistic regression analysis yielding a higher odds ratio but with a wider confidence interval (CI).

Among Malaysian Indian women, as with Malaysian Malay women, the tertiary educated group had the lowest risk of being obese throughout the 1996-2015 period. However, Malaysian Indian women with tertiary education only had a significantly lower risk of being obese than both Malaysian Indian women with none/primary education and Malaysian women with secondary education in 2006 and 2011. Among women from Other Indigenous Minority Ethnic Groups, the tertiary educated group had the lowest risk of being obese in 1996, 2011 and 2015. The only significant difference in risk, it should be emphasised, occurred between tertiary educated women from Other Indigenous Minority Ethnic Groups and secondary educated women from Other Indigenous Minority Ethnic Groups in 2011 (OR=2.46, 95% CI: 1.08, 5.58).

Table 6.10 also shows the odds ratio of being obese among the different education levels and ethnic groups. The results of the interaction terms suggested that overall, the relationship of each education level and the risk of being obese did not differ significantly according to ethnicity. So, the interpretation was due to main effects.

Between ethnic groups, tertiary educated women, and Malaysian Malay women had a significant and much higher risk of being obese than tertiary educated Malaysian Chinese women, over all four time points. For example, tertiary educated Malaysian Malay women were more likely to be obese in 1996 (OR=0.09, 95% CI: 0.03, 0.30) and 2015 (0.21, 95% CI: 0.13, 0.34), compared to tertiary educated Malaysian Chinese women. Except for in 2015, the risk of obesity was also greater among tertiary educated Malaysian Malay women than among tertiary educated Malaysian Indian women; and this difference was significant in 2006 (OR=0.48, 95% CI: 0.23, 1.00). In 2015, the contrary association was found for these groups (OR=1.34, 95% CI: 0.72, 2.52).

Tertiary educated Malaysian Malay women were also more likely to be obese than tertiary educated women from Other Indigenous Minority Ethnic Groups in 1996, 2011 and 2015, but not 2006. That notwithstanding, these differences in association were not significant, excepting one instance, observed in 2011 (OR=0.41, 95% CI: 0.19, 0.88).

Secondary educated Malaysian Malay women had a significant and higher risk of being obese than secondary educated Malaysian Chinese women, at each of the four time points. Greater risk of being obese was further observed among secondary educated Malaysian Malay women when compared to secondary educated women from Other Indigenous Minority Ethnic Groups. Still, these differences were significant exclusively in 2006 (OR=0.63, 95% CI: 0.49, 0.80). In contrast, secondary educated Malaysia Malay women were less likely (but not significantly) to be obese than secondary educated Malaysian Indian women, from 2006 to 2015.

Table 6.10
Results of Logistic Regression Analysis: Odds Ratio (OR) of Obesity versus Healthy Weight for Education and Ethnicities across 1996-2015

Obesity	1996				2006				2011				2015			
Education (Malaysian Malay)	OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.	
NonePrimary	1.67	0.01	1.13	2.45	1.48	0.01	1.12	1.96	2.05	0.00	1.39	3.02	1.53	0.02	1.06	2.21
Secondary	1.34	0.12	0.93	1.94	1.53	0.00	1.21	1.95	1.38	0.01	1.10	1.72	1.40	0.00	1.13	1.72
Tertiary (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	7.85 (0.02)				69.82 (0.00)				15.23 (0.00)				11.26 (0.00)			
Education (Malaysian Chinese)																
NonePrimary	10.90	0.00	3.39	35.07	1.91	0.02	1.12	3.24	3.08	0.00	1.47	6.45	1.51	0.31	0.68	3.37
Secondary	4.23	0.02	1.30	13.69	0.90	0.69	0.54	1.50	2.07	0.02	1.11	3.85	1.17	0.59	0.66	2.07
Tertiary (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	102.83 (0.00)				16.91 (0.00)				9.15 (0.00)				1.02 (0.60)			
Education (Malaysian Indian)																
NonePrimary	2.34	0.19	0.67	8.20	5.82	0.00	2.68	12.64	6.76	0.00	2.69	17.02	1.72	0.32	0.59	5.02
Secondary	1.70	0.41	0.48	5.97	3.79	0.00	1.82	7.92	2.79	0.01	1.36	5.76	1.21	0.60	0.60	2.43
Tertiary (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	2.70 (0.26)				19.95 (0.00)				16.77 (0.00)				0.99 (0.61)			
Education (OIP)																
NonePrimary	2.97	0.14	0.70	12.55	0.78	0.55	0.35	1.76	1.65	0.24	0.71	3.85	1.61	0.14	0.85	3.07
Secondary	3.46	0.09	0.82	14.70	0.87	0.73	0.39	1.94	2.46	0.03	1.08	5.58	1.25	0.46	0.69	2.25
Tertiary (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	3.15 (0.21)				0.56 (0.76)				5.28 (0.07)				2.16 (0.34)			
	1996				2006				2011				2015			
Ethnicity (Tertiary educated)	OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.		OR	p-value	95% C.I.	
Malaysian Chinese	0.09	0.00	0.03	0.30	0.28	0.00	0.17	0.47	0.16	0.00	0.09	0.29	0.21	0.00	0.13	0.34
Malaysian Indian	0.77	0.69	0.22	2.70	0.48	0.05	0.23	1.00	0.60	0.12	0.31	1.13	1.34	0.36	0.72	2.52
Other Indigenous People	0.32	0.12	0.07	1.36	1.11	0.80	0.50	2.47	0.41	0.02	0.19	0.88	0.82	0.44	0.50	1.35
Malaysian Malay (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	17.38 (0.00)				26.87 (0.00)				42.95 (0.00)				43.09 (0.00)			
Ethnicity (Secondary educated)																
Malaysian Chinese	0.28	0.00	0.21	0.39	0.17	0.00	0.13	0.22	0.25	0.00	0.18	0.35	0.17	0.00	0.12	0.25
Malaysian Indian	0.98	0.92	0.66	1.46	1.19	0.19	0.92	1.53	1.21	0.35	0.81	1.80	1.16	0.43	0.80	1.68
Other Indigenous People	0.82	0.21	0.60	1.12	0.63	0.00	0.49	0.80	0.74	0.13	0.50	1.09	0.73	0.10	0.50	1.07
Malaysian Malay (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	63.88 (0.00)				12.37 (0.00)				68.77 (0.00)				88.00 (0.00)			
Ethnicity (NonePrimary educated)																
Malaysian Chinese	0.59	0.00	0.44	0.78	0.37	0.00	0.27	0.50	0.25	0.00	0.13	0.46	0.20	0.00	0.10	0.43
Malaysian Indians	1.08	0.68	0.74	1.59	1.88	0.00	1.30	2.73	1.97	0.08	0.92	4.21	1.52	0.39	0.59	3.87
Other Indigenous People	0.56	0.00	0.42	0.75	0.58	0.00	0.44	0.78	0.33	0.00	0.20	0.57	0.87	0.61	0.50	1.49
Malaysian Malay (ref.)	1.00				1.00				1.00				1.00			
Wald Test (p-value)	26.06 (0.00)				195.97 (0.00)				40.23 (0.00)				20.37 (0.00)			
Interaction terms																
MalaysianChinese# NonePrimary	6.54	0.00	1.92	22.25	1.28	0.41	0.71	2.32	1.50	0.34	0.66	3.44	0.99	0.98	0.41	2.37
Malaysian Chinese# Secondary	3.15	0.07	0.92	10.79	0.59	0.06	0.33	1.03	1.51	0.22	0.78	2.91	0.84	0.56	0.46	1.53
MalaysianIndian# NonePrimary	1.40	0.61	0.38	5.17	3.92	0.00	1.73	8.90	3.30	0.02	1.22	8.92	1.13	0.84	0.37	3.48
Malaysian #Indian Secondary	1.27	0.73	0.34	4.68	2.47	0.02	1.14	5.36	2.03	0.07	0.95	4.32	0.86	0.69	0.42	1.79
OIP# NonePrimary	1.78	0.45	0.40	7.87	0.53	0.14	0.22	1.24	0.81	0.65	0.32	2.03	1.06	0.88	0.51	2.21
OIP#Secondary	2.58	0.21	0.58	11.47	0.56	0.18	0.24	1.31	1.79	0.18	0.77	4.17	0.89	0.72	0.48	1.66
Final Sample	5719				5713				2713				2757			
Total Sample Size	5907				5824				2734				2975			

The risk of being obese was greater among Malaysian Malay women with the lowest education level (no formal education and primary education), relative to that of Malaysian Chinese women, and women from Other Indigenous Minority Ethnic Groups who had reached the same educational level. These differences were mostly significant, except for women from

Other Indigenous Minority Ethnic Groups in 2015. The risk of being obese for Malaysian Malay women with lowest education was, though, lower than the risk of Malaysian Indian women with the same level of education; but only significant in 2006 (OR=1.88, 95% CI: 1.30, 2.73).

In summary, a negative educational level-obesity gradient was evident among Malaysian Malay women in 1996, 2011 and 2015, respectively: Malaysian Chinese women in 1996, 2011 and 2015; Malaysian Indian women in 1996, 2006, 2011 and 2015; and women from Other Indigenous Minority Ethnic Groups in 1996 and 2015. Hence age had a significant positive impact on the risk of being obese. Married women presented the highest risk of obesity, compared to never married and unmarried women. Women living in metropolitan areas had the non-significantly lowest risk of being obese compared to women living in rural areas, small urban areas, and large urban areas over the 1996-2015 period. Irrespective of educational backgrounds, Malaysian Chinese women were most likely to reflect the lowest risk of being obese compared with women from the other three ethnic groups over the four time points. The differences in the risk of being obese were commonly significantly different between Malaysian Chinese women and Malaysian Malay women who had reached the three different educational levels.

6.5 Conclusion

There were four main findings from the logistic regression analysis. First, a negative education level-underweight gradient was evident among Malaysian Malay women in 2015. Second, tertiary educated Malaysian Malay women were consistently and significantly more likely to be pre-overweight than tertiary educated Malaysian Chinese women across the four time points. There was a negative education level gradient in the risk of being pre-overweight for Malaysian Chinese women in 1996 and 2006. Positive gradients were revealed in the risk of pre-overweight for Malaysian Malay women in 2006 and 2015. Negative education level-pre-overweight gradients were found among Malaysian Indian in 2006 and 2011.The influence of the lowest, middle or highest education levels, on the risk of being pre-overweight, were mostly non-significant for each ethnic group – and thus echo the risks of being underweight.

Third, education level had a significant effect on the risk of being overweight, particularly for Malaysian Chinese women. Between ethnic groups, tertiary educated Malaysian Malay women showed a significantly increased risk of being overweight compared with tertiary educated Malaysian Chinese women over the 20 years research period. Similar patterns were observed when Malaysian Malay women with no formal education/primary education and secondary education were compared to Malaysian Chinese women with the same educational level. The negative education level-overweight gradient was clear among Malaysian Malay women in 2006 and 2011; among Malaysian Chinese in 1996, 2006, 2011 and 2015; among Malaysian Indian in 1996 and 2011; and, finally, among women from Other Indigenous Minority Ethnic Groups in 1996.

Fourth, notwithstanding educational background, Malaysian Chinese women were most likely to have the lowest risk of being obese compared with women from the other three ethnic groups, over the four time points. Negative education level-obesity gradients were found for Malaysian Malay women in 1996, 2011 and 2015; Malaysian Chinese women in 1996, 2006 and 2015; Malaysian Indian women in 1996, 2006, 2011 and 2015; and women from Other Indigenous Minority Ethnic Groups in 2015. The highest obesity risk was seen in the lowest education group among Malaysian Indian women between 1996 and 2015. This finding possibly suggests that the transition of the education level-obesity gradient had occurred before 1996 for Malaysian Indian women of lowest education.

Compared to women from other ethnic groups, lower educated Malaysian Indian women were most likely to have undernutrition and overnutrition issues. Malaysian Indian women of secondary education level were more likely to be underweight. Malaysian Indian women of the none/primary education level and secondary education level were more likely to be overweight and obese. By comparison, Malaysian Chinese women were least likely to be obese, irrespective of educational attainment levels.

Chapter 7

Women's views about body weight, strategies for losing weight and influence on body weight: data from qualitative interviews

This chapter outlines the data from the qualitative aspect of this mixed methods study. As described in the methodology chapter, the first phase of my research involved the secondary analysis of data from the 1996, 2006, 2011 and 2015 Malaysian National Health and Morbidity Surveys. These data provided important information on the weight distribution patterns of women from the four main ethnic groups in Malaysia and identified the most influential determinants of women's body weight. While the quantitative data provided information on weight patterns and social determinants at the level of the social group, it could not offer any information on how women in Malaysia understand body weight, seek to maintain a healthy body weight or identify the factors they see as associated with weight gain or weight loss. To address this, a small qualitative study was carried out to explore how Malaysian Chinese women understand and think about their body weight, and their approaches to achieving their desired body weight.

As discussed in Chapter 4 (Methodology), Malaysian Chinese women were selected as the quantitative analysis suggested that they had lower BMIs and were more likely to have healthy body weights than women who were Malaysian Malay, Malaysian Indian or women from Other Indigenous Minority Ethnic Groups. Malaysian Chinese women in the highest education group had the lowest mean BMI in three surveys (20.89 kg/m^2 in 1996, 21.99 kg/m^2 in 2006, and 22.17 kg/m^2 in 2011) of all women and had body weights that were more likely to be classified as 'healthy' than all other women. Furthermore, the presence of a negative educational-overweight gradient for Malaysian Chinese women over the time period 1996-2015 and a negative educational-underweight gradient during1996-2011.

Information on how this group of women – whose weight, as a group, falls into the 'healthy' weight category – perceive their weight, seek to manage it and understand barriers and enablers to healthy weight maintenance may have relevance for health promotion strategies for other Malaysian women.

This chapter begins by describing the women who participated in the qualitative aspect of this study. It then discusses the results from the three main topics areas covered in the interviews: views about body weight in general and women's own body weight; strategies for achieving their desired weight; and factors perceived to be influencing body weight (see Table 7.1 for details).

Table 7.1 Summary of emerging themes

Theme 1: Views about body weight	*Views on Thinness and Overweightness *Perceptions of own body weight
Theme 2: Strategies for losing, gaining and maintaining body weight	*Self-directed Strategies *Weight-loss Strategies *Weight Maintenance Strategy *Weight Gain Strategy
Theme 3: Factors perceived to be influencing body weight and weight maintenance	*The 'Inner Body' *Social Influences *Cultural and Religious Factors *Cultural norms *Emotions

7.1 Introduction

The participants

The qualitative interviews were carried out with 18 Malaysian women of Chinese ethnic origin. 18 participants were thought adequate for the second part of my research because new themes did not emerge after subsequent interviews.

Table 7.2 shows the profile of the women who participated in face-to-face semi-structured interviews. Of the 18 participants, eight were post-secondary educated and the remaining ten had completed secondary education only. Three out of the 18 women were unmarried and childless while the remaining were married with children. Among the 15 married women, nine had at least one child aged five or below.

Table 7.2
Participant Characteristics

Pseudonym	Age	Marital status	Educational level
Leng	36	Married	Tertiary
Sally	39	Married	Tertiary
Kim	28	Married	Tertiary
Cindy	37	Married	Tertiary
Le	48	Married	Tertiary
Tulip	36	Married	Tertiary
Mary	30	Married	Tertiary
Cleo	42	Single	Tertiary
Efa	25	Married	Secondary
Penny	33	Married	Secondary
Agnes	33	Married	Secondary
Xiao	26	Single	Secondary
Megan	23	Married	Secondary
Rina	39	Married	Secondary
Julie	40	Married	Secondary
Becky	38	Married	Secondary
Delia	34	Married	Secondary
Gi	49	Single	Secondary

Note: Tertiary education refers to those who had a certificate, diploma or degree education from universities, colleges, and polytechnics.

7.2 Theme 1: views about body weight

Women gave their views about body weight in general and their own body weight. Their views appeared to be shaped by their daily lived experiences. They discussed how these views often changed over time as their status, material conditions and daily lives changed. For many women, thinness was a positive attribute associated with physical attractiveness, happy marriages, and being able to choose what clothes they wanted. A 'heavy' or overweight body was associated with ill-health, looking unkempt and unattractiveness. Participants constructed a view about their own body weight by comparing their current own bodies (self-body) with a previous self-body shape or weight, and also by comparing their self-body with the bodies of other females they encountered in their daily lives. These included family members, friends, colleagues and women in the local community and the media.

As it was women's views about body weight that were the focus of the study, women were not asked to give information about their current weight. From my observation, however, none of the women that I interviewed were obese, although it is possible, from their visual appearance, that some may have been overweight. Many of the women interviewed perceived that they had unwanted body weight; their weight was heavier than they desired it to be.

7.2.1 Views on thinness and overweightness

For many participants (15/18), thinness was the preferred body shape. All women described what thinness meant to them. They discussed thinness in the context of physical appearance, general health, marriage, aspects of personality (i.e. self-control and self-confidence) and social acceptability. One participant (Penny) stated that a thin body shape was costly. A thin shape called for a careful food choice and more self-control with food. For some, it was synonymous with beauty and attractiveness:

'I would like to stay as thin as them (celebrities), as thinness is pretty. This 'prettiness' and thinness come with a price. You can't simply put anything into your month … I still like thinness…Just simply put on simple and clean clothes, without wearing any make up, I feel I am pretty.' (Penny)

'No, I still prefer thinness...I like to stay thin…I don't want to feel ugly…or unattractive…' (Xiao)

Some women discussed thinness in the context of health; being thin was positive if it was associated with good health or the absence of illness. They felt that having a thin body alone was inadequate; health must be embodied in a thin female body:

'I mean the healthy type…not having a thin body because of illness.'(Cleo)

‘I adore thinness but must be healthy. Some women are thin, but they are sick. I do not want illness. I prefer to have a thin and healthy body.’ (Delia)

‘Thinness means not super skinny for me ... as super skinny women look unhealthy…’ (Tulip)

Although thinness was generally considered attractive, for Le and Penny, body shape was also important. Le disliked a thin and straight body. According to her, a straight body was akin to a lifeless body: dry and bony:

‘… I do not want to be my body looks straight like a stick … it gives people [the impression] that I was dry and bony…flat… I prefer thinness [body weight] with little cut [shape]… I did not hope to have an hourglass body shape… (Le)

‘I feel with 47kg, I look more attractive. I got my figures back. My body looks straight and baggy now...’ (Penny)

For a small group of participants, thinness was also associated with a successful marriage. Efa and Megan discussed how they felt that thinness had a sex appeal that was important in marriage:

‘They told me that thinness got its role in marriage. Thin women can easily keep their husbands happy, faithful and in love with them. Thinness makes you stay attractive, so you can easily win your husband heart... That’s what my friends say. I believe in what they say... (laugh)’ (Efa)

‘Thinness is vital for married women…or you would end up wearing big size t-shirt or baggy t-shirt to cover up your extra flesh…this is ugly for me...’ (Megan)

Being thin was seen as having other advantages. Some women commented on how an advantage of being thin was being able to wear any clothes that they liked and with having greater choice in clothes for social events:

'If I weighed like other women in my age, not big or heavy... I would look and feel great with whatever clothes that I put on.' (Rina)

'…being thin makes it easier to put on any clothes that I want easily. Easy to get small size clothes as well, not really expensive. I would stay attractive and happy [without having any hassle to get big size clothes].' (Le)

'Being thin allows [me] to look pretty during special occasions, parties and when attending wedding ceremonies.' (Penny)

A small number of participants also referred to how body shape can affect other people's views about them and social relationships. For example, Leng and Xiao discussed thinness in the context of having control over one's body. Being thin was associated with being a capable woman:

'[My mother-in-law] likes me because I care about my body weight. I don't look big.' (Leng)

'I like to stay thin…being thin means I have capability to look after my weight. I give positive image to clients [as a macurist]...' (Xiao)

Participants used terms such as 'fat', 'big' and 'heavy' when referring to overweightness, often using these terms interchangeably. Unlike thinness, a 'heavy' body was seen as unattractive and looking unkempt:

'I feel my bones and hips are bigger after giving birth… I am heavier…' (Julie)

'…I feel I am not that attractive… I am bigger than them…' (Xiao)

‘I do not want to look like ‘a big fat pig’ and look bigger than [my husband] when we go out together.’ (Penny)

Some participants associated overweightness with poor health:

‘It [overweightness] has adverse implications on health. Diabetes, heart disease and high blood pressure are related with weight…’ (Tulip)

‘[Being] overly fat…it would affect our daily life…even walking may cause short of breath.’ (Sally)

‘Fat is bad for health…overly heavy can cause me feel tired easily…less energetic to do my work …and even [when] I do my work…it is slow…’ (Julie)

A heavy body or excess body weight, however, was associated with some restrictions on clothes and food choice. Difficulty in buying clothes caused some participants to experience some unpleasant feelings such as discomfort, and feeling upset and unattractive:

‘I feel that the clothes [wraps] is wrapped [around] me tightly, exposing my excess flesh…with heavy body weight, I got to put effort in my make-up so people would focus more on my face [than on my body] …’ (Megan)

‘I can’t get a pair of jeans that fit in my body here…frustrating…and disappointing… My old jeans are too tight...I could hear ‘she, sher…’ [the noise produced by two tights when I walked] … It is very hard to get in my old clothes...hard to get new clothes as well… L size is difficult to get here...I can’t fit in M size clothes…hopeless with M size...’ (Delia)

Being overweight, however, could be associated with some negative characteristics such as low self-confidence, laziness and overeating:

'…I don't feel to have self-confidence with this condition…I feel I send out the message to others that I am not tidy and care for [myself] because I am fat, especially when I walk with my child …or I am lazy in looking after myself...' (Megan)

'*… it means I don't enjoy a variety of food in a moderation way…' (Gi)*

To summarise, thinness is favoured over being overweight or obese for the majority of participants. Thinness was a sign of beauty, associated with successful women and seen as fostering positive social relationships. Finding it easier to shop for clothes was another advantage to being thin. In contrast, overweightness was linked to negative features such as unattractiveness, poor health and negative qualities. Restrictions on food were considered to be the cost of both thinness and overweightness.

7.2.2 Perceptions of own body weight

In the semi-structured interviews, women also talked about their perceptions of their own body weight. The majority of women (14 out of 18) said that they felt that their body weight was heavier than they felt it should be. They had unwanted weight. As a result, they were unhappy with their current body weight. Four participants (Xiao, Efa, Le and Tulip) appeared to have their own definition of what an ideal weight was for themselves and felt that, currently, their weight was not what they wanted it to be:

'No again… (laugh)… I always try to lose weight…my ideal weight is 58kg… [I] am way away from this…I am 6xkg…' (Xiao)

'*I feel I am fat…My weight grows from 42kg to 45kg. I have a tummy as well. …People thought I were pregnant when I wore a body-hugging top. I am not happy with this ... (Efa)*

'…it has stuck at 52kg since I gave birth. I am not happy with my weight. I would like to slim down a bit. I feel I am fat.' (Tulip)

'I always want to be thin…but the more I wanted to be thin, the more I put on weight.' (Mary)

'I don't [feel] satisfied with my body weight… I did a healthy check two weeks ago. They said I had a healthy weight (laughs) … but I would like to shed a few more pounds. I wanted to look great. My target weight is not more than 55kg.' (Leng)

For all of these women, thinness had always been important. Many of the women explained that when they were younger and single, they were content with their body weight. Over time, however, as their life circumstances changed, they frequently reported that they put on unwanted weight. They frequently compared their current self-body with their previous self-body shape or weight. For example, becoming a wife and mother was associated with weight gain. Women described how they had put on weight after marriage and childbirth and that this weight was now unwanted and difficult to lose:

'I did not bother about my weight when I was young…I was thin…before marriage … for my second baby…my body retained water…I was heavy during that time…It was about 100kg…after giving birth to my second child …I was about 70kg…I started to feel that I was not thin anymore…I was fat...' (Julie)

'…when I finished school…and worked…my weight remained the same… After [I got] married…my weight was okay… During my three pregnancies…my weight increased between 10 to 15kg…I managed to lose weight after my first two pregnancies… [but] not the third one…' (Agnes)

'I had always pay attention to my weight before [my] 30s...I did not manage to do that… [pause]…even [though] I took in a temporary helper...with three children aged between 0 to 9, plus preparing my children to new living environment, a day job and … my eldest did not progress well at new school…I got to pay extra attention to him to get him back on the track... All these took a lot of my time. I barely found time for myself... [I] run out of time for looking after my body, or trying to lose weight ...' (Le)

In addition to comparing their current self-body with their former body, some women with unwanted weight compared their current perceived body weight with that of other women. They compared themselves to family members, friends and work colleagues and perceived other women to have a more desirable weight than themselves. Having friends who were thinner made Xiao and Fern unsatisfied with their own weight:

'…my colleagues and friends are thinner than me…I always dream to be [like] them…I feel I am not that attractive… I am bigger than them…' (Xiao)

'I look heavier than women around me, in the office, and my family members are thinner than me …I want to go back to 52kg.' (Delia)

'…I do not feel good when my friends are not as big as me. I look different from them because I am bigger than them...' (Cleo)

'I don't want to…look bigger than him (my husband) when we go out together. It is about how I feel…' (Penny)

Not all women, however, were concerned about unwanted weight. One woman, Rina, described how she perceived herself to be underweight. She wanted to gain extra weight:

'No, I am 43kg, my height is around 158cm ... [I] am slightly underweight. My doctor asked me to eat more in order to gain another 2kg. I got it [BMI] from my doctor…he asked me to 'eat more'. Later, I found the concept of BMI from my son text book.' (Rina)

There was one participant (Mary) who was not happy with her current weight but accepted it. She said: *'I feel I was born to be in this way – plump…so I got to accept my weight.'*

A small number of participants discussed how focusing on having good general health was more important that focusing on body weight:

'I don't really focus on my body weight. I try to learn how to look after my general health not being live in illness ... My weight has been levelled off between 49 to 50kg since [I was] 20 years old …it has never exceeded 52kg. I am okay, don't really [feel] happy or unhappy with my weight...I have a healthy body weight…' (Gi)

'...as I aged, I switched my attention to health more. Body weight is still important but not as important as general health, such as cholesterol level…' (Le)

'… I don't really concern about thinness now as I used to be [before I got married] …I pay attention to health …I hope I will stay healthy...' (Becky)

'For me, health comes first. Being free from diabetes, cholesterol and high blood pressure is the most important thing.' (Cindy)

Some participants expressed how their views on body weight differed to the older generation. They disagreed with their elders that overweightness was a sign of prosperity and abundance. For these women, staying thin with a healthy body or being in a weight range was seen as essential:

‘Grandparents always ask us…don’t ever try to lose weight… fat is pretty for them…fat is blissful for them…women are well fed by husbands… if [they] lose weight and stay thin…means unhealthy… not well-fed by husbands...I prefer to have a thin and healthy body.’ (Delia)

‘older people do not focus on their body weight …their children feel the importance of having healthy weight [after seeing them suffer from disease] …they would look after their weight... As for me, I would like to care about my weight because fat can cause diseases and at the same time, I feel thinness is beauty (laugh)…’ (Kim)

‘They would advise us to eat more …to look nicer…and healthier…they do not know fat is bad for health. I personally feel that balance…not too thin or overly big…must free from illness… look fresh…not fatigue…that is how I coin healthy weight… if overly fat.’ (Sally)

‘Old generation sees fat as a good thing…They see it as a beauty, a sign of good living condition where food is abundant… It has adverse implications on health. Diabetes, heart disease and high blood pressure are related with heavy weight.’ (Tulip)

Two participants felt views on body weight remained the same over generations:

‘Not really…we all like thinness… my nanny also likes to stay thin…thin is always been there…’ (Cleo)

‘My parents think healthy weight is important…they would like me to stay healthy and not being fat…I think my weight perception is influenced by my parents’ view.’ (Julie)

To summarise, how participants perceived their own weight varied across time, social statuses and settings. Most participants considered themselves to have heavy bodies: carrying extra weight or having heavier bodies than they felt they should have. Some women compared their bodies with husbands, friends or colleagues who were relatively lighter than they were and this was associated with feelings of dissatisfaction with their own bodies. While some participants discussed how their elders had different views of what was a healthy body weight, a few felt that weight perception remained the same across generations.

7.3 Theme 2: strategies for losing, gaining and maintaining body weight

The third topic that participants were asked to discuss was the strategies they adopted to lose unwanted weight, maintain their desired weight or gain extra body weight. All of the women appeared to be concerned, in some way, about their own body size, shape or weight.

7.3.1 Self-directed strategies

A clear theme in participants' discourses was that they developed their own self-directed weight loss, weight maintenance or weight gain regimes. These strategies were based on their knowledge of what worked best for them, as individuals. This knowledge came from previous attempts to lose, maintain or gain weight and their understanding of factors in their personal lives that helped or hindered the achievement of their desired weight.

None of them reported seeking specific advice from medical or health professionals regarding weight loss, weight maintenance or weight gain strategies during the course of interviews. They explained that they adopted personalised weight-related strategies, rather than obtaining guidance from the health professionals, because they felt they could control their weight themselves or had felt that, due to previous experiences, they knew what worked best for them:

'No, I am not overly big (obese) …I know that I can bring down my weight a bit through diet and a bit [of] exercise…these worked for me in the past.' (Le)

'I can control my weight easily as long as I do exercise. So, there is no need to discuss with doctor at this moment. The solution is moving around …shaking out unwanted weight… not going to talk to doctor...I am not overly big…' (Mary)

'I will not discuss this with dietician or doctor… because …it is all about determination…if I am determined enough, I can get the weight that I want.' (Sally)

Although participants did not seek specific guidance from medical or health professionals, they gained information from friends and the media. Over half of my participants acquired weight loss, weight maintenance or weight gain-related information from friends. They relied on friends as a source of information first because friends had knowledge to share, and second, because of time and child-rearing constraints:

'I depend on my friends…I don't do much reading…not newspapers…or magazines.' (Agnes)

I don't like to watch TV or read magazines… I got info about weight maintenance from friends…they have more time than me and they know more [about losing and maintaining weight]' (Becky)

'Through friends. Friends get the info from the internet or salons. I don't have the time to search for the info. I would seek info from friends as this is quicker…save my time…short cut...I would like to do that but I don't have the time…my children like to stick with me (clingy) after I reach home everyday… My time is theirs…partly I am not keen to go to salons.' (Kim)

In addition to friends, social media was another preferred source from which to learn weight-related information. These sources included magazines, newspapers and the internet:

‘From newspapers…or from friends... Some friends introduced me to certain lose weight salons. I went there to seek further information about losing weight.’ (Delia)

‘I usually get the information from newspapers as I got a habit to read health-related column every day. My friends [are] another source of information…and the internet has loads of information.’ (Le)

‘Usually, I got the info from magazines such as ...oops...I can’t remember the names of magazines... Yes, they are Feng Chai magazine and sister magazine. I like them. I learn from the internet and magazines that the healthy way to lose weight is through balance diet and doing physical activity, like aerobic, hula hoop.’(Leng)

‘Internet…health-related magazines…’ (Sally)

Some women, however, expressed a lack of knowledge about healthy diet and other strategies that would help them to maintain a healthy weight (see section *Factors perceived to be influencing body weight*).

7.3.2 Weight-loss strategies

As highlighted in Theme 2, many participants (14) wanted to reduce their current body weight. Participants appeared to have tried a range of weight-loss strategies. These included diet-orientated and physical exercise approaches, slimming pills and slimming centres. Participants discussed how they often used a combination of approaches.

Diet-orientated strategies

Some participants embraced dietary approaches to losing weight. There appeared to be several dietary approaches that women adopted. Eating smaller food portions appeared to be a key method that women adopted to lose weight:

'…there isn't any sports facility here. I reach home late everyday…and I am tired and I need to look after my kids after work... So, even [though] I can go to the gym with my car...time does not allow me to do so... Well, nothing except halve my rice portion, nothing has changed so far … (laugh)…' (Cindy)

'... I eat as little as I can … two slices of wholegrain bread every morning, noodles, veg, fish and less meat for lunch and dinner, no supper… I noticed that if I go back to rice…my trousers get tighter… I must have three meals in a smaller amount… I need more energy to look after my kids…and run house…' (Delia)

The quotes above suggest that women used a small portion approach because they found it fitted well with their everyday lives. They were often juggling being a mother, family commitments and employment. Time and money were important considerations. Eating smaller portion was more convenient and easier than exercising, particularly when exercise facilities were not readily available. Two women discussed how they used a smaller portion strategy in combination with the use of weight-loss products:

'I try to control my diet…I take losing weight liquid in the morning…then lunch with less rice or vermicelli, then vegetables only for dinner…' (Xiao)

'I cut my food portion…also take some herbs in capsule form to lose weight…I opt for herbs because the side effect on health is minimal. The tablets flushed out some oily stuff that sat in my stomach. I feel by cutting down my food portion and taking the herbs… my weight drops a bit.' (Kim)

Skipping meals and food restrictions were other diet-orientated strategies adopted by a few of my participants to lose weight:

'I try not to take oily food. Skip supper, cut down the frequency of having a big supper in the evenings... If I enjoy big supper in late evening this causes

my weight to creep up... food takes longer time to digest when I sleep…' (Efa)

'I am controlling my diet a bit. I skip dessert and only have a small slice of cake once a week. I use yogurt to replace santan [coconut milk] when I cook curry. I feel it is less fatty...so I can have curry at least once every week without feeling guilty...coconut milk can increase cholesterol and fat in my body... I don't want my body weight to creep up...' (Tulip)

Physical activity

A few participants (Agnes, Cleo and Leng) referred to using physical activity as a weight-loss strategy. None of these women, however, used exercise as a sole strategy: they used it in combination with diet restrictions. They described how they had developed their own individualised approaches based on what they felt fitted best with their daily lives.

'Before I sleep, I spend about 30 minutes to do some exercises to tone up my arms and thighs… this is not the vigorous exercises…I feel it firms up my upper arms a bit and it does not really help me to lose weight...' (Agnes)

'I still stick to one main meal and breakfast per day…I enrolled myself to fitness centre as well… jogging and yoga…Put in enough and consistent effort...' (Cleo)

'I spend 20 minutes to do 1,500 times hula hoops every day. Eat less... Fruits, vegetables, fish and little lean meat.' (Leng)

Elements of self-determination and self-control were evident in Cleo's and Leng's quotes. For them, putting in consistent effort every day was important. Some participants reported that they had previously tried to lose weight through doing physical activity. None of these participants, however, felt that this had been a successful weight-loss strategy for them. Mary and Xiao had tried being more physically active by using a gym but both reported finding it difficult to keep up attending the gym for a number of reasons, including lack of money, work, and mood:

‘I wanted like to lose weight by going to gym. Then after some time…I dropped out half way…because I did not have money for paying the fees… Sometimes, I was busy with work and other things occupied my time…then sometimes I could not find my way to the gym because of my mood… When negative emotion manifested in me, it dragged me not to go to gyms…’ (Mary)

‘I went to gyms…cycling…and jogging…for some time. I dropped out…partly because of my work nature…I worked from nine to five…but stayed late from time to time…and partly because I was lazy to go to gym…it’s a hard.’ (Xiao)

My participants gave voice to how their multiple roles in daily life influenced their participation in physical exercise. Lack of time to exercise was a common theme:

‘I simply cannot slice the time out for doing physical activity... The gym is close to my house but I am just too busy with work and children...so I don’t have the time for gym…’ (Le)

‘No, I don’t go to swimming anymore. I am tied up, with an infant on board and a full-time job on my hand, I find it very difficult to go out for swimming.’ (Mary)

‘there isn’t any sports facilities here. I reach home late everyday and I am tired and I need to look after my kids after work... So even though I have a car and I can go to the gym...time does not allow me to do so…’ (Cindy)

‘when it is busy…I don’t have time to go to the gym’ (Sally)

‘my working hours are longer …so I am tired after work…I would love to do some exercise…but I don’t have enough energy to move around by the time I reach home…’ (Xiao)

‘’I don’t have the time for myself…I got to look after my children after work…’ (Kim)

Other methods

Some participants had previously tried other methods to lose weight. Delia provided an account of how she successfully lost weight by burning her extra fat through hot and cold body wrap machines at the slimming centre. Xiao also went to slimming centre for the same purpose. None of them, however, managed to maintain their desired weight, which they had hoped to achieve from the slimming centre.

‘I am so busy…with three kids around… and a five-days full-time job…I opted to lose weight by going to slimming centre…There was weight-loss body wrap machine that required the user to apply burnt fat cream all over the body before wrapping my body with a big blanket …let the machine burnt my fat for half hour per session…I tried this for some time. I noticed the positive effect…I lost some weight. I was happy…Another type of machine is ‘cold type’…I lost some weight [with that] too…’ (Delia)

‘I went to slimming centre…the impacts did not last long…The thing is, when I started eating like I used to, I gained weight.’ (Xiao)

Three participants (Mary, Megan and Xiao) mentioned that they had previously used slimming pills to try to lose weight. Slimming pills were initially seen as a convenient and quick fix approach to attain a desired weight; it was easier than other methods. Although slimming pills had the desired effect in the short term, in the longer term, the women put weight back on once they stopped taking the pills:

'I tried slimming pills... the impact was fast, I did not do anything, I did not feel hungry, did not have to [be] starving, thought of which foods [I] should have or not taking certain types of food… So the weight-loss journey was relatively straightforward compared with starving or taking fruits as main meals or changing my diet, which were not easy rides at all…I was okay but put back my weight again after discontinuing the pills…' (Mary)

'… I took weight-loss pills, which discarded my extra fat out of body… they are herbal pills… safer… not that expensive and also I went back to work after one-month maternity leave…I did not have the time to do PA [physical activity] …or put myself on a diet ...I couldn't concentrate on work if I ate less...I noticed that once I stop taking the pills, I put back some weight if I did not control [my eating] a bit… Also, I felt the pills had some side effects.' (Megan)

'I took diarrheal pills…after my meal…I tried some herbs to flush out the fat from my body …I took slimming pills for seven to eight years…I could enjoy eating while controlling my weight… At the beginning, I ate less and took the pills at the same time… the pills helped me to shed some stubborn weight…watching the numbers on the scale dropped was very motivating. I felt empowered with every pound lost. But the weight levelled off after some time… I was demotivated…so I stopped taking the pills' (Xiao)

Two female participants had attempted to lose weight by having herbal tea. Both of them agreed that drinking herbal tea to lose weight was ineffective.

'...I tried to bring down my weight…by taking slimming tea…for four to five months…then I stopped…no effect(laugh)...' (Julie)

'After giving birth to my first child, I took herbal tea for losing some unwanted weight. I managed to bring it down a bit but put back after discontinued it … I

thought home-made herbal tea was better than weight-losing pills, as the tea may not have side effects on health. The tea was not such expensive. It is around RM20, but when I stop taking the tea, my weight went up. So, I gave up the tea...' (Penny)

7.3.3 Weight maintenance strategy

There were two (Le and Gi) participants whose intention was to maintain their weight. They adopted a weight maintenance strategy because health was their priority. They used dieting, mixed mode and physical activity approaches to maintaining their ideal weight. Participants appeared to adopt a dietary approach to maintaining their weight as it seemed to fit well with their daily lives:

'I attempt to skip dinner … (laugh)… [when I skip dinner] I feel good…happy because I feel fresher …and lighter...comfortable because of not being stuffed by food. I still have energy to do housework. I do not feel sluggish at all… I sleep well. Sometimes if I am hungry then I take an apple or a soup or with a few spoons of rice, stir fried vegetables and fish...' (Le)

Gi used physical activity in combination with a dietary approach to maintain her desired body weight. Gi felt that she successfully controlled her weight by restricting herself to a small dinner and practised mindful eating and yoga.

'I also have something light for dinner like noodles or vermicelli in a small portion…I don't eat rice…I feel too full if I take rice...near my sleeping hours… For breakfast and lunch, I eat more [than dinner] as I need energy for my daily activities. I do yoga not because of losing weight. I do yoga because I like it, it calms my mind. The fringe benefit of doing yoga for me is maintaining my weight...I also try to practice eating mindfully…When I eat, I try not to dwell in the past or future, I cut down my thinking on other matters,

I try not to do excess thinking. So I pay attention to the amount of food that I eat…and I can stop eating easily when my tummy is full...' (Gi)

7.3.3 Weight gain strategy

One participant, Rina, discussed how her aim was to gain some body weight. Rina wanted to gain weight as her husband thought that she was too thin. She discussed how she combined increasing her food portions, jogged and staying happy to gain weight:

'Eat more and do a bit more jogging on the treading mill. Try to stay happy. When I am happy, I have good appetite and eat more.' (Rina)

To summarise, participants used self-directed weight strategies in managing their weight. The most common strategies were dietary approaches and exercise. None of the participants said they adopted exercise as a single way to manage weight. Some participants used a diet-related strategy (small food portion, skipping meals, food restriction) to lose or maintain weight. Having a smaller food portion was the main weight loss method used by participants. Some participants combined both diet and exercise approaches in losing, maintaining and gaining weight. Use of slimming products was limited to fewer participants. There was one participant who maintained her weight by practising mindfulness besides adopting a dieting approach and staying active. Three participants felt that losing and maintain weight was an ongoing process:

'I still stick to one main meal and breakfast per day...' (Cleo)

'I spend 20 minutes to do 1,500 times hula hoops every day.' (Leng)

'…If I spend my time doing housework and gardening, I don't do brisk walking, but still do yoga everyday as I see it provides lots of benefits…' (Gi)

7.4 Theme 3: factors perceived to be influencing body weight and weight maintenance

In addition to perceptions about body weight and strategies for managing body weight, participants also discussed the factors they regarded as supporting or acting as barriers to body weight management. Participants discussed how they felt that their 'inner body', the social, cultural, religious and material aspects of their lives, knowledge about diet and exercise and their emotions affected their body weight and weight management in various ways.

7.4.1 The 'Inner Body'

Some women referred to 'inner body' factors to explain how their own weight varied across time and to explain differences in body weight between themselves and other women. References were made to hormone imbalances that resulted in weight gain. Becky and Efa both believed that their unwanted weight could be associated with taking contraceptive pills. Efa thought the pills caused hormone imbalances, which led to weight gain:

'…they [friends] hardly put up weight even [though] they told me that they ate the same food…they are lighter than me… Even [though] they have two children and mine only one … or maybe because I am on the [contraceptive] pills.' (Becky)

'I am taking contraceptive pills now. The pills push up my weight…The pills change my hormone…so I gain some weight. I did ask someone in Klinik Desa about the effect of taking the contraceptive pills. She told me that the effects of contraceptive pills on body weight varied across women...I am the one whose hormones react positively to the pills.'(Efa)

Differences in metabolism between women and the slowing of metabolism with age and childbirth also feature in women's accounts of factors they associated with weight gain:

'I eat quite similar amount of meat…but I used to be thin when I was young, not now though. So, it must have to do with metabolism …I feel my metabolism has changed after giving birth. My inner body has changed after giving birth…so this leads to fatness.' (Megan)

'I feel…some women are thin…no matter how much they eat…some are in the opposite condition…I am in the opposite condition. So it might got to do with how my body reacts to food… My body may react slowly to food and may keep the fatty food in my body more than other thin women.' (Efa)

'Age. I feel as I get older losing weight has become difficult...metabolism gets slower. So, I tend to put on weight.' (Penny)

'I feel my bones and hips are bigger after giving birth… I am heavier... I lost some blood when I gave birth, new blood cell grew… this might push up my weight a bit...' (Julie)

'Inner body' explanations, however, were discussed as part of a complex web of factors that acted together to push up body weight and make weight loss difficult. Delia explained how her metabolism and social situation made it difficult for her to control her body weight:

'Another thing is age. I feel my metabolism slows down a bit now than when I was in my 20s. It takes more time and effort for me to lose weight now…compared with old days…I can easily [be] tempted to eat … although I know I am on a diet…I wanted to go back to 52kg…in my old days… I only had one meal per day…lunch only…a cup of milo [a chocolate drink] for breakfast…that's it…I hardly had dinner…but now I must have three meals in a smaller amount…I need more energy to look after my kids…and run house choir …' (Delia)

7.4.2 Social influences

My participants' views and attempts to achieve their desired body weight appeared to be strongly influenced not only by their social context (such as being a mother, wife, worker, etc.) but also by the views and eating patterns of those around them. The views and eating habits of their loved ones, in particular, featured heavily in women's accounts.

Husband's views

Some participants, such as Rina, Sally and Kim, revealed how their husbands wanted them to manage weight better. While Rina's and Sally's accounts suggested that they found their husbands' interventions encouraging, Kim's account suggested that her husband's comments were less supportive:

'… My husband (laugh) ... he mentioned about my weight yesterday… he hinted me to look after my weight ...' (Sally)

'…My husband encourages me to eat more ... sometimes he buys my favourite food for me ... he feels I am too thin...not taking enough food...to nourish my body.' (Rina)

'Yes … he complains about my weight quite often… (laugh)… he would like me to look after my weight (laugh).' (Kim)

In contrast, there was one participant (Le) who had been discouraged to lose weight. Her husband tempted her with meaty broth, which she believed was the source of her weight gain. However, she had eaten the meaty broth because she did not wish to offend her husband. Another participant (Julie) highlighted that she could not avoid eating high-calorie fast food and spicy food because her husband and children liked them:

‘my husband … he influences my weight a lot … He always asks me to eat and not to worry too much about my weight when I am on a diet ... This is discouraging ... I feel one of the reasons that make me put on weight is how he tempts me to eat meaty broth ... His favourite broth … I feel it is hard for me to turn him down ... I feel bad if I turn him down …. I don’t want to disappoint him...’ (Le)

‘… but after [I got] married to my husband, my husband prefers KFC and spicy food, my children like McD [McDonald’s]… I got no choice … just follow them …’ (Julie)

Some participants also described how their husband’s views influenced their participation in physical exercise, which was an integral part of their weight loss/maintenance regime for some women. For example, they compromised with their husbands’ notions by giving up their preferred physical activities such as dancing or Zumba classes:

‘my husband does not allow me to join the dancing classes...He feels it is inappropriate for a married woman to dance with a man. He is my only dancing male partner... but he does not enjoy dancing as much as I do…’ (Julie)

‘But my husband does not like me to wear tight sport wear. I respect him. So I do aerobic and hula hoop at home. I only jog in the evening...’ (Leng)

Other family members

Other family members were also identified as having an influence on participants’ weight and weight management. A number of accounts highlighted the importance of mothers-in-law’s views on body weight. For example, Leng’s mother-in-law supported her to lose weight by exercising at home:

'I am very lucky to have a mother-in-law who supports me. She likes me because I care about my body weight. I don't look big. She is happy whenever she sees me doing some exercise at home.' (Leng)

Penny's account suggested her mother-in-law was less supportive on her attempts to manage weight better. Penny indicated that her mother-in-law accepted any body weight status because she prioritised general health. Yet, Penny herself preferred thinness:

'My mother-in-law talks about weight from time to time. She has never taken any action to lose weight. For her, skipping dinner to lose weight can have negative impacts on health. Being thin or fat is not that important. They are beautiful …as long as women have good general health…I still prefer thinness.' (Penny)

Three participants also highlighted how other family members influenced their perception on body weight:

'My family members look after their body weight if they notice their weight rise up…they would cut down food. So, how they look after their weight [is] influencing me too.' (Gi)

'… I feel my brother and sister look after their weight seriously. I have noticed this since last year. They often do exercise and watch what they eat. What they do...motivate me to lose some weight and stay active.'(Cleo)

'… my mum perception influences my perception on weight and the way to lose weight.' (Tulip)

Friends and colleagues

Friends and colleagues could be both positive and negative influences on their body weight. Friends and colleagues who were identified as caring about their own body weight were identified as having a positive influence on participants, while those who liked to go out to eat a lot or were less concerned about managing their weight were negative influences:

‘Types of friends that I mixed around…I got friends who like to go out for food… I go out quite often with them…my weight goes up…’ (Xiao)

‘Only few friends around me also care about their weight. Most of my friends are Buddhists. They care about their body and mind because they believe that body and mind is inseparable. Our mind influences [our] body. We have quite the same weight.’ (Gi)

‘Generally, I have friends whose body weight is quite healthy because all of them like to stay attractive. So, they also try to control their diet if they notice they put on some weight. Sometimes, knowing that they are on a diet, motivating me to be on a diet as well …Friends influence me more…not women around my housing area. I spend more time with friends.’ (Le)

‘My craving for food links to friends. I will go out with them if they ask me to do so…I do not really have a self-control on this…If friends are health conscious then [we] go out for Chinese tea, fruits…not fast food…my weight will not increase…’ (Mary)

Generation influences

Many of the women commented on how their views about body weight differed from those of their parents, in-laws and grandparents. They highlighted how social norms about body weight and food had changed across recent generations. The lives of their grandparents were very different and body weight concerns were significantly less:

‘My grandparents did not have any weight perception…they did not pay attention to weight issues as they were busy for work. Their jobs required lots of energy; you know…farming in the paddy field … so they were not fat. They had simple meals…rice with steamed veg… no deep-fried stuff…and

went to bed early as there's hardly entertainment available during their time...I would say …slender and thinness are conventional beauty for women in this century...' (Le)

'People from older generation do not really bother about body weight…busy for living …bringing up children…they don't have knowledge about weight loss products…Now?...weight-loss products are here and there....we focus more on body weight.' (Xiao)

A number of women discussed how their grandparents perceived overweightness to be a sign of prosperity, and how their views conflicted with the participants' own views:

'…elder people don't focus on their body weight…I disagree with old generation's view that fat is blissful…for me, it is not a sign of abundance… [it] is making me feel that I need to go to the gym or salon or on a diet...and to lose weight...' (Kim)

'My nanny and parents like big body size. They often wear baggy clothes. So, it is very hard to feel weight gain. They also believe that big body size is a sign of prosperous. But now ...(laugh) … our fashion is more to tight jeans, body hugging clothes...celebrities always wear tight clothes to show off their body...So, being slim or thin is more common...you know... [my weight perception is influenced by] ...er…modern Chinese culture – thinness is beautiful…' (Rina)

One participant, Delia, described how her grandparents consider being overweight as very positive, and as an indicator that she was 'well looked after' by her husband:

'…. fat is pretty for them. …fat is blissful for them …I am well fed by my husband…if I lose weight and stay thin…means unhealthy….not well-fed by him…I adore thinness…I am trying to lose weight every day.*' (Delia)*

For some women, generational differences in perceptions about body weight and size were linked to conflicting views about eating and control of body weight. As discussed in an earlier section, many of my participants tried to control their body weight by missing meals and reducing portion sizes. They discussed how their grandparents' advice to 'eat more' or eat until the stomach is full conflicted with their view of the value of more regulated eating:

'They would advise us to eat more…to look nicer…and healthier…they do not know fat is bad for health. For me, eating big plate of meal everyday can push up my weight and I know that fat should be avoided...' (Sally)

'Grandparents always ask me…must eat a lot until stomach is full. Don't ever try to lose weight ...or starve yourself…your body is damaged if you starve yourself… Eating until stomach is full is bad for my weight…I don't need that much of food...I will become a big fat lady if I listen to them…' (Delia)

Although there appeared to be some generation differences in views about body weight, some participants' accounts highlighted shared concerns about body weight across generations:

'We all like thinness…my nanny and my mum also liked to stay thin… My mum told me that she attempted to lose weight by drinking tamarind juice...she asked me not to do so… liked my nanny and mum, I like thinness too...thinness is always been there… it has been a dream body weight for us… Otherwise, why [are] artists and celebrities that we see in TV always thin?' (Cleo)

'Mum's concerned about her weight very much especially… after giving birth in her 30s… She felt she was fat during that time so she started to take

weight-lost pills… her liver is badly affected by long-term use of these pills. So…she always reminds us to look after our weight and not to take a shortcut solution to get rid of excessive fat in body…She encourages us to move around a lot as well… go to gyms, brisk walking ...my mum perception influences my perception on weight and the way to lose weight...' (Tulip)

'My parents think healthy weight is important. They exercise quite a lot…my mum does housework…and my dad enjoys tai chi and jogging… when I was young…they always took me to the park and jogging…they would like me to stay healthy and not being fat…I think my weight perception is influenced by my parents' view.' (Julie)

7.4.3 Cultural and religious factors

Cultural norms

Two participants (Efa and Xiao) acknowledged that thinness was a norm of the society in relation to overweightness. Another described thinness as being part of the modern Chinese culture:

'I guess most women, regardless of ethnicity, [are] liking thinness. So do I.' (Efa)

'…the whole world is saying that fat is a bad thing…' (Xiao)

'…modern Chinese culture – thinness is beautiful, fat is bad for health...' (Rina)

Participants also described how their weight management was shaped by the cultural significance of food and eating within their community. Food was of enormous significance in participants' social lives. It was seen by participants as a pathway through which eating behaviour influenced their body weight. A few participants discussed how they felt that some foods that are part of the Malaysian traditional diet, such as roti canai and nasi lemak, were linked to weight gain. These foods were described as oily and could increase weight if consumed everyday:

'…. I like nasi lemak and roti canai too...these foods are not good for health and weight if I have them everyday. Weight would increase if I don't control myself [eat a lot until stomach is full] …' (Delia)

'Yes…we like roti canai, nasi lemak, satay…they are tasty, right? But could be oily…eating these foods everyday just bad for my weight...' (Julie)
'We love nasi lemak…it is lemak, we love fast food, burger, char kueh teow…many choices here…foods are everywhere in town. We can have nasi lemak, char kueh teow as breakfast, lunch, dinner or supper…However, most foods are high fat, oily, bad for body weight and health...' (Mary)

Social events

Several participants mentioned how festival celebrations or eating out with family members posed challenges for them. It seemed difficult for them to break the norm, which in turn increased their likelihood to gain unnecessary weight.

'…for Chinese…we have…er…about seven festive celebrations throughout the year...all celebrations involve food…and eating...each celebration has its own food... For mooncake festival, I have mooncakes… and then for dragon boat festival...we have glutinous rice dumplings...the dumplings are big and filling, humm ...delectable…All of my family members, include me, like these dumplings. I tend to have more than one…everyday for more than a week…Chinese wedding ceremony…kenduri [Malay wedding ceremony] … during this [wedding] season…especially in August…is the most popular wedding month here… the wedding dinner/lunch serve delicious food… and just enjoy eating…Also, we have other festive celebration such as vegetarian festive…nine days…I eat vegetarian foods…there are many stalls selling vegetarian foods...So I got tempted easily. Then different worship celebrations…we eat different food again…the celebrations influence our

eating pattern…I can't eat little…it is not nice to eat little during the festive celebration…also housewarming party…birthday party…it is all about eating and mixing with friends…I guess that's why it is hard to bring down body weight.' (Agnes)

'Err… we always have different types of foods for festival celebrations, birthday celebration, end of confinement period celebration…food is the centre of our celebrations. Without eating sensibly our weight can creep in…we always chat while eats…so we spend longer time at the dining table…eating…influence our weight … my weight.' (Le)

Women's feelings about what was acceptable in contemporary Malaysian society also appeared to be a factor related to weight maintenance. This seemed to be particularly the case in relation to physical activity. As described earlier, a husband's view about exercising in public could result in some women not participating in physical exercise in public places. A number of participants described how they themselves felt uncomfortable wearing tight attire for doing physical activity in public areas: exposing their bodies to others made them feel uncomfortable. They were afraid of societal negative attitudes towards their bodies. Only Cleo held a contrasting view on tight sports attire. She did not pay attention to exercise clothing as she enjoyed doing exercise:

'I feel wearing very tight clothes in public areas is not really nice. It can overly expose certain parts of body, err…it is less courteous...I feel… Wearing loose clothes for PA is okay, especially for outdoor activities...' (Efa)

'…don't like to wear tight clothes in gyms, especially in the presence of men. I feel uneasy ...' (Rina)

'…feel uneasy…of course. Because expose my ugly figures to public. My husband does not say anything about my figures…It is just I feel I am fat and I am worried that wearing body-hugging sport attires would show my excess flesh…' (Megan)

'I feel comfortable to do physical activity when men are around… wearing body-hugging sport attire is fine for me too... My aim is to enjoy doing exercise...so I don't bother about the attire or men...' (Cleo)

Two participants (Mary and Agnes) highlighted how limited sports facilities in their local areas hindered participation in physical exercise. They only felt comfortable engaging in physical activities with other women:

'[There are] limited facilities here. I prefer to do exercise at gym or swim in public pool that restrict to women only. I believe there are other women [that] have such preference too. Feeling shame to do exercise at gym or swim in public pool with men…feeling uneasy…uncomfortable…to reveal my excess body …big breasts…afraid to be noticed by men…so hardly do exercise…sometimes, worried that men would look at my flabby arms…' (Mary)

'I have not seen any women does any sports here...not really okay to do so…men are here most of the time…I do not feel really nice to do it here…most fields…like basketball court and football court in school…have been occupied by men…' (Agnes)

Religion

Six participants of Christian and Buddhist faiths discussed how they felt their religion shaped their eating behaviour and attitudes to food and consequently their body weight. Tulip described how Christianity emphasised sharing food with others, and fasting. The practice of fasting appeared to help her to shed some weight:

'I am a Christian. We eat everything as all food is clean. Food is for practicing hospitality as well. We invite people to come over and share food…I bake some cakes and invite people to taste them…The unclean bit is not food but it is what comes out from our mouth…anyway, the keyword is moderation...There are two types of fasting – in the old day, fasting was about cutting all food by half … we don't eat as much as we used to be in

this type of fasting... but nowadays we fast the whole day and only breaking in the evening. These are good for health and losing some unwanted body weight, I suppose. I did this in the past, and it helped me to lose my weight a bit as I tended to have cake between my meals if I did not fast.' (Tulip)
The teaching of Buddhism was also referred to as an influence on my participants' eating behaviour and body weight. Participants referred to vegetarianism or cutting down on meat eating, a 'no waste' culture and mindful eating. Being vegetarian was seen as a positive and negative influence on weight. Simple and less oily vegetarian dishes were identified as aiding participants to reduce their body weight.

However, one participant (Agnes) commented that she felt hungry quicker and consequently she increased her food portion when she participated in the ritual and vegetarian festive events. Both Agnes and Cleo reported that they gained some weight due to being vegetarians and another (Julie) said that being a vegetarian without having solid nutritional knowledge harmed her health:

'I am a vegetarian on the first and mid [point] of Chinese calendar month…and during the vegetarian festive celebration…I put on weight when I am vegetarian… I eat more and in bigger portion because I feel hungry quickly if I maintain the same portion like non-vegetarian…' (Agnes)

'Yes [my religion affects what I eat] …sometimes I have vegetarian meals…I don't cook, I always buy my vegetarian meals from the hawkers, restaurants...some are oily…so if I have it for many days, say two weeks…it is bad for health…and my weight…ultimately…' (Cleo)

'I am a Buddhist… some vegetarian foods are oily…(laugh)…it does not really help me to maintain my weight, and… I did not know what should I eat in order to become a healthy vegetarian…' (Julie)

Besides eating more vegetables and taking less meat, Buddhist beliefs were also linked with a no-waste culture, avoiding the unnecessary sacrifice of animals’ lives. Wasting food could imply ungratefulness to the universe because food was co-produced by various elements. For Rina and Gi, their Buddhist beliefs appeared to help them be aware of the amount of food that they ate and to exert self-control:

‘…my religion discourages us to eat meat, especially beef. Reducing in eating meat...is an act that can reduce the act of killing animals ... Overeating of meat can push up weight easily. I only have little meat twice or three times a week ... the portion of the meat that I have for a week is usually lesser than the size of my palm...and loads of vegetables everyday... It is hard for me to put on weight.’ (Rina)

‘Wasting food is bad…it is ungrateful towards all hard work put in …Throwing away leftover like meat also linked to unnecessarily killing of animals…I would not eat meat when it exceeds my weekly allowance – a piece of meat – half of my palm. In wedding dinner or any meet up with friends, [a] message would pop up in my mind that I should not take meat anymore as this is it. I got enough meat...I suppose with mindful consumption, it helps to maintain my weight a bit…’ (Gi)

Lack of knowledge

Some participants highlighted that insufficient knowledge about healthy diet, food nutrition and food safety influenced their eating habit and subsequently acted as a barrier to losing weight. Some participants, such as Kim and Penny, argued that information about food was limited and ambiguous during the interviews:

‘I don’t really know what healthy diet is...but I feel balance and healthy diet does not mean having seafood or meat or vegetables only. Eating vegetables can cause health problems because I do not know what pesticide that the farmers use, although eating steam vegetable helps me to lose weight…’ (Penny)

'... right information has not been spread widely…my friends and I don't talk about healthy food when we meet…my friends and I don't have knowledge about it. I don't really know which is right and safe food to put in my tummy…but [I] always depend on taking information from direct sales about supplement only…' (Kim)

'I would use giving birth as an excuse for my weight gain. Actually, it is not …It is because I do not know how to control my diet…' (Megan)

Delia pointed out she felt that eating rice, a staple of the Malaysian diet, was a reason why she gained unwanted weight:

'eating rice pushes up my weight…I notice that if I go back to rice…my trousers get tighter…' (Delia)

Some participants also discussed how their lack of knowledge regarding taking up physical activities was a negative factor. They felt they needed more information about how to exercise and felt that they would have liked to have gained more knowledge and skills at school:

'I don't know how to play sports…I feel the PE lessons at school does not give me enough knowledge and skills to play any sports…' (Becky)

'If I am not busy in shop, I would do some stretching exercises in the shop…I would love to do yoga…but it seems too complicated as my body is not such flexible…I got stiff knee …and I do not know how to do it. I did not gain enough knowledge about how to do different types of exercise from schools …' (Julie)

'*I don't know the minimum hours that I need to do exercise for a week…nobody shares the info…' (Kim)*

'I feel jogging is considered as physical activity and not doing housework.' (Megan)

While some participants felt that government campaigns would help to give them important knowledge to lose or maintain a healthy body weight, they also commented that they were not aware of many health campaigns:
'no…campaign or talk…there is no such things here… to motivate and encourage me and my friends to stay active…' (Kim)

'I would like to learn how to cook healthy food for my kids….how to encourage them…but the campaigns run by the government are limited at the moment...' (Le)

'…for me, friends and neighbour influence me more often than the government and health related campaigns.' (Penny)

'...er...I hardly heard of these campaigns ...self-determination and supports from family members are important for me.' (Rina)

7.4.4 Emotions

Emotions appeared to be inextricably linked with managing body weight. Stress, happiness and loneliness, in various ways, were highlighted by some participants as factors influencing body weight and its management. One group of participants indicated that food was a reliever for them when they had stressful life events. They seemed to find eating fast food, sweet food, or 'any type of comfort food' a temporary fix for their stress. None of the participants confessed that having comforting food during difficult times led to weight gain:

'I must eat if I feel stress…whether the stress is from kids or work. I have been sticking for food for releasing my stress since I was single. I feel a bit better after taking food …fast food…it is quicker and cheaper…like KFC, McD…I don't eat junk food now…I used to eat junk food when I was stressed. With children…I can't have junk food at home. I can have fast food

outside. They don't see this…(laugh)…I don't want them to follow my steps. Sometimes, I would ask my husband to pack fast food as supper or to release my tension when they are asleep.' (Kim)

'Yes, as I said just now. I would like to have good food…make myself forget about stress for some time. Make myself calm…' (Efa)

'I need good food when I am stressed…if the food I order satisfies me…the taste is up to my standard…worth for the money that I pay for…then I am happy… it does not have to be expensive…or comes in a big bowl…big amount…then I acknowledge the circumstances and don't dwell on these bad circumstances…moving forward…' (Cleo)

'I have some keropok [crisps]' (Cindy)

'...as for me, I look for chocolate, like M&M. I will feel happy after having it. Usually, I finish a pack of M&M if I am stressful…but only half if the stress is little...or I would bake a cake for myself. Throughout the baking process, I pay attention to weighting, mixing, making sure [I have] got the right baking temperature and time…so…after baking a cake, I feel lighter…leaving the stress behind me…' (Tulip)

Participants like Rina, Megan and Sally ate less or lost their appetite in response to their stress level:

'I lost my appetite when I was stressed…two to three days…' (Sally)

'I only eat bread or eat little when I am stressed. I notice I lost some weight.' (Rina)

'No, I skip my meal or eat less. I don't have appetite to do so.' (Megan)

Not all participants changed their eating behaviour when they encountered difficult times; for example, Gi and Agnes used a mindfulness technique, singing or shopping to overcome stress.

'Not I practice mindfulness…I try to pull my negative emotions back to present moment...not dwelling in the past…upset with some past incidents…or worry about the future…I acknowledge the negative emotion…but I quickly switch my attention to what I am doing…' (Gi)

'…singing release my tension…I won't use eating to sort my tension out…because I am fear of putting up my weight. Or go out and do shopping…I would feel happy after buying something…and stress would go down…(laugh)' (Agnes)

Happy moods also appeared to be a factor identifiable in participants' narratives about body weight. For some participants, a happy mood was associated with eating more food:

'Happiness creates better luck…Sadness creates negative energy…which influences my health…family...through eating pattern and weight…good mood encourages me to eat …I always have good appetite when I am happy…so my weight may increase…' (Julie)

'eat a lot when I am happy...I am happy when I attend any celebrations…especially during my own birthday and friends' birthdays party…' (Agnes)

'I go to shopping with friends, buying new clothes and enjoy coffee and cakes with my friends when I am happy.' (Le)

While Gi said that being happy did not affect the amount of food she ate, several other participants described how they switched to shopping and hanging out with friends rather than eating when they were happy:

'I go to shopping ...buying clothes…not eating when I am happy' (Tulip)

'I will buy new clothes to reward myself…when I am happy with myself' (Xiao)

'No, physical activity but I would reward myself by buying clothes…when I am happy…' (Sally)

Some of my participants also described how, when feeling lonely, they changed their eating behaviour, eating bread, biscuits and instant noodles rather than having staple food such as rice. Leng also described how she preferred to have instant noodles as a way to beat her loneliness because it not only tasted good but also the small packet portion sizes helped her to control her weight:

'ar…eat something simple…no cooking…eat biscuit or bread…not instant noodles…when I am lonely ... I know they are unhealthy food…' (Agnes)

'…maggi [instant noodles] and Quaker Oat. I know... I should have Quaker Oat because I have gastric and not instant noodles. Instant noodles are unhealthy...less nutritious but quick ...and taste nice...and usually the portion is small. So, it helps me to control my weight a bit…' (Leng)

'I won't eat different…I have never felt lonely…hardly have silent moment…my kids always make noise…' (Delia)

Not all participants who described feeling lonely at times turned to food. For others, other activities such as watching television, talking to friends or eating out were strategies they turned to when they felt lonely.

'I still eat the same food when I am lonely. I watch television or chat with friends or neighbours if I am lonely…' (Efa)

'I don't cook, I go out for meals…eat as usual…' (Le)

Not all participants, however, described feeling lonely at times. Cleo, Xiao and Gi, who were all still single, said that they were not lonely and did not change their eating habits:

‘I have always been alone; it does not mean lonely. So I don’t eat differently…’ (Cleo)

‘no…I have my typical food…pack ready meals…’ (Xiao)

‘I don’t really feel lonely…because I have friends and family members around. I got lots of things to do…I am always busy with my things…my life is busy…I got a day job and I am volunteering for a charity as well.’ (Gi)

To summarise, participants provided diverse accounts of factors that they perceived to be influencing their body weight. Participants stated that how they perceived their ‘inner body’, together with the social, cultural, religious and material context of their lives, their knowledge about diet and physical activity and their emotions were all factors that helped shape their body weight.

Conclusion

This chapter has reported the data from the qualitative part of my study. It reported the views and perceptions of the 18 Malaysian Chinese participants who took part. It outlined that most of them favoured thinness and that this was associated with beauty, success, positive social relationships and being able to wear the clothes they preferred. The majority of them felt that their body weight was heavier than they wanted it to be and that they had unwanted weight. None of them consulted medical professionals on strategies of managing weight better during the interviews. They perceived a myriad of factors as influencing their body weight. These factors appear to be complex and were seen as affecting their weight and weight management. Factors perceived to be affecting body weight included their ‘inner body’, together with the social, cultural, religious and material context of their lives, their knowledge about diet and physical activity and their emotions, and these were all factors that helped shape their body weight. The next chapter discusses the findings from this part of my study together with those from the quantitative arm of the study.

Chapter 8
Conclusions

This final chapter is divided into five sections. It explains the reasons for undertaking the study and its associated research questions in section 8.1. Section 8.2 reviews the key findings and section 8.3 highlights the contribution of the study. Section 8.4 acknowledges the strengths and limitations. Section 8.5 discusses the Implication of the findings of the study for policy and practice.

8.1 Introduction

Like other upper-middle income countries, Malaysia is facing nutritional and epidemiology transitions, alongside demographic and economic transitions as it moves towards becoming a developed nation (Mariapun, Ng and Hairi, 2018). According to the World Bank, it is expected to achieve its transition from an upper-middle income economy to a high income economy by 2024 (The World Bank, 2019).

In Malaysia, analyses of the 1996-2015 National Health and Morbidity Surveys, highlighted body weight inequalities across Malaysian Malay, Malaysian Chinese, Malaysian Indian and women of Other Indigenous People Minority Groups (IKU, 1996, 2006, 2011, 2015; Mariapun, Ng and Hairi, 2018; Dunn, Tan and Nagya, 2012; Chan et al., 2017). However, these previous studies have focused only on overweight and obesity. Only one study, which used the 2015 Malaysia National Health and Morbidity Survey data focused on women of all ethnic groups (Chan et al., 2017). Other studies focused on Malaysian Malay, Malaysian Chinese and or Malaysian Indian groups (Mariapun, Ng and Hairi, 2018; Dunn, Tan and Nagya, 2012).

None of these previous studies considered the nature of the National Health and Morbidity Survey data set in their analyses (Mariapun, Ng and Hairi, 2018; Dunn, Tan and Nagya, 2012; Chan et al., 2017). The survey data were collected by stratifying the population by states, federal territories and enumeration-block. Because of how the data were stratified in the survey, some similarities (i.e. sociodemographic condition, behavioural condition) might present among women resided in the same state and enumeration-block. Therefore, it is important to consider such effect in my study. A further limitation of these studies is that they did not examine the influence of ethnicity on education in relation to the prevalence and determinants of being in underweight and pre-overweight categories between 1996-2015.

Drawing on quantitative and qualitative approaches, my research attempted to address these gaps by first, studying weight inequalities across women of childbearing age (18-49 years) in the four main ethnic groups (Malaysian Malay, Malaysian Chinese, Malaysian Indian and Other Indigenous People Minority); second, by exploring how Malaysian Chinese women, who have the lowest mean BMI, understand and manage their weight. I chose Malaysian Chinese as my interview participants for three reasons. First, my quantitative findings highlighted the association of age, marital status and education. Specifically, Malaysian Chinese women were more prevalent in the healthy weight category than Malaysian Malay, Malaysian Indian and Other Indigenous People women.

Second, it was clear that lower educated Malaysian Chinese were at a greater risk of having a higher mean BMI compared to higher educated Malaysian Chinese in 1996, 2006 and 2011. Additionally, Malaysian Chinese educational advantaged group was more likely to be underweight relatively to Malaysian Chinese educational disadvantaged group. On the other hand, the disadvantaged group was more likely to be overweight. Third, I am a Malaysian Chinese woman. So, I wanted to recruit a range of Malaysian Chinese women with these characteristics to see if they had different or similar facilitators and barriers to managing their weight.

The research questions that guided this study were:

(1) What is the socio-patterning of women mean BMI, underweight, pre-overweight, overweight and obesity for four main ethnic groups in Malaysia in 1996, 2006, 2011 and 2015?

(2) What are the relationships between education and mean BMI, underweight, pre-overweight, overweight and obesity for each ethnic group in Malaysia?

(3) How do Malaysian Chinese women understand body weight?

(4) How do Malaysian Chinese women perceive their own weight?

(5) What strategies do Malaysian Chinese women use for losing, gaining or maintaining body weight?

(6) What factors do Malaysian Chinese women perceive to be influencing their body weight and weight management?

These questions were addressed with the adoption of a sequential mixed methods strategy with the first phase of research comprised of two secondary data analyses of the 1996, 2006, 2011 and 2015 Malaysia National Health and Morbidity Surveys; the second phase of the research drew on semi-structured interviews with 18 Malaysian Chinese women. I utilised the framework of social determinants of health to guide its investigation into the demographic, social and psychosocial factors that influenced the body weight of women of childbearing age in Malaysia.

8.2 Review of empirical findings

The results of two secondary analyses conducted in the first phase of my research suggested that age, marital status and education were three main determinants that influenced the mean BMI and weight statuses of women of childbearing age in the four main ethnic groups living in Malaysia over 1996-2015.

8.2.1 Three-level linear regression models

Age

Drawing from the three-level analyses, the results suggested the presence of a positive mean BMI-age association across 1996-2015 but that such an association was not always significant. The mean BMI of Malaysian Malay women was positively and significantly associated with age with three exceptions. The mean BMI of Malaysian Malay women aged 34-41 was not associated significantly in 1996, 2011 and 2015. The significant positive mean BMI-age association was also observed among Malaysian Chinese women. However, this significant association was not observed among Malaysian Chinese women aged 34-41 years in 2011 and 2015. Similar significant positive association was also found in Malaysian Indian women of all age groups across four time points other than those age ranged 26-33 in 2011 and 2015 and 34-41 in 2011. The mean BMI of Other Indigenous People Minority Groups did not associate significantly with the age group of 34-41 in 1996 and 26-41 in 2015. The findings of positive age-BMI relationships were consistent with previous research undertaken in the US and the UK (Lakdawalla and Philipson, 2002; Robert and Reither, 2004; Wang and Beydoun, 2007; Vahration, 2009; Guendelman et al., 2011; Wardle, Waller and Jarvis, 2002; Scarborough and Allender, 2008; Bruce et al., 2007).

The positive and significant age-BMI associations were also consistent with findings reported in some upper-middle income countries including Peru and China (Poterico et al., 2012; Fang and Liang, 2017). In China, studies based on the longitudinal China Health and Nutrition Survey found that age positively and significantly influenced Chinese women's BMI (Fang and Liang, 2017; Luo and Xie, 2018).

Marital status

My three-level models also showed that married Malaysian Malay women had a significant higher mean BMI than never married and unmarried Malaysian Malay women over 1996-2011. This finding is consistent with the findings of other studies undertaken in upper-middle income countries such as Iran and Tunisia (Janghorbani et al., 2007; Janghorbani et al., 2008; Bakhshi et al., 2008a; Bakhshi et al., 2012; Navadeh et al., 2011; Beltaifa et al., 2008; Letamo, 2011; Colchero and Sosa-Rubi, 2012).

My analyses suggested that varying patterns of mean BMI emerged across marital status and were mostly not significant for women of Other Indigenous People Minority Groups, Malaysian Chinese women and Malaysian Indian women. This was similar to one earlier study undertaken in Malaysia, which drew on 2015 Malaysia National Healthy and Morbidity Survey data. It found that married women had a greater risk of being overweight and obese than never married in 2015 (Chan et al., 2017).

One of the plausible reasons for explaining why never married women tended to have a lighter body weight is that it may have improved their perceived physical appearance including when attempting to attract a partner (Sobal et al., 2003; Averett, Sikora and Argys, 2008). Married women may be more likely to have increased body weight because of factors related to increased family commitments, attending more social events or encouragement from their partners to eat more. The unmarried women, which included divorcees, widows and women who were separated from the partners, tended to have a lower body weight than married women. A contributing factor may have been increased emotional stress due to their life circumstances.

In contrast to Malaysian Malay women, married Malaysian Chinese women only had a significantly higher mean BMI than never married Malaysian Chinese women in 1996 and 2011. This finding, was, however, consistent with the findings of Luo and Xie (2018). They found married Chinese women in China had a greater mean BMI than non-married Chinese women in China in 1997 and 2006. However, these differences were only significant in 1997. Additionally, the findings of the three-level models suggested married Malaysian Chinese women had a lower mean BMI than never married and unmarried women Malaysian Chinese women in 2015. This observation is consistent with Bruce et al.'s studies (2007) who reported that married white women had a lower mean BMI compared with single women of the same ethnic origin.

At the individual-level, the three-level linear regression analyses suggested the presence of differences in mean BMI across the four ethnic groups. Of the four ethnic groups, Malaysian Chinese women had significantly lowest mean BMI throughout the 1996-2015 period. This finding was similar to the findings of Hirani and Stamatakis (2006) in England who used the data from the Health Survey for England, to report that the mean BMI of women of Chinese origin in England was the lowest (23.2 kg/m^2) in 2004. This mean BMI was compared to an average BMI of 26.8 kg/m^2 at the population-level.

Education

The present study also identified mixed patterning of the association between education level-and mean BMI among Malaysian Malay women between 1996 and 2015. Tertiary educated Malaysian Malay women had a significant and a lower mean BMI than primary educated Malaysian Malay women except in 2011. In 2011, a non-significant and negative educational gradient appeared for Malaysian Malay women. A significant negative education level-mean BMI gradient was observed among Malaysian Chinese women in 1996, 2006 and 2011. In 2015, a negative education level-mean BMI gradient was not observed among Malaysian Chinese women because the tertiary educated group had a greater mean BMI than the none educated group. In China, educational attainment level was not associated with mean BMI growth among women aged 18-45 years between 1991 and 2011 (Fang and Liang, 2017).

The findings of my three-level analysis on the education level patterning of BMI for Malaysian Malay women echoed Dunn, Tan and Nagya's studies

(2012) who found that those who completed tertiary education had a lower mean BMI than women who only completed primary education in 2006. However, a non-significant negative education level mean BMI gradient was observed for Malaysian Malay women in 2011 as is the persistent significant negative education level mean BMI gradient which was observed among Chinese women observed in 1996, 2006 and 2011. Neither Dunn, Tan and Nagya (2012) nor Mariapun, Ng and Hairi (2018) reported the presence of negative education level-mean BMI gradient among Malaysian Malay women and Malaysian Chinese women in their studies.

The findings concerning negative education level-mean BMI gradients were consistent with the relationships established in the UK and the US. They were new in Malaysia and in upper-middle income countries. Mixed education level-mean BMI patterns have been observed, and ethnic differences concerning education level-mean BMI patterning within upper-middle income countries have not been not fully explored. Tertiary education appears to play an essential role in protecting women from having a higher body weight. It is linked to better access to the new information and a better financial position. Moreover, differences in obesity among women in Europe is linked to educational inequalities (Loring and Robertson, 2014).

Among Malaysian Indian women, there was no education level gradient in mean BMI. The tertiary educated group had a significantly lower mean BMI than primary and secondary educated groups in 1996 and 2011. This was in contrast with findings generated in India where a positive education level-mean BMI gradient was found (Subramanian, et al., 2009). Unlike the other three ethnic groups in my study, a positive non-significant education level-mean BMI gradient was observed among women from Other Indigenous Minority Ethnic Groups in 2006. In contrast, in 2015 a non-significant negative education level-mean BMI gradient was found among women from Other Indigenous Minority Ethnic Groups. These findings suggested a nutritional transition might have occurred between 2006 and 2015 for women of Other Indigenous People Minority Groups. This is one of my key findings as to my best knowledge none of the previous research examines the body weight issues among Other Indigenous People Minority Groups in Malaysia using more than one National Health and Morbidity Survey data sets.

The findings of my three-level studies in relation to the associations between education level and mean BMI for women from Other Indigenous Minority Groups over 1996-2015 is new in Malaysia. Only one study conducted by Chan et al. (2017) used the 2015 Malaysian National Health and Morbidity Survey to compare the likelihood of being overweight and obesity among women of Other Indigenous People Minority Groups with Malaysian Chinese women. My investigation was the first large-scale empirical study based on four series of nationally representative survey data in Malaysia, as identified by my literature review. Beyond Malaysia, my literature review shows that there is a dearth of research that focuses on trends of mean BMI and underweight and pre-overweight issues for Indigenous populations around the world. Existing research on Indigenous populations in countries such as Mexico, Canada, Brazil and Australia highlights emphasise the determinants of overweight and or obesity at one time point only (Wen, 2014; Ng, Corey and Young, 2011; Colchero and Sosa-Rubi, 2012).

8.2.2 Single-level logistic regression Models

Age

Turning attention to the single-level logistic regression analysis, one of the salient findings was that women aged 42-49 years old had a significantly higher risk of being pre-overweight, overweight and obese from 1996 to 2015. These findings were new in Malaysia as previous studies only focus on overweight and or obesity (Dunn, Tan and Nagya, 2012; Mariapun, Ng and Hairi, 2018). Moreover, there was consistent patterning in relation to age, with the risk of being underweight decreasing significantly with age except in 1996. The risk of being overweight or obese significantly increased with age up to 49 years. Similar findings were reported in upper-middle income countries such as Bostwana, Iran and Jordan (Letamo, 2011; Nsour, Kayyali and Naffa, 2013; Janghorbani et al., 2007).

Marital status

Married women had a significant lower risk of being underweight than never married women over 1996-2015. However, married women had significant highest risk of being pre-overweight and obese between 1996 and 2011. Significant likelihood of being overweight was also greatest among married women over the four time points. These patterns were consistent with investigations that were conducted in the United States (Sobal, Hanson and Frongillo, 2009); and in upper-middle income countries and in India (Janghorbani et al., 2007; Janghorbani et al., 2008; Bakhshi et al., 2008a; Bakhshi et al., 2012; Navadeh et al., 2011; Beltaifa et al., 2008; Letamo, 2011; Colchero and Sosa-Rubi, 2012; Subramanian, Kawachi and Smith, 2007).

In Malaysia, my literature review also found that Dunn, Tan and Nayga (2012), and Tan, Yen and Feisul (2011) did not account for gender differences when they identified the association of BMI, overweight or obesity and marital status in their studies that were based in Malaysia. Hence, the current findings which drew on my logistic regression analyses offered new evidence on the relationships between marital status and the risk of being underweight, pre-overweight, overweight and obese in Malaysia. Family commitment was perceived as one of the potential pathways that explained the reason for being overweight among married and working Malaysian Malay women in the Federal Territory of Putrajaya and the state of Negeri Sembilan in Malaysia (Suriani et al., 2015).

Education

Motivated by the presence of varying associations between education level and mean BMI, among women from the different ethnic groups in my three-level linear regression models and unequal opportunities in education between the different ethnic groups in Malaysia, I examined whether the effect of education on the risk of underweight, pre-overweight, overweight and obesity varied by ethnicity. This has not been previous carried out in These investigations were considered new in Malaysia and to the best of my knowledge have also not been investigated in other upper-middle income countries, as identified in my literature review. The logistic regression analyses suggested that the impact of education on the risk of being in an unhealthy weight category depended on ethnicity in Malaysia.

First, I found that the impact of secondary education on the risk of underweight consistently varied by ethnicity over the four time points. Secondary educated Malaysian Indian women were most likely to be underweight compared to secondary educated women belonging to the other three ethnic groups over 1996-2015. Tertiary educated Malaysian Chinese and Malaysian Indian women were more likely to be underweight than tertiary educated Malaysian Malay women in 2006, 2011 and 2015. As previous studies in Malaysia had not explored the socioeconomic patterning of underweight, these analyses provide new insights to the literature.

Second, secondary and tertiary educated Malaysian Malay women had a significantly higher risk of being pre-overweight compared to Malaysian Chinese women with similar educational backgrounds over 1996-2015. On the other hand, they were significantly more likely to be overweight and obese compared with Malaysian Chinese women, irrespective of their educational attainment levels.

Third, of the women who had the lowest education level, Malaysian Indian women had greater risk of being pre-overweight overweight and obese over 1996-2015. Fourth, Malaysian Chinese had the lowest risk of being pre-overweight, overweight and obese at each time point (1996-2015).

Fifth, as expected the impact of education on the risk of underweight, pre-overweight, overweight, and obesity varied between women belonging to the majority and minority groups of Indigenous Peoples: That is Malaysian Malay women and women from Other Indigenous Minority Ethnic Groups. The secondary educated Malaysian Malay women had a greater risk of being underweight, compared to the secondary educated women from the Other Indigenous Minority Ethnic Groups at each of the four time points. The none/primary and secondary educated Malaysian Malay women had a higher risk in being obese compared to none/primary and secondary educated women from the Other Indigenous Minority Ethnic Groups over the four time points. In contrast out of four ethnic groups women with secondary education, women from the Other Indigenous Minority Ethnic Groups had the highest risk of being pre-overweight during 1996-2015. A greater likelihood of being obese was found among secondary educated women in Iran, however the influence of ethnicity was not considered in this study (Janghorbani et al., 2007).

My current findings on the impact of educational level had on the risk of being underweight, pre-overweight, overweight and obese varied by ethnicity were new in Malaysia and possibly in upper-middle income countries, as identified by my literature review.

When considering how the impact of education varied within an ethnic group, I found a nonsignificant negative education level-underweight gradient among Malaysian Malay women in 2015 and among women from Other Indigenous Minority Ethnic Groups in 1996. That is as education level went up the risk of being underweight went down. In contrast, a positive but non-significant education level-underweight gradient was identified among Malaysian Chinese women in 1996, 2006 and 2011, respectively: the higher education, the greater risk of being underweight. A non-significant negative gradient was also observed in relation to the risk of being overweight for Malaysian Chinese at each of the four time points. These findings contribute to the literature by offering a comprehensive view of the likelihood of being underweight and overweight among Malaysian Chinese women aged 18-49 years over 1996-2015. However, previous studies such as Mariapun, Ng and Hairi (2018) found affluent Malaysian Chinese women aged 30 and above were least likely to be overweight in Peninsular Malaysia.

My current findings also suggest that overweight and obesity had already become a health-related issue for Malaysian Chinese women of the lowest education group in 1996. Mariapun, Ng and Hairi's (2018) reported a similar finding with Malaysian Chinese women aged 30 and above who lived in

Peninsular Malaysia. My investigation highlighted a positive education level patterning of underweight and negative educational patterning of overweight Malaysian Chinese women during the 1996-2011 period. Improving health-related awareness, better access to information, and greater power in making decisions about dietary habit or physical activity may have contributed to these findings (WHO, 2000).

My findings on the presence of a predominantly negative education level-obesity gradient among Malaysian Malay women and Malaysian Indian women aged 18-49 years over the 1996-2015 period contrast with the findings of Mariapun, Ng and Hairi (2018). Mariapun, Ng and Hairi (2018) stated that obesity was most prevalent in the highest income group of Malaysian Malay women in Peninsular Malaysia between 1996-2011 and that income-related differences in overweight and obesity were absent among Malaysian Indian women in Peninsular Malaysia. These differences could possibly have arisen because of the choice of different research methodology such as inclusion of household income variable as the socio-economic indicator rather than education level and study sample which was limited to Peninsular Malaysia.

Noticeably, there was a change in the direction of the education level-obesity gradient among women from Other Indigenous Minority Ethnic Groups. In 2006, a positive obesity gradient was observed for women of Other Indigenous Minority Ethnic Groups but this gradient became negative in 2015. This suggested that obesity had shifted from the highest educational group to the lowest educational group for women from Other Indigenous Minority Ethnic Groups women. As studies focussing on the influence of education and obesity on women from Other Indigenous Minority Ethnic Groups using the nationally representative data have not been conducted in Malaysia, nor upper-middle income countries, these findings add new knowledge to existing studies.

The presence of a negative education level-overweight gradient for Malaysian Chinese women and a similar gradient for obesity among

Malaysian Malay women and Malaysian Indian women across 1996, 2006, 2011 and 2015 and women from Other Indigenous Minority Ethnic Groups in 2015 indicate the latest trends for Malaysia. These findings imply that the socioeconomically most disadvantaged group (as captured by educational attainment level) was most vulnerable and likely to be overweight and obese, for these ethic groups.

Similar negative education level gradient for overweight and obesity were found in Iran, Thailand, Brazil, Seychelles and Mexico (Bakhshi et al., 2012; Jitnarin et al., 2010; Monteiro, Conde and Popkin, 2001, Buttenheim et al, 2010, Bovet et al., 2008). These patterns were also commonly observed in the United States and United Kingdom (Flegal, Harlan and Landis, 1988; Robert and Reither, 2004; Zhang and Wang, 2004b; Guendelman et al., 2011; El-Sayed, Scarborough and Galea, 2012; Devaux et al., 2011).

The risk of being underweight, pre-overweight, overweight and obese was disproportionately distributed across women from the four main ethnic groups. Mariapun, Ng and Hairi (2018) thought a better socioeconomic position along with a cultural preference for being thin contributed to Malaysian Chinese women commonly having more healthy body weight than Malaysian Malay women and Malaysian Indian women. Dunn, Tan and Nagya (2012) thought differences in the likelihood of being obese among Malaysian Malay and Malaysian Chinese were attributable to differences in lifestyle. Chan et al. (2017) who reported that Malaysian Indian women were most susceptible to being overweight and obese compared to women from other ethnic groups. These authors suggested that differences in genetic predispositions, environmental factors and cultural factors may underpin these findings.

There might be other potential pathways, which intermingle with material, neo material and cultural factors, that contribute to the uneven distribution of weight and weight-related categories among women from the four main ethnic groups. Despite rapid economic development due to the export of timber, oil and gas in the states of Sabah and Sarawak, there are still some

Other Indigenous Minority Ethnic Groups who live close to the forest or upriver without infrastructure such as clean water supply and transportation (Saw, 2007; Aeria, 2005). Poor infrastructure in their community areas coupled with other logistical factors has resulted in unequal access to medical care and schools (Aiken and Leigh, 2011; Aeria, 2005; Al-Delaimy et al, 2014). Their well-being is also affected by the construction of dams (Aiken and Leigh, 2015).

Moreover, some people from Other Indigenous Minority Ethnic Groups still make their living by selling non-timber forest products, small-scale fishing, agriculture and hunting which exposes them to food insecurity (Law et al., 2018). For example, the Dusun depend on swidden agriculture (slash and burn rotational farming where land is left to regenerate after a few year). Infant and maternal mortality are relatively higher among people from Other Indigenous Minority Ethnic Groups than among other ethnic groups in Malaysia (Aeria, 2005; Aiken and Leigh, 2011). Moreover, soil-transmitted diseases are more prevalent among people from Other Indigenous Minority Ethnic Groups in the low socioeconomic groups (Mohd-Shaharuddin et al., 2018). These could possibly explain why women of Other Indigenous People of Minority Groups had different socio-patterning of body weight compared with Malaysian Malay women who had the same privileges in education and business and employment opportunities.

In summary, with the national income (measured by Gross National Product per capita) of US$11,080 in 1996, US$17,160 in 2006, US$21,300 in 2011 and US$25,880 in 2015, my two secondary data analyses supported Monteiro et al.'s finding (2004) that obesity in Malaysia has already shifted to lower socioeconomic groups. Within each ethnic group, the risk of being obese was lower among women with tertiary education than women who did not formal education or had primary education or secondary education. There are also consistent patterns of underweight, pre-overweight, overweight and obesity that are related to age, marriage women and being Malaysian Chinese and the risk of being pre-overweight and obese. Both secondary data analyses highlighted that body weight differences among

Malaysian Chinese women were attributable to differences in education level. This salient finding, informed my decision to undertake semi-structured interviews in the second phase of my research that focused on Malaysian Chinese women only.

The output of both secondary analyses had three main commonalities. First, there appeared to be a consistent pattern observed in age and marital status across the period 1996-2015. Age had a positive effect on mean BMI for Malaysian Malay, Malaysian Chinese and Malaysian Indian women over the last two decades. Specifically, the risk of underweight decreased with age, whereas the risk of being pre-overweight, overweight and obese increased with age. Married women had a greater mean BMI than never married at each of the four time points examined with the exception of Malaysian Chinese in 2015. Across the weight status continuum, married women had a greater risk of being pre-overweight, overweight and obese. They were least likely to be underweight compared to women who never married.

Second, both secondary data analyses showed that education had varying impacts on the mean BMI and the risk of being in an unhealthy weight category for each ethnic group. The educational patterning of body weight was apparent among Malaysian Malay, Malaysian Chinese and Other Indigenous People Minority Groups. The three-level linear regression analysis showed the presence of a negative educational gradient among Malaysian Malay in 2011. The single-level logistic regression analysis complemented this finding by providing evidence that negative gradients appeared in the risk of being overweight or obese among Malaysian Malay women in 2011: The higher the education, the lower the risk of being overweight or obesity.

There was a negative educational gradient in mean BMI demonstrated in 1996, 2006 and 2011 for Malaysian Chinese women. The greatest likelihood of being underweight was found among tertiary educated Malaysian Chinese women over the period 1996-2011. There was also a negative overweight-educational gradient exhibited among Malaysian Chinese across the period

1996-2015. In other words, for Malaysian Chinese women, a higher educational level was more likely to be associated with an increased risk of being underweight but also risk of being overweight.

Drawing on the three-level linear regression analysis, the mean BMI educational gradient was absent among Malaysian Indian over the four time points. This could possibly be because an educational gradient was only exhibited for the obese weight category for Malaysian Indian women. The risk of underweight was most prevalent among Indian women in the secondary educated group over the period 1996-2015.

Regarding Other Indigenous People Minority group women, there appeared to be nutritional transition that took place between 2006 and 2015, as identified by the three-level linear model. The positive educational gradient observed in 2006 shifted to a negative educational gradient in 2015 for Other Indigenous People Minority group women. This finding was supported by the presence of a negative educational-obesity gradient in 2015 for Other Indigenous People Minority groups women. This could possibly suggest better access to education for Other Indigenous People Minority Groups in 2015.

Both secondary analyses of my study suggested that as a group, Malaysian Chinese women had lower BMIs and were more likely to have healthier body weights than Malaysian women from other ethnic groups and the presence of negative overweight-educational gradients among Malaysian Chinese women, I undertook the second phase of research by conducting 18 semi-structured interviews in the state of Kedah to explore some of the pathways that may have influenced their body weight, weight perceptions and weight management. After conducting and analysing 18 interviews there was sufficient data to answer the research equestions for the qualitative arm of my study. Furthermore, by the 18th interview no new themes were emerging, suggesting that the point of data saturation had been reached.

My semi-structured interviews findings place positive values on thinness. Additionally, some of my participants stressed that a thin-body needed to be slender and must be embedded in good health condition. These findings are different from Muda et al.'s study (2015), where thinness was thought as a sign of unhappiness by Malaysian female survey participants. My findings on how thinness was a positive values however, are consistent with Bojorque-Chapela et al.'s study (2014) in Mexico. Having a thin and slim body along with a good health condition also resounds with Haworth-Hoeppner's study (2013) which focused on white women who attained at least secondary education where the location of study was not disclosed in the article.

My current findings show unfavourable perceptions towards overweight. They fit with the findings of two qualitative studies, undertaken by Chang et al. (2009) and Aziz et al. (2016) in Malaysia. Nevertheless, these unfavourable perceptions on overweight contrast with Muda et al.'s study (2015) in rural areas of Kelantan. Participants in their study were resistant to these negative values and the majority did not think being overweight or obese was deviant. They associated overweight or obesity with happiness, strength and affluence.

Comparing the negative exemplars of overweight in my findings with studies outside Malaysia, they echo the views of White women in England in Shoneye et al.'s study (2011). But they are different from Black women in Ghana and England and women in South Africa where overweight is socially acceptable and highly valued (Okop et al., 2016; Shoneye et al. 2011).

The findings of my present research which indicate women perceive weight differently from the health authority cut off points are similar with other previous studies, in Malaysia and other countries (Kong et al., 2002; Kim and So, 2018; Park et al., 2019; Agrawal et al., 2017; Crawford and Campbell, 1999).

My current findings suggested the perception that having a heavier bodyweight is prevalent among healthy weight and slightly overweight participants. Their perceived ideal weight is below their current weight. Like Beijing Chinese women, the Malaysian Chinese women in my study tend to feel heavier. A survey in 1999 suggested healthy-weight women in England had an ideal weight that was lower than their actual weight and they perceived themselves as having excess weight as well (Wardle and Johnson, 2002).

Irrespective of educational attainment level, marital status and age, 14 out of 18 participants perceived they had heavier body weight. This finding is similar with the results of Kong, Chua and Alwi's survey (2002). Their survey reports that 'feeling heavier' was more common among Malaysian Chinese women aged 30 to 39 years old in Klang area. Internationally, quantitative studies by Boo (2014) and Langellier et al. (2015) suggested higher socio-economic women were more likely to overestimate their own body weight. Due to a small number of interviewees involved in my study, the presence of differences in weight perception across socioeconomic status could not be addressed.

Research outside Malaysia supported my findings regarding my participants' preference to use diet-related strategies to manage their weight. This research includes a survey in Beijing (Cai et al., 2014). Like Beijing Chinese women, the Malaysian Chinese women in my study were more likely to use a diet-related strategy and less likely to rely on exercise for losing weight Two qualitative studies conducted by Hernandez et al. (2016) and Nissen, Holm and Baarts (2015), which focused on women with normal body weight or moderate overweight, both echoed my findings on losing weight by restricting the consumption of unhealthy food and skipping meals. Consistent with Nissen and Holm's study (2014), my findings suggest that healthy weight and slightly overweight participants preferred a diet-oriented strategy than physical activity in managing their weight.

As in other studies, my current study also recognises the dual impacts that family members and friends have on the weight management process, which potentially contributed to weight differences among women (Ng et al., 2013;

Metzgar et al., 2014; Baruth et al., 2014; Thomas et al., 2009). My finding on the role of motivation offered by family members and friends is in line with Aziz et al.'s study (2016) within the Malaysian context studies conducted in other countries (Baruth et al., 2014; Metzgar et al., 2014).

Family members and friends are two main sources that influenced my participants' body weight through multiple pathways. For example, my interview participants obtained information about weight loss practice through friends. Interaction with friends with healthy behaviour encouraged one of my participants to adopt the same lifestyle. Mingling with like-minded friends promoted weight maintenance for my participant as well. However, social networks also exerted negative influences over several participants' eating behaviour, which in turn influenced their body weight. Friends and colleagues who enjoyed eating or cared less about managing bodyweight increased the risk of gaining extra bodyweight through eating behaviour.

My current findings affirmed how social networks (i.e. family members, friends and colleagues) could influence body weight. Interacting with unsupportive social networks undermine weight loss and maintenance. Therefore, it is not surprising that the pathways to which social networks shape body weight are complicated and influence bodyweight differently. These are also discussed by Aziz et al.'s (2016) and Ismail et al.'s studies (2018) in Malaysia. Similar findings have been shown in studies beyond Malaysia (Ng et al., 2013; McLaughlin et al., 2016; Metzgar et al., 2014; Baruth et al., 2014; Thomas et al., 2009).

Based on my interview data, cultural factors not only shape weight perception and weight management strategies, they also act as barriers and facilitators of bodyweight. Thinness is seen as local social norms and contemporary culture for the majority of my participants. Additionally, it is a popular pursuit although it contrasts with traditional cultural beliefs that fatness is a good sign of every aspect of life. This finding aligns with a culture of rejecting fatness in Chang, Chang and Cheah's study (2009) in Malaysia.

It is different from the cultural preference for the higher bodyweight observed by Aryeetey et al., (2016), Diaz (2007), Shoneye et al. (2012).

Drawing on multiple accounts provided by all participants, there emerged the interplay of Malaysian Chinese culture with food, which acted as barriers or facilitators to managing body weight through eating patterns. The roles of food ranged from being a source of sustenance, social, psychological and physiological functions to body weight regulation for my participants. They felt having traditional Malaysian foods and eating out contributed to weight gain.

Moreover, festive and birthday celebrations were identified as challenging times for some participants when attempting to adhere to their weight management strategy. A few appeared unable to resist to celebrative foods and tended to overeat during festive and birthday celebrations and consequently gained some weight. Some felt the contents of the celebrative food led to unnecessary weight gain. Cultural beliefs against tight sports outfits and husband's notion on dancing with a male partner posed challenges in losing weight too. The interplay of food and Malaysian Chinese culture is one of the key findings in Malaysia. A body of literature discussed the co-influence of culture, traditional food and eating behaviour in promoting overweightness, for example in a study of women within the context of Pakistan (Khalid, Glavin and Lagerlov, 2018).

The findings from my interviews demonstrate potential mechanisms through which religion influences body weight for Malaysian Chinese women. This is one of the key findings because research findings from Malaysia are predominantly survey-based studies. For example, Gan et al. (2018) reported BMI differences emerged between Buddhists' who practised vegetarian and non-vegetarian groups. They found that vegetarians had a lower body weight than non-vegetarians (Gan et al., Wong, et al., 2013). None of the potential pathways were discussed in this paper.

Another finding of my interviews is that social events and festive celebrations dampen weight loss efforts via overeating behaviour. This finding is consistent with other studies outside Malaysia (McLaughlin et al., 2016; Thomas et al., 2009). These investigations found that high calorie-food and high fatty-food served during social events were obstacles to weight loss or maintenance.

As discussed above, cultural factors are one of the key determinants in influencing my participants' perception on body weight and their weight management strategies through eating and exercise behaviour. This finding is supported by the framework of social determinants of health and previous studies such as Furnham and Ablihai (2009). As with perceptions regarding body size, eating habits and attitudes to food, culture also determines attitudes to leisure time physical activity, which, in turn, may potentially influence women's weight. The Jordanian culture, for example, does not favour women's participation in physical activity and sports in outdoor spaces and this may contribute to the relatively high mean BMI of women in Jordan (Hourani, Naffa and Fardous, 2011).

Lack of physical facilities such as exercise equipment and nursery were also obstacles preventing some of my participants engaging actively in exercise to manage their weight. This finding is consistent with neo-materialist explanations which links underinvestment in social and physical amenities to undesirable health outcomes such as perceived heavy body weight (Lynch, 2000).

In my qualitative study, participants discussed how marriage influenced body weight perception and shaped their weight management strategies. Several participants illustrated how their husbands were supportive in the journey of losing unwanted weight or gaining weight. One participant mentioned that her husband encouraged her to gain weight by suggesting she eat more and bought her favourite food. Not all participants had encouragement from their husband to lose or maintain their weight. There were instances where my participants' eating habits and exercise behaviour were bound to family networks. Fewer participants had oily food and fast food because they avoided having conflicts with their husbands. Two acquiesced to their husbands who disagreed with choosing dancing and Zumba to losing weight.

These influences are described in the social causation theory/hypothesis. The theory suggests marriage influences body weight through multiple pathways (Sobal, 2005; Hanson, Sobal and Vermeylen, 2014; Umberson, 1992). For example, my participants husbands' weight perception influenced theirs, and ultimately their eating behaviour and or the choice and engagement in physical activities and food choice. Their husband's perception of body weight was also associated with the types and quality of support received by my participants. My participants also expressed how demanding family commitments occupied their time and used up their energy which restricted them from engaging in exercise as a weight loss or maintenance practice. These findings are commensurate with Aziz et al.'s study (2016) in Malaysia and other countries' studies (Welch et al., 2009; Baruth et al., 2014; Ng et al., 2015; Metzgar et al., 2014; McLaughlin et al., 2016; Bojorquez-Chapela et al., 2014; Mastin, Campo and Askelson, 2012).

Some of my participants wanted to lose weight as body weight is viewed as a measure of physical attractiveness. Participants purported that it is important for marriage. While an attractive body weight is seen as one of the elements for a single woman in attracting a partner, according to the social selection theory, it appears that having a thin body weight still has a role in the marriage life for my participants (Sobal, 2005; Hanson, Sobal and Vermeylen, 2014).

8.3 Contribution to the literature

My present study has made five unique contributions to the existing literature on body weight inequalities in Malaysia. First, I compiled a literature review systematically based on studies that drew on cross-sectional nationally representative data sets in upper-middle income countries to understand potential determinants for body weight variations among women. This to my best knowledge it is the first comprehensive review to be undertaken.

I included studies conducted in India in my review because Malaysian Indian had cultural and other connections with India. I excluded China-based studies in my review because they only have longitudinal studies. The review highlighted a paucity of evidence on ethnic inequalities in mean BMI, underweight, pre-overweight, overweight and obesity. Only one studies in South Africa found that the BMIs of Indian and White women were 1.683 and 3.259 units lower than the BMIs of African women (Puoane et al., 2002). The application of regression analysis on the 1998 Demographic and Health Survey however, had methodological limitations, which ultimately discounted the merits of the findings. The literature review also highlighted a dearth of mixed methods and qualitative based studies in Malaysia (Lim, 2016; Nor et al., 2018; Khambalia and Seen, 2010).

My second major contribution to knowledge is that this is the first study to examine BMI and weight category variations among women of childbearing age through the stratification of four main ethnic groups in Malaysia using data from the latest four Malaysian National Health and Morbidity Surveys (1996, 2006, 2011 and 2015). Therefore, my findings provide the most up-to-date data on the socioeconomic patterning of mean BMI and weight categories for childbearing age women, by considering the characteristic of the data (clustering effect) with the use of three-level linear regression modelling.

A third contribution is that this is the first study to examination underweight and pre-overweight patterning across the four main ethnic groups of women using logistic regression modelling. Studying pre-overweight patterning is important because it is the public health intervention point (WHO, 2004). Understanding the trends of socioeconomic patterning of underweight among women of childbearing age is important as women whose pre-pregnant body weight falls into the underweight category have a higher risk of miscarriage and low birth weight in babies than women who have a healthy weight

(Bolumar et al., 2000; Grodstein, Goldman and Cramer, 1994; Helgstrand and Andersen, 2005; Han et al., 2011). Evidence of the prevalence and social patterning of underweight is important as it can inform polices and strategies to improve the health outcomes for pre-pregnant and pregnant women and their babies.

A fourth contribution is that both secondary data analyses have contributed to new knowledge on the body weight patterning of Other Indigenous People Minority women and Malaysian Indian women. Other Indigenous People Minority women are more likely to experience greater unequal access to health care services, transportation, food, education and employment opportunities than women of other ethnic groups but have received less attention in health research in Malaysia (Lim, 2003). Thus, it is not surprising that the obesity weight transition of Other Indigenous People Minority groups appears to have been slower than other ethnic groups.

Previous studies in Malaysia suggested unclear overweight and obesity patterning for Malaysian Indian women aged 30 and above (Mariapun, Ng and Hairi, 2018). However, my study found the presence of an educational gradient in obesity for Malaysian Indian women. Additionally, the risk of underweight was consistently most prevalent among Indian women within the secondary educated group between 1996 and 2015.

Fifth, the use of mixed sequential research strategy facilitated a qualitative study focused on Malaysian Chinese women to understand some of factors associated with body weight management in this group. The qualitative data provides new, in depth data on how Malaysian Chinese understand body weight and seek to manage their body weight and the factors they perceive as facilitating or acting as barriers to achieving their desired body weight. Although studies by Dunn, Tan and Nagya (2012) and Mariapun, Chan et al. (2017) and Ng and Hairi (2018) identified weight differences between Malaysian Malay women and Malaysian Chinese women it could not provide data to explain these differences. My current qualitative interviews generated new insight particularly on how social support, religion, cultural, structural, physiological and psychological factors co-influenced Malaysian Chinese women's body weight, weight perception and weight management strategies. These insights could possibly contribute to the theoretical framework of social determinants of health.

As Malaysian Chinese women, as a group, have healthier BMI's than Malaysian Malay, Malaysian Indian and Other Indigenous Minority Groups women, information on the factors that they perceive as important in weight management may have resonance for other groups. This information may inform the development of policies and strategies to promote healthy weight among women of childbearing age in Malaysia. While it is necessary to take account of the fact that women in difference ethnic groups experience different social, economic and cultural contexts, the findings from this study that highlight the importance of understanding these aspects of women's lives make a valuable contribution to knowledge in this area.

8.4 Strengths and limitations of the study

The strengths of this research lie in adoption of a sequential mixed methods approach. This approach incorporated the two distinct methodologies of quantitative and qualitative research. While some critics have drawn attention to the epistemological and paradigm arguments against mixed methods approaches (Bryman, 2004), it can be argued that my use of such an approach facilitated a broader and deeper understanding of the phenomenon of body weight. The study used data sets from four sequential national nutrition and health surveys carried out by the Malaysian Ministry for Health. These surveys had been extensively tested. Furthermore, they each had large nationally representative samples of participants.

Having four data time points allowed me to examine trends as well as identify patterns at particular points in time. Another strength of this research was it provided insight on body weight inequalities across women of childbearing age (18-49 years) in the four main ethnic groups (Malaysian Malay, Malaysian Chinese, Malaysian Indian and Other Indigenous People Minority).

A further strength was the incorporation of a qualitative component that facilitated the identification and exploration of Malaysian Chinese's women's views and perspectives on body weight and its management. This provided insights that the quantitative analyses could not. Strengths of this qualitative approach were that interviewing lesser interfering participants' lives in comparison with participant observation and allowed me to build a trusting relationship with participants which would encourage them to share their views and perspectives with me. Second, it allowed me to gather information about both participants' past and present experiences and knowledge (Bryman, 2016).

There are a number of limitations to my research. First, the research could only identify associations between socioeconomic position and weight status. The 1996, 2006, 2011 and 2015 Malaysia National Health and Morbidity Survey data are cross-sectional in nature (Subramanian and Smith, 2006) and such data cannot identify causal trends.

Second, the first phase of my research relied on Body Mass Index in capturing a woman's weight status. Adap, Pallan and Whincup (2018) have pointed out that BMI measures neither body fat nor indicates location of body fat, making it less robust in reflecting central obesity. Waist circumference can determine central obesity for people with low BMI. On the other hand, waist-to-hip ratio is found to be more reliable in predicting the risk of Myocardial Infarction for women in the UK. However, waist circumference and waist-to-hip cut-off points are unavailable for underweight and pre-overweight categories. Moreover, waist circumference was not available in the 1996 Malaysia National Health and Morbidity Survey (IKU, 2019). For these reasons, I adopted BMI to measure weight statuses.

Third, studying the association of body weight and socioeconomic position based on linear regression technique has some limitations. It provides information about the average impact of a socioeconomic factor (i.e. income) may have on BMI. In other words, it offers a single point of estimation (mean BMI) in measuring the influence of income on BMI. As a result, it could neglect the effect of income on BMI that may vary between the lower and upper band of obesity. Studies conducted by Jollifee (2011) found that linear regression provided a relatively low mean BMI estimates in studying the effect of income on obesity.

However, decomposing socioeconomic differences along the BMI distribution requires a big data set (Dunn, Tan and Nagya, 2012). For this reason, Dunn, Tan and Nagya restricted their analysis to Malaysian Malay and Malaysian Chinese women only using the 2006 Malaysia National Health and Morbidity Survey. As the aim of my research was to compare weight inequalities for four main ethnic differences, I chose to use three-level linear regression technique and single-level logistic regression technique. Apart from these, means-centric measures of association as important as measures of dispersion (or distributional changes) in providing information about health inequalities (Murray et al., 1999).

Fourth, my literature review had a limited number of articles pertaining to the second phase of my research, which focuses on women's perceptions of body weight, strategies for and barriers and facilitators to managing body weight. A literature review conducted by Lim (2016) and Nor et al. (2018) confirmed the dearth of qualitative research on body weight in Malaysia. Moreover, a consultation with my subject librarian also affirmed that only a handful of research focuses on healthy weight and slightly overweight and their associated barriers and management strategies. This limited the literature review.

The fifth limitation is associated with the use of semi structured interviews in the second phase of my research. In the second phase of my research, semi structured interviewing was thought to be a suitable tool for collecting information about weight-related perceptions and its associated barriers from 18 Malaysian Chinese women in the state of Kedah. Despite its advantages, semi structured interviewing has been critiqued as relying merely on self-reported information. Consequently, it might miss out some information that possibly could be gathered from observation (Bryman, 2016). Additionally, the semi-structured interviews are restricted to exploring a small sample (18) Malaysian Chinese women's views, it is not possible to generalise the findings to wider population.

The last limitation is associated with other three weaknesses in my qualitative study. First, there is the lack of objective measures of healthy weight and overweight for participants because their body weight has not been taken during the interviews. Hence, some participants might overestimate or underestimate their body weight. The second weakness is my qualitative study did not have a wide range of participants in terms of age and weight statuses. For example, there is no obese Malaysian Chinese women participate in my interviews. I felt that although data saturation had been reached, a bigger and wider sample of women may have generated more or different themes. The third weakness is concerned with the lack of theory underpinning the findings of my qualitative study. Though my general framework for the whole study was on health inequalities, the qualitative phase was not underpinned by an explicit theoretical perspective that could have guided the study, my findings were related to few theories such as the theory of social causation.

It is important to reflect on how I, as a researcher, may have influenced the qualitative findings of this study. Researchers are likely to have an effect on the people they are studying, the data that is collected and the analysis and interpretation of the findings (Ahmed, Hundt and Blackburn, 2011). In chapter 3, I reflected on how I may have influenced the collection of data from my participants. In this final chapter, that summaries and discusses my findings, it is pertinent to reflect on how I, as a researcher, may have influenced the interpretations of the findings. While it is not possible to say that researchers never affect the interpretation of quantitative findings, the application of validated methods of analysis and statistical tests reduce this significantly. Clearly, the quantitative methods and statistical tests I selected affected the quantitative results I generated. My quantitative methods were rigorously selected and I believe, were the most appropriate for this study.

As a researcher, I am most likely to have had an affect the interpretation of my qualitative findings. Although I always tried to be aware of my own personal subjectivity and used this awareness to minimise the influence of this, inevitably this is likely to have affected my interpretation to some extent. My own experiences as a woman of Chinese Malaysian ethnicity may have led me to draw particular inferences from my participants' narratives. I have been explicit about my own personal interest in the body weight of Chinese Malaysian women and my academic interest in health inequalities (see chapter 3). Together, these lens not only led to this project in the first place, but also prompted me to explore particular avenues of enquiry. This may have resulted in the identification of particular themes and failure to identify other themes. It may also have influenced the meaning and explanatory concepts I drew during the data interpretation stage of my research. To minimise the effects of this, my supervisors also checked my coding of the data and scrutinised my interpretations of the findings. They challenged my though processes and the meanings I gave to the data. This is likely to have minimised at least some of the inevitable biases that are inherent in qualitative analysis.

8.5 Implication for policy and practice

Drawing from my key findings, it is possible to make some suggestion for policy and practice. My three-level linear regression found a small variation in BMI at the enumeration-block-level. Drawing on this result, intervention at specific enumeration-block-level is less effective, hence I only discuss the possibility of implementing the policies at the national-level (Merlo et al., 2009).

My quantitative findings suggest that the body weight inequalities in education between Other Indigenous People of Minority Groups and Malaysian Malay who had the same privileges are apparent. Such systematic inequalities are possibly the results of different living and working environment which lead to unequal access to resources. Therefore, policy that aims to narrow weight differences arising from inequalities in access to educational and employment opportunities and infrastructure between these two groups of women is required. Income redistribution policy which targets lower educated women of Other Indigenous People Minority Groups may also in this group.

More investment in structural change policies from the government are also needed to improve the living and working condition of women who belong to Other Indigenous People Minority Groups. This is because some of them still live in areas with a limited access to social, health and economic infrastructures and currently, there is only one Hospital for Other Indigenous People Minority Groups which is located in the state of Selangor, Peninsular Malaysia (Lim, 2003; Law et al., 2018; Aerin, 2005; Aiken and Leigh, 2011; Mohd-Shaharuddin et al., 2018; https://hoag.moh.gov.my, 2020).

My findings suggest a need for the introduction of culturally-sensitive community-based weight management programmes for women in the four main ethnic groups based on my finding of weight inequalities among these women. Such programmes should consider prioritising women in the married and lower education groups (those educated up to secondary education) as they are most likely to be obese regardless of ethnicity.

For instance, a culturally- and gender-sensitive weight programme could be introduced in the state of Kedah for Malaysian Chinese women at the community-level with the aid of mobile apps. Social media is thought to be a suitable channel for promoting healthy weight management because it is one of the main sources by which Malaysian Chinese women in my study obtained weight related information. As family and friends were also important sources of information on nutrition and body weight management, peer-education and support programmes may also be a useful approach. These have been shown to be effective methods in other countries (Jane et al., 2018; Motteli, Siegrist and Keller, 2017).

My findings also indicated the presence of a negative underweight-educational gradient among Malaysian Chinese women. Additionally, secondary educated Malaysian Indian women and women of Other Indigenous People Minority Groups were also more likely to be underweight. On the other hand, the lowest educated Malaysian Chinese women and Malaysian Malay women were most vulnerable to overweight. These findings imply that a policy which focuses on both underweight and overweight or obesity issues is needed to reduce inequalities in body weight status. However, inter-sectoral coordination policy which aims to curb heavy body weight is the focus currently (The Academy of Science, 2013; The Academy of Medical Science, 2017; Ministry of Health, 2016). Extra support needs to be provided to the secondary educated Other Indigenous People Minority group who were most likely to be pre-overweight as this could halt the rise of overweight. Within Malaysian Indian women, a focus needs to be given to secondary educated group who are more likely to be underweight than other none, primary and tertiary educated group.

In conclusion, education is the main indicator explaining weight differences among four ethnic groups women. It appears to facilitate and obscure weight management through behavioural factors in two ways. First, education improves a woman’s power, authority, income and accessibility to support. Second, lack of knowledge was widely discussed as an obstacle ton losing weight by my participants. They expressed how insufficient knowledge about nutrition and balance diet and know-how in physical activity hindered their attempts in losing and maintaining weight. Additionally, they stated that limited information was available for them and that the available information was ambiguous. Others felt they were not equipped with the knowledge and skills at school that they needed to do exercise. Early years education in body weight, nutrition and exercise could possibly help in combating body weight related issues.

Further longitudinal studies, large-scale qualitative research which involves a diverse sociodemographic of participants and intervention studies are called for to better understand ethnic differences in body weight as this topic is still relatively underexplored. There was one intervention programme focused on economically disadvantaged overweight or obese housewives in Klang

Valley, Malaysia, from 2012 to 2013: ‘My Body is Fit and Fabulous at Home’ intervention programme. However, none of them managed to maintain the body fat after the intervention period (Fazliana et al. 2018). Apart from these, a comparison study of socio patterning of body weight of Asian Indian origins, between Malaysian Indian women, Indian women in India and in England would be interesting for future research.

Appendix A

A.2.1 Signed data used agreement: the 1996 NHMS

Data Use Agreement *Research Project*

DATED

15/11 , 2013

CHOO SOOK YEE (1)

AND

MINISTRY OF HEALTH, MALAYSIA (2)

DATA USE AGREEMENT FOR RESEARCH PROJECT

THIS AGREEMENT is effective as of ________________

PARTIES

The Parties to this Agreement are:

(1) Choo Sook Yee and

(2) Ministry of Health, Malaysia

The Principal Investigator and Ministry Of Health shall be referred individually as a "Party" and collectively, as the "Parties".

WHEREAS

I. This agreement form is signed in relation to the approval of the use of macro data, micro data, detailed data and any other data (e.g. aggregated data) issued by Ministry of Health Malaysia (MOH).

II. **I, Choo Sook Yee (User) hereby agree(s) and undertake(s) that:**

a) Macro data, micro data detailed data and any other data (e.g. aggregated data) obtained will be used solely for the purpose of **research project/thesis** entitled

The BMI of Women of Childbearing Age Living in Malaysia : A Quantitative and Qualitative Perspective

b) To ensure the security of the raw data by taking reasonable and adequate measures to protect the data from loss, misuse, exploitation, ravage, unauthorized access, or disclosed to any unnecessary parties.

c) Will use data solely for the purpose referred to in paragraph II (a) only.

d) Will register the research project with National Medical Research Register (NMRR) at http://nmrr.gov.my

e) Will obtain approval from the Director-General of Health, Malaysia for any publication(s) resulted from the use of the data according to the appointed procedure before the article sent for publish.

f) Will acknowledge Director General of Health, Malaysia for his permission to use the data and to publish the article.
e.g. *The authors would like to thank the Director General of Health, Malaysia for his permission to use the data from the National Health and Morbidity Survey 2011 and to publish this paper.*

g) Will submit a copy of the final manuscript of scientific publication to

Secretariat National Institutes of Health (NIH),
Ministry of Health Malaysia,
c/o Institut Pengurusan Kesihatan
Jalan Rumah Sakit Bangsar
59000 Kuala Lumpur

through

Pengarah ,
Institut Kesihatan Umum,
Jalan Bangsar
59000 Kuala Lumpur

III. I am aware that the breach of this contract will lead to blacklist from obtaining and/or using any form of data from Ministry of Health, Malaysia.

IV. I have read and understood all of the above clauses and agree to abide with all the terms mentioned.

A.2.2 BSREC: REGO-2013-553

1st November 2013

Warwick
Medical School

PRIVATE
Sook Choo
Warwick Medical School
University of Warwick
Coventry
CV4 7AL

Dear Sook,

Study Title and BSREC Reference: *The BMI of women of childbearing age living in Malaysia: quantitative and qualitative perspectives* REGO-2013-553

Thank you for submitting the above-named project to the University of Warwick Biomedical and Scientific Research Ethics Committee for Chair's approval.

I am pleased to confirm that your application meets the required standard which means that full approval is granted and your study may commence.

I take this opportunity to wish you success with the study and to remind you any substantial amendments require approval from the committee before they can be made. Please keep a copy of the original signed version of this letter with your study documentation.

Yours sincerely,

P.P. Graham Hewitt

Dr David Davies
Chair
Biomedical and Scientific
Research Ethics Sub-Committee

Biomedical and Scientific
Research Ethics Subcommittee
A010 Medical School Building
Warwick Medical School,
Coventry, CV4 7AL.
Tel: 02476-151875
Email: BSREC@Warwick.ac.uk

THE UNIVERSITY OF
WARWICK

A.2.3 Permission to access to the 2006 data set

From: DR. HAJI TAHIR BIN ARIS [mailto:tahir.a@iku.moh.gov.my[1]]
Sent: Fri 26/11/2010 2:56 AM
To: Choo, Sook
Cc: balkish.mn; fadhli_my@iku.moh.gov.my
Subject: Re: Access To The Third NHMS Data

Dear Sook Yee,

I already ask my staff to prepare the data, Please contact Dr Fadhli or Pn Balkish for the data and further clarification
How many sampel you need?

Dr Hj Tahir Aris
Director
Institute for Public Health
Ministry of Health Malaysia
Tel : 603 22979401
Fax : 603 22881005
Homepage: www.iku.gov.my

A.2.4 Approval letter for using the 2011 NHMS data set for analyses

KETUA PENGARAH KESIHATAN MALAYSIA
DIRECTOR GENERAL OF HEALTH MALAYSIA
Kementerian Kesihatan Malaysia
Aras 12, Blok E7, Kompleks E
Pusat Pentadbiran Kerajaan Persekutuan
62590 PUTRAJAYA

Tel. : 03-8883 2545
Faks : 03-8889 5542
Web : anhisham@moh.gov.my

Rujukan Kami : ( ) dlm. IKU/502/009
Rujukan Tuan :
Tarikh : 25 November 2016

Pn. Choo Sook Yee
Department of Health Sciences
Warwick Medical School
University of Warwick
Coventry CV4 7 AL
United Kingdom

Puan,

KEBENARAN BAGI MENGGUNAKAN DATA DARIPADA *NATIONAL HEALTH AND MORBIDITY SURVEY* 2011 UNTUK PENGAJIAN CALON DrPH (DOCTORATE OF HEALTH SCIENCES) DI UNIVERSITY OF WARWICK, UK

Dengan hormatnya saya merujuk kepada perkara di atas.

2. Merujuk kepada permohonan puan untuk mendapatkan data daripada *National Health Morbidity Survey* 2011 untuk menjalankan penyelidikan yang bertajuk *"The BMI of Women of Childbearing Age Living in Malaysia: A Quantitative and Qualitative Perspective"*, pihak Kementerian Kesihatan Malaysia (KKM) tidak mempunyai halangan untuk membenarkan puan mendapatkan data tersebut.

3. Sehubungan dengan itu, dilampirkan dokumen-dokumen yang perlu dilengkapkan oleh puan bagi melicinkan proses permohonan data tersebut sebelum dapat dibekalkan.

4. Sekiranya ada pertanyaan lanjut, puan boleh berhubung terus dengan Pengarah Institut Kesihatan Umum, Dr. Tahir bin Aris di talian 03-22979400 atau melalui emel pengarahiku@moh.gov.my.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Yang Ikhlas,

(DATUK DR. NOOR HISHAM BIN ABDULLAH)

s.k: Pengarah Institut Kesihatan Umum

A.2.5 Signed data used agreement: the 2015 NHMS

DATED

11/10 , 2018

CHOO SOOK YEE (1)

AND

MINISTRY OF HEALTH, MALAYSIA (2)

DATA USE AGREEMENT FOR SCIENTIFIC PUBLICATION

THIS AGREEMENT is effective as of____________________

PARTIES

The Parties to this Agreement are:

(1) **CHOO SOOK YEE** and

(2) Ministry of Health, Malaysia

The Principal Investigator and Ministry Of Health shall be referred individually as a "Party" and collectively, as the "Parties".

WHEREAS

I. This agreement form is signed in relation to the approval of the use of macro data, micro data, detailed data and any other data (e.g. aggregated data) issued by Ministry of Health Malaysia (MOH).

II. **I, CHOO SOOK YEE ____________________________ (User) hereby agree(s) and undertake(s) that:**

a) Macro data, micro data detailed data and any other data (e.g. aggregated data) obtained will be used solely for the purpose of **scientific publication (article)** entitled

THE BMI OF WOMEN OF CHILDBEARING AGE LIVING IN MALAYSIA: A QUANTITATIVE PERSPEKTIVE AND QUALITATIVE PERSPECTIVE

b) To ensure the security of the raw data by taking reasonable and adequate measures to protect the data from loss, misuse, exploitation, ravage, unauthorized access, or disclosed to any unnecessary parties.

c) Will use *data solely for the purpose referred to in paragraph II (a) only.*

d) Will obtain approval *from the Director-General of Health, Malaysia according to the appointed procedure before the article send for publication*

A.3.1

Inormation sheet

PARTICIPANT INFORMATION LEAFLET

Study Title: The BMI of women of childbearing age living in Malaysia: quantitative and qualitative perspectives

Investigator(s): Sook Choo

Introduction

You are invited to take part in a Research study. Before you decide, you need to understand why the research is being done and what it would involve for you. Please take the time to read the following information carefully. Talk to others about the study if you wish.

(Part 1 tells you the purpose of the study and what will happen to you if you take part. Part 2 gives you more detailed information about the conduct of the study)

Please ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

PART 1

What is the study about?

I am interested in finding out what women who are aged between 18 and 49 years old think about their own weight. What are the things that affect their weight and what if anything makes it difficult for them to maintain the weight they want to be.

Do I have to take part?

It is entirely up to you to decide. We will describe the study and go through this information sheet, which we will give you to keep. If you choose to participate, we will ask you to sign a consent form to confirm that you have agreed to take part (if part of this study is an online or postal questionnaire/survey, by returning a completed questionnaire/survey, you are giving your consent for the information that you have supplied to be used in this study and formal signed consent will not be collected where postal or online questionnaires/surveys are concerned). You will be free to withdraw at any time, without giving a reason and this will not affect you or your circumstances in any way.

What will happen to me if I take part?

I am a researcher called Sook Choo and am conducting a research study on women's weight in order to write up the findings as part of my PhD. This part of the study focuses on interviews with women about women's weight. These interviews will be recorded and will be typed up after they have been completed. I will then look at the information that is provided by the women who take part in this study in order to identify common themes and issues that are raised by the women who take part. I will then include some of this information in my PhD thesis. It is also possible that some of this information will be included in articles that are published in scientific journals.

All the information that is given to me by the women who take part in this study will be treated in the strictest confidence. The audio tapes and the typed-up interviews will be held securely in a locked cabinet in a looked room when I am not using them. I will make every effort to ensure that no one who participates in the study can be identified in my PhD or any articles that I write for publication in scientific journals. So, for example I will not use people's names.

If you choose to take part I will contact you before the interview to arrange a time and place that is convenient for both of us. Once the time and place has been finalised, you will receive a confirmation letter from me. The letter will contain my contact details again. Please feel free to contact me if you have any concerns about the study and would like to discuss them with me or if you are no longer able to take part in the study and do not wish to be interviewed. If for whatever reason you do not wish to take part in the study you do not need to explain these reasons to me. In the interview I will ask you questions about weight in general and your weight, I will then ask you about things that affect your weight, and difficulties that you may have experienced regarding weight. You do not have to answer all the questions in the interview. If you do not want to answer a question then please tell me and I will happily ask the next question. You can also stop the interview at any stage of the interview and you do not have to give me any reasons for why you have decided to stop.

What are the possible disadvantages, side effects, risks, and/or discomforts of taking part in this study?

Talking about issues concerning weight can be a sensitive subject for women. You can decide not to answer any question in the interview or to stop participating in the interview altogether if you feel uncomfortable or unhappy talking about the issues that I raise in the interview. I will happily give you information on counselling services that are available in your area if you feel you want to talk further about your feelings on issues related to weight.

What are the possible benefits of taking part in this study?

You will receive an information pack about healthy lifestyles but there is unfortunately no direct benefit to you in taking part in this study. However, your views and experiences on weight issues will be listened to. Additionally, the information that is given to me by you and the other women who take part in this study may benefit other women outside of my study indirectly through for example extending our understanding of issues that are related to women's weight. The information we get will be shared with the Health Promotion Centre in Alor Setar, Kedah. The people who work there may be able to use this information to further develop healthy eating and exercise programmes. Currently, these programmes are run by the centre twice per week.

Expenses and payments

Travelling expenses (up to RM25) to the place where we have the interview will be reimbursed and I will pay these expenses when we have the interview. If you decide to stop the interview for any reason, you will still be given your travelling expenses.

What will happen when the study ends?

All the information that you give me will be kept securely under lock and key and will be destroyed ten years after I have completed the interviews.

Will my taking part be kept confidential?

Yes. We will follow strict ethical and legal practice and all information about you will be handled in confidence. Further details are included in Part 2.

What if there is a problem?
Any complaint about the way you have been dealt with during the study or any possible harm that you might suffer will be addressed. Detailed information is given in Part 2.

This concludes Part 1.

If the information in Part 1 has interested you and you are considering participation, please read the additional information in Part 2 before making any decision.

PART 2

Who is organising and funding the study?
I am organising the study as part of my PhD research. The study is not funded by any organisations.

What will happen if I don't want to carry on being part of the study?
Participation in this study is entirely voluntary. Refusal to participate will not affect you in any way. If you decide to take part in the study, you will need to sign a consent form, which states that you have given your consent to participate.

If you agree to participate, you may nevertheless withdraw from the study at any time without
affecting you in any way.

You have the right to withdraw from the study completely and decline any further contact by study staff after you withdraw.

Withdrawing from the study will not affect you in any way. If you are a student your withdrawal will not affect your place on the course or your grades in any way.

You may decide after the interview has been conducted that you do not want me to include the information you provided in my Phd thesis and in any papers that I write. If this is the case all you have to do is contact me and I will remove and destroy your information. You do not have to give me any reasons for your decision to withdraw your data.

What if there is a problem?
This study is covered by the University of Warwick's insurance and indemnity cover. If you have an issue, please contact Jo Horsburgh (details below).

Who should I contact if I wish to make a complaint?
Any complaint about the way you have been dealt with during the study or any possible harm you might have suffered will be addressed. Please address your complaint to the person below, who is a Senior University of Warwick official entirely independent of this study:

Jo Horsburgh
Deputy Registrar
Deputy Registrar's Office
University of Warwick
Coventry, UK, CV4 8UW.

T: +00 44 (0) 2476 522713 E: J.Horsburgh@warwick.ac.uk

Will my taking part be kept confidential?

When we have conducted the interviews and typed them up I will give each recorded interview and typed interview a unique code. The unique code will consist of a name that is different to your own name or a code number. I will be the only person who will know that the unique code belongs to you. This unique code will be used in any written paper or report that results from the study.

Personal information including the consent form that you have signed, how many children you have, your marital status and your educational history will be kept separately from the tape recording of your interview and the typed interviews. This means that names on the consent form cannot be easily matched to the unique code that I will create for you. All the information you give will be stored securely in Microsoft Word files which will be password protected. Paper copies of the information that you provide will be kept securely in a locked cabinet in a locked room. This information will be destroyed ten years after it is collected which complies with University of Warwick regulations.

What will happen to the results of the study?

Information from the study will be included in my PhD theses. It is also possible that I will write articles that use this information and publish these articles in scientific journals or present the results at conferences. I will also inform the Health Promotion Centre in Alor Setar, Kedah of the results from the study.

If you would like a summary of the results of this part of the study then please tell me and I will happily send you a copy of the summary. The results of the study will highlight things that affect women's weight and their difficulties in maintaining healthy weight.

Who has reviewed the study?

This study has been reviewed and given favourable opinion by the University of Warwick's Biomedical and Scientific Research Ethics Committee (BSREC): Insert your BSREC number here (given to you when your study is approved) and include the date on your approval letter from BSREC.

What if I want more information about the study?

If you have any questions about any aspect of the study or your participation in it not answered by this participant information leaflet, please contact:
Sook Choo by email or by telephone. My email address is s.y.choo@warwick .ac.uk. My telephone number is 012-6171122

Thank you for taking the time to read this participant information leaflet.

A.3.2

Consent form

THE UNIVERSITY OF WARWICK

CONSENT FORM

(Biomedical and Scientific Research Ethics Committee)Study Number: REGO:2013-553

Participant Identification for this study:

Title of Project: The BMI of women of childbearing age living in Malaysia: qualitative perspective

Name of Researcher(s): Sook Choo; Associate Professor Dr. Wolfgang Markham and Associate Professor Dr. Clare Blackburn

Please initial all boxes

1. I confirm that I have read and understand the information sheet dated **[DATE:]** for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I have had the opportunity to consider the information, ask questions and am satisfied with the answers.

3. I understand that my participation in the interview of the above study is voluntary and that I am free to withdraw my participation and the data at any time without giving any reason.

4. I understand that relevant sections of information collected during the interview of above study, may be looked at by Sook's supervisors from The University of Warwick, where it is relevant to my taking part in this research. I give permission for these individuals to have access to the data provided by me.

5. I agree to take part in the above study and am happy to:

   be individual interviewed

   for the interview to be tape recorded

   for the interview to be typed up and translated into English for the written version of translated interview to be published in journals/reports without me being identified and that all data provide by me being anonymised.

A.3.3

Interview guide

We have had a discussion about what the study involves and you have voluntarily agreed to participate. Thanks for agreeing to talk to me. We have had a discussion about what the study involves and you have voluntarily agreed to participate. I just want to double check if this is still ok for you? At any time during our talk, you can choose stop the interview at any point. You don't have to give me a reason for this. If there are any questions I you don't wish to answer, then that I OK too. If you need a break at any time, then just ask.

As you know I am looking for volunteers to talk to me about their views on women's eight issues. I am particularly interested in listening to different views from women aged 18 to 49 about their body weight issues. As different people have different views about weight, there is no right or wrong views. So, please feel free to talk me about views. I do not expect our talk will last for more than 45 minutes.

Before we start, do you have any questions about the study or interview?

Taking demographic information

I'd like to start by asking you some general questions about yourself? It would be helpful
to know you a bit more about you.

How long have you been living here?
Who lives with you?
Do you rent or own your house?
Did you go to school here?
At what stage did you leave school?
Did you go on to further studies after completing secondary school?
Are you married?
How long have you been married?
Have you got any children?
Tell me about your children (What are their names? How old are they?)
What does your husband do?
And you? Do you work? If so, how long have you been working?
If not working: Have you ever worked? What did you do?
Would you mind telling me how old you are?

Thanks for telling me a bit about yourself.

Perception on weight	**I'd like to ask you some questions about weight.**
	Do you think weight is something women in Malaysia are concern about? Why do you think that is?
	In general, do you think most women in Malaysia are underweight, or overweight or a healthy weight?
	What do you think a healthy weight means for most Malaysian women? If they mention dress size, check whether USA or UK size and ask about height. What about your weight? Are you happy with it?
	What do you consider to be a healthy weight for someone of your height?
	Where do you usually get information about healthy weight from?
	What does be thin mean to you?
	What does be overweight mean to you?
	Do you think your views on body weight are similar to those of other Malaysian Chinese women?
	Generally, do you think most Malaysian Chinese women who are celebrities are underweight, overweight or a healthy weight?
	Do you do anything to control your body weight? Tell me about the kind of things you do? Do these things work for you?
	What things affect you when you are trying to maintain or lose weight? Are any of these things particularly difficult for you? Why?
	Have you ever been on a diet in order to lose weight? (ask directly if they do not mention they diet) Can you tell me a bit about the diet (or diets) that you have tried?
	Where do you usually get information about dieting from?
	How difficult did you find it when you went on a diet? What would make it easier? (e.g. facilities, beliefs,

	culture, money)
	Did you lose any weight when you were dieting? Did you put any weight back on again when you stopped dieting?
	How supportive were your family and friends when you went on a diet? Tell me a bit about this?
Food/eating habit	**Now I would like to ask you some more questions about food and eating habit**
Questions	Tell me what do you eat on a typical day?
	Do you prepare the food you eat on a typical day?
	Who influences the food you eat on a typical day? (eg. husband, children, other family members).
	Do your religious beliefs affect what you eat? (eg. vegetarian, mindful eating)
	Do any of the influences you have already talked about affect the way your food is prepared? If yes, in what way?
	On social occasions, what influences what you eat?
	What would your friends or relatives say if you eat too little or too much on these occasions?
	When you shop for food, do you think about the way that foods might affect your weight? If so, in what way?
	What does healthy eating mean to you?
	Where do you usually get information about healthy eating from?
	How far do you believe that healthy eating can help to maintain and lose weight?
	Would you like the food you usually eat to be healthier? What are the reasons for that?
	How easy would it be for you to eat more healthily (e.g. facilities, beliefs, culture, money)?

	Would your friends or family members support you if you want to change what you usually eat? How?
Physical activity	**Now I'd like to ask you some questions about physical activity**
	What type of physical activity do you do on a typical day (e.g. walk to grocery shop, gardening, housework, play sport)?
	How often do you do these activities?
	Are there any things that you do specifically to increase your physical activity? (eg. walking instead of getting bus, dance classes, swimming). Tell me about these. How often do you do these activities?
	Are there other things you would consider doing to increase your physical activity level, such as gardening, walking or doing tai chi as a way to maintain or lose weight?
	How easy or difficult would it be for you to take up any of these activities? (e.g. facilities, beliefs, culture, money). Tell me about this?
	How supportive would your family members and friends be if you wanted to do more physical activities?
	We are almost at the end of the interview now.
	Do you have anything that would like to share with me?
	Thank you

Appendix B

B.4.1 Distribution of Women of Four Main Ethnic Groups in 1996

1996	MM	MC	MI	OIP	Total
Johor	629 (57.9)	378 (34.8)	68 (6.3)	11 (1.0)	1086 (100.0)
Kedah	429 (74.2)	95 (16.4)	53 (9.2)	1 (0.2)	578 (100.0)
Kelantan	587 (93.8)	29 (4.6)	8 (1.3)	2 (0.3)	626 (100.0)
Melaka	297 (60.4)	154 (31.3)	36 (7.3)	5 (1.0)	492 (100.0)
Negeri Sembilan	248 (55.4)	114 (25.4)	82 (18.3)	4 (0.9)	448 (100.0)
Pahang	335 (67.4)	99 (19.9)	41 (8.2)	22 (4.4)	497 (100.0)
Pulau Pinang	356 (51.3)	254 (36.6)	82 (11.8)	2 (0.3)	694 (100.0)
Perak	406 (45.8)	311 (35.1)	154 (17.4)	15 (1.7)	886 (100.0)
Perlis	370 (87.7)	43 (10.2)	7 (1.7)	2 (0.5)	422 (100.0)
Selangor	783 (51.4)	406 (26.7)	289 (19.0)	44 (2.9)	1522 (100.0)
Terengganu	456 (92.1)	32 (6.5)	0 (0.0)	7 (1.4)	495 (100.0)
Sabah	77 (5.2)	330 (22.2)	0 (0.0)	1079 (72.6)	1486 (100.0)
Sarawak	443 (22.3)	592 (29.9)	2 (0.1)	946 (47.7)	1983 (100.0)
Kuala Lumpur	299 (42.3)	313 (44.3)	93 (13.2)	2 (0.3)	707 (100.0)
Labuan	15 (20.3)	11 (14.9)	2 (2.7)	46 (62.2)	74 (100.0)

B.4.2 Distribution of Women of Four Main Ethnic Groups in 2006

2006	MM	MC	MI	OIP	Total
Johor	908 (67.5)	296 (22.0)	123 (9.1)	19 (1.4)	1346 (100.0)
Kedah	642 (77.2)	82 (9.9)	105 (12.6)	3 (0.4)	832 (100.0)
Kelantan	616 (97.3)	14 (2.2)	1 (0.2)	2 (0.3)	633 (100.0)
Melaka	199 (67.7)	59 (20.1)	28 (9.5)	8 (2.7)	294 (100.0)
Negeri Sembilan	226 (55.8)	96 (23.7)	79 (19.5)	4 (1.0)	405 (100.0)
Pahang	452 (76.5)	89 (15.1)	25 (4.2)	25 (4.2)	591 (100.0)
Pulau Pinang	377 (51.7)	254 (34.8)	96 (13.2)	2 (0.3)	729 (100.0)
Perak	454 (56.8)	205 (25.6)	110 (13.8)	31 (3.9)	800 (100.0)
Perlis	86 (90.5)	7 (7.4)	1 (1.1)	1 (1.1)	95 (100.0)
Selangor	1316 (59.2)	440 (19.8)	418 (18.8)	49 (2.2)	2223 (18.7)
Terengganu	480 (97.6)	11 (2.2)	1 (0.2)	0 (0.0)	492 (100.0)
Sabah	391 (28.1)	124 (8.9)	4 (0.3)	873 (62.7)	1392 (11.7)
Sarawak	315 (28.6)	296 (26.9)	2 (0.2)	489 (44.4)	1102 (100.0)
Kuala Lumpur	371 (50.0)	239 (32.2)	116 (15.6)	16 (2.2)	742 (6.3)
Labuan	90 (48.1)	21 (11.2)	2 (1.1)	74 (39.6)	187 (1.6)

B.4.3 Distribution of Women of Four Main Ethnic Groups in 2011

2011	MM	MC	MI	OIP	Total
Johor	277 (57.0)	149 (30.7)	53 (10.9)	7 (1.4)	486 (100.0)
Kedah	264 (81.2)	41 (12.6)	19 (5.8)	1 (0.3)	325 (100.0)
Kelantan	306 (94.2)	18 (5.5)	0 (0.0)	1 (0.3)	325 (100.0)
Melaka	223 (65.6)	85 (25.0)	26 (7.6)	6 (1.8)	340 (100.0)
Negeri Sembilan	154 (51.2)	58 (19.3)	86 (28.6)	3 (1.0)	301 (100.0)
Pahang	268 (84.3)	32 (10.1)	10 (3.1)	8 (2.5)	318 (100.0)
Penang	201 (54.8)	105 (28.6)	59 (16.1)	2 (0.5)	367 (100.0)
Perak	167 (57.8)	74 (25.6)	44 (15.2)	4 (1.4)	289 (100.0)
Perlis	276 (94.2)	14 (4.8)	3 (1.0)	0 (0.0)	293 (100.0)
Selangor	511 (59.8)	183 (21.4)	142 (16.6)	18 (2.1)	854 (100.0)
Terengganu	306 (95.3)	15 (4.7)	0 (0.0)	0 (0.0)	321 (100.0)
Sabah	62 (12.0)	67 (13.0)	4 (0.8)	384 (74.3)	517 (100.0)
Sarawak	107 (29.1)	79 (21.5)	6 (1.6)	176 (47.8)	368 (100.0)
Kuala Lumpur	106 (55.8)	51 (26.8)	31 (16.3)	2 (1.1)	190 (100.0)
Labuan	7 (46.7)	1 (6.7)	0 (0.0)	7 (46.7)	15 (100.0)
Putrajaya	244 (94.2)	2 (0.8)	4 (1.5)	9 (3.5)	259 (100.0)

B.4.4 Distribution of Women of Four Main Ethnic Groups in 2015

2015	MM	MC	MI	OIP	Total
Johor	337 (66.2)	123 (24.2)	38 (7.5)	11 (2.2)	509 (100.0)
Kedah	294 (86.2)	10 (2.9)	35 (10.3)	2 (0.6)	341 (100.0)
Kelantan	323 (98.2)	6 (1.8)	0 (0.0)	0 (0.0)	329 (100.0)
Melaka	255 (78.2)	50 (15.3)	17 (5.2)	4 (1.2)	326 (100.0)
Negeri Sembilan	227 (69.4)	28 (8.6)	69 (21.1)	3 (0.9)	327 (100.0)
Pahang	262 (76.6)	32 (9.4)	24 (7.0)	24 (7.0)	342 (100.0)
Penang	209 (57.1)	129 (35.2)	28 (7.7)	0 (0.0)	366 (100.0)
Perak	228 (61.5)	56 (15.1)	82 (22.1)	5 (1.3)	371 (100.0)
Perlis	277 (92.0)	17 (5.6)	7 (2.3)	0 (0.0)	301 (100.0)
Selangor	521 (66.5)	139 (17.7)	109 (13.9)	15 (1.9)	784 (100.0)
Terengganu	325 (98.5)	5 (1.5)	0 (0.0)	0 (0.0)	330 (100.0)
Sabah	7 (1.8)	26 (6.8)	1 (0.3)	349 (91.1)	383 (100.0)
Sarawak	103 (27.1)	98 (25.8)	0 (0.0)	179 (47.1)	380 (100.0)
Kuala Lumpur	114 (54.8)	65 (31.3)	26 (12.5)	3 (1.4)	208 (100.0)
Labuan	1 (5.9)	1 (5.9)	0 (0.0)	15 (88.2)	17 (100.0)
Putrajaya	176 (94.1)	0 (0.0)	3 (1.6)	8 (4.3)	187 (100.0)

Appendix C

Social patterning of mean BMI at the population-level for 1996

Table C.5.1 shows the results of the fixed part of the null model for year 1996. The intercept in the null model (or Model 1) is the overall mean BMI for the sample containing all four main ethnic groups across all states (n=13) and federal territories (n=2) in Malaysia. As can be seen in Table C.5.1, the overall mean BMI for four main ethnic groups was 23.205 kg/m^2 in 1996. This indicates that the mean weight was in the healthy range, as defined by the WHO International Classification (24.9 kg/m^2). However, a mean weight of 23.205 kg/m^2 is higher than the maximum Asian cut-off points for a healthy weight (18.5 kg/m^2 to 22.9 kg/m^2) and indicates that a public health intervention focusing on weight is required.

The total variance reported in Table C.5.1 was separated into three components: state-level, enumeration-block-level and individual-level. The variability of mean BMI that could be assigned to differences between states was 0.154, which was smaller than the BMI variance at the enumeration-block level (0.845). The main source of variation in mean BMI arose because of differences between women at the individual-level, which accounted for 20.399 of the variances in mean BMI in the year of 1996.

The state ICC was 0.007 whereas the ICC at the enumeration-block level was approximately seven times higher (0.047) than the state-level ICC. This suggested that the similarities between women were greater at the enumeration-block-level than at the state-level.

Table C.5.1

Results of the Fixed and Random Parts of Model 1 Population-level Analyses for 1996

Model 1			
Parameter	Mean	Std. Err.	P-value
Intercept	23.205	0.116	0.000
State-level variance	0.154	0.092	
Enumeration-block-level variance	0.845	0.122	
Individual-level variance	20.399	0.286	
Intraclass Correlation Coefficients (ICCs)			
State-level	0.007		
Enumeration-block-level	0.047		

Model 2: addition of individual-level explanatory variables using the 1996 data set

Table C.5.2 presents the results of the fixed part of Model 2. Model 2 was built on Model 1 by adding four individual-level socio-demographic characteristics: ethnicity, age, marital status and education. The Model 2 analysis was based on n=11629 women, n=2019 enumeration blocks and n=15 (13 states, Federal Territory of Kuala Lumpur and Federal Territory of Labuan).

There was an increase in the overall mean BMI as represented by the intercept after adjusting for individual-level explanatory variables and clustering effects. Results in Table C.5.2 suggest ethnic differences in BMI might have existed in 1996 across four main ethnic groups women. The Malaysian Chinese women had the lowest mean BMI, which was significantly lower (1.043 kg/m^2) than the mean BMI of Malaysian Malay women. The mean BMI of women from Other Indigenous Minority Ethnic Groups was significantly lower (0.457 kg/m^2) than the mean BMI of Malaysian Malay women. In contrast to both Malaysian Chinese and women from Other Indigenous Minority Ethnic Groups, Malaysian Indian women had a higher mean BMI than Malaysian Malay women (0.066 kg/m^2). However, the difference in mean BMI between Malaysian Malay women and Malaysian Indian women was not significant.

As expected, there was a significant mean BMI-age gradient across the four main ethnic groups. The difference in mean BMI between the youngest age group (18-25 year-old) and the oldest (42-49 year-old) was 2.442 kg/m^2. Women in the age group of 26-33 years old had a mean BMI that was 1.489 kg/m^2 lower than the mean BMI for the oldest group. The difference in mean BMI for women who were 34-41 years old compared to the mean BMI of women who were 42-49 years old was 0.359 kg/m^2. Thus, the mean BMI increased as women got older.

Married women had a higher mean BMI than unmarried and never married women. Being unmarried was linked to a significantly lower (0.598 kg/m^2) mean BMI when compared with women who were married. Being a never married woman was also linked to a significantly lower (1.078 kg/m^2) mean BMI when compared with women who were married.

The associations between mean BMI and education varied according to education level. Tertiary educated women had a lower mean BMI than non-tertiary educated women. Women without a formal education had a significantly higher mean BMI (0.327 kg/m^2) than women who had completed tertiary education. The significant difference in mean BMI was even higher when tertiary educated women were compared to women who were educated to the primary level (1.056 kg/m^2) and women who were educated to the secondary level (0.427 kg/m^2).

Table C.5.2
Results of the Fixed Parts of Model 1 and 2 Population-level Analyses for 1996

Fixed Part	Model 1			Model 2		
BMI	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value
Intercept	23.205	0.116	0.000	24.355	0.188	0.000
Ethnicity						
Malaysian Chinese				-1.043	0.109	0.000
Malaysian Indian				0.066	0.168	0.343
Other Indigenous Minority Ethnic Groups				-0.457	0.149	0.002
Malaysian Malay (ref.)						
Age						
18-25				-2.442	0.146	0.000
26-33				-1.489	0.130	0.000
34-41				-0.359	0.125	0.002
42-49 (ref.)						
Marital Status						
Never Married				-1.078	0.116	0.000
Unmarried				-0.598	0.242	0.005
Married (ref.)						
Education						
None				0.327	0.201	0.050
Primary				1.056	0.157	0.000
Secondary				0.427	0.141	0.001
Tertiary (ref.)						
Sample size						
Women	11974			11629		
Enumeration-block	2023			2019		
States	15			15		

Note: ref. refers to base category

The random part of Model 2 is shown in Table C.5.3. There was a reduction in variance at all three levels after adjusting for individual-level explanatory variables. The mean BMI variability that was related to differences between states fell from 0.154 in Model 1 to 0.048 in Model 2. Variability in mean BMI between enumeration blocks within a state decreased from 0.845 to 0.687. The mean BMI variability was also lower at the individual level in Model 2 but was still large among individual women (18.506).

The ICC for state and enumeration-block were also lower in Model 2 than Model 1 as a consequence of adding individual-level explanatory variables together with the consideration of clustering effects. As can be seen in Model 2, the reported state ICC fell by 0.005, from 0.007 to 0.002 whereas the enumeration-block ICC decreased by 0.009, from 0.047 to 0.038.

Table C.5.3
Results of the Random Parts of Model 1 and 2 Population-level Analyses for 1996

	Model 1		Model 2	
Parameter	Mean	Std. Err.	Mean	Std. Err.
State-level variance	0.154	0.092	0.048	0.045
Enumeration-block-level variance	0.845	0.122	0.687	0.134
Individual-level variance	20.399	0.286	18.506	0.263
Intraclass Correlation Coefficients (ICCs)				
State-level	0.007		0.002	
Enumeration-block-level	0.047		0.038	

The normality assumption was checked with Quantile-quantile plots, as illustrated in Figures C.5.1 to C.5.3. Each plot showed some residuals dots scattered along some parts of a diagonal line. Therefore, the assumption of normality in Model 2 was acceptable.

Figure C.5.1 Quantile-quantile Plot for Model 2: Individual-level

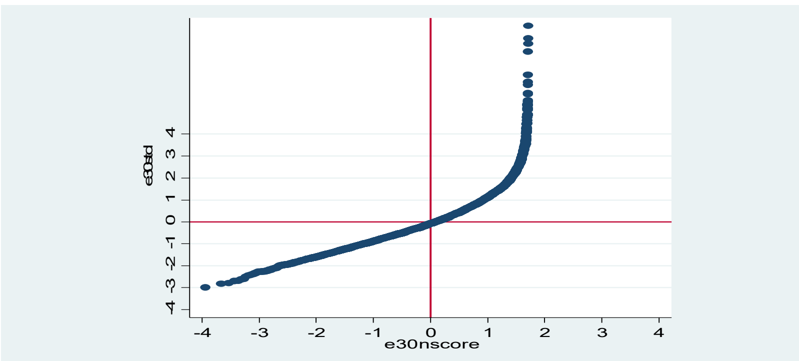


Figure C.5.2 Quantile-quantile Plot for Model 2: Enumeration-block-level

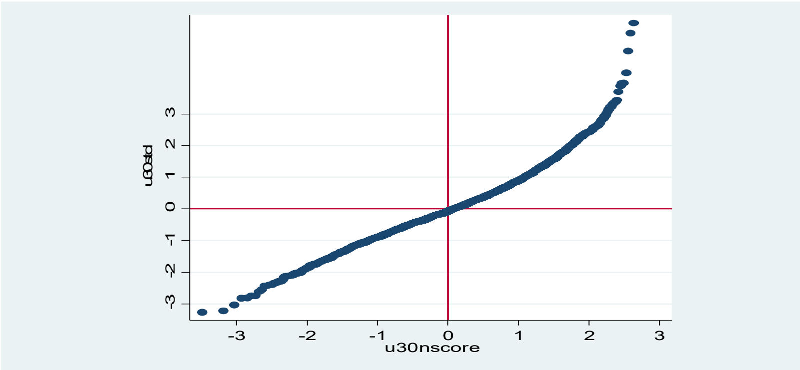
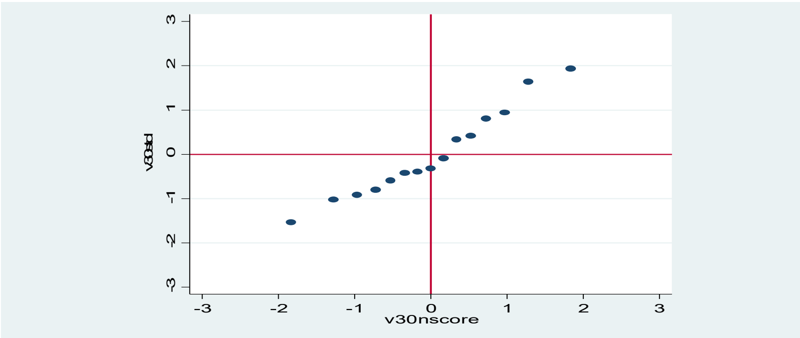


Figure C.5.3 Quantile-quantile Plot for Model 2: State-level



Model 3: addition of enumeration-block level explanatory variable using the 1996 data set

Table C.5.4 provides the results of the fixed part of Model 3. Model 3 was fitted with four individual-level explanatory variables together with an enumeration-block-level explanatory variable. The relative importance and significance of the intercept and individual-level factors in relation to mean BMI were similar to those in Model 2.

Differing relationships between BMI and the four classifications of the enumeration-block level are also presented in Model 3. The mean BMI of women living in rural areas was 0.145 kg/m^2 lower than the mean BMI of women living in metropolitan areas. In contrast, the mean BMI of women living in small and large urban areas was higher than the mean BMI of women living in metropolitan areas. The difference between the mean BMI of women living in small urban areas and women living in metropolitan areas was 0.314 kg/m^2. The mean BMI differed by 0.097 kg/m^2 when women living in large urban areas were compared to women living in metropolitan areas. However, the differences between the mean BMI of women living in metropolitan areas compared to the mean BMI of women living in rural, small urban areas, large urban areas were not significant at the five percent level.

Table C.5.4
Results of the Fixed Parts of Model 1, 2 and 3 Population-level Analyses for 1996

Fixed Part	Model 1			Model 2			Model 3		
BMI	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value
Intercept	23.205	0.116	0.000	24.355	0.188	0.000	24.380	0.191	0.000
Ethnicity									
Malaysian Chinese				-1.043	0.109	0.000	-1.092	0.115	0.000
Malaysian Indian				0.066	0.168	0.343	0.035	0.166	0.420
Other Indigenous Minority Ethnic Groups				-0.457	0.149	0.002	-0.440	0.150	0.002
Malaysian Malay (ref.)									
Age									
18-25				-2.442	0.146	0.000	-2.433	0.149	0.000
26-33				-1.489	0.130	0.000	-1.485	0.130	0.000
34-41				-0.359	0.125	0.002	-0.361	0.125	0.003
42-49 (ref.)									
Marital Status									
Never Married				-1.078	0.116	0.000	-1.085	0.117	0.000
Unmarried				-0.598	0.242	0.005	-0.608	0.237	0.004
Married (ref.)									
Education									
None				0.327	0.201	0.050	0.372	0.200	0.030
Primary				1.056	0.157	0.000	1.084	0.163	0.000
Secondary				0.427	0.141	0.001	0.442	0.141	0.001
Tertiary (ref.)									
Enumeration block Urbanicity									
Rural							-0.145	0.109	0.091
Small Urban							0.314	0.245	0.099
Large Urban							0.097	0.136	0.235
Metropolitan (ref.)									
Sample size									
Women	11974			11629			11629		

Enumeration-block	2023			2019			2019		
States	15			15			15		

Note: ref. refers to base category

The random part of Model 3 is shown in Table C.5.5. The mean BMI variability at the state- and individual-level increased to 0.053 and 18.511 respectively after taking neighbourhood characteristics, individual characteristics as well as the clustering effects into account. However, the enumeration-block variance decreased from 0.687 to 0.678 in Model 3. The state-level ICC (0.003) was smaller than the enumeration-block ICC (0.038). It indicated similarities were largely found between enumeration-blocks in a state or federal territory.

Table C.5.5
Results of the Random Parts of Model 1, 2 and 3 Population-level Analyses for 1996

	Model 1		Model 2		Model 3	
Parameter	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
State-level variance	0.154	0.092	0.048	0.045	0.053	0.044
Enumeration-block-level variance	0.845	0.122	0.687	0.134	0.678	0.145
Individual-level variance	20.399	0.286	18.506	0.263	18.511	0.267
Intraclass Correlation Coefficients (ICCs)						
State-level	0.007		0.002		0.003	
Enumeration-block-level	0.047		0.038		0.038	

The Quantile-quantile plots, as illustrated in Figures C.5.4 to C.5.6, demonstrated the assumption of normality was being met.

Figure C.5.4 Quantile-quantile Plot for Model 3: Individual-level

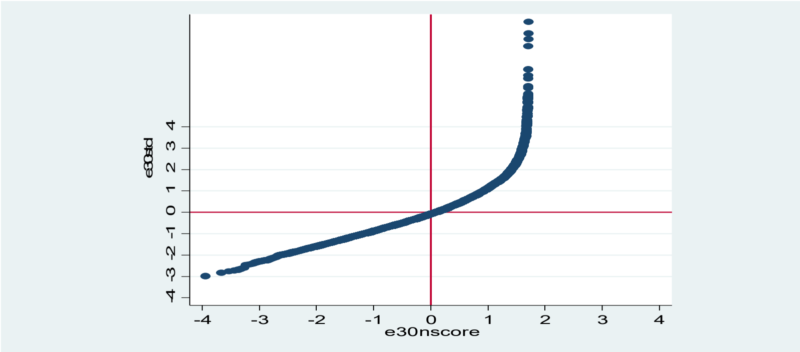


Figure C.5. 5 Quantile-quantile Plot for Model 3: Enumeration-block-level

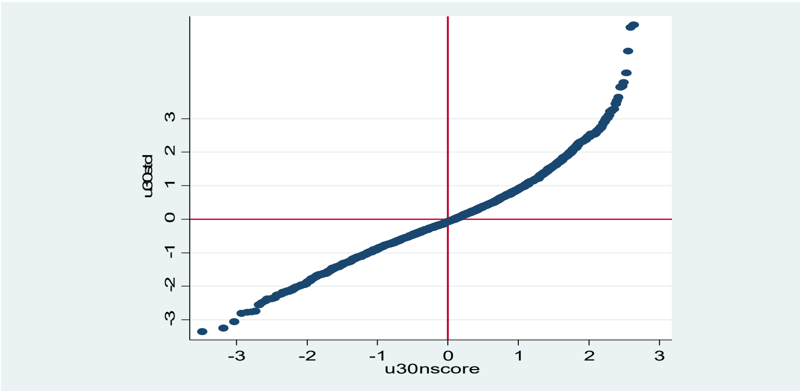
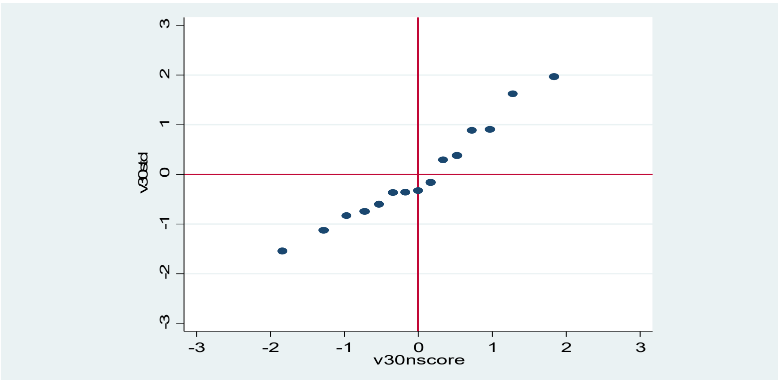


Figure C.5.6 Quantile-quantile Plot for Model 3: State-level



Model 4: addition of state-level explanatory variables using the 1996 data set

Model 4 comprised of individual-, enumeration-block- and state-level explanatory variables and the outcome of women's mean BMI. Table C.5.6 shows the results for Model 4. The final sample size for Model 4 was 11,629 women who lived in 2019 enumeration-blocks across 13 states, Federal Territory of Kuala Lumpur and Labuan in Malaysia. After adjusting for compositional, contextual and clustering effects on the mean BMI, the means for individual- and enumeration-block-level related variables remained largely the same. Hence, the remainder of this section focuses on changes in the Means of intercept, the effect of the two state-level explanatory factors (proportion of tertiary educated women in a state or federal territory (TEW) and income inequality) on mean BMI.

Differences in the proportion of tertiary educated women in a state had small and non-significant effect on women's mean BMI. Compared to the mean BMI of women living in a state that had a high proportion of tertiary educated women, the mean BMI was lower among women living in both a state that had a low proportion of women who were tertiary educated (0.006 kg/m^2), and a state that had a middle proportion of tertiary educated women (0.120 kg/m^2).

Income inequality was negatively associated with women's mean BMI. An increase in income inequality by one unit contributed to a decrease of BMI by 3.883 kg/m^2. The effect size was therefore large. The association between income inequality and mean BMI was not however significant. This was because the standard error was also large. The large standard error was I propose largely related to having a small sample size for states and federal territories (n=15).

The large effect size of income inequality could be reduced by replacing current raw Gini Coefficients value with the one that was divided by 0.1. The use of transformed Gini Coefficient attenuated the strength of the association between mean BMI and income inequality but did not affect the direction of the association. But the overall mean remained unchanged. In my case, an increase in a unit of income inequality (0.1) led to an increase of mean BMI by 0.3883 kg/m^2, while holding other variables at constant.

The output of the random part of Model 4 is shown in Table C.5.7. There were some changes in BMI variances after considering compositional and contextual effects on mean BMI. The variability in mean BMI that was attributable to differences between states increased from 0.053 to 0.063. As for enumeration-block-level, the variability decreased from 0.678 to 0.664. An increase in variability was also observed across individuals, rising from 18.511 to 18.523, as reported in Model 4. The reported ICCs in Model 4 were similar to those reported in Model 3. Hence, the same interpretations were drawn for Model 4.

The normality assumption on Model 4 was checked using the Quantile-quantile plot. Inspection on each plot of these plots (as displayed from Figures C.5.7 to C.5.9) indicated that the assumption of normality was being met.

Table C.5.6
Results of the Fixed Parts of Model 1, 2, 3 and 4 Population-level Analyses for 1996

Fixed Part	Model 1			Model 2			Model 3			Model 4		
BMI	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value
Intercept	23.205	0.116	0.000	24.355	0.188	0.000	24.380	0.191	0.000	26.056	1.292	0.000
Ethnicity												
M. Chinese				-1.043	0.109	0.000	-1.092	0.115	0.000	-1.102	0.112	0.000
M. Indian				0.066	0.168	0.343	0.035	0.166	0.420	0.003	0.168	0.490
OIP				-0.457	0.149	0.002	-0.440	0.150	0.002	-0.406	0.161	0.006
M.Malay (ref.)												
Age												
18-25				-2.442	0.146	0.000	-2.433	0.149	0.000	-2.434	0.147	0.000
26-33				-1.489	0.130	0.000	-1.485	0.130	0.000	-1.482	0.130	0.000
34-41				-0.359	0.125	0.002	-0.361	0.125	0.003	-0.360	0.122	0.002
42-49 (ref.)												
Marital Status												
Never Married				-1.078	0.116	0.000	-1.085	0.117	0.000	-1.081	0.115	0.000
Unmarried				-0.598	0.242	0.006	-0.608	0.237	0.004	-0.612	0.236	0.004
Married (ref.)												
Education												
None				0.327	0.201	0.050	0.372	0.200	0.030	0.370	0.198	0.033
Primary				1.066	0.157	0.000	1.084	0.163	0.000	1.077	0.157	0.000
Secondary				0.427	0.141	0.001	0.442	0.141	0.001	0.433	0.138	0.001
Tertiary (ref.)												
EB Urbanicity												
Rural							-0.145	0.109	0.091	-0.145	0.112	0.096
Small Urban							0.314	0.245	0.099	0.320	0.247	0.098
Large Urban							0.097	0.136	0.235	0.099	0.139	0.235
Metropolitan (ref.)												
Proportion of TEW												
Low										-0.006	0.234	0.496
Mild										-0.120	0.214	0.279
High (ref.)												
Income Inequality										-3.883	2.979	0.094
Sample Size												
Women	11974			11629			11629			11629		
EB	2023			2019			2019			2019		
States	15			15			15			15		

Notes:
1) ref. refers to base category
2) M.Chinese refers to Malaysian Chinese, M.Indian refers to Malaysian Indian, OIP refers to Other Indigenous Minority Groups, M.Malay refers to Malaysian Malay
3) TEW refers to tertiary educated women in a given state

Table C.5.7 Results of the Random Parts of Model 1, 2, 3 and 4 Population-level Analyses for 1996

	Model 1		Model 2		Model 3		Model 4	
Parameter	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
State-level variance	0.154	0.092	0.048	0.045	0.053	0.044	0.063	0.055
Enumeration-block-level variance	0.845	0.122	0.687	0.134	0.678	0.145	0.664	0.117
Individual-level variance	20.399	0.286	18.506	0.263	18.511	0.267	18.523	0.263
Intraclass Correlation Coefficients (ICCs)								
State-level	0.007		0.002		0.003		0.003	
Enumeration-block-level	0.047		0.038		0.038		0.038	

Figure C.5.7 Quantile-quantile Plot for Model 4: Individual-level

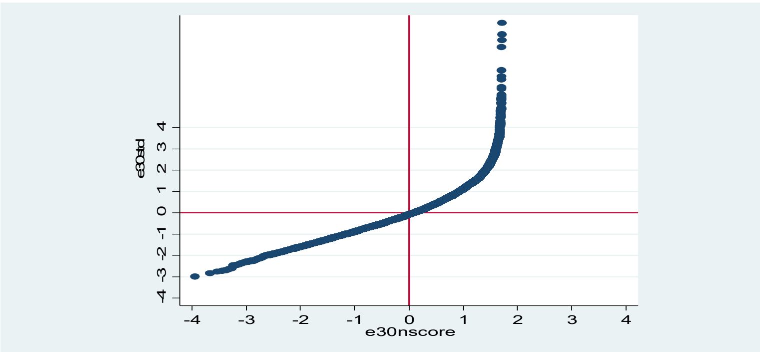


Figure C.5.8 Quantile-quantile Plot for Model 4: Enumeration-block-level

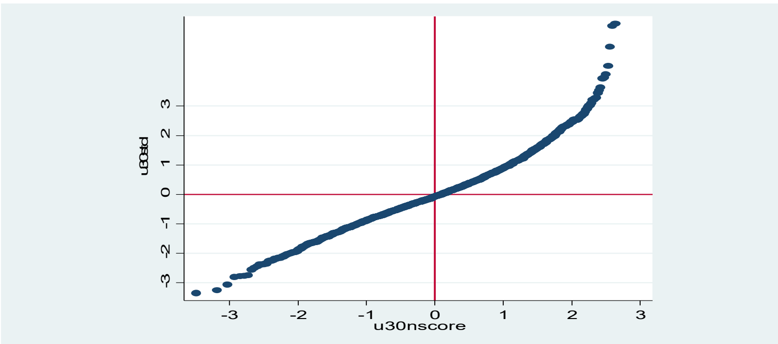
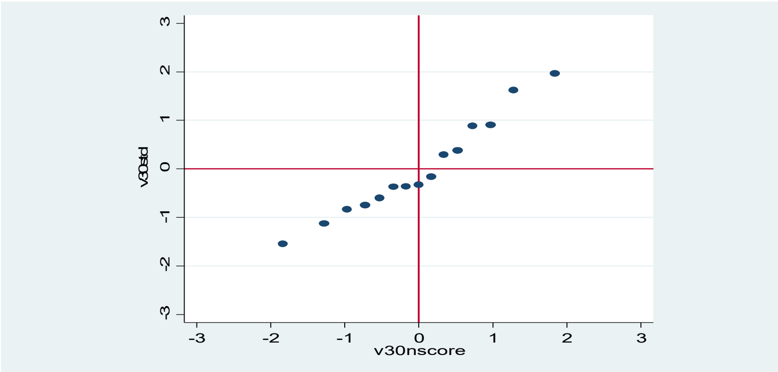


Figure C.5.9 Quantile-quantile Plot for Model 4: State-level



Summary of key findings of 1996 data

In sum, Malaysian Malay women had a significantly higher mean than BMI Malaysian Chinese women and women from Other Indigenous Minority Ethnic Groups. However, the mean BMI of Malaysian Malay women and Malaysian Indian women was not significantly different. Age was positively and significantly related to mean BMI. Positive age-mean BMI gradient existed across four main ethnic groups women in 1996. Married women had a significantly higher mean BMI than unmarried women and women who had never married. Tertiary educated women had a significantly lower mean BMI than women who had no formal education, women who were educated to the primary level and women who were educated to the secondary level.

Social patterning of mean BMI at the population-level for 2006

Table C.5.8 presents the results of the fixed part models for year 2006. Before estimating the fixed part of the full models, the null model was built without including any explanatory variables, based on n=11,519 women, n= 2,108 enumeration blocks and n=15 states (13 states and two Federal Territories: Kuala Lumpur and Labuan). The intercept in the null model is the overall mean BMI for a sample containing women from all four main ethnic groups in Malaysia. As reported in Table C.5.8, the overall mean BMI for women from the four main ethnic groups was 25.068 kg/m^2.

Model 6 represented my full model for the 2006 population-based analysis using the same sample as the null model. It was built on the null model by including four individual-level socio-demographic factors (ethnicity, age, marital status and education), one enumeration-block-level variable (urbanicity) and two state-level variables (proportion of tertiary educated women in a state (TEW) and state-level income inequality).

Results in Table C.5.8 suggested ethnic differences in the mean BMI emerged in 2006 across the four main ethnic groups. After adjusting for compositional, contextual and clustering effects on the mean BMI, the overall mean BMI increased from 25.068 kg/m^2 to 28.867 kg/m^2.

The Malaysian Chinese women had the lowest mean BMI and their mean BMI was significantly lower (2.390kg/m^2) than the mean BMI of Malaysian Malay women. The mean BMI of women from Other Indigenous Minority Ethnic Groups was also significantly lower (0.509 kg/m^2) than the mean BMI of Malaysian Malay women. In contrast to both Malaysian Chinese and women from Other Indigenous Minority Ethnic Groups, Malaysian Indian women had a higher mean BMI than Malaysian Malay women (0.147 kg/m^2). However, the difference in mean BMI between Malaysian Malay women and Malaysian Indian women was not significant.

As expected, there was a significant mean BMI-age gradient across the four main ethnic groups and mean BMI increased as women got older. The largest significant difference in mean BMI (3.534 kg/m^2) was found between the youngest age group (18-25 year-old) and the oldest age group (42-49 year-old). Women in the age group of 26-33 years old had a mean BMI that was significantly lower (1.708 kg/m^2) than the mean BMI for the oldest group. The difference in mean BMI for women who were 34-41 years old compared to the mean BMI of women who were 42-49 years was also significantly lower (0.896 kg/m^2). In 2006, unmarried women had a significantly lower mean BMI (0.503 kg/m^2) than married women as did never married women (1.079 kg/m^2).

In 2006, tertiary educated women had a lower mean body weight than non-tertiary educated women. Women without a formal education had a mean BMI that was 0.257 kg/m^2 higher than those who had completed tertiary education but this difference was not significant. In contrast, the mean BMI of tertiary educated women was significantly lower than the mean BMI of women who were educated to the primary level (0.935 kg/m^2) and secondary level (0.416 kg/m^2). Urbanicity of enumeration blocks was not significantly related to mean BMI. Residents of metropolitan areas had a higher mean BMI (0.022 kg/m^2) than residents of rural enumeration blocks but a lower mean BMI than residents of small urban areas (0.338 kg/m^2) and large urban areas (0.036 kg/m^2).

Differences in the proportion of tertiary educated women at the state-level had small and non-significant associations with women's mean BMI. The mean BMI of women living in a state that had a high proportion of tertiary educated women was higher than the mean BMI of women living in a state that had a low proportion of women who were tertiary educated (0.243 kg/m^2). But their mean BMI was lower than the mean BMI of women living within a state with middle proportion of tertiary educated women (0.018 kg/m^2).

Income inequality was negatively associated with women's mean BMI. An increase in income inequality by one unit contributed to decrease of BMI by 4.715 kg/m^2. The association between income inequality and mean BMI was not significant in 2006.

Table C.5.8
Results of the Fixed Part of Model 5 and 6 Population-level Analyses for 2006

	Model 5			Model 6		
Fixed Part	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value
Intercept	25.068	0.146	0.000	28.867	2.324	0.000
Ethnicity						
Malaysian Chinese				-2.390	0.145	0.000
Malaysian Indian				0.147	0.180	0.202
Other Indigenous Minority Ethnic Groups				-0.509	0.194	0.006
Malaysian Malay (ref.)						
Age						
18-25				-3.534	0.174	0.000
26-33				-1.708	0.143	0.000
34-41				-0.896	0.139	0.000
42-49 (ref.)						
Marital status						
Never married				-1.079	0.148	0.000
Unmarried				-0.503	0.251	0.022
Married (ref.)						
Education						
None				0.257	0.281	0.179
Primary				0.935	0.190	0.000
Secondary				0.416	0.155	0.003
Tertiary (ref.)						
Enumeration Block Urbanicity						
Rural				-0.022	0.167	0.446
Small urban				0.338	0.269	0.105
Large urban				0.036	0.135	0.389
Metropolitan (ref.)						
Proportion of TEW						
Low				-0.243	0.387	0.263
Mid				0.018	0.442	0.488
High (ref.)						
Income Inequality				-4.715	5.296	0.163
Sample Size						
Women	11519			11519		
Enumeration-block	2108			2108		
States	15			15		

Notes:
1) ref. refers to base category
2) TEW refers to tertiary educated women in a given state or federal territory

The random parts of Models 5 (null model) and 6 (full model) are shown in Table C.5.9. All BMI variances declined after considering compositional, contextual and clustering effects on mean BMI. As compared to Model 5, the random output in Model 6 indicated that the variability in mean BMI that was attributable to differences between states decreased from 0.292 to 0.194. At the enumeration-block-level, the variability also decreased from 1.414 to 0.949. Despite a decrease in variability at the individual-level, variability between individuals was still the largest (25.904).

The ICC for state and enumeration-block were also lower in Model 6 than in Model 5 as a consequence of adding explanatory variables together with the clustering effects. As can be seen in Model 6, the reported state ICC fell from 0.010 to 0.007 whereas the enumeration-block ICC decreased from 0.055 to 0.042. Hence, similarities were still concentrated between enumeration-blocks within a state or federal territory.

Quantile-quantile plots were employed to test whether errors in Model 6 were distributed normally. Inspection of each plot indicated that the assumption of normality was reasonable (Figures C.5.10 to C.5.12).

Table C.5.9
Results of the Random Part of Models 5 and 6 for Population Analyses in 2006

	Model 5		Model 6	
Parameter	Mean	Std. Err.	Mean	Std. Err.
State-level variance	0.292	0.155	0.194	0.134
Enumeration-block-level variance	1.414	0.215	0.949	0.191
Individual-level variance	29.057	0.417	25.904	0.371
Intraclass Correlation Coefficients (ICCs)				
State-level	0.010		0.007	
Enumeration-block-level	0.055		0.042	

Figure C.5.10 Quantile-quantile Plot for Model 6: Individual-level

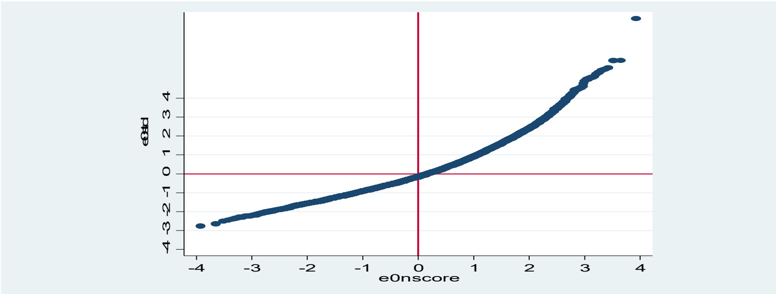


Figure C.5.11 Quantile-quantile Plot for Model 6: Enumeration-block-level

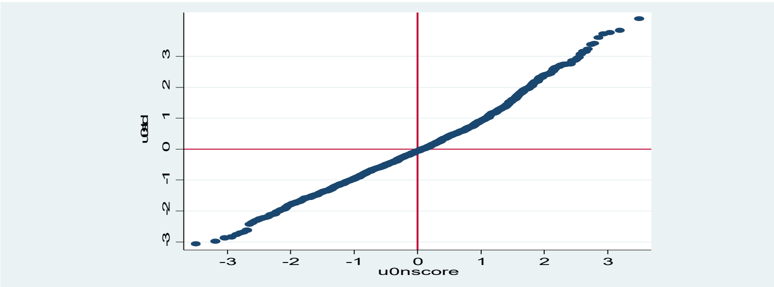
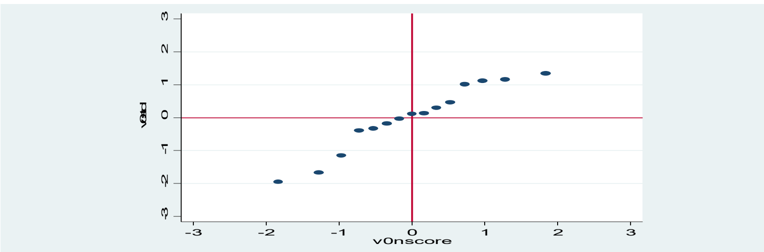


Figure C.5.12 Quantile-quantile Plot for Model 6: State-level



Summary of key findings of 2006 data

The mean BMI differed significantly across Malaysian Chinese, Other Indigenous Minority Ethnic Groups, all age groups, never married and unmarried women in 2006. The relationships of mean BMI-ethnicity, -age, -marital status and –income inequality remained the same direction as in 1996 but their strengths varied in 2006.

In 2006, women with tertiary education had a lower mean BMI than women with no formal education, primary education and secondary education. However, significant differences in mean BMI were only observed between women of tertiary education and women of primary and secondary education.

Social patterning of mean BMI at the population-level for 2011

Table C.5.10 presents the results of the fixed part for the null and full models for year 2011. Before estimating the fixed part of models, the null model (Model 7) was built without including any explanatory variables. It was fitted based on n=5,451 women, n= 781 enumeration blocks, n=16 (13 states and 3 federal territories: Kuala Lumpur, Labuan and Putrajaya). The intercept in the null model is the overall mean BMI for sample containing women from all four main ethnic groups in Malaysia. As reported in Table C.5.10, the overall mean BMI for the sample that included women from the four main ethnic groups was 25.491 kg/m^2.

Model 8 represented my full model for the 2011 population-based analysis using the same sample as the null model. It was built on the null model by including four individual-level socio-demographic factors (ethnicity, age, marital status and education), one enumeration-block-level variable (urbanicity) and two state-level variables (proportion of tertiary educated women in a state (TEW) and state-level income inequality).

As can be seen in Table C.5.10, Model 8 suggested ethnic differences in mean BMI presented in 2011. Assuming other factors were held at constant, the Malaysian Chinese women had a significantly lower mean BMI (3.040 kg/m^2) than Malaysian Malay women. The mean BMI of women from Other Indigenous Minority Ethnic Groups was also significantly lower (1.202 kg/m^2) than the mean BMI of Malaysian Malay women. In contrast to both Malaysian Chinese women and women from Other Indigenous Minority Ethnic Groups, Malaysian Indian women had a smaller (0.035 kg/m^2) but not significantly different mean BMI than Malaysian Malay women.

As expected, there was a significant positive mean BMI-age gradient and mean BMI therefore increased as women got older. The mean BMI of women in the oldest age group (42-49 year-old) was 0.440 kg/m^2 greater than the mean BMI of women aged 34-41 years old, 1.106 kg/m^2 greater than the mean BMI of women aged 26-33 years old and 2.734 kg/m^2 greater than the mean BMI of women aged 18-25 years old.

Married women had a higher mean BMI than unmarried women (0.110 kg/m^2) but this difference in mean BMI was not significant. However, married women had a significantly higher mean BMI than women who had not married (0.994 kg/m^2).

There were significant negative associations between mean BMI and education level whereby women who were educated to the tertiary level had the lowest mean BMI. The mean BMI of tertiary educated women was lower than the mean BMI of secondary educated women (0.607 kg/m^2), primary educated women (1.188 kg/m^2) and women who had no formal education (1.281 kg/m^2). There appeared a negative monotonic relationship between education level and mean BMI.

At the enumeration-block level, the mean BMI of women living in metropolitan areas was slightly lower than the non-metropolitan residents. However, the mean BMI of women living in metropolitan areas was not significantly different to the mean BMI of women living in large urban areas, small urban areas or rural areas. Women who resided in metropolitan areas had a lower mean BMI of 0.116 kg/m^2 than women who resided in rural areas. Their mean BMI was also lower by 0.404 kg/m^2 unit and 0.296 kg/m^2 unit compared to women from small and large urban areas.

At the state-level, differences in the proportion of tertiary educated women in a state were not associated with significant differences in mean BMI. Living states with a in high proportion of tertiary educated women was associated with a non-significant greater mean BMI compared with living in low (0.172

kg/m²) or middle (0.176 kg/m²) proportion of tertiary educated women states. Income inequality was negatively but was not significantly associated with women's mean BMI. An increase in income inequality by one unit contributed to an increase of BMI by 5.219 kg/m².

Table C.5.10
Results of the Fixed Part of Model 7 and 8 Population-level Analyses for 2011

	Model 7			Model 8		
Fixed Part	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value
Intercept	25.491	0.166	0.000	24.944	1.369	0.000
Ethnicity						
Malaysian Chinese				-3.040	0.224	0.000
Malaysian Indian				-0.035	0.289	0.449
Other Indigenous Minority Ethnic Groups				-1.202	0.358	0.000
Malaysian Malay (ref.)						
Age						
18-25				-2.734	0.278	0.000
26-33				-1.106	0.233	0.000
34-41				-0.440	0.218	0.023
42-49 (ref.)						
Marital status						
Never married				-0.994	0.231	0.000
Unmarried				-0.110	0.441	0.401
Married (ref.)						
Education						
None				1.281	0.545	0.008
Primary				1.188	0.287	0.000
Secondary				0.607	0.181	0.000
Tertiary (ref.)						
Enumeration Block Urbanicity						
Rural				0.116	0.196	0.275
Small urban				0.404	0.328	0.104
Large Urban				0.296	0.298	0.164
Metropolitan (ref.)						
Proportion of TEW						
Low				-0.172	0.392	0.316
Middle				-0.176	0.311	0.262
High (ref.)						
Income inequality				5.219	3.589	0.070
Sample size						
Women	5451			5319		
EB	781			786		
States	16			16		

The three random effects, which arose from the state-, enumeration-block- and individual-level are shown in Table C.5.11. There was a reduction in variance at all three levels after adjusting for the individual-level, enumeration-block-level and state-level related explanatory variables (see Model 8). The variability in mean BMI that was related to differences between states fell from 0.270 in the null model to 0.119 in the full model. Variability in mean BMI between enumeration-blocks within a state decreased from 1.568 to 0.323. The mean BMI variability was also lower at the individual level for the full model (30.478) compared to the null model (32.417).

The ICC for state-level and enumeration-block level were also lower in the full model than the null model as a consequence of adding all the explanatory variables and simultaneously considering the clustering effects. The state ICC fell by 0.005, from 0.008 to 0.003 whereas the enumeration-block ICC decreased from 0.054 to 0.014. The ICC statistics indicated that there was greater similarity between Malaysian Malay women who lived in the same enumeration-block than between Malaysian Malay women who lived in the same state but different enumeration-blocks within a state.
The normality assumption was checked using Quantile-quantile plots (Figures C.5.13 to C.5.15). Each plot showed some residuals dots scattered along some parts of a diagonal line and within the normality range values (-2.000 to +2.000). Therefore, the assumption of normality in Models 7 and 8 was acceptable.

Table C.5.11
Results of the Random Part of Models 7 and 8 for Population Analyses in 2011

	Model 7		Model 8	
Parameter	Mean	Std. Err.	Mean	Std. Err.
State-level variance	0.270	0.204	0.119	0.127
Enumeration-block-level variance	1.568	0.293	0.323	0.357
Individual-level variance	32.417	0.667	30.478	0.682
Intraclass Correlation Coefficients (ICCs)				
State-level	0.008		0.003	
Enumeration-block-level	0.054		0.014	

Figure C.5.13 Quantile-quantile Plot for Model 8: Individual-level

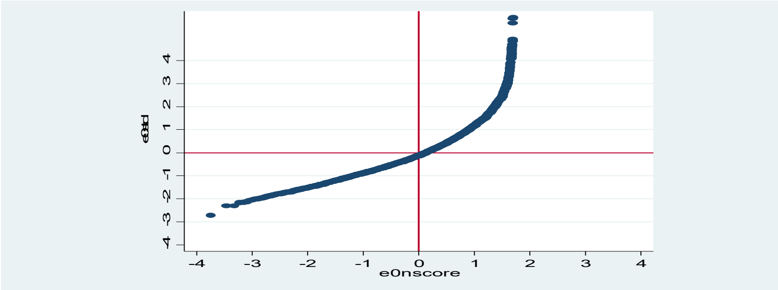


Figure C.5.14 Quantile-quantile Plot for Model 8: Enumeration-block-level

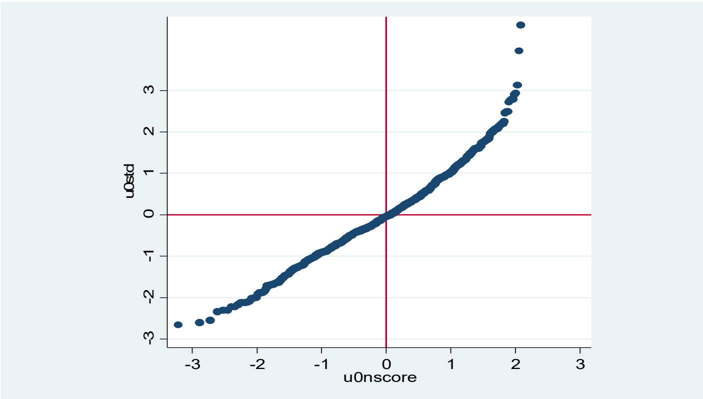
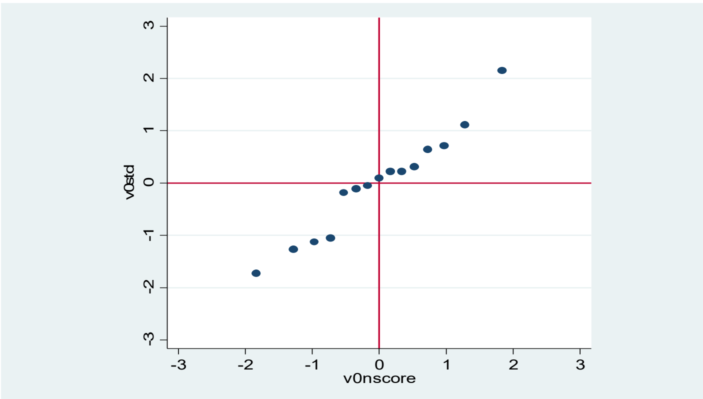


Figure C.5.15 Quantile-quantile Plot for Model 8: State-level



Summary of key findings of 2011 data

The 2011 population-based studies suggested the presence of higher mean BMI among Malaysian Malay relative to other three ethnic groups. Malaysian Malay women had a significant higher mean BMI than Malaysian Chinese women and women from Other Indigenous People Minority Groups. Their mean BMI was not significantly greater when compared to Malaysian Indian women. Age-BMI gradient still persisted in year 2011. Being a married woman was associated with a higher mean BMI, when compared with being a single w9oman or an unmarried woman. Significant differences in mean BMI were only found between married and never married women in 2011. A negative education/mean BMI gradient emerged in 2011: higher educated, lower mean BMI.

5.4 Social patterning of mean BMI at the population-level for 2015

Table C.5.12 presents the results of the fixed part of models using 2015 data set. As usual, the null model (Model 9) was created prior to the full model. The null model was specified without any independent variables. As reported in Table C.5.12, the null model consisted of 5948 women, 867 enumeration-blocks, 13 states and three federal territories (Kuala Lumpur, Labuan and Putrajaya). The intercept for the null model represented the overall mean BMI for four main ethnic groups women. It was reported as 26.154 kg/m^2 in Model 9.

Model 10 represented the full model for the 2015 population-based analyses, drawing on the sample of n=5,464 women from n=860 enumeration-blocks and n=16 states and federal territories. It was fitted with four individual-level socioeconomic factors (ethnicity, age, marital status and educational level), one enumeration-block-level factor (urbanicity) and two state-level factors (proportion of tertiary educated women in a state and income inequality).

The results in Model 10 (Table C.5.12) indicated that the overall mean BMI increased from 26.154 kg/m^2 to 29.458 kg/m^2, after adjusting for the influences of socio-economic factors and clustering effects. Differences in mean BMI were persistent among women of four main ethnic groups in year 2015. The Malaysian Chinese women (3.062 kg/m^2) had a significantly lower mean BMI relative to Malaysian Malay women. Differences in mean BMI were also observed among women from Other Indigenous Minority Ethnic

Groups (0.470 kg/m^2) and Malaysian Indian women (0.220 kg/m^2) when compared with Malaysian Malay women. However, these differences were not significant.

In 2015, a negative age-mean BMI gradient appeared. The greatest age differences in mean BMI were between women aged 18-25 years-old and women aged 42-49 years-old (3.320 kg/m^2). The differences in mean BMI between women aged 26 to 33 year-old and women aged 42-49 years old was 1.407 kg/m^2. There was a difference of 0.178 kg/m^2 when women aged 42-49 years-old were compared with women aged 34-41 years-old but this difference was not significant.

In 2015, married women had a significantly higher mean BMI than never married women (0.434), but there was no significant difference between the mean BMIs of married and unmarried women.

Education influenced women's mean BMI differently. Mean BMI was higher for women who had no formal education (0.107), primary education (0.823) and secondary education (0.503) than the mean BMI of women who had tertiary education. A significant impact of education on mean BMI was only observed among women with primary and secondary education. Differences in mean BMI were not significant for women with no formal education and tertiary educated women (0.107). These changes could possibly be due to the small number of none educated women aged 18-49 years in the 2015 survey (n=162 or 2.5% of total sample size) which is likely to be underpinned by improvements in years of education among women in Malaysia.

Urbanicity appeared to have varying influences on mean BMI but most of its influences on mean BMI were not significant. Women living in rural areas had a significantly higher mean BMI, compared with women living in metropolitan areas (0.359 kg/m^2). At the state-level, I did not find any significant relationships between mean BMI and both the proportion of tertiary education women and income inequality.

However, living in the states with a high proportion of tertiary educated women was associated with a greater mean BMI compared with living in the states with a low proportion of tertiary educated women. Living in the states with middle proportion of tertiary educated women was associated with a difference in mean BMI of 0.410 kg/m^2. A one-unit increase in income inequality resulted in a decrease of BMI by 4.973 kg/m^2.

Table C.5.12
Results of the Fixed Part of Model 9 and 10 Population-level Analyses for 2015

	Model 9			Model 10		
Fixed Part	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value
Intercept	26.154	0.166	0.000	29.458	1.972	0.000
Ethnicity						
Malaysian Chinese				-3.062	0.251	0.000
Malaysian Indian				0.220	0.319	0.248
Other Indigenous Minority Ethnic Groups				-0.470	0.380	0.109
Malaysian Malay (ref.)						
Age						
18-25				-3.320	0.291	0.000
26-33				-1.407	0.233	0.000
34-41				-0.178	0.225	0.213
42-49 (ref.)						
Marital status						
Never married				-0.434	0.240	0.039
Unmarried				-0.110	0.383	0.385
Married (ref.)						
Education						
None				0.107	0.646	0.430
Primary				0.823	0.309	0.004
Secondary				0.503	0.189	0.004
Tertiary (ref.)						
Enumeration Block Urbanicity						
Rural				0.359	0.213	0.047
Small urban				0.400	0.396	0.157
Large Urban				0.359	0.258	0.080
Metropolitan (ref.)						
Proportion of TEW						
Low				-0.132	0.338	0.338
Middle				-0.410	0.299	0.075
High (ref.)						
Income inequality				-4.973	5.209	0.163
Sample size						
Women	5948			5464		
EB	867			860		
States	16			16		

Notes:
1) ref. refers to base category
2) TEW refers to tertiary educated women in a given state or federal territory
3) EB refers to enumeration-block

Table C.5.13 shows the random part of Model 11 and Model 12. The variance at the state, enumeration-block and individual levels decreased after adjustment for socioeconomic influences and clustering effects. The variances provided for state-level in the full model (Model 10) was smaller than the null model (Model 11). As shown in Table C.5.13, variability in mean

BMI decreased from 0.302 to 0.066. The variability in mean BMI at the enumeration-block-level decreased by almost half, (from 1.441 to 0.754) and the individual-level variance also decreased from 36.070 to 34.274.

The ICCs at the state- and enumeration-block-level also declined when socioeconomic factors and clustering effects were adjusted for. The ICC at the state-level decreased from 0.008 to 0.002 while the ICC at the enumeration-block fell from 0.046 to 0.023. Quantile-quantile plots were used to examine whether the normality assumption was held on errors generated by Model 10. Inspection on the plots confirmed that this assumption was being met (Figures C.5.16 to C.5.18).

Table C.5.13
Results of the Random Part of Models 11 and 12 for Population Analyses in 2015

	Model 11		Model 12	
Parameter	Mean	Std. Err.	Mean	Std. Err.
State-level variance	0.302	0.214	0.066	0.097
Enumeration-block-level v	1.441	0.314	0.754	0.281
Individual-level variance	36.07	0.707	34.274	0.707
Intraclass Correlation Coefficients (ICCs)				
State-level	0.008		0.002	
Enumeration-block-level	0.046		0.023	

Figure C.5.16 Quantile-quantile Plot for Model 10: Individual-level

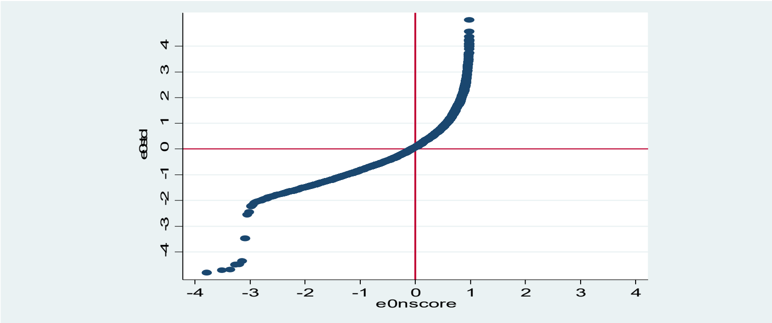


Figure C.5.17 Quantile-quantile Plot for Model 10: Enumeration-block-level

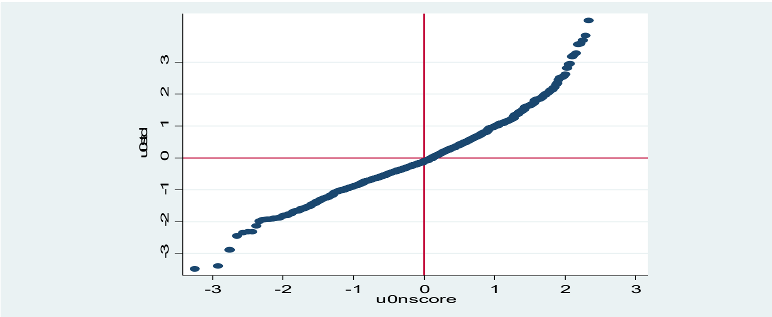
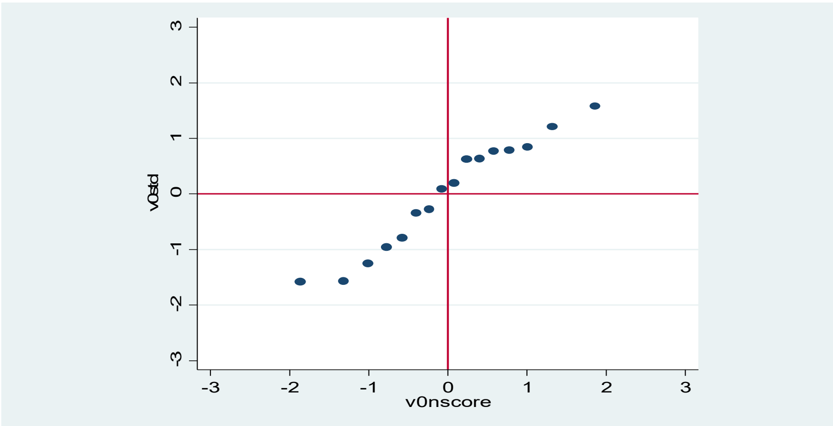


Figure C.5.18 Quantile-quantile Plot for Model 10: State-level



Summary of key findings of 2015 data

The analyses based on the 2015 data found that the mean BMI was higher for Malaysian Malay women when compared with Malaysian Chinese women and women from Other Indigenous Minority Ethnic Groups. In contrast, the reverse trend was true for Malaysian Indian women. The only significant differences in mean BMI were observed between Malaysian Chinese women and Malaysian Malay women. A negative mean BMI/age relationship was identified in 2015. The oldest age group (42-49) had a higher mean BMI compared with the younger age groups. All differences in mean BMI that were related to age were significant, except for women aged 34-41 years old. Never married women had a significantly lower mean BMI than married women. Tertiary educated women had a significantly lower mean BMI than, primary educated and secondary educated women but there was no significant difference between the mean BMI of tertiary educated women and women who had no formal education in 2015.

To reiterate, there were consistent and significant differences in mean BMI Malaysian Chinese women during the 19-year period. Malaysian Chinese women had a significant lower mean BMI than Malaysian Malay women. Additionally, their differences in mean BMI became wider over the time (year 1996: 1.102 kg/m^2, year 2006: 2.390 kg/m^2, year 2011: 3.040 kg/m^2; year 2015: 3.062 kg/m^2).

Significant differences in mean BMI were also found among women from Other Indigenous Minority Ethnic Groups in years 1996, 2005 and 2011 when their mean BMI was significantly lower compared with Malaysian Malay women. Malaysian Indian women, had a higher mean BMI was higher than Malaysian Malay women in 1996, 2006 and 2015. These differences were not significant.

There was also some evidence that significant age gradient emerged at most time points. Mean BMI was positively associated with all age groups except 34-41 years old in 2015. Married women appeared to have a significant higher mean BMI than never married women over the years of 1996, 2006, 2011 and 2015. Similar significant relationships were found among unmarried women in 1996 and 2006 but not in 2011 and 2015.

Women with tertiary education had a significantly lower mean BMI than women with primary education or secondary education over four time points. A mixed association was reported for women who had no formal education.

BMI-educational gradients at the population-level, from 1996 to 2015

Table C.5.22 shows the results of t-test and Wald Test that were used to assess the impact of education on mean BMI during the periods of 1996-2015. The p-value of the t-test indicated that a significant association occurred between education level and mean BMI for most years except for women who did not receive formal education in 2006 and 2015.

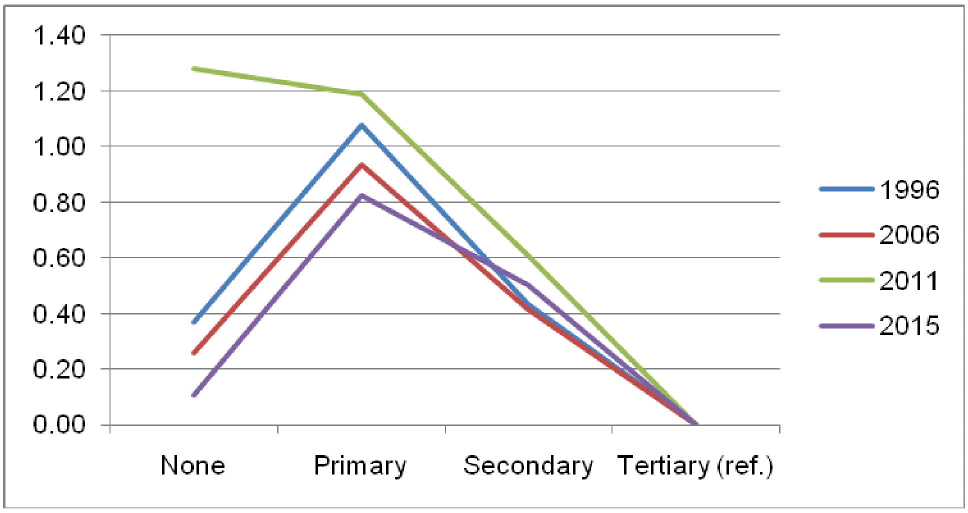
As displayed in Figure C.5.18, women with tertiary education had a significantly lower mean BMI than women with primary education and secondary education over the four time points. Additionally, there was a significant education gradient in mean BMI for women from the four main ethnic groups in 2011: more educated, less weight. The mean BMI-education level differences were wider in 2011 than at the other three time points. As in the population-based analyse of the 1996, 2006, 2011 and 2015, the p-value of Wald Test was smaller than 0.05. Taken as on a whole, education was significantly related to the mean BMI among women from the four main ethnic groups. Thus, education appeared to be a good marker in explaining differences in mean BMI at the population-level.

Table C. 5.22

The Significance of Educational Levels on Mean BMI of Four Main Ethnic Groups Malaysian Women, 1996-2015

Fixed Part	1996			2006			2011			2015		
BMI	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value	Mean	Std. Err.	P-value
Education												
None	0.37	0.198	0.033	0.257	0.281	0.179	1.281	0.545	0.008	0.107	0.646	0.43
Primary	1.077	0.157	0	0.935	0.19	0	1.188	0.287	0	0.823	0.309	0.004
Secondary	0.433	0.138	0.001	0.416	0.155	0.003	0.607	0.181	0	0.503	0.189	0.004
Tertiary (ref.)												
Wald Test	62.28 (0.000)			28.12 (0.000)			20.97 (0.001)			10.21 (0.017)		

Figure C.5.18 BMI-educational gradients at the population-level, 1996 to 2015



Appendix D

Figure D.5.1 Quantile-quantile Plot for Malaysian Malay 1996: Individual-level

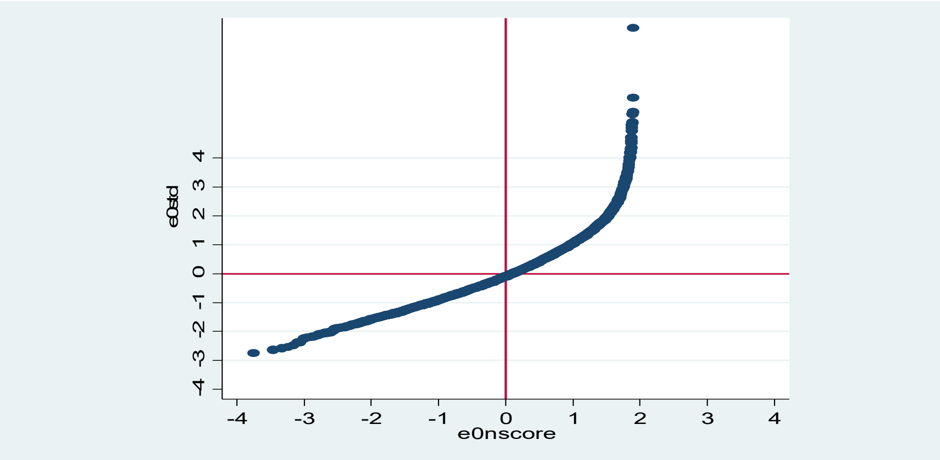


Figure D.5.2 Quantile-quantile Plot for Malaysian Malay 1996: Enumeration-block-level

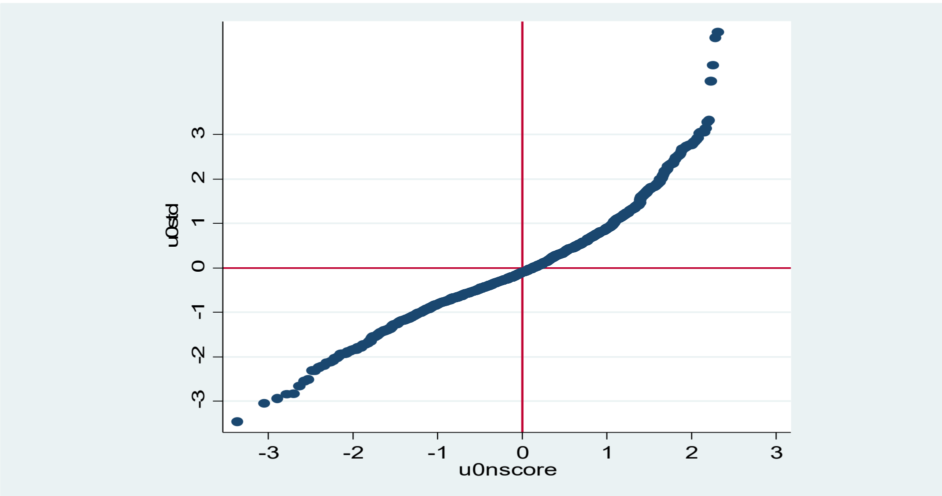


Figure D.5.3 Quantile-quantile Plot for Malaysian Malay 1996: State-level

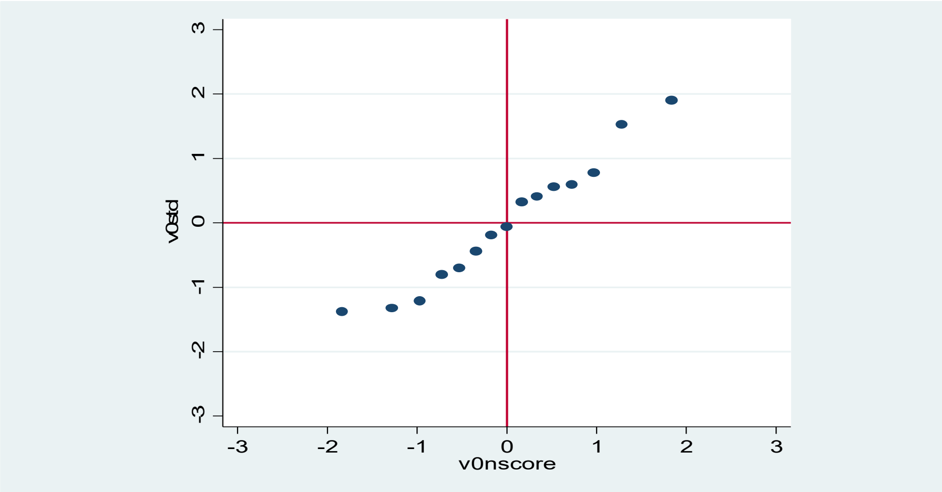


Figure D.5.4 Quantile-quantile Plot for Malaysian Malay 2006: Individual-level

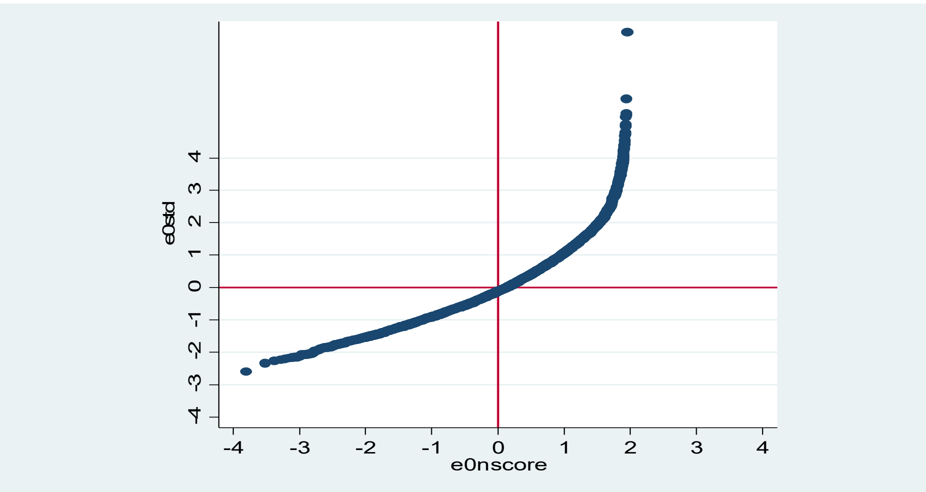


Figure D.5.5 Quantile-quantile Plot for Malaysian Malay 2006: Enumeration-block-level

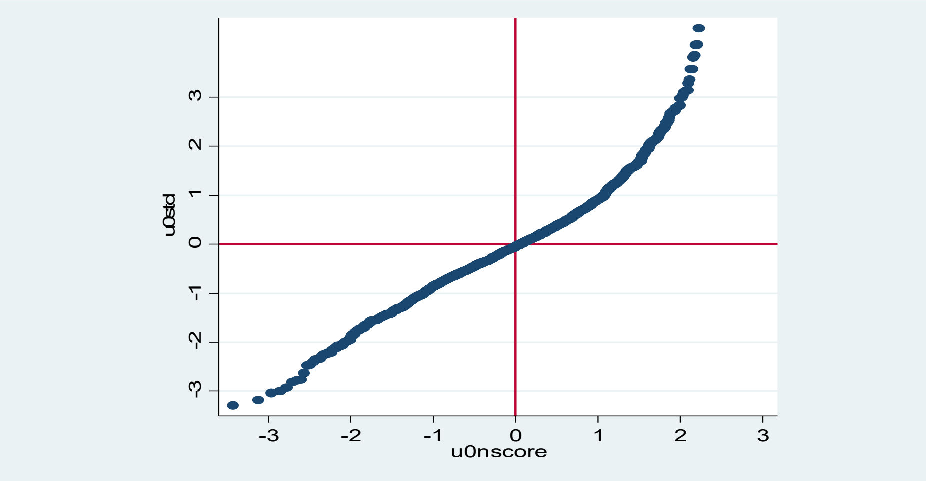


Figure D.5.6 Quantile-quantile Plot for Malaysian Malay 2006: State-level

Figure D.5.7 Quantile-quantile Plot for Malaysian Malay 2011: Individual-level

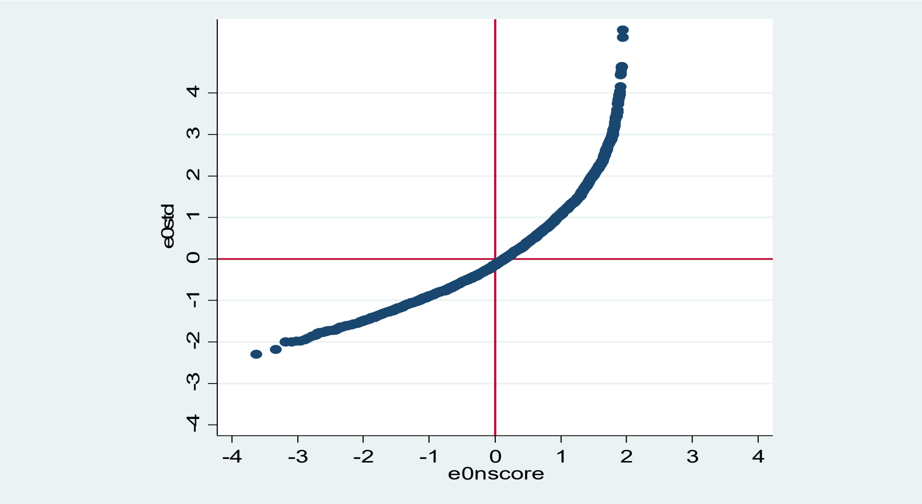


Figure D.5.8 Quantile-quantile Plot for Malaysian Malay 2011: Enumeration-block-level

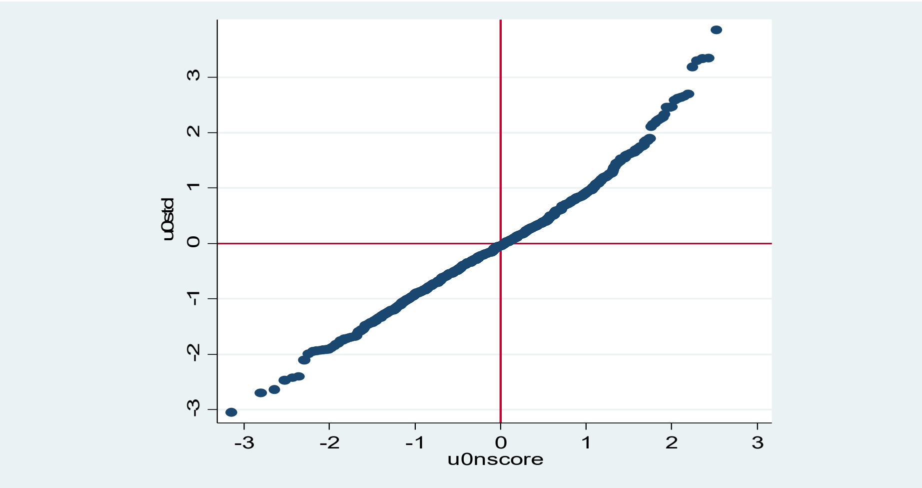


Figure D.5.9 Quantile-quantile Plot for Malaysian Malay 2011: State-level

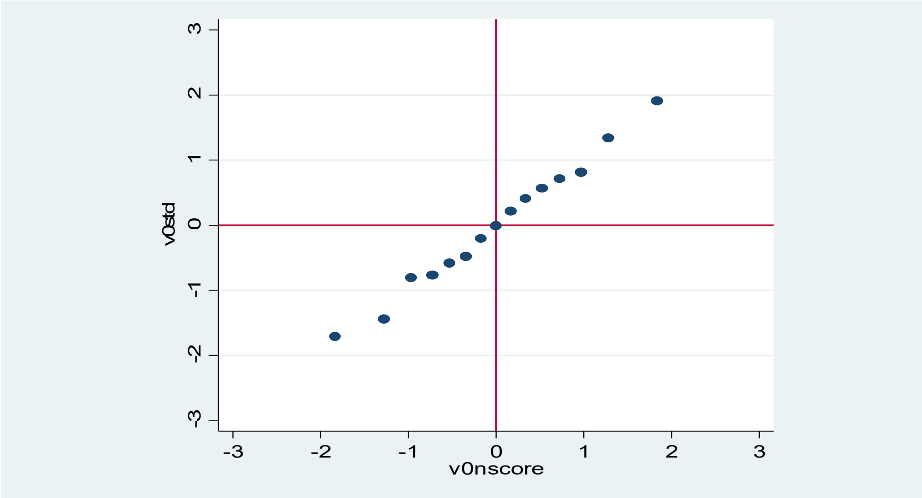


Figure D.5.10 Quantile-quantile Plot for Malaysian Malay 2015: Individual-level

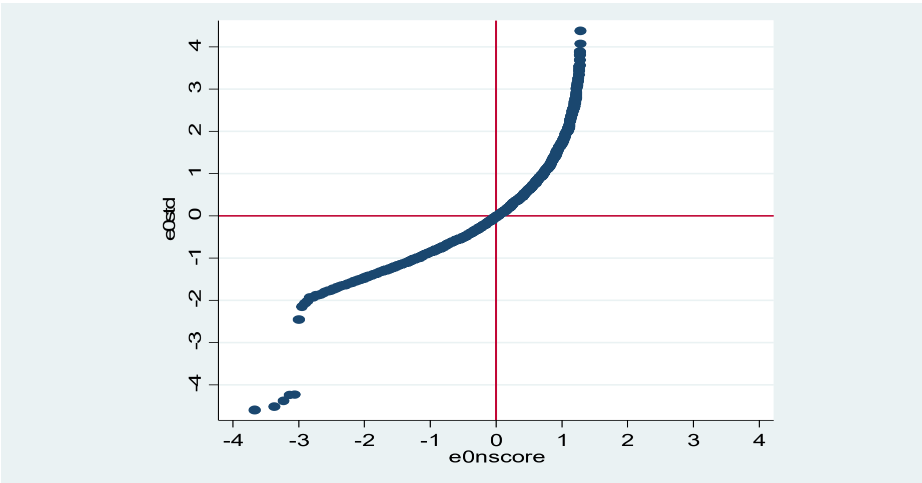


Figure D.5.11 Quantile-quantile Plot for Malaysian Malay 2015: Enumeration-block-level

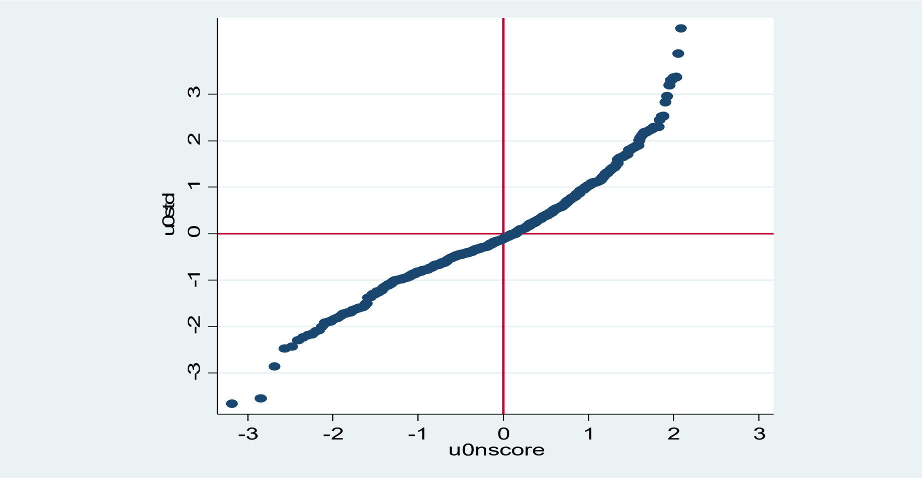


Figure D.5.12 Quantile-quantile Plot for Malaysian Malay 2015: State-level

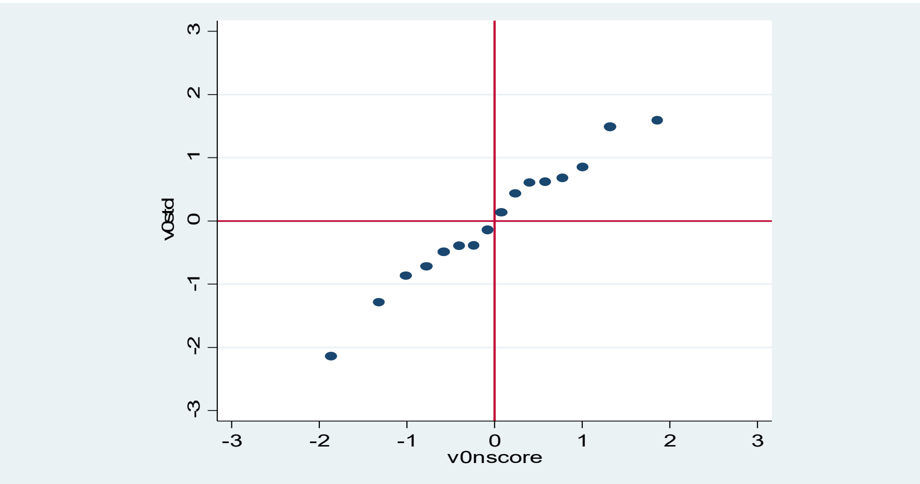


Figure D.5.13 Quantile-quantile Plot for Malaysian Chinese 1996: Individual-level

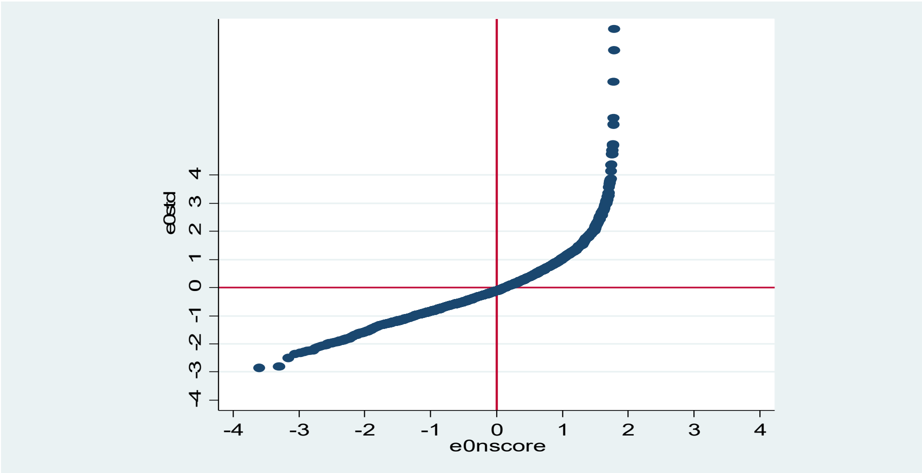


Figure D.5.14 Quantile-quantile Plot for Malaysian Chinese 1996: Enumeration-block-level

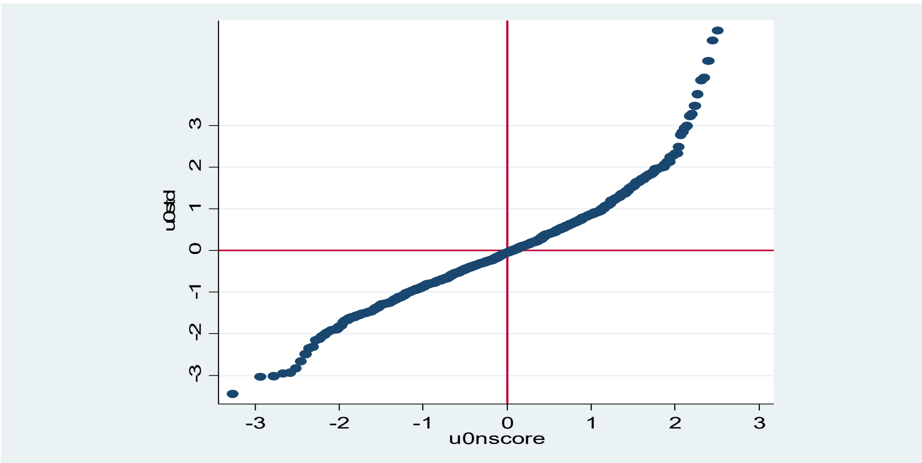


Figure D.5.15 Quantile-quantile Plot for Malaysian Chinese 1996: State-level

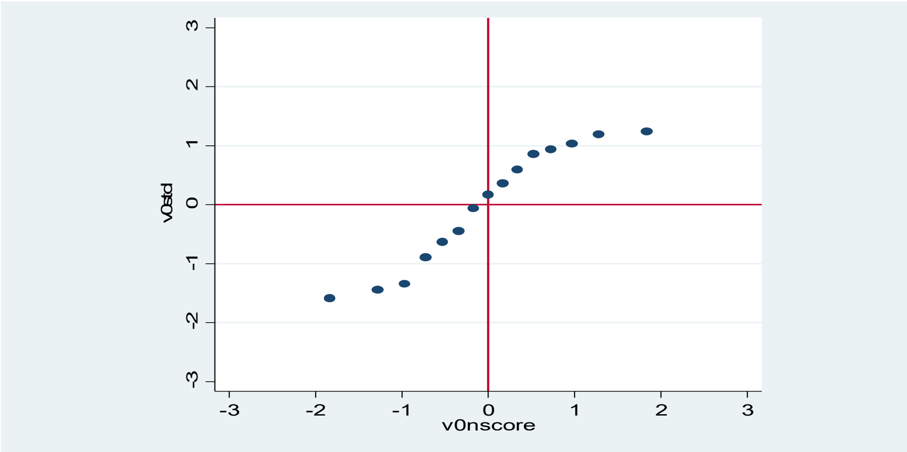


Figure D.5.16 Quantile-quantile Plot for Malaysian Chinese 2006: Individual-level

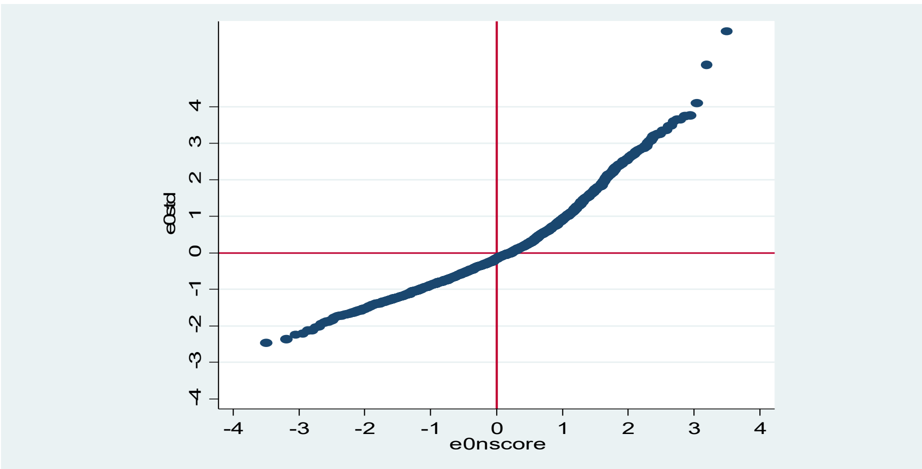


Figure D.5.17 Quantile-quantile Plot for Malaysian Chinese 2006: Enumeration-block-level

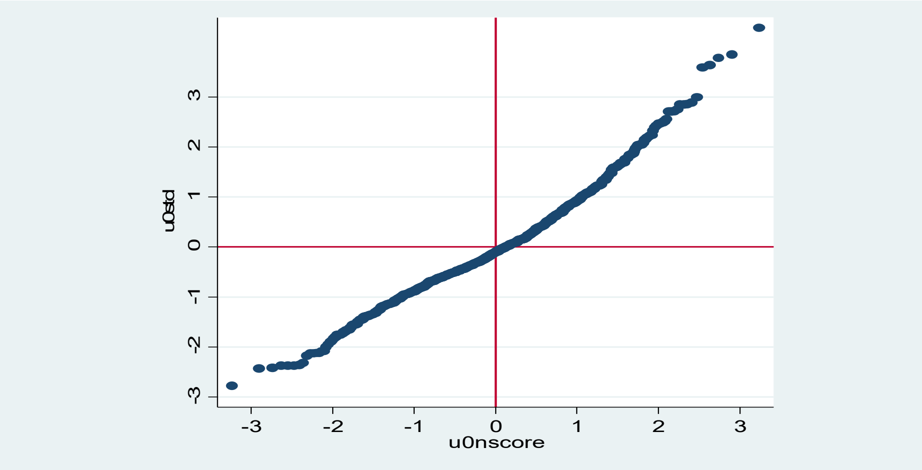


Figure D.5.18 Quantile-quantile Plot for Malaysian Chinese 2006: State-level

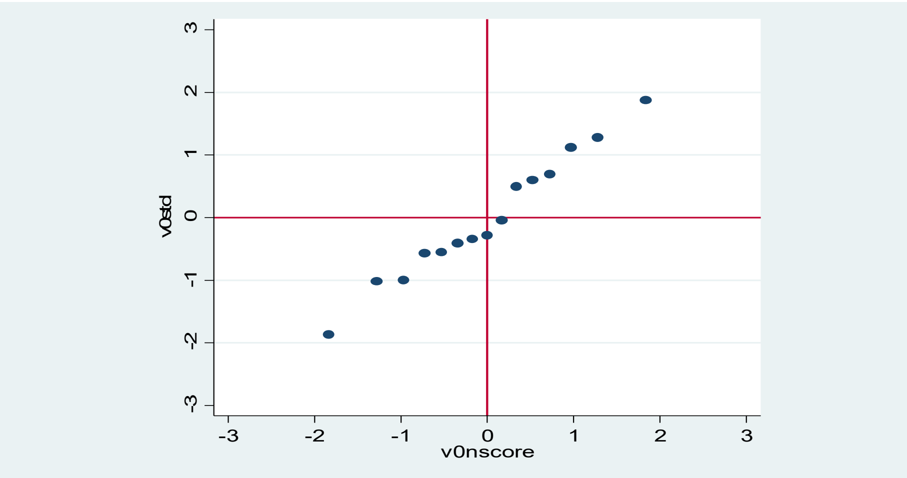


Figure D.5.19 Quantile-quantile Plot for Malaysian Chinese 2011: Individual-level

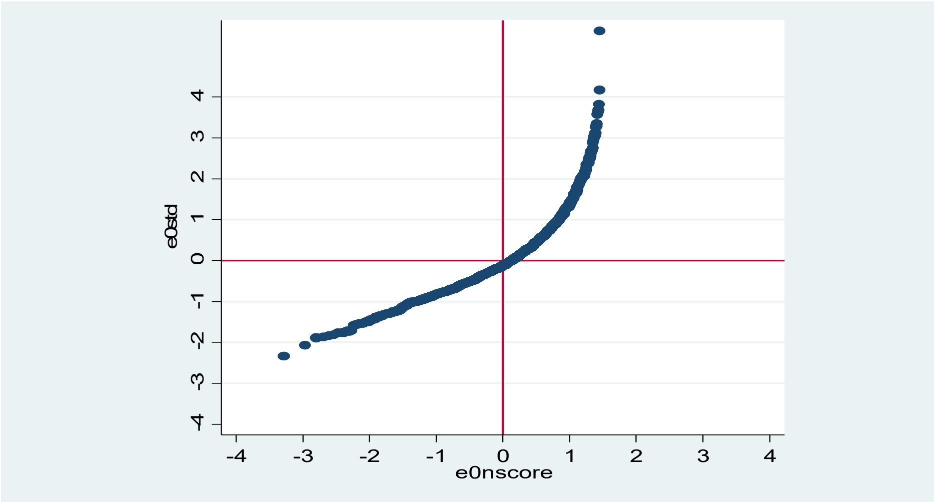


Figure D.5.20 Quantile-quantile Plot for Malaysian Chinese 2011: Enumeration-block-level

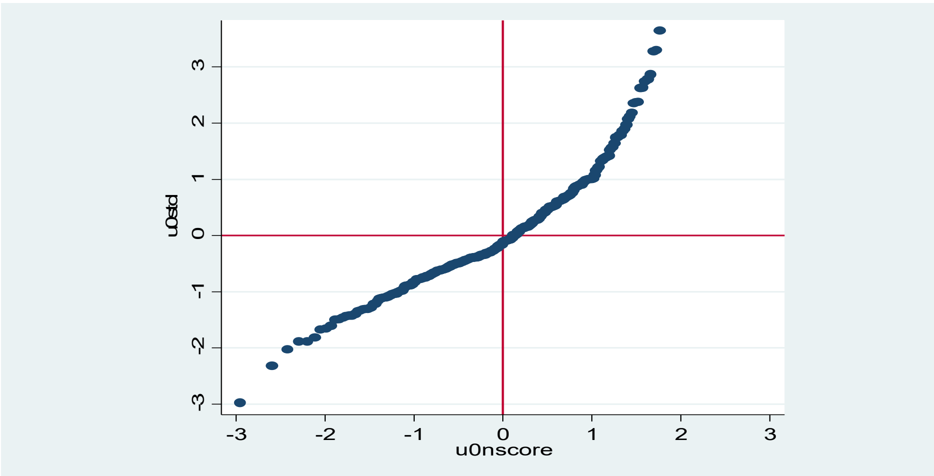


Figure D.5.21 Quantile-quantile Plot for Malaysian Chinese 2011: State-level

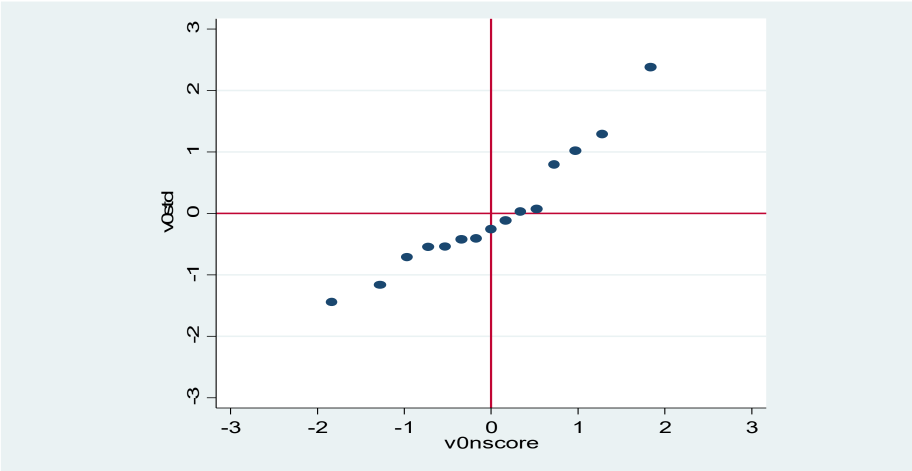


Figure D.5.22 Quantile-quantile Plot for Malaysian Chinese 2015: Individual-level

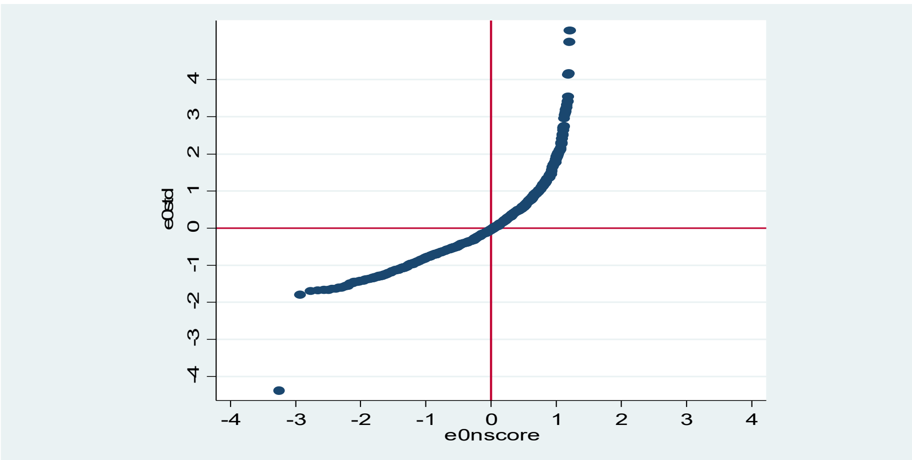


Figure D.5.23 Quantile-quantile Plot for Malaysian Chinese 2015: Enumeration-block-level

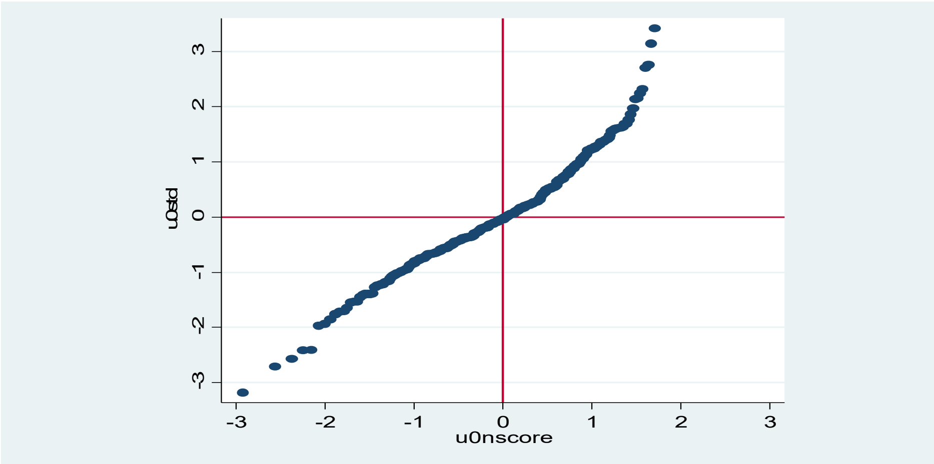


Figure D.5.24 Quantile-quantile Plot for Malaysian Chinese 2015: State-level

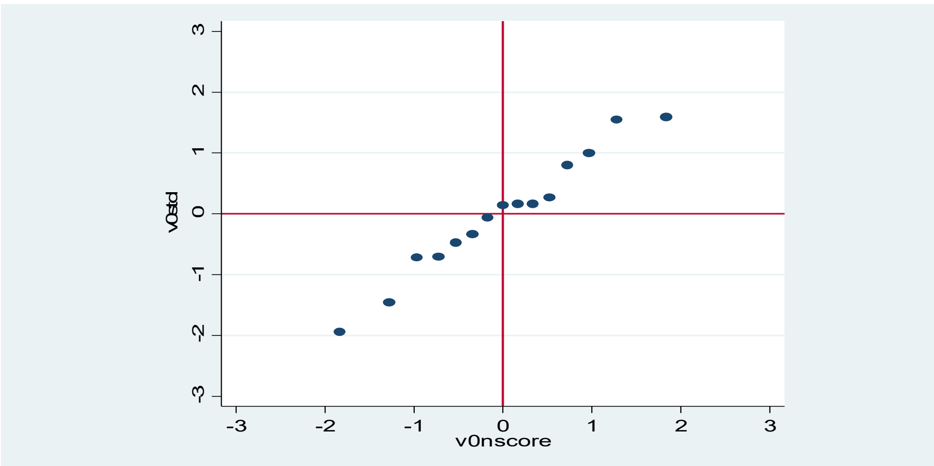


Figure D.5.25 Quantile-quantile Plot for Malaysian Indian 1996: Individual-level

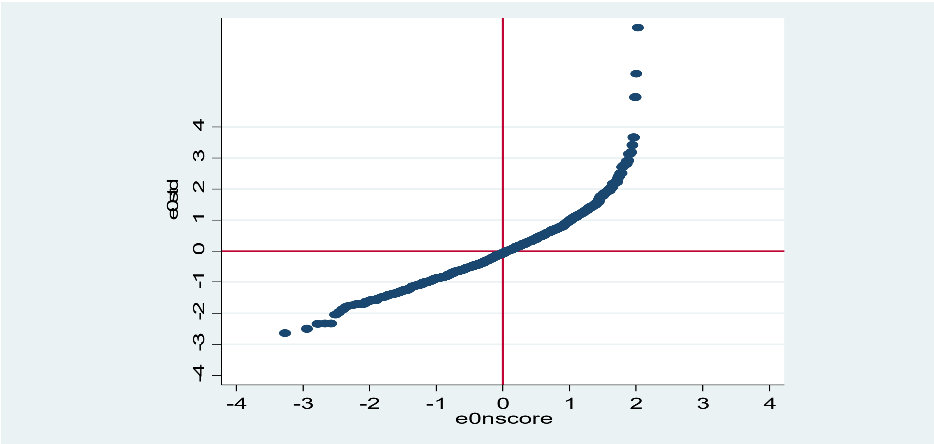


Figure D.5.26 Quantile-quantile Plot for Malaysian Indian 1996: Enumeration-block-level

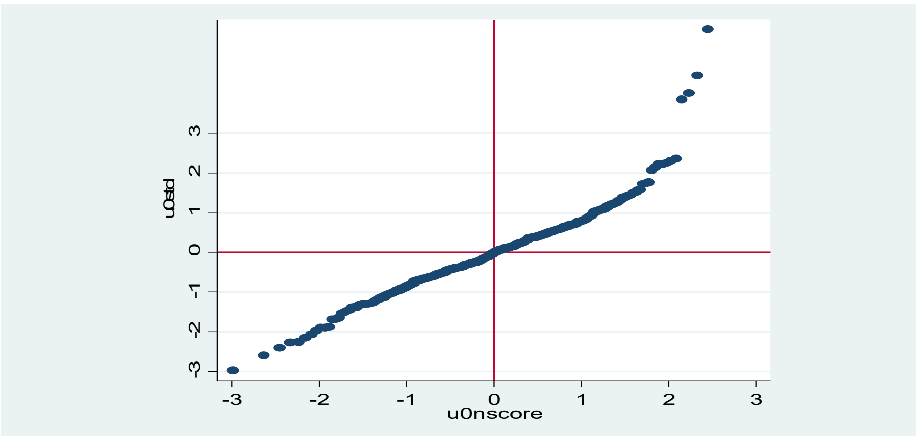


Figure D.5.27 Quantile-quantile Plot for Malaysian Indian 1996: State-level

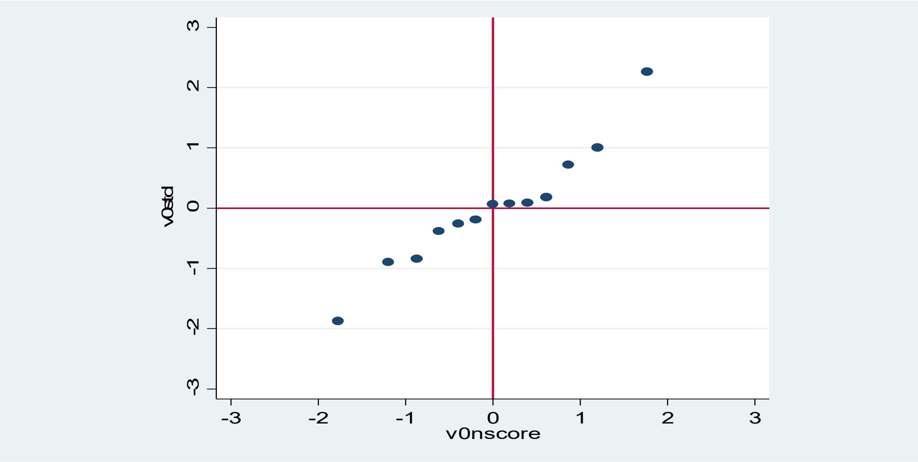


Figure D.5.28 Quantile-quantile Plot for Malaysian Indian 2006: Individual-level

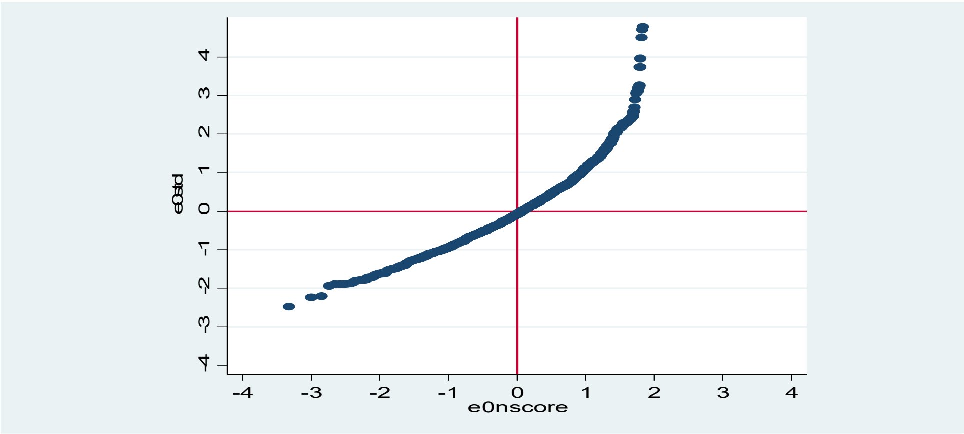


Figure D.5.29 Quantile-quantile Plot for Malaysian Indian 2006: Enumeration-block-level

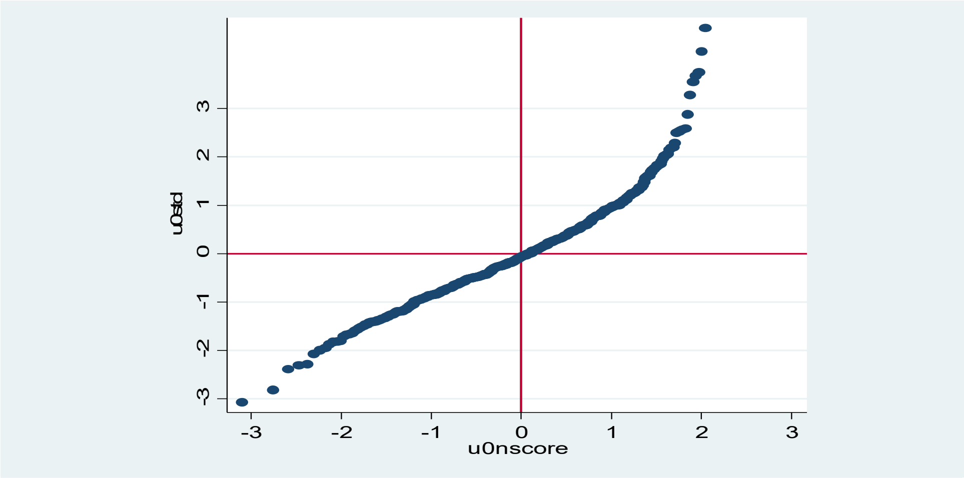


Figure D.5.30 Quantile-quantile Plot for Malaysian Indian 2006: State-level

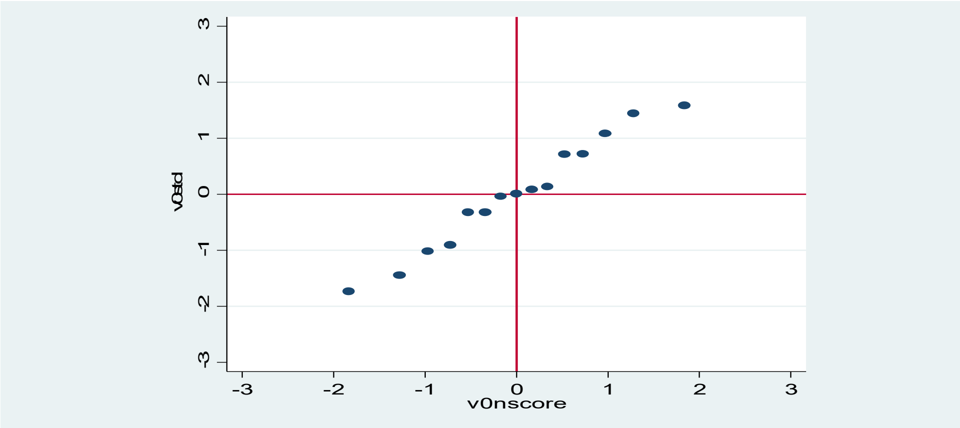


Figure D.5.31 Quantile-quantile Plot for Malaysian Indian 2011: Individual-level

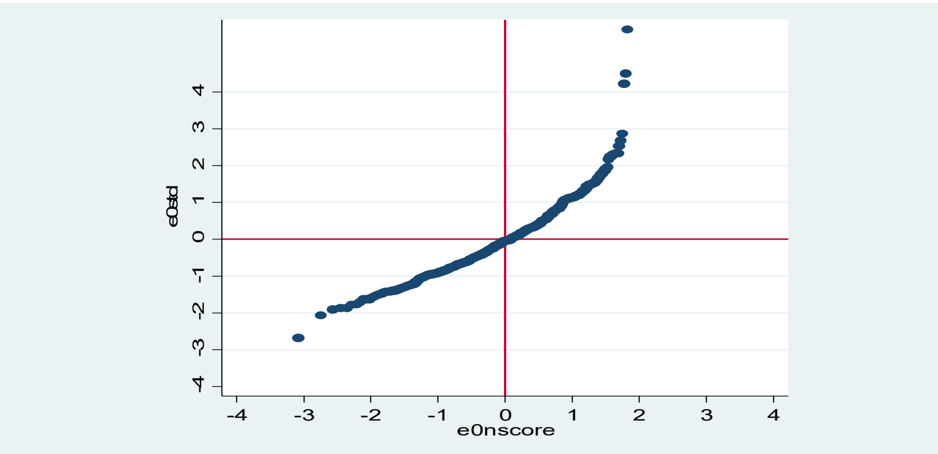


Figure D.5.32 Quantile-quantile Plot for Malaysian Indian 2011: Enumeration-block-level

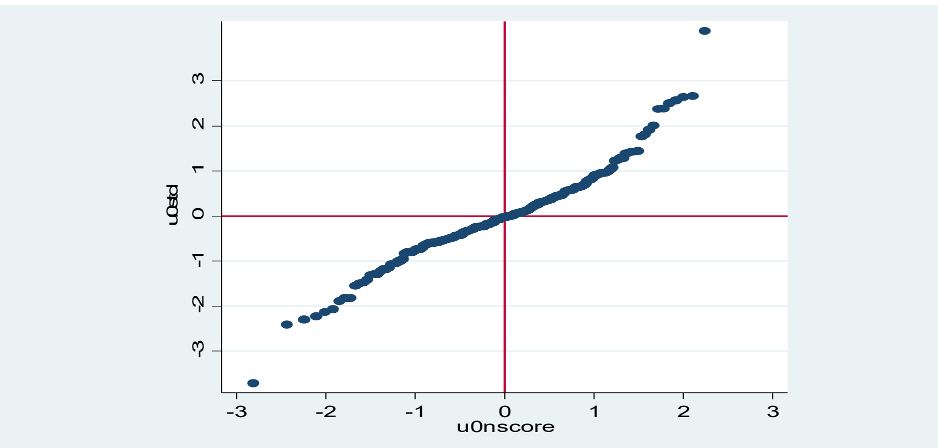


Figure D.5.33 Quantile-quantile Plot for Malaysian Indian 2011: State-level

Figure D.5.34 Quantile-quantile Plot for Malaysian Indian 2015: Individual-level

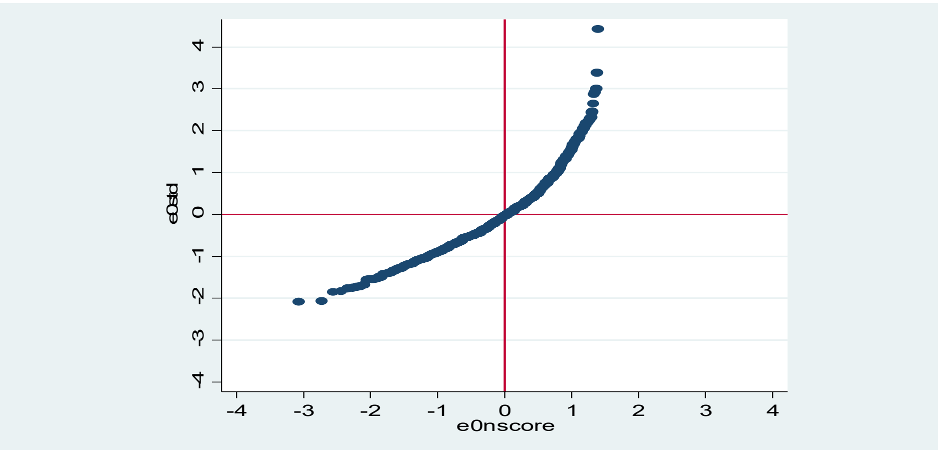


Figure D.5.35 Quantile-quantile Plot for Malaysian Indian 2015: Enumeration-block-level

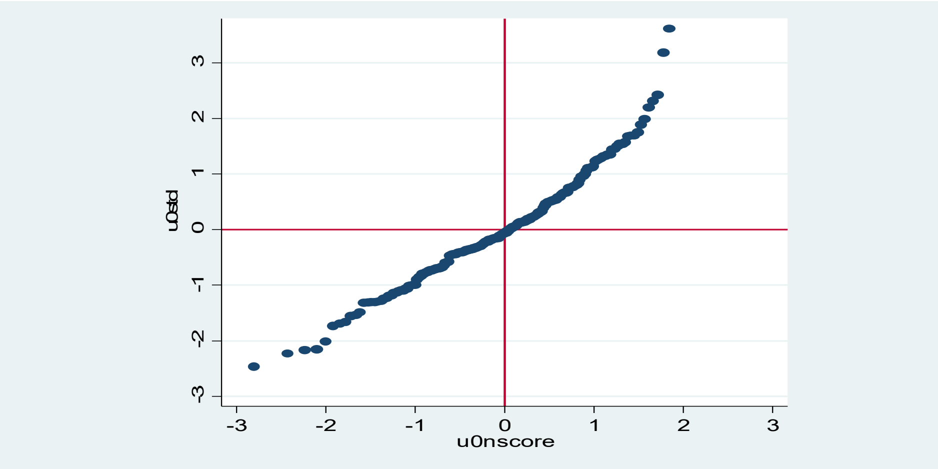


Figure D.5.36 Quantile-quantile Plot for Malaysian Indian 2015: State-level

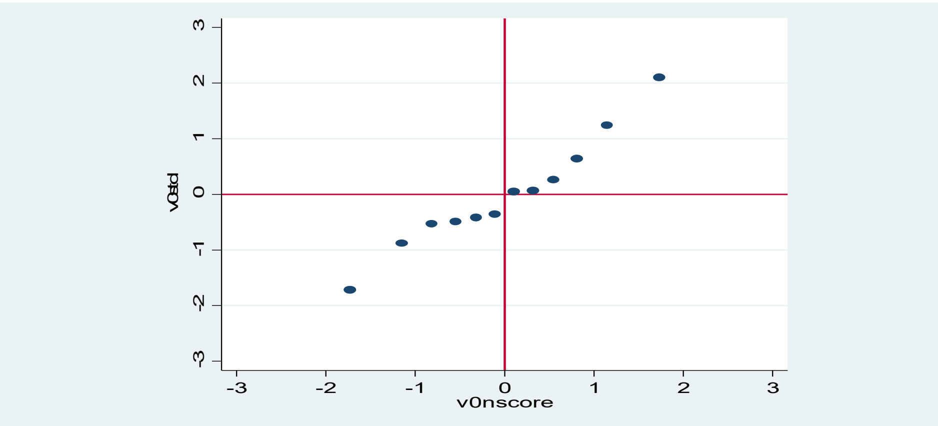


Figure D.5.37 Quantile-quantile Plot for Other Indigenous People Minority Groups 1996: Individual-level

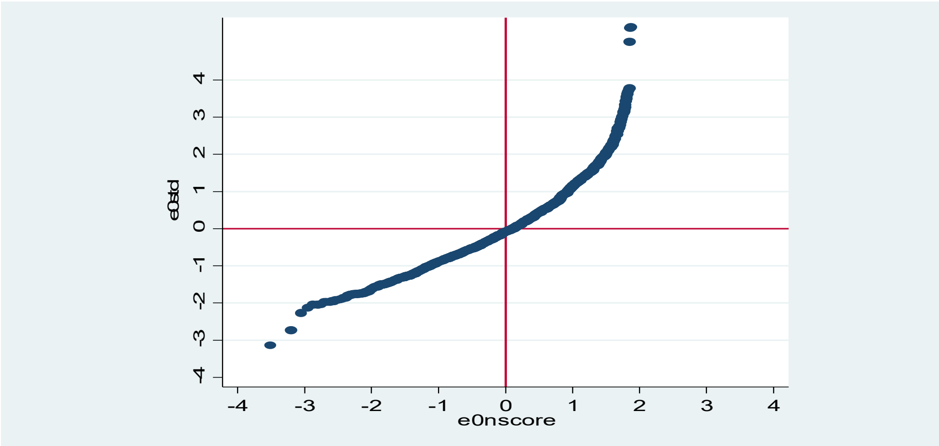


Figure D.5.38 Quantile-quantile Plot for Other Indigenous People Minority Groups 1996: Enumeration-block-level

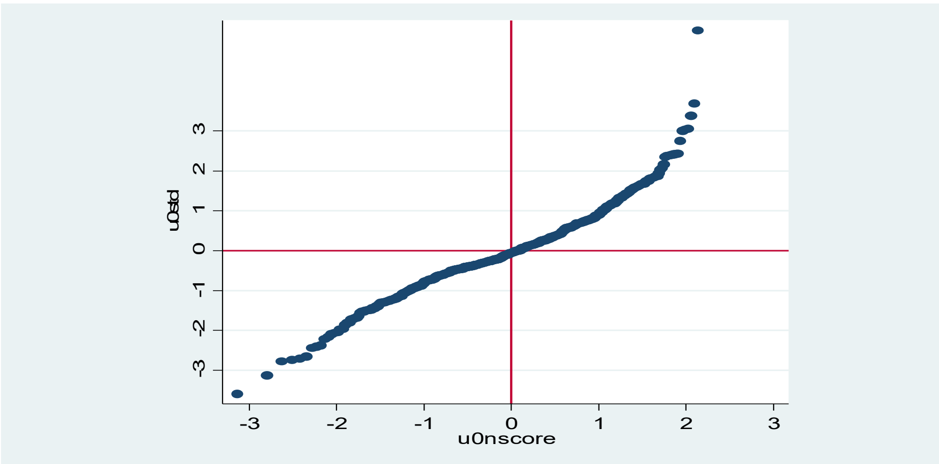


Figure D.5.39 Quantile-quantile Plot for Other Indigenous People Minority Groups 1996: State-block-level

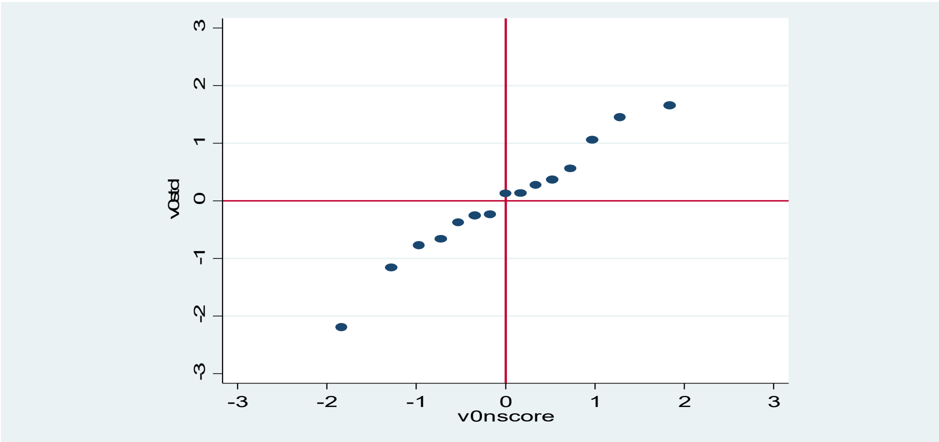


Figure D.5.40 Quantile-quantile Plot for Other Indigenous People Minority Groups 2006: Individual-level

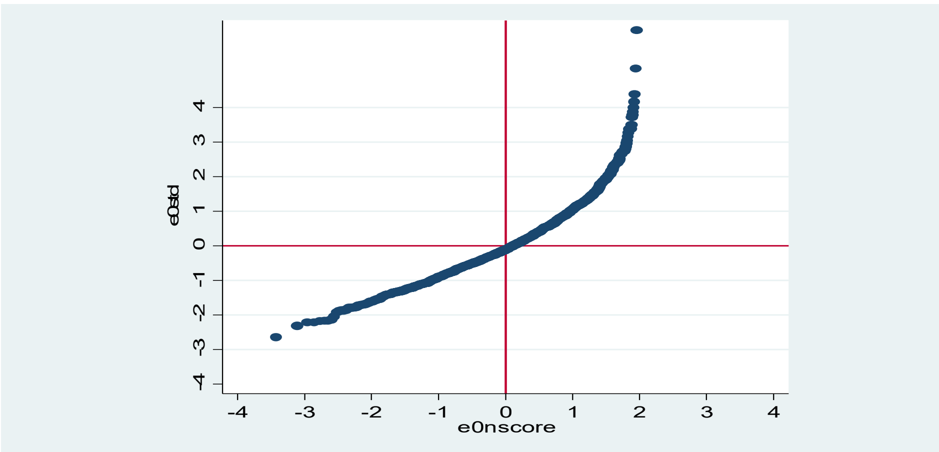


Figure D.5.41 Quantile-quantile Plot for Other Indigenous People Minority Groups 2006: Enumeration-block-level

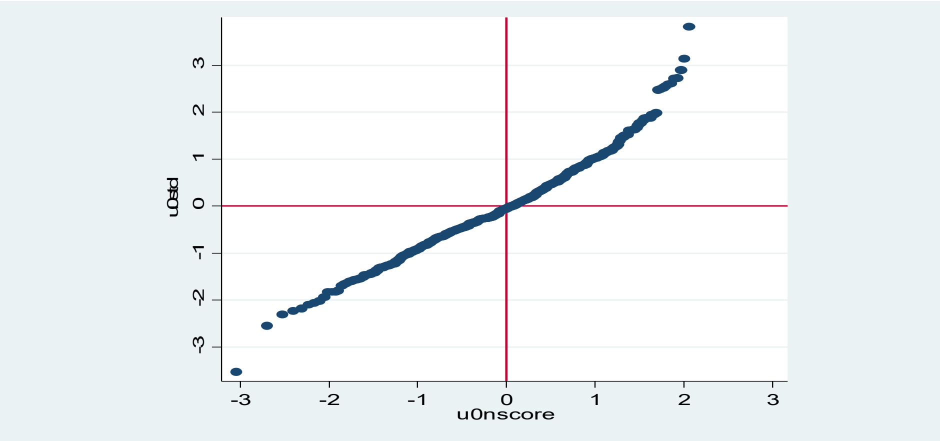


Figure D.5.42 Quantile-quantile Plot for Other Indigenous People Minority Groups 2006: State-block-level

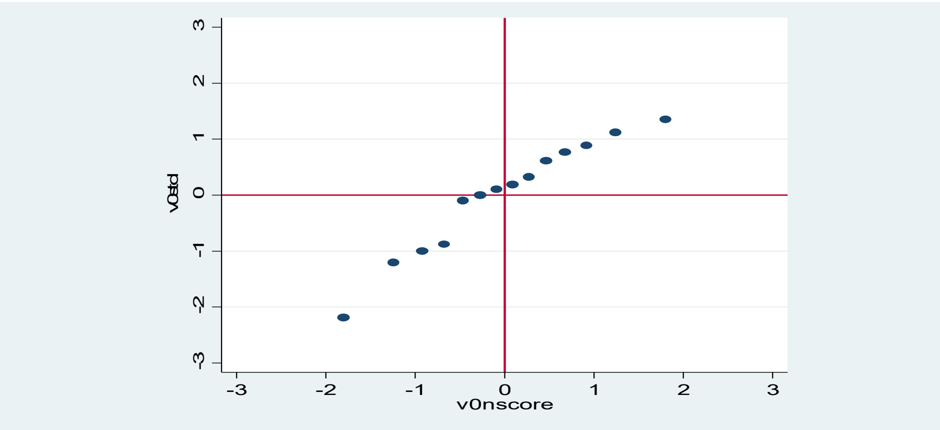


Figure D.5.43 Quantile-quantile Plot for Other Indigenous People Minority Groups 2011: Individual-level

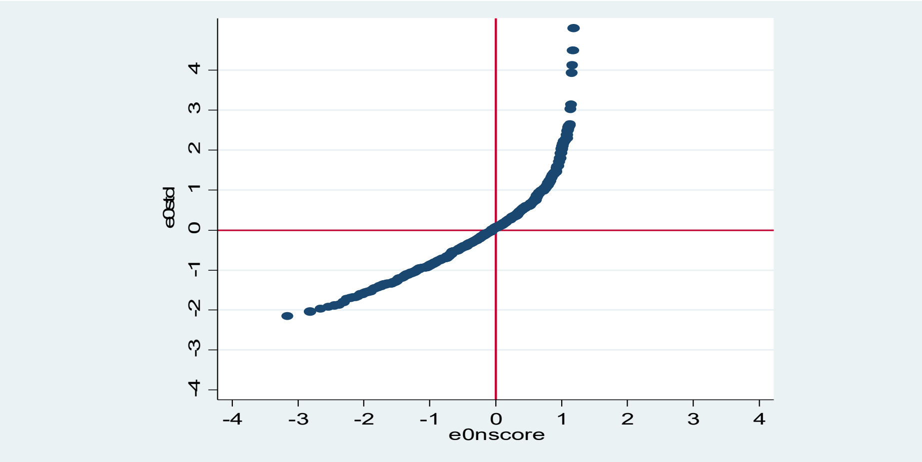


Figure D.5.44 Quantile-quantile Plot for Other Indigenous People Minority Groups 2011: Enumeration-block-level

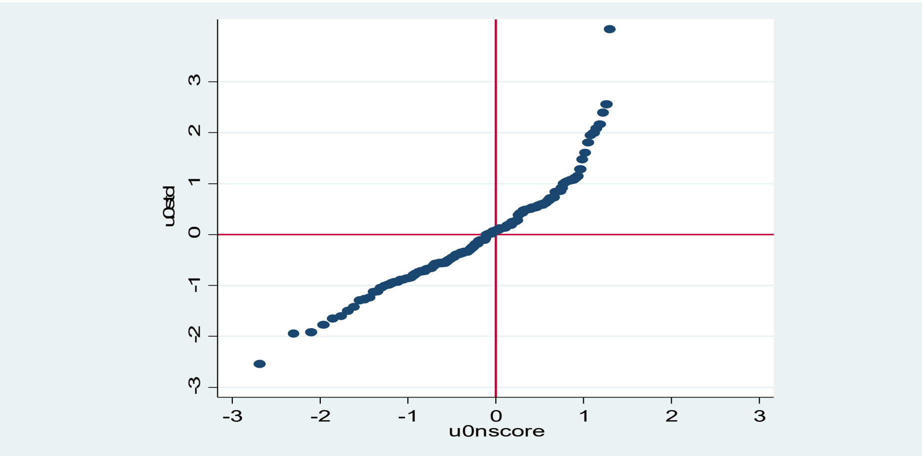


Figure D.5.45 Quantile-quantile Plot for Other Indigenous People Minority Groups 2011: State-block-level

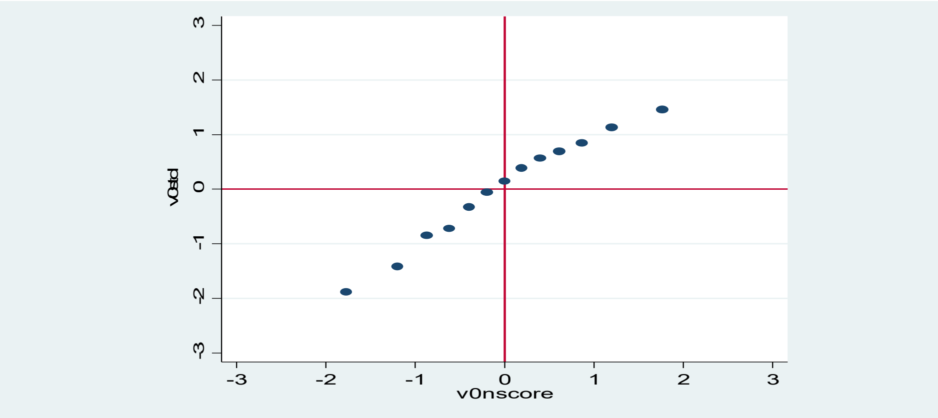


Figure D.5.46 Quantile-quantile Plot for Other Indigenous People Minority Groups 2015: Individual-level

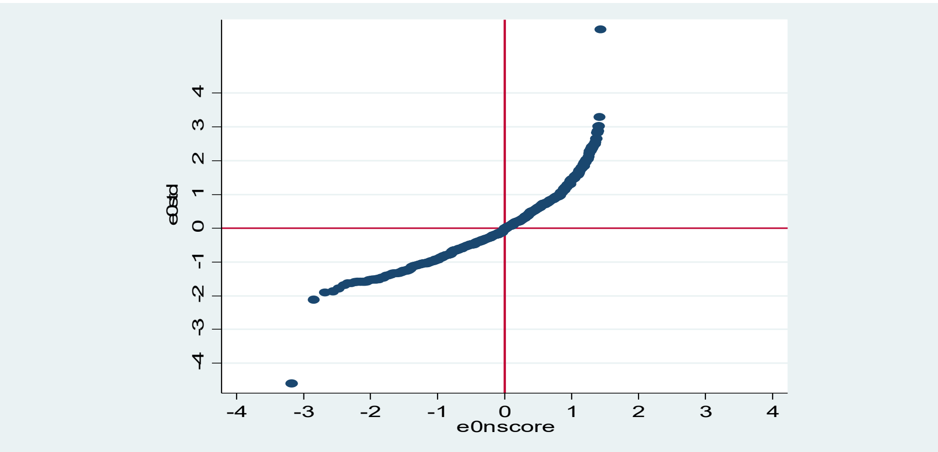


Figure D.5.47 Quantile-quantile Plot for Other Indigenous People Minority Groups 2015: Enumeration-block-level

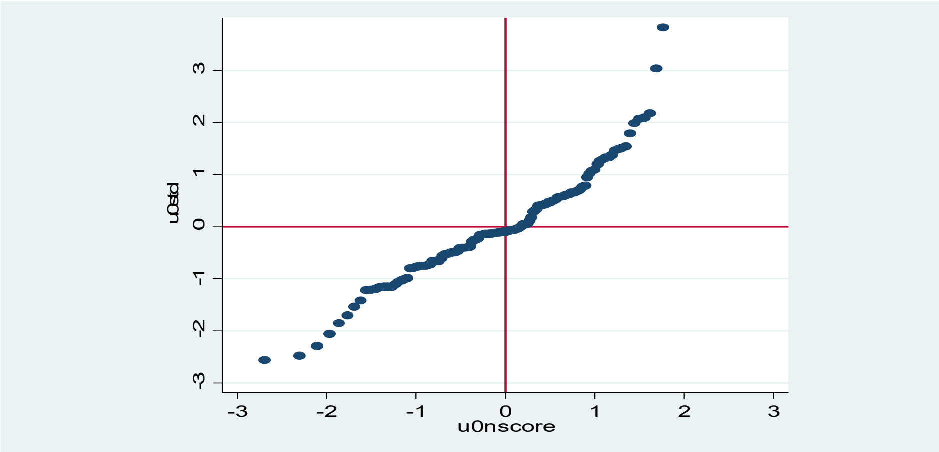
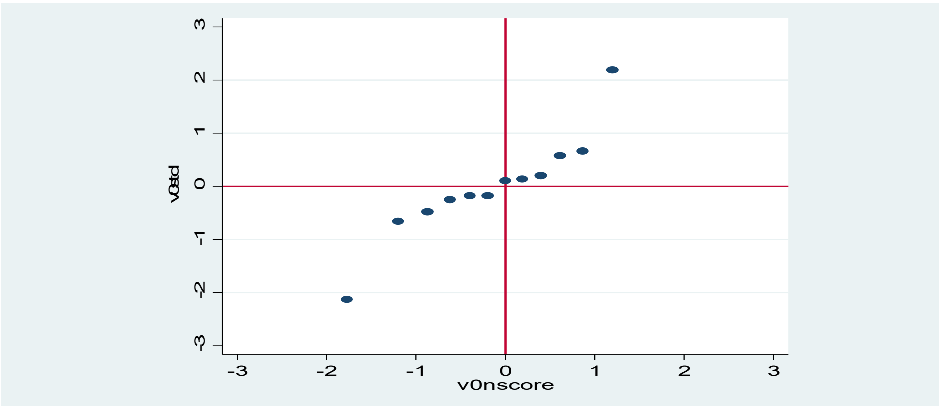


Figure D.5.48 Quantile-quantile Plot for Other Indigenous People Minority Groups 2015: State-block-level



References

Abdullah, K., Noor, N. M., & Saodah, W. (2008). The perception of women's roles and progress: A Study of Malay Women. *Social Indicators Research, 89*(3), 439-455.

Abdullah, R. B., Mamat, W. H. W., Zal, W. A. A., & Ibrahim, A. M. B. (2013). Teaching and Learning Problems of the Orang Asli Education: Students' Perspective. *Asian Social Science, 9*(12). doi:10.5539/ass.v9n12p118

Abu Bakar, N. R. (2006). Women in the Labour Force in Malaysia. *The International Journal of the Humanities, 4*(6), 117-126.

Abubakari, A. R., & Bhopal, R. S. (2008). Systematic review on the prevalence of diabetes, overweight/obesity and physical inactivity in Ghanaians and Nigerians. In *Public Health* (Vol. 122, pp. 173-182). England.

Ackerson, L. K., Kawachi, I., Barbeau, E. M., & Subramanian, S. V. (2008). Geography of underweight and overweight among women in India: a multilevel analysis of 3204 neighborhoods in 26 states. *Econ Hum Biol, 6*(2), 264-280.

Acock, A. (2005). Working with missing values. *Journal of marriage and family, 67*, 1012-1028.

Adair, L. S., Popkin, B. M., Akin, J. S., Guilkey, D. K., Gultiano, S., Borja, J., . . . Hindin, M. J. (2011). Cohort profile: the Cebu longitudinal health and nutrition survey. In *Int J Epidemiol* (Vol. 40, pp. 619-625). England.

Adap, P., Pallan, M., & Whincup, P. H. Is BMI the best measure of obesity? *360*. doi:10.1136/bmj.k1274

Adler, N. E. (2006). Overview of health disparities. In G. E. Thomson, Mitchell, F. and Williams, M.B. (Ed.), *Examining the health disparities research plan of the National Institues of Health: unfinished businesses* (pp. 121-174).

Adler, P. A., & Adler, P. (1987). *Membership roles in field research*. Newbury Park, CA.: Sage.

Aekplakorn, W., Hogan, M. C., Chongsuvivatwong, V., Tatsanavivat, P., Chariyalertsak, S., Boonthum, A., . . . Lim, S. S. (2007). Trends in Obesity and Associations with Education and Urban or Rural Residence in Thailand. Obesity. *Obesity (Silver Spring), 15*(12), 3113-3121.

Aeria, A. (2005). Southeast Asian Responses to Globalization: Restructuring Governance and Deepening Democracy. In F. K. W. Loh & J. Ojendal (Eds.), *Globalization, Inequitable Development and Disenfranchisement in Sarawak* (pp. 173-200). Singapore Institute of Southeast Asian Studies

Agrawal, P., Gupta, K., Mishra, V., Agrawal, S. (2014). A Study on Body-Weight Perception, Future Intention and Weight-Management Behaviour Among Normal-Weight, Overweight and Obese Women in India. *Public Health Nutr., 17*(4), 884-895.

Agyemang, C., Kunst, A., Bhopal, R., Zaninotto, P., Nazroo, J., & al., e. (2011). Dutch versus English advantage in the epidemic of central and generalised obesity is not shared by ethnic minority groups: comparative secondary analysis of cross-sectional data. *International Journal of Obesity, 35*, 1334-1346.

Ahmad, A. (1998). *Women in Malaysia*. Retrieved from http://www.adb.org/sites/default/files/institutional-document/32552/women-malaysia.pdf

Ahmad, A. (2009). Gender differences and trends in the participation of Malaysians in education: implications on employment outcomes. *The Journal of International Management Studies, 4*(2), 65-74

Ahmad, Z., Ahmad, N., & Abdullah, H. (2009). Urbanism, space, and human psychology: value change and urbanization in Malaysia. *European Journal of Social Sciences, 11*(3), 464-470

Ahmed, L. (1992). *Women and Gender in Islam: Historical Roots of a Modern Debate*. New Haven and London: Yale University Press.

Ahmed, D., Hundt, G., Blackburn, C. (2011) Issues of Gender, Reflexivity and Positionality in the Field of Disability: Researching Visual Impairment in an Arab Society. Qualitative Social Work: Vol. 10(4): 467–484

Aiken, S.R., & Leigh, C. H. (2011). In the Way of Development: Indigenous Land-Rights Issues in Malaysia. *The Geographical Review, 101*(4), 471-496.

Aiken, S. R., & Leigh, C. H. (2015). Dams and Indigenous Peoples in Malaysia: Development, Displacement and Resettlement. *Journal Human Geography*, 69-93.

Aitsi-Selmi, A., Bell, R., Shipley, M. J., & Marmot, M. G. (2014). Education modifies the association of wealth with obesity in women in middle-income but not low-income countries: an interaction study using seven national datasets, 2005-2010. *9*(3)

Al-Delaimy, A., Al-Mekhlafi, H., Nasr, N. A., Sady, H., Atroosh, W. M., Nashiry, M., . . . Mahmud, R. (2014). Epidemiology of Intestinal Polyparasitism among Orang Asli School Children in Rural Malaysia. PLOS Neglected Tropical Diseases. doi:https://doi.org/10.1371/journal.pntd.0003074

Allison, P.D. (2003) Logistic regression using the SAS system: theory and application. SAS Institute and Wiley: USA

Al-Qalah, S. A. A. J., Ghazi, H.F., Isa, Z.M., Karim, N.A. (2014). Dietary Weight Loss Practice among Government Working Women Who Successfully Lose Weight in Malaysia. *Pakistan Journal of Nutrition, 13*(8), 486-491.

Alaba, O., & Chola, L. (2014). Socioeconomic inequalities in adult obesity prevalence in South Africa: a decomposition analysis. *Int. J. Environ. Res. Public Health, 11*, 3387-3406.

Ali, K. K. (2014). The Role of Malay Women in the Malaysian Workforce and its Impact on the Consciousness of Ethnics and Integrity. *Global Business and Management Research: An International Journal, 6*(4), 324-333.

Ali, S. M., & Lindstrom, M. (2005). Socioeconomic, psychosocial, behavioural, and psychological determinants of BMI among young women: differing patterns for underweight and overweight/obesity. *European Journal of Public Health, 16*(3), 325-331.

Allan, J. D., Mayo, K., & Michel, Y. (1993). Body size values of white and black women. *Research in nursing and health, 16*(5), 323-333.

Allender, S., & Rayner, M. (2007). The burden of overweight and obesity-related ill health in the UK. *Obesity Rev., 8*(5), 467–473.

Alley, D. E., & Chang, V. W. (2007). The changing relationship of obesity and disability, 1988–2004. *Journal of the American Medical Association 298*, 2020–2027.

Allison, D. B., Fontaine, K. R., Manson, J. E., Stevens, J., & VanItallie, T. B. (1999). Annual deaths attributable to obesity in the United States. *Journal of the American Medical Association 298*, 1530–1538.

Allison, D. B., Kaprio, J., Korkeila, M., Koskenvuo, M., Neale, M. C., & Hayakawa, K. (1996). The heritability of body mass index among an international sample of monozygotic twins reared apart. *Int J. Obes. Relat. Metab. Disord, 20*, 501-506.

Allison, K. R., Adlaf, E. M., Ialomiteanu, A., & Rehm, J. (1999). Predictors of health risk behaviours among young adults: analysis of the National Populaiton Health Survey. *Can J. Public Health, 90*(2), 85-89.

Altman, D. G., & Bland, J. M. (1996). Detecting skewness from summary information. *BMJ,* (313), 1200.

Altman, D. G., & Bland, J. M. (2007). Statistics Note: Missing Data. *BMJ, 334*(424). doi:10.1136/bmj.38977.682025

Alvarado, M., Murphy, M. M., Guell, C. (2015). Barriers and Facilitators to Physical Activity Amongst Overweight and Obese Women in an Afro-Caribbean Population: A Qualitative Study. *Nutrition and Physical Activity, 12*. doi:10.1186/s12966-015-0258-5

Amanah Saham Berhad. Frequently Ask Questions. Retrieved from http://www.asnb.com.my/faqs_e.php

Amin, S., & Alam, I. (2008). Women's Employment Decisions in Malaysia: Does Religion Matter? *The Journal of Socio-Economics, 37*, 2368-2379.

Amir, F. Z., & Mahmud, N. (2014). Relationship Between Discrimination in Career Development and Stress Among Female Workers in Malaysia. *Australian Journal of Basic and Applied Sciences, 8*(23), 101-107.

Andaya, B. W., & Andaya, L. Y. (2001). *A history of Malaysia*. London: Palgrave.

Arab, M. (2006). *Barriers to Exercise: Kuwaiti Individuals with and without Physical Disabilities.* (Doctor of Philosophy). Oregon State University,

Arcaya, M., Brewster, M., & Subramanian, S. V. (2012). Area variations in health: a spatial multilevel modeling approach. *Health Place, 18*(4), 824-831.

Archer, L. (2004). Re/theorizing "difference" in feminist research. *Women's studies international forum, 27*(5-6), 459-473.

Ariff, M. (1998). The Malaysian Economic Experience and its Relevance for the OIC Member Countries. *Islamic Economic Studies, 6*(1). Retrieved from https://ssrn.com/

Ariffin, R. (1988). Malaysian Women's Participation in Trade Unions. In N. Heyzer (Ed.), *Daughters in Industry: Work Skills and Consciousness of Women Workers in Asia*. Kuala Lumpur: Asian & Pacific Dev Centre.

Ariffin, R. (1989). Women and Trade Unions in West Malaysia. *Journal of Contemporary Asia, 19*(1), 78-94.

Ariffin, R. (1997). Malaysian Women in Modern Era. *The Copenhagen Journal of Asia Studies, 12*, 69-88.

Arps, S. (2011). Socioeconomic status and body size among women in Honduran Miskito communities. *Annals of Human Biology, 38*(4), 508-519. doi:10.3109/03014460.2011.564206

Arredondo, E. M., Elder, J. P., Ayala, G. X., Campbell, N., Baquero, B., & Duerksen, S. (2006). Is parenting style related to children`s healthy eating and physical activity in Latino families. *Health Educ. Res., 21*(6), 862-871.

Arts, N. D. f. C. a. National Culture Policy. Retrieved from http://www.jkkn.gov.my/en/national-culture-policy

Aryeetey, R. N. O. (2016). Perceptions and Experiences of Overweight Among Women in the Ga East District, Ghana. *Frontiers in Nutrition, 3*(13). doi:10.3389/fnut.2016.00013

Asada, Y. (2003). *A framework for measuring health inequality*. Madison: University of Wisconsin, Department of Population Health Science.

Asia Pacific Cohort Studies Collaboration. (2006). Central Obesity and Risk of Cardiovascular Disease in the Asia Pacific Region. *Asia Pac J Clin Nutr, 15*(3), 287-292.

Asra, A. (1999). Urban-Rural Differences In Costs of Living and Their Impact on Poverty Measures.

Averett, S. L., Sikora, A., & Argys, L. M. For better or worse: relationship status and body mass index. *Econ Hum Biol. 6*(3), 330-349.

Aziz, A. (2011). *Role demands and work-family balance experience in Malaysia: the different moderating effects of collectivism and gender role identity among diverse groups.* (Doctor of Philosophy Doctor of Philosophy). Queensland University of Technology, Australia. Retrieved from http://eprints.qut.edu.au/41845/1/Azelin_Aziz_Thesis.pdf,

Aziz, N. S. A., Zaki, N.A.M., Nor, N.S.M., Ambak, R., Man, C.S. (2016). Perspective on Obesity Problems and Associated Factors to Reduce Weight among Overweight and Obese Housewives: A Qualitative Study. *Journal of Women's Health, Issues & Care, 5:6*. doi:10.4172/2325-9795.1000255

Aziz, R. A., & Y*usooff, F.* (2012). Intergenerational Relationships and Communication among the Rural Aged in Malaysia. *Asian Social Science, 8*(6). doi:10.5539/ass.v8n6p184

Azmi, M. Y., Junidah, R., Siti Mariam, A., Safiah, M. Y., Fatimah, S., Norimah, A. K., . . . Tahir, A. (2009). Body Mass Index (BMI) of Adults: Findings of the Malaysian Adult Nutrition Survey (MANS). *Mal J Nutr, 15*(2), 97-119.

Babones, S. (2016) Interpretive quantitative methods for the social sciences. Sociology. 50(3) https://doi.org/10.1177/0038038515583637

Baca Zinn, M., & Dill, T. (1996). Theorizing difference from multiracial feminism. *Feminist Studies, 22*, 321-331.

Baeten, J. M., Bukusi, E. A., & Lambe, M. (2001). Pregnancy complications and outcomes among overweight and obese nulliparous women. *Am J of Public Health, 91*(3), 436-440.

Bahreynian, M., Qorbani, M., Khaniabadi, B.M., Motlagh, M.E., Safari, O., Asayesh, H., and Kelishadi, R. (2017) Association between obesity and parental weight status in children and adolescents. *J Clin Res Pediatr Endocrinol.* 9(2): 111-117

Baharudin, N. (2004). Unemployed Graduates: Pre- and Post- 1997 Crisis. *Statistics Malaysia Journal, 1*, 27-42.

Baju Hindia Traditional. Retrieved from https://www.google.co.uk/search?q=malaysian+women&espv=2&biw=1680&bih=959&source=lnms&tbm=isch&sa=X&ei=Zp_oVPHaI8XV7QajpID4Ag&ved=0CAYQ_AUoAQ#tbm=isch&q=traditional+malaysian+clothes&revid=135059739&imgdii=_&imgrc=w-cl_m3rXujUGM%253A%3BKCh9v1JWAooESM%3Bhttp%253A%252F%252Fwww.vtaide.com%252FASEAN%252FMalaysia%252Fimages%252Fgirls-clothes.jpg%3Bhttp%253A%252F%252Flokerjakarta.com%252Ftag%252Fbaju-hindia-tradisional%3B300%3B282

Baker, S. E., & Rosalind, E. (2012). *How many qualitative interviews is enough*. Retrieved from UK: http://eprints.ncrm.ac.uk/2273/4/how_many_interviews.pdf

Bakhshi, E., Eshraghian, M. R., Mohammad, K., Foroushani, A. R., Zeraati, H., Fotouhi, A., . . . Seifi, B. (2008a). Sociodemographic and Smoking Associated with Obesity in Adult Women in Iran: Results from the National Health Survey. *Journal of Public Health, 30*(4), 429-435.

Bakhshi, E., Eshraghian, M. R., mohammad, K., Foroushani, A. R., Zeraati, H., Fotouhi, A., . . . Seifi, B. (2008b). The positive association between number of children and obesity in Iranian women and men: results from the National Health Survey. *BMC Public Health*. doi:10.1186/1471-2458-8-213

Bakhshi, E., Selfi, B., Biglarian, A., & Mohammad, K. (2012). Changes in Body Mass Index Across Age Groups in Iranian Women: Results from the National Health Survey. *Journal of Nutrition and Metabolism*. doi:10.1155/2012/848403

Balarajan, Y., & Villamor, E. (2009). Nationally representative surveys show recent increases in the Prevalence of Overweight and Obesity among women of reproductive age in Bangladesh, Nepal and India. *The Journal of Nutrition*. doi:10.3945/jn.109.112029

Bandura, A. (2002). Social foundations of thought and action: a social cognitive theory. In D. F. Marks (Ed.), *Health Psychology Reader* (pp. 94-106). Great Britain: The Cromwell Press.

Barghchi, M., Omar, D., & Aman, M. S. (2010). Sports Facilities in Urban Areas: Trends and Development Considerations. *Pertanika J. Soc. Sci. & Hum., 18*(2), 427 - 435.

Barlett, J., & Carpenter, J. (2013). Missing data Stata practical. Retrieved from http://www.bristol.ac.uk/cmm/learning/module-samples/14-stata-example.pdf

Barrington, D. S., Baquero, M. C., Borrell, L. N., & Crawford, N. D. (2010). Racial/ethnic disparities in obesity among US-born and foreign-born adults by sex and education. *Obesity, 18*(2), 422-424.

Barry, A.-M., & Yuill, C. (2008). *Understanding the sociology of health: an introducicition*. London: SAGE publisher.

Bartley, M. (2012). Explaining health inequality: evidence from the UK. *Soc Sci Med, 74*(5), 658-660.

Bartley, M., Blane, D., & Davey-Smith, G. (1998). Beyond the Black Report. In D. B. M. Bartley, and G. Davey-Smith, eds. (Ed.), *The Sociology of Health Inequality* Oxford: Blackwell.

Barton, H., & Grant, M. (2006). A health map for the local human habitat. *The Journal for the Royal Society for the Promotion of Health, 26*(6), 252-253.

Baruth, M., Sharpe, P.A., Parra-Medina, D., Wilcox, S. (2014). Perceived Barriers to Exercise and Healthy Eating among Women from Disadvantaged Neighborhoods: Results from a focus groups assessment. *Women Health, 54*(4), 336-353.

Batnitzky, A. (2008). Obesity and household roles: gender and social class in Morocco. *Sociol Health Illn., 30*(3), 445-462.

Batnitzky, A. (2010). Cultural constructions of "obesity": understanding body size, social class and gender in Morocco. *Health Place, 17*(1), 345-352.

Bauman, A. E., Reis, R. S., Sallis, J. F., Wells, J. C., Loos, R. J. F., Martin, B. W., & Group, f. t. L. P. A. S. W. (2012). Correlates of physical activity: why are some people physically active and others not? *The Lancet, 380*, 258-271.

Beardsworth, A., & Keil, T. (1992). The vegetarian option: varieties, conversions, motives and careers. *Sociological review, 40*, 253-293.

Becker, A. T. (1995). *Body, self, and society: the view from Fiji*. Philadelphia: University of Pennsylvania Press.

Belin, T. R., Hu, M.-Y., Young, A. S., & Grusky, O. (1999). Performance of a general location model with an ignorable missing-data assumption in a multivariate mental health service study. *Statist. Med., 18*, 3123-3135.

Bell, B. A., Ene, M., Smiley, W., & Schoeneberger, J. A. (2013). *A multilevel model primer using SAS PROC MIXED*. Paper presented at the SAS Global Forum 2013, San Francisco.

Bell, B. A., Schoeneberger, J. A., & Morgan, G. B. (2010). *Fundamental diagnostics for two-level mixed models: the SAS Macro MIXED_DX*. Paper presented at the SAS Global Forum 2010, Washington, USA.

Bell, C. G., Walley, A. J., & Froguel, P. (2005). The genetics of human obesity'. *Nature Reviews, 6*, 221-234.

Beltaifa, L., Traissac, P., El Ati, J., Lefevre, P., Romdhane, H. B., & Delpeuch, F. (2008). Prevalence of obesity and associated socioeconomic factors among Tunisia women from different living environments. *Obesity Reviews, 10*, 145-153.

Benjelloun, S. (2002). Nutrition transition in Morocco. In *Public Health Nutr* (Vol. 5, pp. 135-140). England.

Bennett, G. G., Wolin, K. Y., & Duncan, D. T. (2008). Social determinants of obesity. In F. B. Hu (Ed.), *Obesity Epidemiology* (pp. 342-376). New York: Oxford University Press.

Berry, W. D., & Feldman, S. (1985) Multiple regression in practice. In, *Quantitative applications in the social science*. Thousand Oaks, CA.: Sage university paper.

Bhattacharya, S., Campbell, D. M., Liston, W. A., & Bhattacharya, S. (2007). Effect of body mass index on pregnancy outcomes in nulliparous women delivering singleton babies. *BMC Public Health, 24*(7), 168. doi:10.1186/1471-2458-7-168

Bhopal, R. S. (2014). *Migration, Ethnicity, Race and Health in Multicultural Societies*. Oxford: Oxford University Press.

Bill, J. S. (1848). *Principles of political economy with some of their applications to social philosophy*. London: Routledge and Kegan Paul.

Bingenheimer, J. B., & Raudenbush, S. W. (2004). Statistical and substantive inferences in public health: issues in the application of multilevel models. *Annu Rev Public Health, 25*, 53-77.

Birch, L. L., & Fisher, J. O. (1998). Development of eating behaviors among children and adolescents. *Pediatrics, 101*(Supplement 2), 539-549.

Blalock, H. M. (1984). Contextual-effects models: theoretical and methodological issues. *Annu. Rev. Socio. 10*, 353-372.

Blaxter, M. (1997). Whose fault is it? People's own conceptions of the reasons for health inequalities. *Soc. Sci. Med., 44*(6), 747-756.

Blaxter, M. (2000). Class, time and biography. In M. Calnan, J. Gabe, & S. J. Williams (Eds.), *Health, medicine and society: key theories* (pp. 27-50). New York: Routledge.

Blaxter, M. (2010). *Health* (2 ed.). Cambridge: Polity Press.

Bleich, S. N., Thorpe, R.J., Sharif-Harris, H., Fesahazion, R., Laveist, R.A. (2010). Social context explains race disparities in obesity among women. *J Epidemiol Community Health, 64*(5), 465-469.

Block, J. P., Christakis, N. A., O'Malley, A. J., & Subramanian, S. V. (2011). Proximity to food establishments and body mass index in the Framingham Heart Study Offspring Cohort Over 30 years. *American Journal of Epidemiology, 174*(10), 1108-1114.

Block, J. P., HE, Y., & Zaslavsky, A. M. (2009). Psychosocial stress and change in weight among US adults. *American Journal of Epidemiology, 170*, 181-192.

Blundell, J. E., Stubbs, R. J., Golding, C., Croden, F., Alam, R., Whybrow, S., & Et, a. (2005). Resistance and susceptibility to weight gain. Individual variability in response to a high-fat-diet. *Physiology and Behaviour, 86*, 614-622.

Boing, A. F., & Subramanian, S. V. (2015). The influence of area-level education on bodymass index, waist circumference and obesity according to gender. *Int. J. Public Health, 60*(6), 727-736. doi:10.1007/s00038-015-0721-8

Bojorquez-Chapela, I., Unikel, C., Mendoza, M-E., de Lachica, F. (2014). Another Body Project: The Thin Ideal, Motherhood, and Body Dissatisfaction among Mexican Women. *Journal of Health Psychology, 19*(9). doi:10.1177/1359105313484783

Bolumar, F., Olsen, J., Rebagliato, M., Saez-Lloret, I., & Bisanti, L. (2000). Body mass index and delayed conception: a European multi-center study on infertility and subfecundity. *Am J Epidemiol, 151*(11), 1072-1079.

Bond, M. J., McDowell, A. J., & Wilkinson, J. Y. (2001). The measurement of dietary restraint, disinhibition and hunger. An examination of the factor structure of the Three Factor Eating Questionnaire (TFEQ). *International Journal of Obesity and Related Metabolic Disorders, 25*(6), 900-906.

Bonde, D. Qualitative market research: When enough is enough. Retrieved from:http://www.raptureconsulting.com/uploads/2/4/3/8/24380515/how_many_qualitative_ interviews.pdf

Boo, S. (2014). Misperception of Body Weight and Associated Factors. *Nursing and Health Sciences, 16*, 468-475.

Boon, N. S. Governance of Education Related ECCE Policies in Malaysia. *International Journal of Child Care and Education Policy, 4*(1), 45-57

Booth, D. A., & Booth, P. (2011). Targeting cultural changes supportive of the healthiest lifestyle patterns. A biosocial evidence-base for prevention of obesity. *Appetite, 56*(1), 210-221.

Bordo, S. (2003). *Unbearable weight*. United States of America: University of California Press, Ltd.

Borodulin, K., Zimmer, C., Sippola, R., Makinen, T. E., Laatikainen, T., & Prattala, R. (2012). Health behaviours as mediating pathways between socioeconomic position and body mass index. *Int J Behav Med, 19*(1), 14-22.

Boslaugh, S. (2007). *Secondary Data Sources for Public Health: A Practical Guide*. Cambridge: Cambridge University Press.

Bosma, H., Marmot, M. G., Hemingway, H., Nicholson, A., Brunner, E. J., & Stansfeld, S. (1997). Low job control and risk of coronary heart disease in the Whitehall II (prospective cohort) study. *BMJ, 314*, 558-565.

Bourdieu, P. (1986). The forms of capital. In J. Richardson (Ed.), *Handbook of theory and research for the sociology of education* (pp. 241-258). New York: Greenwood.

Bovet, P., Chiolero, A., Shamiaye, C., & Paccaud, F. (2008). Prevalence of overweight in Seychelles: 15-year trends and association with socio-economic status. *Obesity Reviews, 9*, 511-517.

Boyle, M. H., & Willms, J. D. (1999). Place effects for areas defined by administrative boundaries. *Am. J. Epidemiol., 149*, 577-585.

Braden, A., Musher-Eizenman, D., Watford, T., & Emley, E. (2018). Eating When Depressed, Anxious, Bored, or Happy: Are Emotional Eating Types Associated
with Unique Psychological and Physical Health Correlates? *Appetite, 125*, 410-417.

Brahnen, A., & Shaw, S. (1992). *Working choices - South Asian young women and the labour market*. Retrieved from Sheffield, England:

Brannen, J. (1992). Combining qualitative and quantitative approaches: an overview. In *Mixing methods: qualitative and quantitative research*. Aldershot: Avebury.

Brannen, J. (2005). Mixed methods research: a discussion paper. *ESRC National Centre for Research Methods NCRM Methods Review Papers*.

Brassington, G., Atienza, A. A., Perczek, R. E., DiLorenzo, T. M., & King, A. C. (2002). Intervention-related cognitive versus social mediators of exercise adherence in the elderly. *American Journal of Preventive Medicine, 23*(2), 80-86.

Braveman, P. (2006). Health disparities and health equity: concepts and measurement. *Annual review of public health, 27*, 167-194.

Braveman, P., Krieger, N., & Lynch, J. (2000). Health inequalities and social inequalities in health. *Bulletin of the world health organization, 78*(2), 232-234.

Braveman, P., Starfield, B., & Geiger, H. J. (2001). World health report 2000: how it removes equity from the agenda for public health monitoring and policy. *British medical journal, 323*, 678-680.

Braveman, P. A., Cubbin, C., Egerter, S., Chideya, S., Marchi, K. S., Metzler, M., & Posner, S. (2005). Socioeconomic status in health research - One size does not fit all. *Jama-Journal of the American Medical Association, 294*(22), 2879-2888. doi:10.1001/jama.294.22.2879

Brewis, A. A. (2014). Stigma and the perpetuation of obesity. *Soc. Sci. Med., Oct.* (118), 152-158.

Brinkmann, S., & Kvale, S. (2015). *InterViews: Learning the craft of qualitative
research interviewing*. California: Sage Publications, Inc.

Broom, A., & Willis, E. (2007). Competing paradigms and health research. In M. Saks & J. Allsop (Eds.), *Researching health: qualitative, quantitative and mixed methods* (pp. 16-31). London: Sage publications.

Brown, G. K. (2007). Making ethnic citizens: the politics and practice of education in Malaysia. *International Journal of education development, 27*(3), 318-330.

Bruce, M. A., Sims, M., Miller, S., Elliot, V., & Ladipo, M. (2007). One size fits all? Race, gender and body mass index among U.S. adults? *Journal of the national medical association, 99*(10), 1152-1158.

Brunner, E., & Marmot, M. (1999). Social organization, stress and health. In M. M & W. R. G (Eds.), *Social determinants of health*. Oxford: Oxford Press.

Bryant, E. J., King, N. A., & Blundell, J. E. (2007). Disinhibition. Its effects on appetite and weight regulation. *Obesity Reviews, 9*(5), 409-419.

Bryman, A. (2004). *Social research methods* (2nd edition ed.). Oxford: Oxford University Press.

Bryman, A. (2006). Integrating quantitative and qualitative research: how is it done? *Qualitative research, 6*(1), 97-113.

Bryman, A. (2008). The end of the paradigm wars? In P. Alasuutari, Bickman, L. and Nrannen, J (Ed.), *The Sage handbook of social research methods* (pp. 13-25). Great Britain: Sage publications Ltd.

Bryman, A. (2012). *Social research methods* (4 ed.). Oxford: Oxford University Press.

Bryman, A. (2016). *Social Research Methods*. United Kingdom: Oxford University Press.

Busfield, J. (2000). *Health and health care in modern Britain*. Oxford: Open university press.

Butland, B., Jebb, S., Kopelman, P., McPherson, K., Thomas, S., Mardell, J. and Parry, V. (2007). *Foresight, Tackling Obesities: Future Choices, Project Report 2nd edition.* Retrieved from http://www.foresight.gov.uk/Obesity/17.pdf

Buttenheim, A. M., Wong, R., Goldman, N., & Pebley, A. R. (2009). Does social status predict adult smoking and obesity? results from the 2000 Mexican National Health Survey. *Global Public Health*, 1744-1706.

Buuren, S. V. (2007). Multiple imputation of discrete and continuous data by fully conditional specification. *Stat Methods Med Res, 16*. doi:10.1177/0962280206074463

Buuren, S. V. (2012). *Multivariate missing data*. United States of America: Taylor and Francis Group.

Buuren, S. V., Boshuizen, H. C., & Knook, D. L. (1999). Multiple imputation of missing blood pressure covariates in survival analysis. *Statist. Med., 18*, 681-694.

cabinet.gov.my. Ahli-ahli Jemaah Menteri. Retrieved from http://cabinet.gov.my/bkpp/index.php/anggota-pentadbiran/menteri

Cai, L., Han, X., Qi, Z., Li, Z., Zhang, Y., Wang, P., Liu, A. (2014). Prevalence of Overweight and Obesity and Weight Loss Practice among Beijing Adults, 2011. *PLoS One, 9*(9). doi:10.1371/journal.pone.0098744

Cairns, B. J., Yang, T. Y. O., & Beral, V. (2011). That rising obesity levels will greatly add to the burden of cancer: misconceptions I. *Br J Cancer, 104*(1), 4-5.

Calle, E. E., & Kaaks, R. (2004). Overweight, obesity and cancer: epidemiological evidence and proposed mechanisms. *Nat Rev Cancer, 4*, 579–591.

Campbell, J. C., & Bunting, S. (1991). Voices and Paradigms: Perspectives on Critical and Feminist Theory in Nursing. *Adv Nurs Sci 13*(3), 1-15.

Canetti, L., Bachar, E., & Berry, E. M. (2002). Food and emotion. *Behavioural processes, 60*, 157-164.

Carpenter, J. R., & Kenward, M. G. (2013). *Multiple imputation and its application*. Singapore: John Wiley & Sons, Ltd.

Carpenter, J. R., Kenward, M. G., & Vanstealandt, S. (2006). A comparison of multiple imputation and doubly robust estimation for analyses with missing data. *3*(169), 571-584. doi:10.1111/j.1467-985X.2006.00407.x

Carpenter, J. R., Kenward, M. G., & White, I. R. (2007). Sensitivity analysis after multiple imputation under missing at random: a weighting approach. *Stat Methods Med Res*. doi:10.1177/0962280206075303

Carpenter, M., & Dolan, A. (2001). Poverty, inequality, social exclusion and health. In K. C (Ed.), *Dilemmas in UK health care* (3rd ed., pp. 193-216). Oxford, UK: The open university press.

Carr, D., & Friedman, M. A. (2005). Is obesity stigmatizing? Body weight, perceived discrimination, and psychological well-being in the United States. *J Health Soc Behav, 46*(3), 244-259.

Cawley, J. (2004). The impact of obesity on wages. *The journal of human resources, 39*(2), 451-474.

Cedar, S. H. (2008). Human biology and health. In J. Naidoo & J. Wills (Eds.), *Health studies: An introduction* (8 ed., pp. 22-45). New York: Palgrave MacMillan.

Celio, A., Zabinski, M., & Wifley, D. (2002). African American body image. In T. F. Cash & T. Pruzinsky (Eds.), *Body image: a handbook of theory, research, and clinical practice*. New York: Guilford Press.

Chambers, E. C., Schechter, C., Tow, A., Torrens, L., Kohlieber, R., & Calderon, R. (2010). Household Density and Obesity in Young Black and White adults. *Ethnicity & Disease, 20*(4), 366-369.

Chan, Y. Y., Lim, K. K., Lim, K. H., Teh, C. H., Kee.C.C., Cheong, S. M., . . . Ahmad, N. A. (2017). Physical Activity and Overweight/Obesity among Malaysian Adults: Findings from the 2015 National Health and Morbidity Survey
(NHMS). *BMC Public Health 17*(733). doi:10.1186/s12889-017-4772-z

Chandola, T., Kuper, H., Singh-Manoux, A., Bartley, M., & Marmot, M. (2004). The effect of control at home on CHD events in the Whitehall II study: gender differences in psychosocial domestic pathways to social inequalities in CHD. *Social Science & Medicine, 58*(8), 1501-1509.

Chang, C. T., Chang, K. H., & Cheah, W. L. (2009). Adults’ perceptions of being overweight or obese: a focus group study *Asia Pac J Clin Nutr, 18*(2), 257-264.

Chang, H. H., Just, D. R., & Lin, B. H. (2010). Smoking, drinking, and the distribution of adult body weight. *Social Science Journal, 47*(2), 372-391. doi:10.1016/j.soscij.2009.12.006

Chang, M. W., Nitzke, S., Guilford, E., Adair, C. H., & Hazard, D. L. (2008). Motivators and barriers to healthful eating and physical activity among low-income overweight and obese mothers. *J Am Diet Assoc., 108*(6), 1023-1028.

Chang, V. W., & Christakis, N. A. (2002). Medical modelling of obesity: a transition from action to experience in a 20th century American medical textbook. *Sociology of Health and Illness, 24*(2), 151-177.

Chang, V. W., & Lauderdala, D. S. (2005). Income disparities in body mass index and obesity in the United States, 1971-2002. *Arch Intern Med, 165*(2122-2128).

Chaparro, M. P., & Koupil, I. (2014). The impact of parental educational trajectories on their adult offspring's overweight/obesity status: A study of three generations of Swedish men and women. *Soc Sci Med, 120*, 199-207.

Chapter 6 Improving Income Distribution and Standards of the People In *Sabah Development Corridor* (pp. 149-170). Retrieved from http://sedia.com.my_SDC_Blueprint

Charmaz, K., & Belgrave, L. L. (2012). Qualitative interviewing and grounded theory analysis. In *the SAGE Handbook of Interview Research: The Complexity of the Craft.* (pp. 347-366). California: Sage Publications, Inc.

Cheah, B. K. (2002). *Malaysia: The making of a nation*. Singapore: Institute of Southeast Asian Studies.

Chee, H.-L., Kandiah, M., Khalid, M., Shamsuddin, K., Jamaluddin, J., Nordin, N. A. M. M., . . . Osman, I. (2004). Body mass index and factors related to overweight among women workers in electronic factories in Peninsular Malaysia. *Asia Pacific Journal of Clinical Nutrition, 13*(3), 248-254.

Chee HL, K. M., Khalid M, Shamsuddin K, Jamaluddin J, Nordin NA, Shuib R, Osman I. (2004). Body mass index and factors related to overweight among women workers in electronic factories in Peninsular Malaysia. *Asia Pac J Clin Nutr, 13*(3), 248-254.

Chen, L., Toma-Drane, M., Valois, R. F., & Drane, J. W. (2005). Multiple imputation for missing ordinal data. *Journal of modern applied statistical methods, 4*(1), 288-299.

Chen, M., Vanek, J., Lund, F., Heintz, J., Jhabuala, R., & Bonner, C. (2005). *The Progress of The World's Women*. Retrieved from New York:

Chen, R. L., & Tunstall-Pedoe, H. (2005). Socioeconomic deprivation and waist circumference in men and women: The Scottish MONICA surveys 1989-1995. *European Journal of Epidemiology, 20*(2), 141-147. doi:10.1007/s10654-004-4498-y

Chen, Z., & Crawford, C. A. G. (2012). The role of geographic scale in testing the income inequality hypothesis as an explanation of health disparities. *Social Science & Medicine, 75*, 1022-1031.

Cheung, Y. T., Lee, A. M., Ho, S. Y., Li, E. T., Lam, T. H., Fan, S. Y., & Yip, P. S. (2011). Who wants a slimmer body? The relationship between body weight status, education level and body shape dissatisfaction among young adults in Hong Kong. *BMC Public Health*. doi:10.1186/1471-2458-11-835

Chin, J. (2000). *The Chinese of South-East Asia*. London: Minority Rights Group International.

Choi, Y., Choi, E., Shin, D., Park, S.M., Lee, K. (2015). The Association Between Body Weight Misperception and Psychosocial Factors in Korean Adult Women Less than 65 Years Old with Normal Weight. *Medicine General & Social Medicine, 30*, 1558-1566.

Choo, V. (2002). WHO reassesses appropriate body-mass index for Asian populations. *The Lancet, 360*, 235.

Christakis, N. A., & Fowler, J. H. (2007a). The spread of obesity in a large social network over 32 years. *The new England journal of medicine, 357*, 370-379.

Christakis, N. A., & Fowler, J. H. (2007b). The spread of obesity in a large social network over 32 years. *N Engl J Med., 357*(4), 370-379.

Cicourel, A. V. (1964). *Method and measurement in Sociology*. New York: Free Press.

Cleland, J., Laird, S., & Smith, B. (2011). An introduction to health and illness in society. In J. Cleland & P. Cotton (Eds.), *Health behaviour and society: clinical medicine in context* (pp. 7-24). Great Britain: Learning Matters Ltd.

Cleveland, W. S. (1993). *Visualizing data*. Summit, New Jersey: Hobart Press.

Clucas, M. (2009). *Researching Irish health inequalities in England: a case study of first and second generation Irish men and women in Coventry.* (Thesis (Ph.D) - University of Warwick, 2009.).

CMM. (2014) Random Intercept Models. Retrieved from http://www.bristol.ac.uk/cmm/learning/videos/random-intercepts.html

Cohen, L., Manian, L., & Morrison, K. (2007). *Research methods in education*. Oxon: Routledge.

Colchero, M. A., & Bishai, D. (2008). Effect of neighborhood exposures on changes in weight among women in Cebu, Philippines (1983-2002). *Am J Epidemiol, 167*(5), 615-623.

Colchero, M. A., Caro-Vega, Y., & Kaufer-Horwitz, M. (2014). Socioeconomic status and misperception of body mass index among Mexican adults. *Salud Publica Mex, 56*(3), 251-258.

Colchero, M. A., & Sosa-Rubi, S. G. (2012). Heterogeneity of income and lifestyle determinants of body weight among adult women in Mexico, 2006. *Soc Sci Med, 75*(1), 120-128.

Collins, P. H. (2000). *Black feminist thought: knowledge, consciousness, and the politics*. Boston: Unwin Hyman.

Corsi, D., Finlay, J. E., & Subramanian, S. V. (2012). Weight of communities: a multilevel analysis of body mass index in 32,814 neighborhoods in 57 low- to middle-income countries (LMICs). *Social Science and Medicine, 75*(2), 311-322.

Costanzo, P. R., & Schiffman, S. S. (1989). Thinness—not obesity—has a genetic component. *Biobehavioral Reviews, 13*(1), 55–58.

CPDS. (2016). Poverty Summary: Malaysia-Incidence of Poverty in Malaysia and MDGs. Retrieved from http://cpds.um.edu.my/wp-content/uploads/2016/08/Poverty-Summary_Malaysia_270516.pdf

Crawford, D., Campbell, K. (1999). Lay Definitions of Ideal Weight and Overweight. *International Journal of Obesity, 23*, 738-745.

Creswell, J. W. (2007). *Qualitative inquiry & research design: choosing among five approach*. Thousand Oaks, CA.: Sage Publications, Inc.

Creswell, J. W., & Clark, P. (2011). *Designing and conducting mixed methods research* (2nd edition ed.). Thousand Oaks: Sage.

Creswell, J. W., & Plano Clerk, W. L. (2007). *Designing and conducting mixed methods research*. Thousand Oak, California: Sage.

Crichton, N., & Mulhall, A. (2008). Epidemiology and health. In J. Naidoo & J. Wills (Eds.), *Health studies: an introduction* (pp. 73-104). Great Britain: Palgrave Macmillan.

Crinis, V. (2004). *The Silence and Fantasy of Women and Work.* University of Wollongong, Australia.

Crinis, V. (2008). Malaysia: Women, Labour Activism and Unions. In K. Broadbent & M. Ford (Eds.), *Women and Labour Organising in Asia, Diversity, Autonomy and Activitism* (pp. 50-65). Abingdon: Routledge.

Crosnoe, R. (2007). Gender, obesity, and education. *Sociology of Education, 80*(3), 241-260.

Crossan, F. (2003). Research philosophy: towards an understanding. *Nurse Res., 11*(1), 46-55.

Crotty, M. (1998). *The foundations of social research: meaning and perspective in the research process*. London: SAGE publications Ltd.

Crouch, M., & McKenzie, H. The logic of small samples in interview-based qualitative research.

CSDH. (2008). *Closing the gap in the generation, health equity through action on the social determinants of health. Final report of the Commission on Social Determinants of Health*. Retrieved from Geneva: http://whqlibdoc.who.int/publications/2008/9789241563703_eng.pdf

Curry, L. A., Nembhard, I. M., & Bradley, E. H. (2009). Qualitative and mixed methods provide unique contributions to outcomes research. *Circulation, 119*, 1442-1452.

Dahlgren, G., & Whitehead, M. (1991). *Policies and strategies for promoting social equity in health*. Stockholm: Institute of Future Studies.

Dahlgren, G., & Whitehead, M. (2007). *Policies and strategies for promoting social equity iin health. Background document to WHO - Strategy paper for Europe.*: Institute for Futures Studies.

Dale, A., Arber, S., & Procter, M. (1988). *Doing secondary analysis*. London: Unwin Hyman.

Dale, A., Wathan, J., & Higgins, V. (2008). The secondary analysis of quantitative data source. In P. Alasuutari, L. Bickman, & J. Brannen (Eds.), *Handbook of social research methods*. London: Sage.

Dallman, M. F. (2010). Stressed-induced obesity and the emotional nervous system. *Trends endocrinol. metab*, 159-165.

Dasar Pendidikan Kebangsaan. Retrieved from http://pmr.penerangan.gov.my/index.php/component/content/article/88-dasar-dasar-negara/242-dasar-pendidikan-kebangsaan.html

Davidson, R., Kitzinger, J., & Hunt, K. (2006). The wealthy get healthy, the poor get poorly? Lay perceptions of health inequalities. *Soc. Sci. ~& Med, 62*(9), 2171–2182.

Daykin, N., & Jones, M. (2008). Sociology and health. In J. Naidoo & J. Wills (Eds.), *Health studies: an introduction* (pp. 108-140). Great Britain: Palgrave Macmillan.

de Leeuw, J., & Kreft, I. G. G. (1986). Random coefficient models for multilevel analysis. *Journal of Educational Statistics, 11*, 57-85.

De Maio, F. G. (2007). Income inequality measures *J Epidemiol Community Health, 61*(10), 849-852. doi:10.1136/jech.2006.052969

De Vaus, D. A. (2002). *Surveys in Social Research* (Fifth edition ed.). Australia: Allen & Unwin.

Dedrick, R. F., Ferron, J. M., Hess, M. R., Hogarty, K. Y., Kromrey, J. D., & Lang, T. R., et al. (2009). Multilevel modeling: A review of methodological issues and applications. *Review of Educational Research, 79*, 69-102.

Demirtas, H., Freels, S. A., & Yucal, R. M. (2008). Plausibility of multivariate normality assumption when multiply imputing non-Gaussian continuous outcomes: a simulation assessment. *Journal of Statistical of Computation and Simulation, 78*(1), 69-84.

Denney, J. T., Krueger, P. M., Rogers, R. G., & Boardman, J. D. (2004). Race/ethnic and sex differentials in body mass among US adults. *Ethnicity and Disease, 14*(Summer), 389-398.

Denscombe, M. (2014). *The good research guide: for small-scale social research projects*. England: Open University Press.

Department of Statistics, M. Average Household Size by State: 1980-2010. Retrieved from http://www.statistics.gov.my/portal/images/stories/files/LatestReleases/banci/jadual3.pdf

Department of Statistics, M. (2016) Income and Expenditure. Retrieved from http://www.statistics.gov.my/portal/download_Stats_Malaysia/files/MMS/2010/BI/07_Income_and_Expenditure.pdf

Department of Statistics, M. (2018) Johor. Retrieved from https://www.dosm.gov.my/v1/index.php?r=column/cone&menu_id=d1dTR0JMK2hUUUFnTnp5WUR2d3VBQT09

Department of Statistics, M. (2018) Kelantan. Retrieved from https://www.dosm.gov.my/v1/index.php?r=column/cone&menu_id=RU84WGQxYkVPeVpodUZtTkpPdnBmZz09

Department of Statistics, M. (2018) Perlis. Retrieved from https://www.dosm.gov.my/v1/index.php?r=column/cone&menu_id=UDZaUXd2N2k2L2orK2FpdDJ1UjVtZz09

Department of Statistics, M. (2018) Migrants and Migration Status, Malaysia. Retrieved from https://www.dosm.gov.my/v1/index.php?r=column/cone&menu_id=akw3aytRcnk0eTZpTzQvRkVLOW5hQT09

Department of Statistics, M. (2015). *Population Distribution and Basic Demographic Characteristic Report 2010* Retrieved from Putrajaya: http://www.statistics.gov.my/portal/index.php?option=com_content&id=1215

Department of Statistics, M. (2000). *Population and Housing Census*. Kuala Lumpur: Department of Statistics, Malaysia.

Department of Statistics, M. (2013a). State/District Social Statistics Malaysia. Retrieved from http://www.statistics.gov.my/portal/download_Labour/files/PSND/Perangkaan_Sosial_Negeri-Daerah_Malaysia2013.pdf

Department of Statistics, M. (2013b). The Household Income Survey 2012.

Department of Statistics, M. (2013c). Vital Statistics.

Department of Statistics, M. (2009) Summary Finding. Retrieved from https://www.statistics.gov.my/images/stories/files/LatestReleases/household/Press_Release_household2009_BI.pdf

Department of Statistics, M. (2011). *Population Distribution and Basic Demographic Characteristics 2010*. Retrieved from Putrajaya, Malaysia: http://www.statistics.gov.my/portal/download_Population/files/census2010/Taburan_Penduduk_dan_Ciri-ciri_Asas_Demografi.pdf

Department of Statistics, M. (2013). *Vital Statistics 2012*. Retrieved from Putrajaya: http://statistics.gov.my/portal/images/stories/files/LatestReleases/vital/Vital_Statistics_Malaysia_2012.pdf

Department of Statistics, M. (2014). Labour Force and Social Statistics. Retrieved from https://www.dosm.gov.my/v1/index.php?r=column/ctwoByCat&parent_id=123&menu_id=U3VPMldoYUxzVzFaYmNkWXZteGduZz09

Department of Statistics, M. (2015). *Population Distribution and Basic Demographic Characteristic Report 2010* Retrieved from Putrajaya: http://www.statistics.gov.my/portal/index.php?option=com_content&id=1215

der Meera, T. V., Grotenhuis, M. T., & Pelzerb, B. (2010). Influential cases in multilevel modeling a methodological comment. *American Sociological Review, 75*(1), 173-178.

Deurenberg, P., Deurenberg-Yap, M., & Guricci, S. (2002). Asians are different from Caucasians and from each other in their body mass index/body fat per cent relationship. *Obes Rev., 3*(3), 141-146.

Deurenberg, P., Yap, M., & Staveren, W. A. V. (1998). Body mass index and per cent body fat: a meta-analysis among different ethnic groups. *Int J obes Relat Metab Disord 22*(12), 1164-1171.

Deurenberg-Yap, M., & Deurenberg, P. (2003). Is a re-evaluation of WHO body mass index cut-off values needed? The case of Asians in Singapore. *Nutr Re, 61*(5), s80-s87.

Deurenberg-Yap, M., Schmidt, G., van Staveren, W. A., & Deurenberg, P. (2000). The paradox of low body mass index and high body fat percentage among Chinese, Malays and Indians in Singapore. *Int J Obes Relat Metab Disord., 24*(8), 1011-1017.

Devasahayam, T. W. (2005). Power and Pleasure Around the Stove: the Construction of Gendered Identity in Middle-Class South Indian Hindu Households in Rural Malaysia. *Women's Studies International Forum, 28*, 1-20.

DeVault, M. L., & Gross, G. (2007). Feminist interviewing experience, talk and knowledge. In S. N. Hesse-Biber (Ed.), *Handbook of feminist research: theory and praxis* (pp. 173-198). the United States of America Sage Publisher.

Devaux, M., Sassi, F., Church, J., Cecchini, M., & Borgonovi, F. (2011). Exploring the Relationship Between Education and Obesity. *OECD Journal Economic Studies, 1*.

Devine, C. M., Olson, C. M., & Bpve, C. F. (2000). Continuity and change in women's weight orientations and lifestyle practices through pregnancy and the postpartum period: the influence of life course trajectories and transitional events. *Soc Sci Med, 50*(4), 567-582.

DHSS. (1980). *Inequalities in health: Report of a research working group*. Retrieved from London:

Diaz, V. A., Mainous, A.G., and Pope, C. (2007). Cultural Conflicts in the Weight Loss Experience of Overweight Latinos. *International Journal of Obesity, 31*, 328-333.

Diderichsen, F., Evans, T., & Whitehead, M. (2001). The social basis of disparities in health. In T. Evans, M. Whitehead, E. Diderichsen, A. Bhuiya, & M. Wirth (Eds.), *Challenging inequities in health: from ethics to action*. Oxford: Oxford University Press.

Diener, E., & Crandall, R. (1978). *Ethics in social and behavioural research*. Oxford, England: University Chicago Press.

Diez Roux, A. V. (2002). A glossary for multilevel analysis. *Journal of Epidemiology and Community Health, 56*, 588-594. doi:10.1136/jech.56.8.588

Dijkshoorn, H., Ujcic-Voortman, J. K., Viet, L., Verhoeff, A. P., & Uitenbroek, D. G. (2011). Ethnic variation in validity of the estimated obesity prevalence using self-reported weight and height measurements. *BMC Public Health, 11*. doi:10.1186/1471-2458-11-408

Dinsa, G. D., Goryakin, Y., Fumagalli, E., & Suhrcke, M. (2012). Obesity and socioeconomic status in developing countries: a systematic review. *Obesity reviews, 13*(11), 1067-1079.

Disease Control Division, M. o. H. (2006). *MyNCD-1 Malaysia NCD Surveillance-1 2005/2006*. Retrieved from Putrajaya:

Doll, H. A., Petersen, S. E. K., & Stewart-Brown, S. L. (2000). Obesity and physical and emotional well-being: associations between body mass index, chronic illness, and the physical and mental components of the SF-36 questionnaire. *Obesity Research, 8*(2), 160-170.

Drake, A. J., & Reynolds, R. M. (2010). Impact of maternal obesity on offspring obesity and cardiometabolic disease risk. *Reproduction, 140*(3), 387-398.

Du Prel, J.-B., Hommel, G., Rohrig, B., & Blettner, M. Confidence Interval or P-Value? *Deutsches Arzteblatt Int. 106*(19).

Dunn, R. A., Tan, A. K. G., & Nayga, R. M. (2012). Obesity inequality in Malaysia: decomposing differences by gender and ethnicity using quantile regression. *Ethnicity and Health, 57*(2), 279-288.

Earle, S. (2007). Promoting public health: exploring the issues. In S. Earle, C. E. Lloyd, M. Sidell, & S. Spurr (Eds.), *Theory and research in promoting public health* (pp. 1-36). London: Sage.

Economic Planning Unit, M. (EPU). Rural Development. Retrieved from http://www.epu.gov.my/en/pembangunan-luar-bandar

Economic Planning Unit, M. (EPU). The Malaysian Economy in Figures 2012 (Updated version). Retrieved from http://www.epu.gov.my/documents/10124/72ac36d7-fe5a-489b-a34c-a2cb2be073a6

Economic Planning Unit, M. (EPU) (2018). *Chapter 20 Women in Development*. Retrieved from Kuala Lumpur, Malaysia: http://www.epu.gov.my/epu-theme/RMK7/Chapter%2020%20-%20Women%20And%20Development.pdf

Economic Planning Unit, M. (2004). Malaysia: 30 years of poverty reduction, growth and racial harmony Paper presented at the Shanghai Poverty Conference - Scaling Up Poverty Reduction, Shanghai, China. http://www.epu.gov.my/c/document_library/get_file?uuid=99bd8cae-3e64-4f1c-af73-3ba6740027e2&groupId=283545

Economic Planning Unit, M. (EPU) (2012). Infrastructures and Utilities. In *The Ninth Malaysia Plan: 9MP (2006-2010)* (pp. 267-301). Putrajaya: Economic Planning Unit, Prime Minister's Department.

Economic Planning Unit, M. (EPU) (2013). The Malaysia Economy in Figures 2013 (Updated edition). Retrieved from http://www.epu.gov.my/documents/10124/1e9cd2e5-67a8-4b6c-b530-b1448a6a1475

Economic Planning Unit, M. (EPU). (2019). Fourth Malaysia Plan 1981-1985. Retrieved from http://epu.gov.my/sites/default/files/Chapterpercent20XXIIpercent20-percent20Socialpercent20Development.pdf

Economic Planning Unit, M. (EPU). The Malaysian Economy in Figures. Retrieved from http://www.epu.gov.my/en/the-malaysian-economy-in-figures-2012

Economic Planning Unit, M. (EPU). (2019) Jadual 6- Pekali Gini Mengikut Kumpulan Ethnik, Strata dan Negeri, Malaysia, 1970-2016. Retrieved from http://103.8.145.121/sites/default/files/Jadual%206%20-%20Pekali%20Gini%20Mengikut%20Kumpulan%20Etnik%2C%20Strata%20dan%20Negeri%2C%20Malaysia%2C%201970-2016.pdf

Economic Planning Unit, M. (EPU) MDG 3 Promote Gender Equality and Empower Women. Retrieved from http://www.epu.gov.my/c/document_library/get_file?uuid=90c6a4db-02da-4de4-8c1d-bec2dd05ce1a&groupId=283545

Economic Planning Unit, M. (EPU) New Economic Policy. Retrieved from http://www.epu.gov.my/en/dasar-ekonomi-baru

Economic Planning Unit, M. (EPU) The Malaysian Economy in Figures. Retrieved from http://www.epu.gov.my/documents/10124/72ac36d7-fe5a-489b-a34c-a2cb2be073a6

Economic Planning Unit, M. (EPU) *The National Mission - Ninth Malaysia Plan 2006-2010*. Retrieved from Putrajaya, Malaysia: http://www.epu.gov.my/epu-theme/rm9/english/Mission.pdf

Economic Planning Unit, M. (2006) Ninth Malaysia Plan (2006-2010) https://www.pmo.gov.my/dokumenattached/RMK/RM9_E.pdf

Economic Planning Unit, M. (EPU) (2018b) National policy for women. Retrieved from: http://epu.gov.my/sites/default/files/Chapterpercent2016percent20-percent20Womanpercent20Inpercent20Development.pdf

Egan, M., Tannahill, C., Petticrew, M., & Thomas, S. (2008). Psychosocial risk factors in home and community settings and their associations with population health and health inequalities: A systematic meta-review. *BMC Public Health 8*(239).

Eknoyan, G. (2008). Adolphe Quetelet (1796 – 1874) – the average man and indices of obesity. *Nephrol. Dial. Transplant., 23*, 47-51. doi:10.1093/ndt/gfm517

El Ati, J., Traissac, P., Beji, C., Aounallah-Skhiri, H., Delpeuch, F., Ben Romdhane, H., & Maire, B. (2011). Gender differences in prevalence and environmental and socioeconomic cofactors of obesity among Tunisian adults. *Annals of Nutrition and Metabolism, 58*, 317-317.

El-Sayed A.M., S., P. and Galea, S. (2012). Unevenly distributed: A systematic review of the health literature about socioeconomic inequalities in adult obesity in the United Kingdom. *BMC Public Health, 12*(18). doi:10.1186/1471-2458-12-18

El-Sayed, A. M., Scarborough, P., & Galea, S. (2011). Ethnic inequalities in obesity among children and adults in the UK: a systematic review of the literature. *Obesity Reviews, 12*(5). doi:10.1111/j.1467-789X.2010.00829.x

Elgar, F. J., & Steward, J. M. (2008). Validity of self-report screening for overweight and obesity. Evidence from the Canadian Community Health Survey. *Can J Public Health, 99*(5), 423-427.

Elliott, J., & Marsh, C. (2008). *Exploring Data: An Introduction to Data Analysis for Social Scientists* (Second edition ed.). Cambridge, UK: Polity Press.

Ellis, S., Rosenblum, K., Miller, A., Peterson, K.E., Lumeng, J.C. (2014). Meaning of the Terms "Overeweight" and "Obese" Among Low-Income Women. *Journal of Nutrition Education and Behaviour, 46*(4), 299-303.

Elstad, J. I. (1998). The psycho-social perspective on social inequalities in health. *Sociology of Health and Illness, 20*(5), 598-618.

Embong, A. R. (2001). The Culture and Practice of Pluralism in Post Colonial Malaysia. In R. W. Hefner (Ed.), *The Politics of Multiculturalism: Pluralism and Citizenship in Malaysia* (pp. 59-85). United States of America: University of Hawai'i Press.

Engel, G. L. (1977). The need for a new medical model: a challenge for biomedicine. *Science, 196*(4286), 129-136.

Epstein, L. H., Leddy, J. J., Temple, J., & Faith, M. (2007). Food reinforcement. A multilevel analysis. *Psychological Bulletin, 133*, 884-906.

Ergin, I., Hassoy, H., & Kunst, A. (2011). Socio-economic inequalities in overweight among adults in Turkey: a regional evaluation. *Public Health Nutrition, 15*(1), 58-66.

Ersoy, C., Imamoglu, S., Tuncel, E., Erturk, E., & Ercan, I. (2005). Comparison of the factors that influence obesity prevalence in three district municipalities of the same city with different socioeconomical status: a survey analysis in an urban Turkish population. *Prev Med, 40*(2), 181-188.

Europe, W. R. O. f. Body mass index - BMI. Retrieved from http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi

European Commission. Directorate-General for Employment Social Affairs and Equal Opportunities., & European Commission. Directorate General for Health & Consumers. (2010). *Reducing health inequalities in the European Union*. Luxembourg: Office for Official Publications of the European Communities.

Fadhli, Y., Azahadi, O., Noor Ani, A., Balkish, M.N., Ahmed Jessree, K. and Tahir, A. (2013) Approaches in methodology of a population-based study in Malaysia: The National Health and Morbidity Survey 2011 (NHMS 2011). *Malaysian Journal of Medicine and Health Sciences*, 9(2) June 2013: 25-33

Fan, J. X., Wen, M., & Kowaleski-Jones, L. (2016). Tract and county-level income inequality and individual risk of obesity in the United States.

Fang, C., & Liang, Y. Social Disparities in Body Mass Index (BMI) Trajectories among Chinese Adults in 1991-2011. *International Journal for Equity in Health, 16*(146). doi: 10.1186/s12939-017-0636-5

Farooqi, S., & O'Rahily, S. (2006). Genetics of Obesity in Humans. *Endocrine Reviews, 27*(7), 710-718.

Fazlina, M., Liyana, A. Z., Omar, A., Ambak, R., Nor, N. S. M., Shamsudin, U. K., . . . Aris, T. Effects of weight loss intervention on body composition and blood pressure among overweight and obese women: findings from the MyBFF@home study. *18 (Suppl 1)*(93). doi:10.1186/s12905-018-0592-2

Fernald, L. C. (2007). Socio-economic status and body mass index in low-income Mexican adults. *Soc Sci Med, 64*(10), 2030-2042.

Fernandez, J. (2009). Intra-occupational Gender Earnings Gaps in Malaysia. *Jurnal Kemanusiaan, 14*, 20-36.

Fernandez, J. R., Heo, M., Heymsfield, S. B., Pierson, R. N. J., Pi-Sunyer, F. X., & al., e. (2003). Is percentage body fat differently related to body mass index in Hispanic Americans, African Americans, and European Americans? *Am J Clin Nutr, 77*(1), 71-75.

Ferrer, C. P., McMunn, A., & Dommarco, J. A. R. (2014). Educational inequalities in obesity among Mexican women: time-trends from 1988 to 2012. *PLOS ONE, 9*, e90195. doi:10.1371/journal.pone.0090195

Field, A. (2009). *Discovering Statistics Using SPSS*. London: SAGE Publications Ltd.

Finlay, L. (2006a). 'Going exploring': The nature of qualitative research. In L. Finlay & C. Ballinger (Eds.), *Qualitative research for health professionals: challenging choices* Chichester: John Wiley Publishers.

Finlay, L. (2006b). ‘Rigour’, ‘Ethical Integrity’ or ‘Artistry’? Reflexivity reviewing criteria for evaluating qualitative research. *British Journal of Occupational Therapy*. doi:https://doi.org/10.1177/030802260606900704

Finucane, M. M., Stevens, G. A., Cowan, M. J., Danaei, G., & al., e. (2011). National, regional, and global trends in body-mass index since 1980: systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9.1 million participants. *Lancet, 377*(9765), 557-567.

Flegal, K. M., Carroll, M.D., Kit, B.K. and Ogden, C.L. (2012). Prevalence of obesity and trends in the distribution of Body Mass Index among US adults, 1999-2010. *JAMA*.

Flegal, K. M., Carroll, M.D., Ogden, C.L. and Curtin, L.R. (2010). Prevalence and trends in obesity among US adults 1999-2008. *JAMA, 303*(3), 235-241.

Flegal, K. M., Graubard, B. I., Williamson, D. F., & Gail, M. H. (2005). Excess deaths associated with underweight, overweight, and obesity. *Journal of the American Medical Association 293*, 1861–1867.

Flegal, K. M., Graubard, B. I., Williamson, D. F., & Gail, M. H. (2007). Cause-specific excess deaths associated with underweight, overweight, and obesity. *Journal of the American Medical Association 298*, 2028–2037.

Flegal, K. M., Harlan, W. R., & Landis, J. R. (1988). Secular trends in body mass index and skinfold thickness with socioeconomic factors in young adult women. *Am J Clin Nutr, 48*, 535-543.

Flegal, K. M., Shepherd, J. A., Looker, A. C., Graubard, B. I., & al., e. (2009). Comparisons of percentage body fat, body mass index, waist circumference, and waist-stature ration in adults. *The American Journal of Clinical Nutrition, 89*(2), 500-508.

Fletcher, R. H., & Fletcher, S. W. (2005). *Clinical epidemiology. The Essential* (4 ed.). Philadelphia: Lippincott Williams & Wilkins.

Flick, U. (2012). *Introducing research methodology: a beginner's guide to doing a research project.* London: Sage Publication Ltd.

Flynn, K. J., & Fitzgibbon, M. (1998). Body images and obesity risk among black females: a review of the literature. *Ann Behav Med., 20*(1), 13-24.

Fontaine, K. R., Redden, D. T., Wang, C., Westfall, A. O., & Allison, D. B. (2003). Years of life lost due to obesity. *JAMA, 289*(2), 187-193.

Ford, E. S., Moriarty, D. G., Zack, M. M., Mokdad, A. H., & Chapman, D. P. (2001). Self-reported body mass index and health-related quality of life: findings from the Behavioral Risk Factor Surveillance System. *Obes Res, 9*(1), 21-31.

Fox, J. (1991) Regression diagnostics. In. *Quantitative applications in the social science*. Iowa city: Sage QASS series.

Fox, K. R., & Hillsdon, M. (2007). Physical activity and obesity. *Obesity Reviews, 8*(Suppl.1), 115-121.

Francis, J. J., Johnston, M., Robertson, C., Glidewell, L., Entwistle, V., Eccless, M. P., & Grimshaw, J. M. (2010). What is an adequate sample size? Operationalising data saturation for theory-based interview studies. *Psychol Health 25*(10), 1229-1245.

Francis, L. A., & Sussman, E. J. (2009). Self-regulation and rapid weight gain in children from age 3 to 12 years. *Archives of pediatrics and adolescent medicine, 163*, 297-302.

Franck, A. K. (2011). "I am too old! Who is going to give me a job?" Women hawkers in Teluk Bahang, Penang, Malaysia. *Journal of Workplace Rights, 15*(1), 111-132.

Frayling, T. M., Timpson, N. J., Weedon, M. N., Zeggini, E., Freathy, R. M., & al., e. (2007). A common variant in the FTO Gene is associated with body mass index and predisposes to childhood and adult obesity. *Science, 316*(5826), 889-894.

French, S. A., Epstein, L. H., Jeffery, R. W., Blundell, J. E., & Wardle, J. (2012). Eating behaviour dimensions. Associations with energy intake and body weight. *Appetite, 59*, 541-549.

Freund, P. E. T., McGuire, M., & Podhurst, L. S. (2002). *Health, Illness, and the Social Body: A Critical Sociology* (4 ed.). Upper Saddle River, NJ: Prentice-Hall.

Friedman, J. M., & Halaas, J. L. (1998). Leptin and the regulation of body weight in mammals. *Nature, 395*, 763-770.

Friedman, K. E., Reichmann, S. K., Costanzo, P. R., Costanzo, P. R., Zelli, A., & al., e. (2005). Weight stigmatization and ideological beliefs: relation to psychological functioning in obese adults. *Obes Res, 13*(5), 907-916.

Frisancho, A. R. (2004). Bio-cultural components of the coexistence of under-nutrition and obesity in Latin America. *American Journal of Physical Anthropology*, 96-97.

Fuchs, V. (1974). *Who shall live? Health, economics and social choice*. New York: Basic Books.

Fuemmeler, B.F., Lovelady, C.A., Zucker, N.L. and Ostbye, T. (2013) Parental obesity moderates the relationship between childhood appetitive traits and weight. *Obesity (silver Spring),* 21(4): 815-823

Fukuyama, F. (1995). *Trust: the social virtues and the creation of prosperity*. London: Hamish Hamilton.

Gale, E. A. M., & Gillespie, K. M. (2001). Diabetes and gender. *Diabetologica, 44*, 3-15.

Gallagher, D., Visser, M., Sepulveda, D., Pierson, R. N., Harris, T., & Heymsfield, S. B. (1996). How useful is body mass index for comparison of body fatness across age, sex, and ethnic groups? *American Journal of Epidemiology, 143*(3), 228-239.

Gan, W. Y., Boo, S., Seik, M. Y., & Khoo, H. E. (2018). Comparing the nutritional status of vegetarians and non-vegetarians from a Buddhist Organisation in Kuala Lumpur, Malaysia. *Malaysia Journal of Nutrition, 24*(1).

Garg, C., Khan, S. A., Ansari, S. H., & Garg, M. (2010). Prevalence of obesity in Indian women. In *Obes Rev* (Vol. 11, pp. 105-108). England.

Garn, S. M., Hawthorne, V. M., & Leonard, W. R. (1986). Three limitations of the body mass index. *Am J Clin Nutr, 44*(6), 996-997.

Garcia, M., Greenley,R., Martin-Onraet, V. and Pollack, L. (2015) Women's workforce participation in Indonesia and Malaysia. Retrieved from https://elliott.gwu.edu/sites/g/files/zaxdzs2141/f/Nathan%20Associates,%20Inc..pdf

Gaskin, J. L., Pulver, A. J., Branch, K., Kabore, A., James, T., & Zhang, J. (2013). Perception or reality of body weight: Which matters to the depressive symptoms. *Affective Disorders, 150*(2), 350-355.

Gaudart, H. (1987). English language teaching in Malaysia: a historical account. *The english teacher, XVI*.

Gebel, K., Bauman, A., & Owen, N. (2009). Correlates of non-concordance between perceived and objective measures of walkability. *Ann Behav Med, 37*(2), 228-238.

Geliebter, A., & Aversa, A. (2003). Emotional eating in overweight, normal weight, and underweight individuals. *Eat behav, 3*(4), 341-347.

Germov, J. a. W., L. (1996). The sexual division of dieting: women's voices. *The Sociological Review*.

Gesink Law, D. C., Maclehose, R. F., & Longnecker, M. P. (2007). Obesity and time to pregnant. *Hum Reprod., 22*(2), 414-420.

Ghani, A.A. (2015) Revitalizing the indigenous Semai orang asli language in Malaysia. First Asia Pacific Conference on Advanced Research. Retrieved from https://apiar.org.au/wp-content/uploads/2015/08/APCAR_BRR747.pdf

Ghani, M. A. (2014). *Exploring Domestic Violence Experiences From the Perspective of Abused Women in Malaysia.* (Doctor of Philosophy). Loughborough University, Loughborough.

Giddens, A. (2009). *Sociology* (6 ed.). Cambridge: Polity.

Gigante, D. P., Barros, F. C., Post, C. L. A., & Olinto, M. T. A. (1997). Prevalence and risk factors of obesity in adults. *Revista De Saude Publica, 31*(3), 236-246.

Gigante, D. P., Moura, E.C. and Sardinha, L.M. (2009). Prevalence of Overweight and Obesity and Associated Factors,Brazil, 2006. *Rev Saude Publica, 43 Suppl 2*, 83-89.

Gillum, R. F., & Sempos, C. T. (2005). Ethnic variation in validity of classification of overweight and obesity using self-reported weight and height in American women and men: the Third National Health and Nutrition Examination Survey. doi:10.1186/1475-2891-4-27

Goldstein, H. (2011). *Multilevel Statistical Models*. United Kingdom: John Wiley & Sons, Ltd.

Goldstein, J., Jacoby, E., del Aguila, R., & Lopez, A. (2005). Poverty is a predictor of non-communicable disease among adults in Peruvian cities. *Preventive Medicine, 41*(3-4), 800-806. doi:10.1016/j.ypmed.2005.06.001

Gorber, S. C., Tremblay, M., Moher, D., & Gorber, B. (2007). A comparison of direct vs. self-report measures for assessing height, weight and body mass index: a systematic review. *Obes Rev, 8*(4), 307-326.

Gorstein, J., Grosse, R.N. (1994). The indirect costs of obesity to society. *Pharmacoeconomics, 5(Suppl 1)*, 58-61.

Grabauskas, V., Petkevicience, J., Klumbiene, J., & Vaisvalavieus, V. (2003). The Prevalence of Overweight and Obesity In Relation To Social and Behavioral Factors (Lithuanian Health Behavior Monitoring). *Medicina, 39*(12), 1223-1230.

Graham, H. (2000). *Understanding health inequalities*. Buckingham: Open university press.

Graham, H. (2004a). Social determinants and their unequal distribution: clarifying policy understandings. *The Milbank Quarterly, 82*(1), 101-124.

Graham, H. (2004b). Tackling inequalities in health in England: remedying health disadvantages, narrowing health gaps or reducing health gradients. *Journal of Social Policy, 33*(1), 115-131.

Graham, H. (2009). *understanding health inequalities* (2 ed.). Buckingham: Open University.

Graham, H. (2010). *Unequal lives: health and socioeconomic inequalities*. England: Open University Press.

Graham, H., & Kelly, M. K. (2004). Health inequalities: concepts, frameworks and policy.

Graham, H., & Power, C. (2004). Childhood disadvantage and health inequalities: a framework for policy based on lifecource research. *Child: care, health & Development, 30*(6), 671-678.

Granberg, E. (2011). Depression and obesity In J. Cawley (Ed.), *The oxford handbook of the social science of obesity* (pp. 329-349).

Green, J., & Thorogood, N. (2010). *Qualitative methods for health research* Thousand Oaks, CA: Sage.

Greendale, G. A., Lee, N. P., & Arriola, E. R. (1999). The menopause. *Lancet, 353*, 571-580.

Greenland, S. (2000). Principles of multilevel modelling. *The International Journal of Epidemiology, 29*(1), 158-167.

Griffiths, P. L., & Bentley, M. E. (2002). Fat or thin, rich or poor? Perceptions of body image and size among urban Indian women. *Faseb Journal, 16*(4), A275-A275.

Grodstein, F., Goldman, M. B., & Cramer, D. W. (1994). Body mass index and ovulatory infertility. *Epidemiology, 5*(2), 247-250.

Guan, L. H. (2012). Education of the Chinese in Malaysia. In L. H. Guan & L. Suryadinata (Eds.), *Malaysian Chinese Receny Developments and Prospects*. Singapore.

Guba, E. G., & Lincoln, Y. S. (2005). Paradigmatic controversies, contradictions, and emerging confluences. In *The SAGE handbook of qualitative research 3rd edn.* (pp. 191-215). Thousand Oaks, California: Sage Publications.

Guendelman, S., Fernandez, A., Thornton, D., & Brindis, C. (2011). Birthplace, language use, and body size among Mexican American women and men: findings from the National Health and Nutrition Examination Survey (NHANES) 2001-2006. *Journal of Health Care for the poor and underserved, 22*, 590-605.

Guest, G., MacQueen, K. M., & Namey, E. E. (2012). *Applied thematic analysis*. Thousand Oaks, CA.: Sage.

Gómez, L. M., Hernández-Prado, B., Morales Mdel, C., & Shamah-Levy, T. (2009). Physical activity and overweight/obesity in adult Mexican population: the Mexican National Health and Nutrition Survey 2006. *Salud Publica Mex, 51*(4).

Haas, J. D., Khan, A. D., Rivera, J., & Martorell, R. (1995). Body mass index (BMI) and body composition in rural Guatemalan young adults. *FASEB Journal, 9*(4), A1015.

Hadi, A. S. (1986). The Forgotten Contribution: Women and Rural Development in Sabah. *Sojourn: Journal of Social Issues in Southeast Asia, 1*(2), 199-212.

Hagaman, A. K., & Wutich, A. (2016). How many interviews are enough to identify
Metathemes in mutisited and cross-cultural research? Another perspective on Guest, Bunce, and Johnson's (2006) landmark study. *Field Methods*

Hajian-Tilaki, K. O., & Heidari, B. (2009). Association of Educational Level with Risk of Obesity and Abdominal Obesity in Iranian Adults. *Journal of Public Health, 32*(2), 202-209.

Hajikazemi, E., Javadikioa, M., & Seyedfatemi, N. (2010). Relation between menopause: age, body mass index and reproductive history. *European Journal of Scientific Research, 46*(3), 410-415.

Hamid, A. F. A., & Ismail, M. T. (2012). The Monarchy and Party Politics in Malaysia in the Era of Abdullah Ahmad Badawi (2003-09): The Resurgence of the Role of Protector. *Asian Survey, 52*(5), 900-923.

Han, Z., Mulla, S., Beyene, J., Liao, G., & McDonald, S. D. (2011). Maternal underweight and the risk of preterm birth and low birth weight: a systematic review and meta analyses. *International Journal of Epidemiology, 40*(1).

Hanson, K.L., Sobal, J. and Vermeylen, F.M. (2014) Social Selection and Social Causation in Marriage and Health: Longitudinal Evidence of Body Weight Change, Marriage & Family Review, 50:5, 373-394.

Haralambos, M., Holborn, M., & Heald, R. (1997). *Sociology themes and perspectives*. Italy: Harper Collins Publishers.

Harding, S. (1987b). Conclusion: epistemological questions'. In S. Harding (Ed.), *Feminism and Methodology: social science issues* (pp. 181-190). Milton Keynes, Bloomington and Indianapolis: Open University and Indiana University Press.

Harding, S. (1998). *Is science multicultural? Postcolonialisms, feminisms, and epistemologies*. Bloomington: Indiana University Press.

Hardy, M., & Bryman, A. (2004). Introduction: common threads among techniques of data analysis. In A. Bryman (Ed.), *Handbook of data analysis* (pp. 1-14). London: Sage.

Harita, N., Kariya, M., Hayashi, T., Sato, K. K., Aoki, T., Nakamura, K., . . . Narimoto, K. (2012). Gestational bodyweight gain among underweight Japanese women related to small-for-gestational-age birth *J. Obstet. Gynaecol. Res., 38*(9), 1137–1144. doi:10.1111/j.1447-0756.2012.01848.x

Harper, S., King, N. B., Meersman, S. C., Reichman, M. E., Breen, N., & Lynch, J. (2010). Implicit value judgments in the measurement of health inequalities. *The Milbank Quarterly, 88*(1), 4-29.

Harrington, D. W., & Elliott, S. J. (2009). Weighing the importance of neighbourhood: a multilevel exploration of the determinants of overweight and obesity. *Social Science and Medicine, 68*(4), 593-600.

Harris, J. L., Bargh, J. A., & Brownell, K. D. (2009). Priming effects of television food advertising on eating behaviour. *Health psychology, 28*, 404-413.

Hartmann-Boyce, J. Boylan, A.M., Jebb, S.A., Fletcher, B. and Aveyard, P. (2017) Cognitive and behavioural strategies for self-directed weight loss: systematic review of qualitative studies. Obes Rev. 2017 Mar 18(3):335-349.

Hasan, Z. (2002). The 1997-98 Financial Crisis in Malaysia: Causes, Response, and Results. *MPRA Paper No. 2948:* IIAU of Malaysia.

Haskell, J. (2005). Racial Politics, Power and Dominant PArty Autocracy in Malaysia. *Standford Journal of International Relations, 6*(1), 231-239.

Hassan, M. K., Joshi, A. V., Madhavan, S. S., & Amonkar, M. M. (2003). Obesity and health-related quality of life: a cross-sectional analysis of the US population. *International Journal of Obesity and Related Metabolic Disorders, 27*, 1227-1232.

Hassan, O. R., & Rasiah, R. (2011). Poverty and Student Performance in Malaysia. *International Journal of Institutions and Economics, 3*(1), 61-76.

Hatta, Z. A., & Ali, I. (2013). Poverty Reduction Policies in Malaysia: Trends, Strategies and Challenges. *Asian Culture and History, 5*(8), 48-56.

Haworth-Hoeppner, S. (2013). Medical Discourse on Body Image: Reconceptualizing the Differences between Women with and without Eating Disorders. In J. Sobal & D. Maurer (Eds.), *Interpreting Weight: The Social Management of Fatness and Thinness*. New York: Walter de Gruyter Inc.

Haynes, A., Kersbergen, I., Sutin, A., Daly, M., & Robinson, E. (2018). A Systematic Review of the Relationship Between Weight Status Perceptions and Weight Loss Attempts, Strategies, Behaviours and Outcomes. *Obesity Reviews, 19*, 347-363.

Hebebrand, J., Bammann, K., & Hinney, A. (2010). Genetic determinants of obesity. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz, 53*(7), 674-678.

Hebebrand, J., Volckmar, A.-L., Knoll, N., & Hinney, A. (2010). Chipping Away the ‘Missing Heritability’: GIANT Steps Forward in the Molecular Elucidation of Obesity – but Still Lots to Go. *Obes Facts, 3*(5), 294-303. doi: 10.1159/000321537

Helgstrand, S., & Andersen, A. M. (2005). Maternal underweight and the risk of spontaneous abortion. *Acta Obstet Gynecol Scand., 84*(12), 1197-1201.

Helman, C. G. (2007). Diet and nutrition. In C. G. Helman (Ed.), *Culture, health and illness* (5th ed., pp. 52-80). London: Oxford University Press.

Henderson-King, D., & Stewart, A. J. (1999). Educational experiences and shifts in group consciousness: studying women. *PSPB*.

Heng, P. K. (1996). Chinese Responses to Malay Hegemony in Peninsular Malaysia 1957-96. *Southeast Asian Studies, 34*(3), 32-55.

Hennink, M., Hutter, I., & Bailey, A. (2011). *Qualitative research methods*. London: Sage Publications Ltd.

Heo, M., Allison, D. B., Faith, M. S., Zhu, S., & Fontaine, K. R. (2003). Obesity and quality of life: mediating effects of pain and comorbidities. *Obes Res, 11*, 209-216.

Hernandez, C. A., Hernandez, D.A., Wellington, C.M., Kidd, A. (2016). The Experience of Weight Management in Normal Weight. *Applied Nursing Research, 32*, 289-295.

Higgins, V. (2017). *Ethnic Differences in Obesity.* (Doctor of Philosophy). University of Manchester, Retrieved from https://www.research.manchester.ac.uk/portal/files/83387394/FULL_TEXT.PDF

Hindle, L., & Carpenter, C. (2011). An exploration of the experiences and perceptions of people who have maintained weight loss. *J. Hum Nutr Diet, 24*(4), 342-350.

Hirani, V. (2006). *Health Survey for England 2004: The Health of Minority Ethnic Groups – headlines tables Chapter 6 Anthropometric Measures, Overweight, and Obesity* (pp. 21-27).

Hirschman, C. (1972a). Educational Patterns in Colonial Malaya. *Comparative Education Review, 16*(3), 486-502.

Hirschman, C. (1972b). Educational patterns in colonial Malaya. *Comparative Education Review, 16*(3), 486-502.

Holdsworth, M., Gartner, A., Landais, E., Maire, B., & Delpeuch, F. (2004). Perceptions of healthy and desirable body size in urban Senegalese women. *International Journal of Obesity, 28*, 1561-1568.

Horton, N. J., & Lipsitz, S. R. (2001). Multiple imputation in practice: comparison of software packages for regression models with missing variables. *The American Statistician, 55*(3), 245-254.

Hourani, H. M., Naffa, S., & Fardous, T. (2011). National commitment to action on social determinants of health in Jordan: addressing obesity.

Howel, D., Stamp, E., Chadwick, T. J., Adamson, A. J., & White, M. (2013). Are social inequalities widening in generalised and abdominal obesity and overweight among English adults? *8*(11).

Hox, J. (1998). Multilevel modeling: when and why. In I. Balderjahn, R. Mathar, & M. Schader (Eds.), *Classification, data analysis and data highways*. New York: Springer Verlag.

Hox, J. J. (2010). *Multilevel analysis: techniques and applications*. Mahwah, N.J.: Lawrence Erlbaum.

Hox, J. J., & Kreft, I. G. G. (1994). Multilevel analysis methods. *Sociological Methods & Research, 22*, 283-299. doi:10.1177/0049124194022003001

Hox, J. J., & Maas, C. J. M. (2005). Multilevel analysis. *Encyclopedia of social measurement, 2*, 785-793.

http://pmr.penerangan.gov.my. Unjuran Populasi
Penduduk 2015. Retrieved
from https://web.archive.org/web/20160212125740/http://pmr.penerangan.gov.my/index.php/info-terkini/19463-unjuran-populasi-penduduk-2015.html

https://pugwash.lib.warwick.ac.uk/.Retrievedfrom https://pugwash.lib.warwick.ac.uk/search/y?SEARCH=web+of+knowledge
https://www.royalark.net. Perlis: Brief History. Retrieved
from https://www.royalark.net/Malaysia/perlis.htm

Hu, F. B. (2008). Genetic predictors of obesity In F. B. e. Hu (Ed.), *Obesity Epidemiology* (pp. 437-460). New York: Oxford University Press.

Hubley, J., & Copeman, J. (2008). *Practical health promotion*. Cambridge: Polity.

Hughes, C. (2013). Introduction to research methodologies. Retrieved from http://www2.warwick.ac.uk/fac/soc/sociology/staff/academicstaff/chughes/hughesc_index/teachingresearchprocess/whatisresearch/

Husbands, J. (2007). Promoting healthy lifestyles. In W. J (Ed.), *Vital lnotes for nurses: promoting health lifesytle* (pp. 129-153). Oxford: Blackwell.

Huxley, R., Medies, S., Zheleznyakov, E., Reddy, S., & Chan, J. (2010). Body Mass Index, Waist Circumference and Waist: Hip Ratio as Predictors of Cardiovascular Risk – A Review of the Literature BMI, WC and WHR as Predictors of Cardiovascular Risk. *European Journal of Clinical Nutrition, 64*, 16-22. doi:10.1038/ejcn.2009.68

Ichinohe, M., Mita, R., Saito, K., Shinkawa, H., Nakaji, S., Coombs, M., . . . Fuller, E. L. (2005). The prevalence of obesity and its relationship with lifestyle factors in Jamaica. *Tohoku J Exp Med, 207*(1), 21-32.

Igbedioh, S. O. (1993). Undernutrition in Nigeria: dimension, causes and remedies for alleviation in a changing socio-economic environment. *Nutr Health, 9*(1), 1-14.

IKU. NHMS 1996. Retrieved from http://www.iku.gov.my/index.php/research-eng/list-of-research-eng/iku-eng/nhms-eng/nhms-1996-eng

IKU. NHMS 2011. Retrieved from http://iku.moh.gov.my/index.php/research-eng/list-of-research-eng/iku-eng/nhms-eng/nhms-2011-eng

IKU. NHMS 2015. Retrieved from http://iku.gov.my/index.php/research-eng/list-of-research-eng/iku-eng/nhms-eng/nhms-2015

IKU. The Third National Health and Morbidity Survey 2006 (NHMS III): General Findings Retrieved from http://iku.moh.gov.my/images/IKU/Document/REPORT/2006/GeneralFindings.pdf

IKU. (1997). *Report of the Second National Health and Morbidity Survey Conference: Vol.14 Nutritional Status of Adults* (Vol. 14). Kuala Lumpur, Malaysia: Ministry of Health, Malaysia.

IKU (1997). *Report of the Second National Health and Morbidity Survey Conference: (Part 1) Methodology* (Vol. 1). Kuala Lumpur, Malaysia: Ministry of Health, Malaysia.

Illich, I. (1975). *Medical nemesis: the expropriation of health*. London: Caldar and boyers.

Inagami, S., Cohen, D. A., Brown, A. F., & Asch, S. M. (2009). Body mass index, neighborhood fast food and restaurant concentration, and car ownership. *J Urban Health, 86*(5), 683-695.

Inhorn, M. C., & Whittle, K. L. (2001). Feminism meets the “new” epidemiologies: toward an appraisal of antifeminist biases in epidemiological research on women’s health. *Social Science & Medicine, 53*(5), 553-567.

Institute for Public Health (IPH) 2015. National Health and Morbidity Survey 2015 (NHMS 2015). Vol 1: Methodology and General Findings: 2015. Retrieved from http://www.moh.gov.my/moh/resources/nhmsreport2015vol1.pdf

Ismael, N. N. (1994). A study on the menopause in Malaysia. *Maturitas, 19*(3), 205-209.

Ismail MN, C. S., Nawawi H, Yusoff K, Lim TO, James WP. (2002). Obesity in Malaysia. *Obes Rev, 3*(3), 203-208.

Ismail, R., & Jajri, I. (2012). Gender Wage Differentials and Discrimination in Malaysian Labour Market. *World Applied Science, 19*(5), 719-728.

Ismail, R., & Sulaiman, N. (2014). Married Women Labour Supply Decision in Malaysia. *Asian Social Science, 10*(3), 221-231.

Ismail, T. A. T., Jalil, R.A., Ishak, W.R.W., Hamid, N.F., Nik, W.S.W., Mohamed, H.J.J. (2018). Understanding Dieting and Previous Weight Loss Attempts among Overweight and Obese Participants: Insights into My Body Is Fit and Fabulous at Work Program. *Korean Journal of Family Medicine, 39*, 15-22.

Jaafar, S., Noh, K. M., Muttalib, K. A., Othman, N. H., & Healy, J. (2012). *Malaysia Health System Review*. Retrieved from Geneva:

Jaaskelainen, A., Pussinen, J., Nuutinen, O., Schwab, U., Pirkola, J., Kolehmainen, M., Jarvelin, M.R. and Laitinen, J. (2011) Intergenerational transmission of overweight among Finnish adolescents and their parents: a 16-year follow-up study. *Int J Obes (Lond).* 35(10): 1289-1294

Jaccard, J. (2001) Interaction effects in logistic regression. In*. Quantitative applications in the Social Sciences135*. California.: Sage Publications, Inc.

Jackson, M., Walker, S., Forrester, T., Cruickshank, J. K., & Wilks, R. (2003). Social and dietary determinants of body mass index of adult Jamaicans of African origin. *Eur J Clin Nutr, 57*(4), 621-627.

Jacoby, E., Goldstein, J., López, A., Núñez, E., & López, T. (2003). Social class, family, and life-style factors associated with overweight and obesity among adults in Peruvian cities. *Prev Med, 37*(5), 396-405.

Jain, H. C., Sloane, P. J., & Horwitz, F. M. (2003). *Employment Equity and Affirmative Action: An International Comparison*. New York: M.E. Sharpe.

Jamil, H., & Raman, S. R. (2012). Malaysian educational policy for national integration: contested terrain of multiple aspirations in a multicultural nation. *Journal of language and culture, 3*(1), 20-31.

Jane, M., Hagger, M., Foster, J., Ho, S. & Pal, S. (2018) Social Media for Health Promotion and Weight Management: A Critical Debate. BMC Public Health 18: 932 https://doi.org/10.1186/s12889-018-5837-3

Janghorbani, M., Amini, M., & Rezvanian, H. (2008). Association of Body Mass Index and Abdominal Obesity with Marital Status in Adults. *Arch Iranian Med, 11*(3), 274-281.

Janghorbani, M., Amini, M., Willett, W. C., Mehdi Gouya, M., Delavari, A., Alikhani, S., & A, M. (2007). First Nationwide Survey of Prevalence of Overweight, Underweight, and Abdominal Obesity in Iranian Adults. *Obesity (Silver Spring), 15*(11), 2797-2808.

Jantan, R., & Ahmad, A. (2013). Literacy and Psychosocial Problems Among Aboriginal Students in Primary School in Cameron Highlands. *Journal of Education and Research, 1*(9), 1-8.

Jaworowska, A., & Bazylak, G. (2009). An outbreak of body weight dissatisfaction associated with self-perceived BMI and dieting among female pharmacy students. *Biomedicine and pharmacotherapy, 63*, 679-692.

Jebb, S. A., & Moore, M. S. (1999). Contribution of a sedentary lifestyle and inactivity to the etiology of overweight and obesity: current evidence and research issues. *Med Sci Sports Exerc, 31*(11 Suppl), S534 - 541.

Jelas, Z.M. and Dahan, H.M. (2010) Gender and education performance: the Malaysisan perspective. Procedia – Social and Behavioural Sciences 7: 720-727

Jitnarin, N., Kosulwat, V., Rojroongwasinkul, N., Boonpraderm, A., Haddock, C. K., & Poston, W. S. C. (2010). Risk Factors for Overweight and Obesity Among Thai Adults: Results of the National Thai Food Consumption Survey. *Nutrients, 2*(1), 60–74. doi:10.3390/nu20100060

JKKN. (2015). National Culture Policy. Retrieved from http://www.jkkn.gov.my/en/national-culture-policy

Johnston, D. W., & Lee, W.-S. (2011) Explaining the female Black-White obesity gap: a decomposition analysis of proximal causes. In*. IZA discussion paper*.

Jolliffe, D. (2011). Overweight and poor? On the relationship between income and the body mass index. *Economics and Human Biology, 9*(4), 342-353.

Jomo, K. S. (2004). *The new economic policy and interethnic relations in Malaysia*. Switzerland: UNRISD.

Jomo, K. S. (2006). Growth with equity in East Asia. *Desa Working Paper, 30*.

Jones, L. J. (1994). Health in a social context. In *The social context of health and health work* (pp. 1-37). London: The Macmillan Press.

Jones, N., & Marsden, H. (2010). *Assessing the Impacts of and Responses to the 1997-98 Asian Financial Crisis through a Child Rights Lens: Including Children in Policy Responses to Previous Economic Crises*. Retrieved from New York:

Jones-Smith, J. C., Gordon-Larsen, P., Siddiqi, A., & Popkin, B. M. (2011). Cross-national comparisons of time trends in overweight inequality by socioeconomic status among women using repeated cross-sectional surveys from 37 developing countries, 1989-2007. *Am J Epidemiol, 173*(6), 667-675.

Jones-Smith, J. C., Gordon-Larsen, P., Siddiqi, A., & Popkin, B. M. (2012). Is the burden of overweight shifting to the poor across the globe? Time trends among women in 39 low- and middle-income countries (1991–2008). *International Journal of Obesity, 36*(8), 1114-1120. doi:10.1038/ijo.2011.179

Jordanova, L. (1995). The social construction of medical knowledge. *8*, 361-381. doi: 10.1093/shm/8.3.361

Joseph, C. (2008). Ethnicities and Education in Malaysia: Difference, Inclusions and Exclusions. *The Education of Diverse Student Populations Explorations of Educational Purpose, 2*, 183-206.

Joseph, C. (2014a). Becoming Women: Marriage, Sexuality and Gender Relation. In C. Joseph (Ed.), *Growing Up Female in Multi-Ethnic Malaysia* (pp. 176-186). Oxon: Routledge.

Joseph, C. (2014b). Education in the 21st Century. In C. Joseph (Ed.), *Growing Up Female in Multi-Ethnic Malaysia* (pp. 50-65). Oxon: Routledge.

Joseph, C. (2014c). Education Politics in Postcolonial Malaysia: Ethnicity, Difference and Inequalities. In C. Joseph & J. Matthew (Eds.), *Equity, Opportunity and Education in Postcolonial Southeast Asia* (pp. 150-168). London: Routledge.

Joseph, C. (2014d). Ethnicities in Postcolonial Malaysia. In C. Joseph (Ed.), *Growing Up Female in Multi-Ethnic Malaysia* (pp. 22-49). Oxon: Routledge.

Joseph, C. (2014e). Young Women in Multi-Ethnic Malaysia. In C. Joseph (Ed.), *Growing Up Female in Multi-Ethnic Malaysia* (pp. 66-80). Oxon: Routledge.

Judge, K., Platt, S., Costongs, C., & Jurczak, K. (2006). *Health inequalities: a challenge for Europe, an independent expert report commissioned by and published under the auspices of the UK Presidency of the EU.* . Retrieved from London:

Jutel, A. (2006). The emergence of overweight as a disease entity: measuring up normality. *Soc Sci Med, 63*(9), 2268-2276.

Kamaruddin, K. (2008). Educational Policy and Opportunities of Orang Asli : a Study of Indigenous People in Malaysia. *The Journal of Human Resource and Adult Learning, 4*(1), 86-97.

Kamarudin, Z. B. (1993). *A Comparative Study of Divorce Among Muslims and Non-Muslims in Malaysia With Special Reference to the Federal Territory of Kuala Lumpur.* (Doctoral Thesis). University of London,

Kamogawa, A. (2003a). Higher education reform: challenges towards a knowledge society in Malaysia. *African and Asian Studies, 2*(4), 545-563.

Kamogawa, A. (2003b). Higher Education Reform: Challenges Towards a Knowledge Society in Malaysia. *African and Asian Studies, 2*(4), 545-563.

Kanter, R., & Caballero, B. (2012). Global gender disparities in obesity: a review. *Advances in nutrition, 3*(4), 491-498. doi: 10.3945/an.112.002063.

Kaplan, H. I., & Kaplan, H. S. (1957). The psychocomatic concept of obesity. *Journal of nervous and mental disease, 125*, 181-201.

Karlsen, S., & Nazroo, J. Y. (2010). Religious and Ethnic Differences in Health: Evidence from the Health Surveys for England 1999 to 2004. *Ethn Health, 15*(6), 549-568.

Karubi, N. P., & Khalique, M. (2012). Socioeconomic Realities At Work: A Study on Female Workers in the SME's Located in Malaysia. *Information Management and Business Review 46*, 311-316.

Kasper, N. M., Herran, O. F., & Villamor, E. (2014). Obesity Prevalence in Colombian Adults Is Increasing Fastest in Lower Socio-economic Status Groups and Urban Residents: Results from Two Nationally Representative Surveys. *Public Health Nutr., 17*(11), 2398-2406.

Kawachi, I., & Kennedy, B. P. (1999). Income inequality and health: pathways and mechanisms. *Health Services Research, 34*(1), 215-227.

Kawachi, I., Subramanian, S. V., & Almeida-Filho, N. (2002). A glossary for health inequalities. *J Epidemiol Community Health, 56*, 647-652.

Keddie, A. M. (2011). Associations between severe obesity and depression: results from the National Health Nutrition Examination Survey, 2005-2006. *Preventive Chronic Diseases, 8*(3), 1-10.

Kee, C. C., Jamaiyah, H., Noor Safiza, M. N., Geeta, A., Khor, G. L., & al., e. (2008). Abdominal obesity in Malaysian adults: National Health and Morbidity Survey III. *Mal J Nutr., 14*(2), 125-135.

Kelly, J., & De Graaf, N. D. (1997). National Context, Parental Socialization, and Religious Belief: Results from 15 Nations. *American Sociology Review, 62*(4), 639-659.

Kelly, T., Yang, W., Chen, C. S., Reynolds, K., & He, J. (2008). Global burden of obesity in 2005 and projections to 2030. *Int J Obes (Lond), 32*(9), 1431-1437.

Kemp, E., Bui, M., & Grier, S. (2013). When Food Is More Than Nutrition: Understanding Emotional Eating and Overconsumption. *Journal of Consumer Behaviour, 12*, 204-213.

Kenayathulla, H. B. (2014). Ethical Issues in the Malaysian Education System. *Educational Philosophy and Theory*, 1-15. doi:10.1080/00131857.2013.866534

Kennedy, G., Nantel, G., & Shetty, P. (2006). Assessment of the double burden of malnutrition in six case study countries. doi:ftp://ftp.fao.org/docrep/fao/009/a0442e/a0442e00.pdf

Kenward, M. G., & Carpenter, J. (2007). Multiple imputation: current perspectives. *Stat Methods Med Res, 16*(3), 199-218. doi:10.1177/0962280206075304

Keys, A., Fidanza, F., Karvonen, M. J., Kimura, N., & Taylor, H. L. (1972). Indices of Relative Weight and Obesity. *J Chron Dis., 25*, 329-343.

Khalid, T.A., Glavin, K. and Lagerlov, P. (2018). Food traditions and overweight among Pakistanis in Norway: a qualitative interview study. *Health Science Journal.* Retrieved from http://www.hsj.gr/medicine/food-traditions-and-overweight-among-pakistanis-in-norway-a-qualitative-interview-study.php?aid=23839

Khambalia, A. Z., & Seen, L. S. (2010). Trends in overweight and obese adults in Malaysia (1996-2009): a systematic review. *Obes Rev, 11*(6), 403-412.

Khoo, B. T. (2006). Malaysia: balancing development and power. In G. Rodan, K. Hewison, & R. Robison (Eds.), *The political economy of south-east asia: markets, power and contestation* (3 ed.). Oxford: Oxford university press.

Khor, G. L., & Shariff, Z. M. (2008). The Ecology of Health and Nutrition of "Orang Asli" (Indigenous Peoples) Women and Children in Peninsular Malaysia. In: Health and Nutritional Problems of Indigenous Populations. *Journal of Studies of Tribes and Tribals, 2*, 67-77.

Khor, G. L., Zalilah, M. S., Phan, Y. Y., Ang, M., Maznah, B., & Norimah, A. K. (2009). Perceptions of body image among Malaysian male and female adolescents. *Singapore Med J., 50*(3), 303-311.

Kiecolot, K. J., & Nathan, L. E. (1985). *Secondary analysis of survey data, issues 51-53*. Newbury Park, CA: Sage.

Kim, D., & Kawachi, I. (2008). Obesity and Health-Related Quality of Life' In F. B. Hu, *Obesity Epidemiology* (pp. 234-260). New York: Oxford University Press.

Kim, D., Subramanian, S. V., Gortmaker, S. L., & Kawachi, I. (2008). Social capital and physical health: a systematic review of the literature. In I. Kawachi, V. Subramanian, & D. Kim (Eds.), *Social capital and health* (pp. 139-190). New York: Springer.

Kim, D. S., Kim, H. S., Cho, Y., Cho, S. I. (2008). The Effects of Actual and Perceived Body Weight on Unhealthy Weight Control Behaviors and Depressed Mood among Adult Women in Seoul, Korea. *Journal of Preventive Medicine and Public Health, 41*(5).

Kim, H.-Y. (2013). Statistical notes for clinical researchers: assessing normal distribution (2) using skewness and kurtosis.

Kim, S., & So, W. Y. (2016). Secular trends in the prevalence of weight misperception among Korean adults, 2001-2013. *Obesity Research & Clinical Practice*. doi:10.1016/j.orcp.2016.05.002

Kim, S. A., Stein, A. D., & Martorell, R. (2007). Country development and the association between parity and overweight. *International journal of obesity, 31*(5), 805-812.

Kim, S. A., Yount, K. M., Ramakrishnan, U., & Martorell, R. (2007). The relationship between parity and overweight varies with household wealth and national development. *International journal of epidemiology, 36*, 93-101.

King, N., & Horrocks, C. (2010). *Interviews in qualitative research*. London: Sage.

King, T., Kavanagh, A. M., Jolley, D., Turrell, G., & Crawford, D. (2006a). Weight and place: a multilevel cross-sectional survey of area-level social disadvantage and overweight/obesity in Australia. *International Journal of Obesity, 30*, 281-287.

Klein, J. T. (1990). *Interdisciplinarity: history, theory and practice*. Detroit: Wayne State University Press.

Klok, M. D., Jakobsdottir, S., & Drent, M. L. (2007). The role of leptin and ghrelin in the regulation of food intake and body weight in humans: a review. *Obes Rev., 8*(1), 21-34.

Kodama, H. (2010). Problems of underweight in young females and pregnant women in Japan. *JMAJ, 53*(5), 285-289.

Koeneman, M. A., Verheijden, M. W., Chinapaw, M. J., & Hooman-Rock, M. (2012). Determinants of physical activity and exercise in healthy older adults: a systematic review. *Int J BehavNutrPhys Act*. doi:10.1186/1479-5868-8-142

Kokonyei, G., Baldacchino, A., Urban, R., & Demetrovics, Z. The psychological basis of obesity. doi:http://dx.doi.org/10.1016/B978-0-12-416045-3.00004-2

Kolotkin, R. L., Meter, K., & Williams, G. R. (2001). Quality of life and obesity. *Obesity Reviews, 2*(4), 219-229.

Kong, W.-T., Chua, S-S., Alwi, S. (2002). Weight Loss Practices Among Malaysian Adults. *Asia Pac J Public Health, 14*(2), 99-104.

Koon, H. P. (1997). The New Economic Policy and The Chinese Community in Peninsular Malaysia. *35, 3*, 262-292.

Kopp, L. L., & Zimmer-Gembeck, M. J. (2011). Women's global self-determination, eating regulation, and body dissatisfaction: Exploring the role of autonomy support. *Eating behaviour, 12*(3), 222-224.

Krieger, N. (1994). Epidemiology and the web of causation: has anyone seen the spider? *Social Science & Medicine, 39*(7), 887-903.

Kropko, J., Goodrich, B., Gelman, A., & Hill, J. (2013). Multiple imputations for continuous and categorical data: comparing joint and conditional approaches.

Kulie, T., Slattengren, A., Redmer, J., Counts, H., Eglash, A., & Schrager, S. (2011). Obesity and women's health: An Evidence-Based Review. *J Am Board Fam Med, 24*(1), 75-85.

Kumar, N., Lucio, M., & Che Rose, R. (2013). Workplace industrial relations in a developing environment: barriers to renewal within unions in Malaysia. *Asia Pacific Journal of Human Resources, 51*(1), 22-44.

Kunh, T. S. (1970). *The structure of scientific revolutions*. Chicago: University of Chicago Press.

Kushner, R. F., & Foster, G. D. (2003). Obesity and quality of life. *Nutrition, 16*(10), 947–952.

Kvale, S. (1996). *InterViews: An Introduction to Qualitative Research Interviewing*. Thousand Oaks, CA: Sage Publications.

Kvale, S. (2008). *Doing interviews*. Thousand Oaks: Sage Publications Ltd.

Lahelma, E., Martikainen, P., Laaksonen, M., & Aittomäki, A. (2004). Pathways between socioeconomic determinants of health. *J Epidemiol Com Health, 58*, 327-332.

Lahmam, A., Baali, A., Hilali, M. K., Cherkaoui, M., Chapuis-Lucciani, N., & Boetsch, G. (2008). Obesity, overweight and body-weight perception in a High Atlas Moroccan population. *Obesity Review, 9*, 93-99.

Lakdawalla, D., & Philipson, T. (2002). The growth of obesity and technological change: a theoretical change and empirical examination.

Lamb, G., & K., H. Reflexivity in nursing research. *Western Journal of Nursing Research, 11*(6), 765-772.

Langellier, B. A., Glik, D., Ortega, A.N., Prelip, M.L. (2015). Trends in racial/ethnic disparities in overweight self-perception among U.S. adults, 1988–1994 and 1999–2008. *Public Health Nutr., 18*(12), 2115–2125.

Langford, I. H., & Lewis, T. (1998). Outliers in multilevel data. *Journal of the Royal Statistical Society: Series A (Statistics in Society), 161*(2), 121-160.

Lanti, I. G. (2004). Comparing ethnic minorities in control and in hegemonic consociational situations: the political and economic roles of the Chinese in Malaysia and Indonesia. *Graduate Journal of Asia-Pacific Studies, 2*(1), 69-82.

Lantz, P., Lynch, J. W., House, J. S., Lepkowski, J. M., Mero, R. P., Musick, M. A., & Williams, D. R. (2001). Socio-economic disparities in health change in a longitudinal study of US adults: The role of health risk behaviours. *Social Science & Medicine, 53*(1), 29-40.

Lantz, P. M., House, J. S., Lepkowski, J. M., Williams, D. R., Mero, R. P., & Chen, J. (1998). Socioeconomic factors, health behaviors, and mortality: results from a nationally representative prospective study of US adults. *JAMA, 279*(21), 1703-1708.

Laqueur, T. (1990). *Making sex: body and gender from the Greeks to Freud*. Cambridge, Mass: Harvard University Press.

Larson, U., Karlsson, J., & Sullivan, M. (2002). Impact of overweight and obesity on health-related quality of life – a Swedish population study. *International Journal of obesity and related metabolic disorders, 26*(3), 417-424.

Lauderdale, D. S., & Rathouz, P. J. (2000). Body mass index in a US national sample of Asian Americans: effects of nativity, years since immigration and socioeconomic status. *International Journal of Obesity, 24*, 1188-1194.

Law, C., Power, C., Graham, H., & Merrick, D. (2007). Obesity and Health Inequalities. *Obesity Reviews, 8*(Suppl. 1), 19-22.

Law, L. S., Norshasmah, S., Gan, W. Y., Nasir, & M.T.M. (2018). Qualitative study on identification of common coping strategies practised by Indigenous Peoples (Orang Asli) in Peninsular Malaysia during periods of food insecurity. *Public Health Nutrition, 21* (15), 2819-2830.

Lean, M., Han, T., & Seidell, J. (1999). Impairment of health and quality of life using new U.S. federal guidelines for the identification of obesity. *Arch Intern Med., 159*, 837–843.

Lebel, A., Kestens, Y., Clary, C., Bisset, S., & Subramanian, S. V. (2014). Geographic variability in the association between socioeconomic status and BMI in the USA and Canada. *PLOS ONE, 9*(6). doi:10:1371/journal.pone.0099158

Leckie, G., & French, R. (2013). Three-level Multilevel Models - MLwiN Practical. LEMMA VLE Module 11.

Lee, C. (2011). Infrastructure and Economic Development. In *Malaysia: Policies and Issues in Economic development* (pp. 423-436).

Lee, H.-A. (2014). Affirmative Action Regime Formation in Malaysia and South Africa. *Journal of Asian and African Studies*. doi:10.1177/0021909614550895

Lee, H. G. (2012). Education of The Chinese in Malaysia. In H. G. Lee & L. Suryadinata (Eds.), *Malaysian Chinese: Recent Developments and Prospects* (pp. 166-192). Singapore: ISEAS Publishing.

Lee, K. J., & Carlin, J. B. (2010). Multiple imputation for missing data: fully conditional specification versus multivariate normal imputation. *American Journal of Epidemiology, 171*(5), 624-632.

Lee, K. J., Galati, J. C., Simpson, J. A., & Carlin, J. B. (2011). Comparison of methods for imputing ordinal data using multivariate normal imputation: a case study of non-linear effects in a large cohort study. *Statistics in Medicine, 31*, 4164-4174.

Lee, M. N. N. (2004). Malaysian universities: towards equality, accessibility and quality. In A. P. G & U. T (Eds.), *Asian universities: hisotrical perspectives and contemporary challenges* (pp. 221-246). Baltimore: JHU Press.

Lee, S.-K., Sobal, J., Frongillo, E. A., Olson, C. M., & Wolfe, W. S. (2005). Parity and body weight in the United States: differences by race and size of place of residence. *Obesity research, 13*(7), 1263-1269.

Leigh, J. P., Fries, J. F., & Hubert, H. B. (1992). Gender and race differences in the correlation between body mass and education in the 1971-1975 NHANES I. *Journal of epidemiology and community health, 46*, 191-196.

Lemiere, S. (2007). Apostasy & Islamic civil society in Malaysia. *ISIM REVIEW, 20*.

Lemon, S.C. (2009). Contributions of weight perceptions to weight loss attempts: Differences by body mass index and gender. *Body Image, 6*(2), 90-96.

Leong, S. L., Madden, C., Gray, A., & Horwath, C. (2012). Self-determined, autonomous regulation of eating behaviour is related to lower body mass index in a nationwide survey of middle-aged women. *J AcadNutr Diet, 112*(9), 1337-1346

Leslie, W. S., Hankey, C. R., & Lean, M. E. (2007). Weight gain as an adverse effect of some commonly prescribed drugs: a systematic review. *QJM, 100*(7), 395-404.

Letamo, G. (2011). The prevalence of, and factors associated with, overweight and obesity in Botswana. *Journal of Biosocial Science, 43*(1), 75-84. doi:10.1017/S0021932010000519

Letamo, G., & Navaneetham, K. (2014). Prevalence and determinants of adult under-nutrition in Botswana. *PLOS ONE, 9*(7).

Letherby, G. (2003). *Feminist research in theory and practice*. Buckingham: Open University Press.

Leung, T. Y., Leung, T. N., Sahota, D. S., Chan, O. K., Chan, L. W., Fung, T. Y., & Lau, T. K. (2008). Trends in maternal obesity and associated risks of adverse pregnancy outcomes in a population of Chinese women. *BJOG, 115*(12), 1529-1537.

Lewis, G. (1993). Some studies of social causes of and cultural response to disease. In G. G. N. Mascie-Taylor (Ed.), *The anthropology of disease* (pp. 73-124). Oxford: Oxford Press.

Li, L., Law, C., Lo Conte, R., & Power, C. (2009). Intergenerational influences on childhood body mass index: the effect of parental body mass index trajectories. *Am J Clin Nutr, 89*(2), 551-557.

Liang, W. L. T. (2011). Framing the Malaysian Brain Drain: A comparison between the reporting styles of the STAR Online versus Malaysia kini. *The Journal of the South East Asia Research Centre for Communications and Humanities, 6*(1), 97-121.

Liem, E. T., Pieter, J. J. S., Oldehinkel, A. J., & Stolk, R. P. (2008). Association between depressive symptoms in childhood and adolescence and overweight in later life: review of the recent literature. *Arch PediatrAdolesc Med., 162*(10), 981-988.

Lim, H. E., Rich, J., & Harris, M. N. (2008). Employment outcomes of graduates: The case of Universiti Utara, Malaysia. *Asian Economic Journal, 22*(3), 321-341.

Lim, H. F. (2003). *Economic advancement and poverty eradication among the aborigines in Malaysia.* Paper presented at the the XIII World Forestry Congress, Quebec City, Canada. http://www.fao.org/3/xii/0175-a2.htm

Lim, K. G. (2016). A Review of Adult Obesity Research in Malaysia. *Med J Malaysia, 71*, 1-19.

Lim, L. L., Jones, G. W., & Hirschman, C. (1987). Continuing fertility transitions in a plural society: ethnic trends and differentials in Peninsular Malaysia. *J biosoc. sci, 19*, 405-425.

Lim, T. O., Ding, L. M., Zaki, M., Suleiman, A. B., Fatimah, S., Siti, S., . . . Maimunah, A. H. (2000). Distribution of body weight, height and Body Mass Index in a national sample of Malaysian adults. *Med J Malaysia, 55*, 108-128.

Lin, A. C. (1988) Bridging positivist and interpretivist approaches to qualitative methods. *Policy Studies Journal, 26*(1), 162-180.

Linabery, A. M., Nahhas, R. W., Johnson, W., Choh, A. C., Towne, B., Odegaard, A. O., . . . Demerath, E. W. (2013). Stronger influence of maternal than paternal obesity on infant and early childhood body mass index: the Fels Longitudinal Study. *Pediatr Obes., 8*(3), 159-169.

Lincoln, Y. (1990). The making of a constructivist: A remembrance of transformations past. In E. Guba (Ed.), *The paradigm dialog* (pp. 67-87). Newbury Park, CA.: Sage.

Linde, J. A., Rothman, A. J., Baldwin, A. S., & Jeffery, R. W. (2006). The impact of self-efficacy on behavior change and weight change among overweight participants in a weight loss trial *Health Psychol., 25*(3), 282-291.

Liu, X. (2016). *Applied ordinal logistic regression using STATA*. California: Sage Publications, Inc.

Lobstein, T., & Leach, R. J. (2007). *Foresight. Tackling obesities: future choices - international comparisons of obesity trends, determinants and responses - evidence review, adults.* Retrieved from London:

Locker, D. (2008). Social determinants of health and disease. In G. Scambler (Ed.), *Sociology as applied to medcine* (pp. 18-33). Edinburgh, New York: Saunders/Elsevier.

Long, J. S., & Freese, J. (2014). *Regression models for categorical dependent variables using STATA* (3 ed.). United States of America: STATA Press.

Loo, S. P. (2009). Ethnicity and Educational Policies in Malaysia and Brunei. *SA-eDUC JOURNAL, 6*(2), 146-157.

Loos, R. J., & Bouchard, C. (2008). FTO: the first gene contributing to common forms of human obesity. *Obes Rev, 9*(3), 246-250.

Loos, R. J. F., & Bouchard, C. (2003). Obesity – is it a genetic disorder? *Journal of Internal Medicine, 254*(5), 401-425.

Loring, B., & Robertson, A. (2014). Obesity and inequities: Guidance for addressing inequities in overweight and obesity. Retrieved from http://www.euro.who.int/__data/assets/pdf_file/0003/247638/obesity-090514.pdf

Lovasi, G. S., Hutson, M. A., Guerra, M., & Neckerman, K. M. (2009). Built environment and obesity in disadvantaged populations. *Epidemiologic Reviews, 31*, 7-20.

Low, K. L., & Goy, S. C. (2006). Male-female earnings differentials in Sarawak, Malaysia. *International Journal of the Humanities*.

Ludwig, A., Cox, P., & Ellahi, B. (2010). Social and cultural construction of obesity among Pakistani Muslim women in North West England. *Public Health Nutrition, 14*(10), 1842-1850.

Luke, D. A. (2004) Multilevel Modelling. In*. Quantitative Applications in the Social Science*. Thousand Oaks: Sage Publications, Inc.

Luo, W., & Xie, Y. Variation in the education gradient of body weight in contemporary China. Chinese Journal of Sociology. *4*(3), 301-329

Lynch, J. W., Smith, G. D., Kaplan, G. A., & James, S. H. (2000). Income inequality and mortality: importance to health of individual income, psychosocial environment, or material conditions. *BMJ, 320*, 1200-1204.

Lyon, H. N., & Hirschhorn, J. N. (2005). Genetics of common forms of obesity: a brief overview. *Am J Clin Nutr, 82*, 215S-2157S.

Ma, J., & Xiao, L. (2010). Obesity and depression in US women: results from the 2005-2006 National Health and Nutritional Examination Survey. *Obesity, 18*(2), 347-353.

Mackenbach, J. P., van de Mheen, H., & Stronks, K. (1994). A prospective cohort study investigating the explanation of socio-economic inequalities in health in the Netherlands. *Social science and medicine, 38*(2), 299-308.

Maes, H., Neale, M., & Eaves, L. (1997). Genetic and environmental factors in relative body weight and human adiposity. *Behavior Genetics, 27*(4), 325–351.

Mahari, Z., Othman, W. R., Khalili, N. M. M., Esa, S., & Miskiman, N. (2011). *Demographic Transition in Malaysia: The Changing Roles of Women*. Paper presented at the 15th Conference of Commonwealth Statisticians, New Delhi, India. http://www.cwsc2011.gov.in/papers/demographic_transitions/Paper_1.pdf

Majlis Amanah Rakyat, M. (2014). CORPORATE MISSION AND VISION. Retrieved from http://www.mara.gov.my/en/misi-visi-korporat

Majlis Amanah Rakyat, M. Introduction and history. Retrieved from http://www.mara.gov.my/en/pengenalan-sejarah

Malaysian women. Retrieved from http://www.google.co.uk/imgres?imgurl=http://dgreymatter.files.wordpress.com/2008/10/malaysia-truly-asia-girls11.jpg&imgrefurl=http://dgreymatter.wordpress.com/2008/10/27/shame-and-stupidity-a-brief-history-of-malaysian-womanhood/&h=329&w=350&sz=30&tbnid=WP5zdAv-3kb_MM:&tbnh=79&tbnw=84&zoom=1&usg=__mn9KPYvy9xBj9zT0tQU6q

MY3vYY=&docid=ne3wnknPeFFd7M&sa=X&ei=uzijUfiWOIOh0QXD74GQDQ&ved=0CE0Q9QEwCA&dur=595

Mamun, A. A., Callaway, L. K., O'Callaghan, M. J., Williams, G. M., Najman, J. M., Alati, R., . . . Lawlor, D. A. (2011). Associations of maternal pre-pregnancy obesity and excess pregnancy weight gains with adverse pregnancy outcomes and length of hospital stay. *BMC Pregnancy and Childbirth*. doi:10.1186/1471-2393-11-62

Mandal, B., & Stasny, E. A. (2004). *Imputing Missing Income Data and Weighting Data with Imputed Income*. Paper presented at the ASA Section on Survey Research Methods, Toronto, Canada.

map-malaysia. Retrieved from http://www.google.co.uk/imgres?imgurl=http://dgreymatter.files.wordpress.com/2008/10/malaysia-truly-asia-girls11.jpg&imgrefurl=http://dgreymatter.wordpress.com/2008/10/27/shame-and-stupidity-a-brief-history-of-malaysian-womanhood/&h=329&w=350&sz=30&tbnid=WP5zdAv-3kb_MM:&tbnh=79&tbnw=84&zoom=1&usg=__mn9KPYvy9xBj9zT0tQU6qMY3vYY=&docid=ne3wnknPeFFd7M&sa=X&ei=uzijUfiWOIOh0QXD74GQDQ&ved=0CE0Q9QEwCA&dur=595

map-malaysia. Retrieved from http://www.google.co.uk/imgres?q=malaysia+mapandhl=enandsa=Xandtbo=dandbiw=1680andbih=963andtbm=ischandtbnid=WUAEUJbSnsRUBM:andimgrefurl=http://www.malaysia-maps.com/anddocid=7sIDb_sDQhBVvMandimgurl=http://www.malaysia-maps.com/images/map-malaysia600.gifandw=600andh=236andei=_Iz1UJhJjpjUBZaQgcgIandzoom=1andiact=rcandsig=114087474045819399004andpage=1andtbnh=115andtbnw=292andstart=0andndsp=16andved=1t:429,r:1,s:0,i:151andtx=402andty=251

Marcum, J. A. (2004). Biomechanical and phenomenological models of the body, the meaning of illness and quality of care *Medicine, Health Care and Philosophy 7*, 311-320

Mardiah, B. A., Hazizi, A.S., Nasir, M.T.M., Zaitun, Y., Jan, J.M.H. (2012). Gender Differences in the Attitude and Strategy Towards Weight Control Among Government Employees in Penang, Malaysia. *Iranian J Public Health, 41*, 28-36.

Mariapun, J., Ng., C.-W., & Hairi, N. N. (2018). The Gradual Shift of Overweight, Obesity, and Abdominal Obesity Towards the Poor in a Multi-ethnic Developing Country: Findings from the Malaysian National Health and Morbidity Surveys. *J Epidemiol 28*(6), 279-286.

Marmot, M. (1999). Importance of the psychosocial environment in epidemiologic studies. *Scand J Work Environ Health, 25(Suppl 4)*, 49-53.

Marmot, M. (2001). Economic and social determinants of disease. *Bulletin of the World Health Organization, 79*(10), 988-989.

Marmot, M. (2002). The influence of income on health: views of an epidemiologist. *Health affairs, 21*(2), 31-46.

Marmot, M. (2004). *Status syndrome*. London: Bloomsbury.

Marmot, M. (2005). Social determinants of health inequalities. *The Lancet, 365*(1099-1104).

Marmot, M. (2006). Introduction. In M. Marmot & R. G. Wilkinson (Eds.), *Social determinants of health*. Great Britain: Oxford University Press.

Marmot, M., & Bell, R. (2010). Social determinants of health and obesity. In L. Dube, A. Bechara, A. Dagher, D. Drewnowski, J. Lebel, P. James, & R. Y. Yada (Eds.), *Obesity Prevention: the role of brain and society on individual behaviour* (pp. 701 - 711). Oxford: Elsevier.

Marmot, M., & Wilkinson, R. G. (2001). Psychosocial and material pathways in the relation between income and health: a response to Lynch et al. *BMJ, 322*, 1233.

Martinez-Gonzalez, M. A., Martinez, J. A., Hu, F. B., Gibney, M. J., & Kearney, J. (1999). Physical inactivity, sedentary lifestyle and obesity in the European Union. *Int J obes relat metab disord, 23*(11), 1192-1201.

Martorell, R., Khan, L. K., Hughes, M. L., & Grummer-Straw, L. M. (1998). Obesity in Latin American women and children. *J Nutr, 128*(9), 1464-1473.

Martorell, R., Khan, L. K., Hughes, M. L., & Grummer-Strawn, L. M. (2000). Obesity in women from developing countries. *Eur J Clin Nutr, 54*(3), 247-252.

Mascie-Taylor, C. G. N., & Goto, R. (2007). Human variation and body mass index: a review of the universality of BMI cut-offs, gender and urban-rural differences, and secular changes. *J Physio Anthropol, 26*(2), 109-112.

Mason, K. O. (1997). How family position influences married women's autonomy and power in five Asian countries. *Eugenia COSIO-ZAVALA, Paris, CICRED*, 353-370.

Mason, M. Sample size and saturation in PhD studies using qualitative interviews. *Forum: Qualitative Social Research 11*. doi:http://www.qualitative-research.net/index.php/fqs/article/view/1428/3027

Mastin, T., Campo, S., and Askelson, N.M. (2012). African American Women and Weight Loss: Disregarding Environmental Challenges. *Journal of Transcultural Nursing, 23*(1), 38-45.

Matheson, F. I., Moineddin, R., & Glazier, R. H. (2008). The weight of place: a multilevel analysis of gender, neighborhood material deprivation, and body mass index among Canadian adults. *Social Science and Medicine, 66*(3), 975-690.

Matthews, K. A., Gallo, L.C. and Taylor, S.E. (2010). Are psychosocial factors mediators of socioeconomic status and health connections? A progress report and blueprint for the future. *Ann. N. Y. Acad. Sci., 1186*, 146-173.

McAdams, M. A., Van Dam, R. M., & Hu, F. B. (2007). Comparison of self-reported and measured BMI as correlates of disease markers in US adults. *Obesity (Silver Spring)*, 188-196.

McAuley, E., Jerome, G. J., & Marquez, D. X. (2003). Exercise self-efficacy in older adults: social, affective, and behavioral influences. *Annals of behavioral medicine, 25*, 1-7.

McDonald, S. D., Han, Z., Mulla, S., & Beyene, J. (2010). Overweight and obesity in mothers and risk of preterm birth and low birth weight infants: systematic review and meta analyses. doi:10.1136/bmj.c3428

McKee, H., Ntoumanis, N., Smith, B. (2013). Weight Maintenance: Self-Regulatory Factors Underpinning Success and Failure. *Psychology & Health, 28*(10), 1207-1223.

McKee, M., Sim, F., & Pomerleau, J. (2011). Inequalities in health. In S. F & M. M (Eds.), *Issues in public health* (Vol. 2nd edition, pp. 78-106). UK: Open university press.

McKeown, T. (1979). *The role of medicine: dream, mirage or nemesis*. Oxford: Basil Blackwell.

McLaren, L. (2007). Socioeconomic status and obesity. *Epidemiologic Reviews, 29*, 29-48.

McLaughlin, E. A., Campos-Melady, M., Smith, J.E., Serier, K.N., Belon, K.E., Simmons, J.D., Kelton, K. (2016). The Role of Familism in Weight Loss Treatment for Mexican American Women. *Journal of Health Psychology, 22*(12), 1510-1523.

Mendez, M. A., Monteiro, C. A., & Popkin, B. M. (2005). Overweight exceeds underweight among women in most developing countries. *Am J Clin Nutr, 81*(3), 714 - 721.

Merlo, J., Yang, M., Chaix, B., Lynch, J., & Rastam, L. (2005). A brief conceptual tutorial on multilevel analysis in social epidemiology: investigating contextual phenomena in different groups of people. *J Epidemiol Community Health, 59*, 729-736.

Merrill, R. M., & Richardson, J. S. (2009). Validity of self-reported height, weight, and body mass index: findings from the National Health and Nutrition Examination Survey 2001-2006. *Preventing chronic disease, 6*(4), A121.

Mertens, D. M. (1998). *Research methods in education and psychology: Integrating diversity with quantitative & qualitative approaches*. Thousand Oaks, California: Sage Publications.

Metom, L. (2013). *Emotion Concepts of the Ibans in Sarawak*. Singapore: Trafford Publishing.

Metzgar, C. J., Preston, A.G., Miller, D.L., Nickols-Richardson, S.M. (2014). Facilitators and Barriers to Weight Loss and Weight Loss Maintenance: A Qualitative Exploration. *Journal of Human Nutrition and Dietetics, 28*, 593-603.

Micheal, E., & Chuen, E. M. (2012). Education and Health Awareness Among Indigenous People: A Study in Perak, Malaysia. *ARPN Journal of Science and Technology, 2*(8), 745-749.

Midha, T., Nath, B., Kumari, R., Krishna, V., Rao, Y. K., & Pandey, U. (2011). Prevalence and determinants of obesity in the adult population of Kanpur district -- a population-based study. *J Indian Med Assoc, 109*(8), 538-542.

Miles, L. (2014). The Social Relations Approach, Empowerment and Women Factory Workers in Malaysia. *Economic and Industrial Democracy*. doi:10.1177/0143831X14533734

Ministry of Education, M. Education System. Retrieved from http://www.moe.gov.my/en/sistem-pendidikan

Ministry of Health, M. (2012). Country Health Plan: 10th Malaysia Plan 2011-2015. Retrieved from Putrajaya, Malaysia: http://www.moh.gov.my/moh/images/gallery/Report/Country_health.pdf

Ministry of Health, M. (2016) Nutrition Research Priorities in Malaysia for 11th Malaysia Plan (2016-2020) Retrieved from: http://www.moh.gov.my/moh/images/gallery/Garispanduan/nutri/7-Nutrition_Research_Priorities_Area_5.pdf

Ministry of Women, M. (2007). *Measuring and Monitoring Gender Equality - Malaysia's Gender Gap Index*. Retrieved from Malaysia: http://www.my.undp.org/content/malaysia/en/home/library/womens_empowerment/MGGI.html

Ministry of Women, M. (2014). *Study to Support the Development of National Policies and Programmes to Increase and Retain the Participation of Women in the Malaysian Labour Force: Key Findings and Recommendations*. Retrieved from Putrajaya: http://www.my.undp.org/content/dam/malaysia/docs/Women%20In%20Malaysian%20Labour%20Force%20Study%20with%20UNDP-2013.pdf

Ministry of Education, M. Carta Sistem Pendidikan. In. http://www.moe.gov.my/v/carta-sistem-pendidikan: Kementerian Pendidikan Malaysia.

Ministry of Education, M. (2015). Murid/Pelajar: Program Matrikulasi. Retrieved from http://www.moe.gov.my/v/program-matrikulasi

Ministry of Education, M. National Education Policy. Retrieved from http://www.moe.gov.my/v/dasar-pendidikan-kebangsaan

Mirowsky, J., & Ross, C. E. (1984). Mexican culture and its emotional contradictions. *Journal of health and social behaviour, 25*(1), 2-13.

Mohammad, K., Golestan, B., Majdzadeh, R., Chaman, R., Nedjat, S., & Karimloo, M. (2009). Socioeconomic Status and Obesity Relationship in Non-Menopause Women Aged 15-49 Years in Tehran, Iran. *Iranian J Publ Health, 38*(8), 84-89.

Mohar, R. N. D. (1984). *Labour Shortages in the Agricultural Sector of the Malaysian Economy-With Reference to the Rubber and Oil Palm Estates.* (Master of Art). Durham University, Durham. Retrieved from http://etheses.dur.ac.uk/7166/ (7166)

Mohd-Shaharuddin, N., Lim, Y. A. L., Hassan, N.-A., Nathan, S., & Ngui, R. Soil-transmitted Helminthiasis among Indigenous Communities in Malaysia: Is This the Endless Malady with no Solution? Tropical Biomedicine, 35(1), 168-180.

Montague, C. T., Farooqi, I. S., Whitehead, J. P., Soos, M. A., Rau, H., Wareham, N. J., . . . al., e. (1997). Congenital leptin deficiency is associated with severe early-onset obesity in humans. Nature, 387, 903 –908.

Monteiro, C. A., Conde, W. L., & Popkin, B. M. (2001). Independent effects of income and education on the risk of obesity in the Brazilian adult population. *J. Nutr., 131*(3), 881S-886S.

Monteiro, C. A., Conde, W.L. and Popkin, B.M. (2002). Is obesity replacing or adding to undernutrition? Evidence from different social classes in Brazil. *Public Health Nutr, 5(1A)*, 105-112.

Monteiro, C. A., Conde, W.L. and Popkin, B.M. (2007). Income Specific Trends in Obesity in Brazil: 1975-2003. In (Vol. 97, pp. 1808-1812).

Monteiro, C.A., C. W., Lu B, Popkin BM. (2004). Obesity and inequities in health in the developing world. *Int J Obes Relat Metab Disord, 28*(9), 1181-1186.

Monteiro, C. A., Moura, E. C., Conde, W. L., & Popkin, B. M. (2004). Socioeconomic status and obesity in adult populations of developing countries: a review. *Bull World Health Organ, 82*(12), 940-946.

Moraeus, L., Lissner, L., Yngve, A., Poortvliet, E., Al-Ansari, U. and Sjoberg, A. (2012) Multi-level influences on childhood obesity in Sweden: societal factors, parental determinants and child's lifestyle. *International Journal of Obesity* 36: 969-976

Moore, S. (2010). Social networks, social capital and obesity: a literature review. In L. Dude, A. Bechara, A. Dagher, A. Drewnowski, J. LeBel, P. James, & R. Y. Yada (Eds.), *Obesity prevention: the role of brain and society on individual behaviour* (pp. 673-684). United States of America: Academic Press.

Moore, S., Hall, J. N., Harper, S., & Lynch, J. W. (2010). Global and national socioeconomic disparities in obesity, overweight and underweight status. *Journal of Obesity*. doi:10.1155/2010/514674

Morgan, D. L. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research, 1*(1), 48-76.

Morse, J. M. (1991). Approaches to qualitative-quantitative methodological triangulation. *Nursing research, 40*(2), 120-123.

Moser, S. (2010). Putrajaya: Malaysia's New Federal Administrative Capital. *Cities, 27*(4), 285-297.

Moskovich, A., Hunger, J., & Mann, T. (2011a). Chapter 6 - The psychology of obesity. In J. Cawley (Ed.), *The oxford handbook of the social science of obesity* (pp. 87-104). United States of America: Oxford University Press.

Motteli, S., Siegrist, M and Keller, C. (2017) Women's Social Eating Environment and Its Associations with Dietary Behaviour. Appetite 110: 86-93

Moustakas, C. (1994). *Phenomenological Research Methods*. Thousand Oaks, Ca.: SAGE Publications, Inc.

Mowafi, M., Khadr, Z., Bennett, G., Hill, A., Kawachi, I., & Subramanian, S. V. (2012). Is access to neighbourhood green space associated with BMI among Egyptians? A multilevel study of Cairo neighbourhoods. *Health & Place, 18*(2), 385-390.

Mowafi, M., Khadr, Z., Subramanian, S. V., Bennett, G., Hill, A., & Kawachi, I. (2011). Are neighborhood education levels associated with BMI among adults in Cairo, Egypt? *Social Science and Medicine, 72*(8), 1274-1283.

Muda, W. A. M., Kuate, D., Jalil, R.A., Nik, W.S.W., Awang, S.A. (2015). Self-perception and Quality of Life Among Overweight and Obese Rural Housewives in Kelantan, Malaysia. *Health and Quality of Life Outcomes, 13*(19). doi:10.1186/s12955-015-0210-z

Mukherjee, H. (2010) Access to and equity in higher education-Malaysia. Retrieved from https://www.semanticscholar.org/paper/Access-to-and-Equity-in-Higher-Education-Malaysia-Mukherjee/f2b5545d5028c08b1d253911c21333263805fc32

Mummery, W. K., Schofield, G. M., Steele, R., Eakin, E. G., & Brown, W. J. (2005). Occupational sitting time and overweight and obesity in Australian workers. *American journal of preventive medicine, 29*, 91-97.

Murray, C. J. L., Gakidou, E. E., & Frenk, J. (1999). Health inequalities and social group differences: what should we measure? *Bull World Health Organ, 77*, 537-543.

Musaiger, A. O., & Al-Mannai, M. (2014). Role of obesity and media in body weight concern among female university students in Kuwait. *Eat Behav., 14*(2), 229-232.

Must, A., Spadano, J., Coakley, E. H., Field, A. E., Colditz, G., & al., e. (1999). The disease burden associated with overweight and obesity. *JAMA, 282*, 1523-1529.

Must, A., Spadano, J., Coakley, E. H., Field, A. E., Colditz, G., & Dietz, W. H. (1999). The Disease Burden Associated with Overweight and Obesity *JAMA, 282*(16), 1523-1529.

Mutch, D. M., & Clément, K. Unraveling the Genetics of Human Obesity. *PLoS Genet, 2*(12). doi:10.1371/journal.pgen.0020188

Nah, A. M. (2008). Recognizing Indigenous Identity in Post Colonial Malaysian Law: Rights and Realities for the Orang Asli of Peninsular Malaysia. *Bijdragen tot de Taal-, Land- en Volkenkunde, 164*(2/3), 212-237.

Naidoo, J., & Wills, J. (2008). *Health studies: an introduction* (2 ed.). Basingstoke: Palgrave Macmillan.

National, E. A. C. (1998). *National economic recovery plan: agenda for action*: Economic Planning Unit Prime Minister's Dept., Malaysia.

Navadeh, S., Sajadi, L., Mirzazadeh, A., Asgari, F., & Haghazali, M. (2011). Housewives' Obesity Determinant Factors in Iran; National Survey – Stepwise Approach to Surveillance. *Iranian J Publ Health, 40*(2), 87-95.

Nazroo, J. (2001). *Ethnicity, 'race' and health* London: PSI.

Neely, M. C. (1999). Paper Tigers? How the Asian Economies Lost Their Bite. *The Regional Economist*. Retrieved from https://www.stlouisfed.org/publications/re/articles/?id=1734

Neighbors, L. A., & Sobal, J. (2007). Prevalence and magnitude of body weight and shape dissatisfaction among university students. *Eat Behav., 8*(4), 429-439.

Neuman, M., Finlay, J. E., Smith, G. D., & Subramanian, S. V. (2011). The poor stay thinner: stable socioeconomic gradients in BMI among women in lower- and middle-income countries. *Am J Clin Nutr, 94*, 1348-1357.

Newkirk, C., Oths, K. S., Dresslen, W. W., & Dos Santos, J. E. (2009). Intracultural diversity in food knowledge in southern Brazil. *Ecol. Food Nutr., 48*(4), 285-302.

Newton, R. R., & Rudestam, K. E. (1999). *Your statistical consultant*. Thousand Oaks, CA: Sage.

Ng, C., Corey, P. N., & Young, K. (2011) Socio-economic patterns of obesity among aboriginal and non-aboriginal Canadians. *Can J Public Health, 102*(4), 264-268.

Ng, K.-M., Loy, J. T.-C., Gudmonson, C.-G., & Cheong, W. N. (2009). Gender Differences in Marital and Life Satisfaction Among Chinese Malaysians. *Sex Roles, 60*, 33-43.

Ng, L. W. C., Malhotra, R., Lai, D., Tai, E.S., Ostbye, T. (2013). Perceived Barriers to and Ideas for Weight Control Interventions in Malay Homemakers: Results from Focus Groups. *Asia-Pacific Journal of Public Health, 27*(2). doi:10.1177/1010539513479966

Nieuwenhuis, R., Grotenhuis, M. t., & Pelzer, B. (2012). Influence.ME: Tools for detecting influential data in mixed effects models. *The R Journal, 4*(2), 38-47.

Nikolaou, C. K., Hankey, C. R., & Lean, M. E. (2014). Weight changes in young adults: a mixed-methods study. *Int J Obes (Lond).* doi:10.1038/ijo.2014.160

Nissen, N. K., & Holm, L. (2014). Literature Review: Perceptions and Management of Body Size Among Normal Weight and Moderately Overweight People. *Obesity Reviews, 16*, 150-160.

Nissen, N. K., Holm, L., Baarts, C. (2015). Monitoring the Normal Body: Ideals and Practices among Normal-Weight and Moderately Overweight People. *Obesity Facts, 8*, 329-341.

Noble, H., & Smith, J. Issues and validity and reliability in qualitative research. *18*(2). doi.org/10.1136/eb-2015-102054

Noh, K. M., & Jaafar, S. (2011). *Health in all policies: the primary health care approach in Malaysia - 50 years experience in addressing social determinants of health through intersectoral action for health*. Paper presented at the World Conference on Social Determinants of Health, Brazil. http://www.who.int/sdhconference/resources/draft_background_paper7_malaysia.pdf

NOO. (2009). Body Mass Index as a measure of obesity. Retrieved from http://www.noo.org.uk/uploads/doc789_40_noo_BMI.pdf

NoorAni, A., Rajini, S., Balkish, M.N., Noraida, M.K., SMaria, A, Fadhli, M.Y., Jabrullah, A.H., Tahir, A. (2018). Morbidity patterns and healthcare utilisation among older people in Malaysia: 1996-2015. *Public Health* (163): 105-112.

Nor, N. S. M., Ambak, R., Zaki, N. M., Aziz, N. S. A., Cheong, S. M., . . . Aris, T. An Update on Obesity Research Pattern among Adults in Malaysia: A Scoping Review *2018, 181*(1). doi:org/10.1186/s12905-018-0590-4

Nor, S. M., Roslan, S., Kamaruddin, A. M., Ali, M. A. M., & Manaf, J. A. (2011). Dropout Prevention Initiatives for Malaysian Indigenous Orang Asli Children. The International Journal on School Disaffection, 42-56.

Nsour, M. A., Kayyali, G. A., & Naffa, S. (2013). Overweight and obesity among Jordanian women and their social determinants. *Eastern Mediterranean Health Journal,* (12), 1-9.

Obesity, W. C. o. (2000). *Obesity: preventing and managing the global epidemic: report of a WHO consultation*. Retrieved from: https://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/

Odoms-Young, A. (2008). Factors that influence body image representations of black Muslim women. *Social Science and Medicine, 66*(12), 2573-2584. http://dx.doi.org/10.1016/j.socscimed.2008.02.008

OECD. Household disposable income. (2016). Retrieved from https://data.oecd.org/hha/household-disposable-income.htm

Office for national statistics. (2002). *Health inequalities - national targets on infant mortality and life expectancy - technical briefing*. Retrieved from London:

Ogden, C. L., Lamb, M.M., Carroll, M.D. and Flegal, K.M. (2010). Obesity and socioeconomic status in adults: United States, 2005-2008. *NCHS Data Brief, Dec* (50), 1-8.

Ogden, J. (2007). *The psychology of eating: from healthy to disordered behaviour*. Oxford: Blackwell.

Okop, K. J., Mukumbang, F. C., Mathole, T., Levitt, N., & Puoane, T. (2016). Perceptions of body size, obesity threat and the willingness to lose weight among black South African adults: a qualitative study. *BMC Public Health 16*(365). doi:10.1186/s12889-016-3028-7

Olesen, V. (2007). Early millennial feminist qualitative research: challenges and contours. In N. Denzin & Y. Lincoln (Eds.), *Landscape of qualitative research* (pp. 311-370). London: Sage Publications Ltd.

Ong, A. (1990). State versus Islam: Malay families, women's bodies and the body politics in Malaysia. *American Ethonologist, 17*(2), 258-276.

Ong, E. C. (2012). *Education and Labour Market Outcomes of Malaysia's Affirmative Action Policies*. Retrieved from United States: http://www.econ.brown.edu/students/eecheng_ong/Paper_NEP.pdf

Ong, S. K., Fong, C. W., Ma, S., Lee, J., Heng, D., Deurenberg-Yap, M., . . . Tai, E. S. (2009). Longitudinal study of the socio-demographic determinants of changes in body weight and waist circumference in a multi-ethnic Asian population. *International Journal of Obesity, 33*(11), 1299-1308. doi:10.1038/ijo.2009.173

ONS (2002) Marriage, cohabitation and civil partnership. Retrieved from https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/marriagecohabitationandcivilpartnerships

Onwuegbuzie, A. J., & Leech, N. L. (2007). A call for qualitative power analyses. *Quality & Quantity, 41*, 105-121.

Onyike, C. U., Crum, R. M., Lee, H. B., Lyketsos, C. G., & Eaton, W. W. (2003). Is obesity associated with major depression? Results from the Third National Health and Nutrition Examination Survey. *American Journal of Epidemiology, 158*(12), 1139-1147.

Ortega, A., Abdullah, H., Ahmad, N., & Ibrahim, R. (2013). Stress Indicators and Eating Habits among Working Malaysian Women. *Asian Social Science 9*(7), 12-21.

Osborne, J. W., & Overbay, A. (2004). The power of outliers (Why the researchers should always check for them). *Practical Assessment, REsearch and Evaluation, 9*(6). doi:http://pareonline.net/getvn.asp?v=9&n=6

Oths, K. S., Carolo, A., & Santos, J. E. D. (2003). Social status and food preferences in southeast Brazil. *Ecol. Food Nutr., 42*(4-5), 303-324.

O' Rahilly, S., & Farooqi, I. S. (2006). Genetics of obesity. *Philos. Trans. R. Soc. Lond B Biol Sci, 361*(1471), 1095-1105.

Paeratakul, S., White, M. A., Williamson, D. A., Ryan, D. H., & Bray, G. A. (2002). Sex, race/ethnicity, socioeconomic status, and BMI in relation to self-perception of overweight. *Obes Res., 10*(5), 345-350.

Pallant, J. (2010). *SPSS survival manual: a step by step guide to data analysis using SPSS for Windows*. Buckingham: Open university press.

Pampel, F. C., Denney, J. T., & Patrick, M. K. (2012). Economic development: a test of the reversal hypothesis. *Social Science & Medicine, 74*(7), 1073-1081.

Panotopoulos, G., Raison, J., Ruiz, J. C., Guy-Grand, B., & Basdevant, A. (1997). Weight gain at the time of menopause. *Human Reproduction, 12*(1), 126-133.

Papas, M. A., Alberg, A. J., EWings, R., Helzlsouer, K. J., Gary, T. L., & Klassen, A. C. (2007). The built environment and obesity. *Epidemiologic Reviews*. doi:10.1093/epirev/mxm009

Parlimen of Malaysia. (2014). Political Parties. Retrieved from http://www.parlimen.gov.my/pautan-laman.html?&uweb=p&view=71⟨=en

Park, B., Cho, H.N., Choi, E., S.D.H., Kim, S. Park, Y-R., Choi, K.S., Rhee, Y. (2019). Self-perceptions of body weight status according to age-groups among Korean women: a nationwide population-based survey. *PLoS ONE, 14*(1). http://doi.org/10.1371/journal.pone.0210486

Patton, M. (1990). *Qualitative evaluation and research methods*. Beverly Hills, CA.: Sage.

Peacock, M., & Bissell, P. (2011). The social determinants of health inequalities: implications for research and practice.

Pedersen, S., Sniehotta, F.F., Sainsbury, K., Evans, E.H., Marques, M.M., Stubbs, R.J., Heitmann, B.I., Lahteenmaki, L. (2018). The Complexity of Self-Regulating Food Intake in Weight Loss Maintenance. A Qualitative Study Among Short- and Long-Term Weight Loss Maintainers. *Social Science & Medicine*, 18-24

Peel, E. (2004). Gaining informed consent. In A. Bryman (Ed.), *Understanding research for social policy and practice: themes, methods, and approaches*. Bristol: Policy Press.

Pelletier, L. G., Dion, S. C., Slovinec-D'Angelo, M., & Reid, R. (2004). Why Do You Regulate What You Eat? Relationships Between Forms of Regulation, Eating Behaviors, Sustained Dietary Behavior Change, and Psychological Adjustment *Motivation and Emotion, 28*(3), 245-277.

Peterson, K., Dubowitz, T., Stoddard, A., Troped, P., Sorensen, G., & Emmons, K. (2007). Social context of physical activity and weight status in working class populations. *Journal of physical activity and health, 4*(381-396).

Peugh, J. L. (2010). A practical guide to multilevel modeling. *Journal of School Psychology, 48*, 85-112.

Pickett, K. E., Kelly, S., Brunner, E., Lobstein, T., & Wilkinson, R. G. (2005). Wider income gaps, wider waistbands? An ecological study of obesity and income inequality. *J Epidemiol Community Health, 59*, 670-674.

Pill, R., Peters, T. J., & Robling, M. R. (1995). Social class and preventive health vehaviour: a British example. *J epidemiol community health, 49*, 28-32.

Pillinger, R. Random Intercept Model. Retrieved from http://www.bristol.ac.uk/cmm/learning/videos/random-intercepts.html#single

Platt, L. (2011). *Understanding inequalities: stratification and difference*. Cambridge, UK: Polity Press.

Plowright, D. (2011). *Using Mixed Methods: Frameworks for an Integrated Methodology*. London: SAGE publications Ltd.

PNS. Executive Francis Scheme. Retrieved from http://www.smeinfo.com.my/index.php?option=com_content&view=article&id=1239&Itemid=1205

Poag-DuCharme, K. A., & Brawley, L. R. (1993). Self-efficacy theory: use in the prediction of exercise behaviour in the community setting. *J. Appl. Sport Psychol., 5*, 178-194.

Pollock, N. J. (1995). Cultural elaborations of obesity - fattering practices in Pacific societies. *Asia Pacific J Clin Nutr, 4*(357-360).

Pon, L. W., Noor-Aini, M. Y., Ong, F. B., N., A., Seri, S. S., Shamsuddin, K., . . . Wan, H. W. (2006). Diet, Nutritional Knowledge and Health Status of Urban Middle-Aged Malaysian Women. *Asia Pac J Clin Nutr, 15*(3), 388-399.

Poobalan, A. S., Aucott, L. S., Gurung, T., Smith, W. C., & Bhattacharya, S. (2009). Obesity as an independent risk factor for elective and emergency caesarean delivery in nulliparous women –systematic review and meta-analysis of cohort studies. *Obes Rev, 10*(1), 28-35.

Poortinga, W. (2006). Do health behaviours mediate the association between social capital and health? *Preventive Medicine, 43*, 488-493.

Popay, J., Bennett, S., Thomas, C., Williams, G., Gatrell, A., & Bostock, L. (2003). Beyond 'beer, fags, egg and chips'? Exploring lay understandings of social inequalities in health. *Sociology of health & illness, 25*(1), 1-23.

Popay, J., Williams, G., Thomas, C., & A., G. (1998). Theorising inequalities in health: the place of lay knowledge. *Sociology of health and illness, 20*(5), 619-644.

Portes, A. (1998). Social capital: its origins and applications in modern sociology. *Annual review sociol, 24*, 1-24.

Poterico, J. A., Bernabe-Ortiz, A., de Mola, C. L., & Miranda, J. J. (2012). Association between television viewing and obesity in Peruvian women. *Rev Saude Publica*.

Poterico, J. A., Stanojevic, S., Ruiz-Grosso, P., Bernabe-Ortiz, A., & Miranda, J. J. (2011). The Association Between Socioeconomic Status and Obesity in Peruvian Women. *Obesity (Silver Spring), 20*(11), 2283-2289. doi: 10.1038/oby.2011.288

Povey, R., Conner, M., Sparks, P., James, R., & Shephered, R. (2000). The theory of planned behaviour and healthy eating: examining additive and moderating effects of social influence variables. *Psychology and Health, 14*, 991-1006.

Prentice, A. M., & Jebb, S. A. (2001). Beyond Body Mass Index. *Obesity Reviews, 2*(3), 141-147. doi: 10.1046/j.1467-789x.2001.00031.x

Price, R. A., & Gottesman, I. I. (1991). Body fat in identical twins reassured apart: roles for genes and environment. *Behav. Genet., 21*(1), 1-7.

Prime Minister Office, Cabinet Members: List of Ministers and Deputy Ministers by seniority. Retrieved from https://www.pmo.gov.my/home.php?menu=cabinet&page=1797

Prince, S. A., Kristjansson, E. A., Russell, K., Billette, J.-M., & al., e. (2012). Relationships between neighborhoods, physical activity, and obesity: a multilevel analysis of a large Canadian City. *Obesity (Silver Spring), 20*(10), 2093-2100.

Probert, A. (2006). Searching for an appropriate research design: a personal journey. *Journal of Research Practice, 2*(1).

Prospective Studies Collaboration. (2009). Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. *The Lancet, 373*(9669), 1083-1096.

Pryer, J. (1990). *Socio-economic and environmental aspects of undernutrition and ill health in an urban slum in Bangladesh.* London University,

Puhl, R., Moss-Racusin, C., & Schwartz, M. B. (2007). Internalization of weight bias: implications for binge eating and emotional well-being. *Obesity, 15*, 19-23.

Puhl, R. M., & Brownell, K. D. (2006). Confronting and coping with weight stigma: an investigation of overweight and obese adults. *Obesity, 14*(10), 1802-1815.

Punch, M. (1994). Politics and ethics in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 83-95). Thousand Oaks, CA: Sage Publications.

Puoane, T., Steyn, K., Bradshaw, D., Laubscher, R., Fourie, J., Lambert, V., & Mbananga, N. (2002). Obesity in South Africa: the South African demographic and health survey. *Obes Res, 10*(10), 1038-1048.

Puteh, A. (2012). Medium of Instruction Policy in Malaysia: The Fishman's Model. *European Journal of Business and Social Science, 1*(1), 11-22.

Putland, C., Baum, F. E., & Ziersch, A. M. (2011). From causes to solutions - insight from lay knowledge about health inequalities. *BMC public health, 11*. doi:10.1186/1471-2458-11-67

Putnam, R. D. (1995). Bowling alone: America's declining social capital. *Journal of Democracy, 6*, 65-78.

Qiao, Q., & Nyamdorj, R. (2010). Is the association of Type II Diabetes with waist circumference or waist-to-hip ratio stronger than that with Body Mass Index? *European Journal of Clinical Nutrition, 64*(1), 30-34. doi:10.1038/ejcn.2009.93

Quezada, A. D., & Lozada-Tequeanes, L. L. (2015). Time trends and sex differences in associations between socioeconomic status indicators and overweight-obesity in Mexico (2006-2012). *BMC Public Health, 15*, 1244. doi:10.1186/s12889-015-2608-2

Ragayah, H. M. Z. (2008). Income Inequality in Malaysia. *Asian Economic Policy Review, 3*, 114-132.

Raghunathan, T. E. (2004). What do we do with missing data? Some options for analysis of incomplete data. *Annu. Rev. Public Health, 25*, 99-117. doi:10.1146/annurev.publicalth25.102802.124410

Rahimah, A. A. (2012). New Economic Policy and the Malaysian Multi-ethnic Middle Class. *Asian Ethnicity, 13*(1), 29-46.

Rahman, M., & Berenson, A. B. (2010). Racial difference in lean mass distribution among reproductive-aged women. *Ethn Dis. Autumn, 20*(4), 346-352.

Rahman, S. R., & Sua, T. Y. (2010). Ethnic Segregation in Malaysia's Education System: Enrolment Choices, Preferential Policies and Desegregation. *Paedagogica Historica: International Journal of the History of Education, 46*(1-2), 117-131.

Ramachandran, A., Ma, R. C. W., & Snehalatha, C. (2010). Diabetes in Asia. *The Lancet, 9712*(375), 408-418.

Ramli, M. Z., & Mohamad, F. S. (2014). *Investigating the State of Education Among Orang Asli Children in 21st Century, Malaysia*. Paper presented at the 2nd Learning Science Colloquium, Universiti Malaysia Sarawak (UNIMAS).

Rampal, L., Rampal, S., Khor, G. L., Zain, A. M., Ooyub, S. B., Rahmat, R. B., . . . Krishnan, J. (2007). A national study on the prevalence of obesity among 16,127 Malaysians. *Asia Pac J Clin Nutr, 16*(3), 561-566.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: applications and data analysis methods*. Thousand Oaks, CA: Sage.

Reeves, G. K., Pirie, K., Beral, V., Green, J., Spencer, E., & Bull, D. (2007). Cancer incidence and mortality in relation to body mass index in Million Women Study: cohort study. *335*(7630). doi:10.1136/39367.495995

Renehan, A. G., Tyson, M., Egger, M., Heller, R. F., & Zwahlen, M. (2008). Body-mass index and incidence of cancer: a systematic review and meta-analysis of prospective observational studies. *The Lancet, 371*, 569–578.

Review, T. M. (2010). *Fair society, healthy lives. Strategic lives, strategic review of health inequalities in England post-2010.* Retrieved from: http://www.instituteofhealthequity.org/resources-reports/fair-society-healthy-lives-the-marmot-review/fair-society-healthy-lives-full-report-pdf.pdf

Reyes, N. R., Oliver, T.L., Klotz, A. A., LaGrotte, C.A., Veur, S.S.V., Virus, A., Bailer, B.A., Foster, G.D. (2012). Similarities and Differences between Weight Loss Maintainers and Regainers: A Qualitative Analysis. *Journal of The Academy of Nutrition and Dietetics, 112*(4), 499-504.

Reynolds, K., Gu, D., Whelton, P. K., Wu, X., Duan, X., Mo, J., . . . Group, I. C. (2007). Prevalence and risk factors of overweight and obesity in China. *Obesity (Silver Spring), 15*(1), 10-18.

Rguibi, M., & Belahsen, R. (2006). Body size preferences and sociocultural differences on attitudes towards obesity among Moroccan Sahraoui women. *Body image, 3*(4), 395-400.

Riphahn, R. T., & Sefling, O. (2002). Item No-response on Income and Wealth Questions.

Rivera, J. A., Irizarry, L. M., & González-de Cossío, T. (2009). Overview of the nutritional status of the Mexican population in the last two decades. *Salud Publica Mex, 51*(4), S645-656.

Robert, S., & Reither, E. N. (2004). A multilevel analysis of race, community disadvantage, and body mass index among adults in the U.S. *Social science & Medicine, 59*, 2421-2434.

Robinson, E., Kersbergen, I. (2016). Overweight or About Right? A Norm Comparison Explanation of Perceived Weight Status. *Obesity Science & Practice*. doi:10.1002/osp4.89

Robinson, E., Oldham, M. (2016). Weight Status Misperceptions among UK Adults: The Use of Self-Reported vs Measured BMI. *BMC Obesity, 3*(21). doi:10.1186/s40608-016-0102-8

Robson, K., & Pevalin, D. (2016). *Multilevel Modeling in Plain Language*. London: Sage Publications Ltd.

Roddin, R., Sultan Sidi, N. S., Hadi, M. Y. A., & Yusof, Y. (2012). *Poverty Eradication Through 'Pro-Poor Tourism' (PPT) Approach Among Orang Asli Communities In Malaysia*. Paper presented at the 4th International

Conference on Education and New Learning Technologies, Barcelona, Spain.

Rogers, W. A. (2006). Feminism and public health ethics. *J Med Ethics, 32*, 351-354.

Rogerson, D., Soltani, H., Copeland, R. (2016). The Weight-Loss Experience: a Qualitative Exploration. *BMC Public Health, 16*. doi:10.1186/s12889-016-3045-6

Roh, L., Braun, J., Chiolero, A., Bopp, M., Rohrmann, S., & Faeh, D. (2014). Mortality Risk Associated with Underweight: A Census-Linked Cohort of 31,578 Individuals with Up to 32 Years of Follow-Up. *14*. doi: 10.1186/1471-2458-14-371

Romero-Corral, A., Somers, V. K., Sierra-Johnson, J., Thomas, R. J., Bailey, K. R., Collazo-Clavell, M. L., . . . Jimenez, F., L. (2008). Accuracy of body mass index to diagnose obesity in the US adult population. *Int J Obes (Lond), 32*(6), 959-966.

Ronnenberg, A. G., Wang, X., Xing, H., & al., e. (2003). Low preconception body mass index is associated with birth outcome in a prospective cohort of Chinese women *J Nutr., 133*, 3449–3455.

Roslan, A. (2001). *Income Inequality, Poverty and Development Policy in Malaysia*. Paper presented at The International Seminar on "Poverty and Sustainable Development".

Rosliza, A. M., & Muhamad, H. J. (2011). Knowledge, attitude and practice on antennal care among orang asli women in Jempol, Negeri Sembilan. *Malaysian Journal of Public Health Medicine, 11*(2), 13-21.

Rosnon, M. R. (2016). Indigenous Education Policy in Malaysia: A Discussion of Normalization in Schooling *Journal of Education and Social Sciences, 4(June)*, 25-32

Rubin, D. B. (1987). United States of America: John Wiley & Sons. Inc.

Ruel, e., Reither, E. N., Robert, S. A., & Lantz, P. M. (2010). Neighbourhood effects on BMI trends: examining BMI trajectories for Black and White women. *Health & Place, 16*, 191-198.

Ruzek, S. B., Olesen, V. L., & Clarke, A. E. (1997). *Women's health: differences and complexities*. Columbus: Ohio State University Press.

Ryan, G. W., & Bernand, H. R. (2003). Techniques to identify themes. *Field Methods, 15*, 85-109.

Sabanayagam, C., Shankar, A., Saw, S.M., Tai, E.S. and Wong, T.Y. (2009). The Association Between Socioeconomic Status and Overweight/Obesity in a Malay Population in Singapore. *Asia Pac J Public Health, 21*(4), 487-496.

Saldana, J. (2009). *The coding manual for qualitative researchers*. London: Sage Publication Ltd.

Salvy, S.-J., Roemmich, J., N., Bowker, J. C., Romero, N. D., Stadler, P. J., & Epstein, L. H. (2009). effect of peers and friends on youth physical activity and motivation to be physically active. *J Pediatr Psychol., 34*(2), 217–225.

Sarafino, E. P., & Smith, T. W. (2012). *Health Psychology Biopsychosocial Interaction 7th ed.* Asia: John Wiley and Sons, Inc.

Sarantakos, S. (2005). *Social research* (3 ed.). Hampshire: Palgrave Macmillan.

Sarmiento, O. L., Parra, D. C., Gonzalez, S. A., Gonzalez-Casanova, I., Forero, A. Y., & Garcia, J. (2014). The dual burden of malnutrition in Colombia. *Am J Clin Nutr, 100(Suppl)*, 1628S-1635S.

Saw, S-H. (2007). *The Population of Malaysia*. Singapore: Institute of Southeast Asian Studies.

Scambler, G., & Scambler, S. (2007). Social patterning of health behaviours. In S. A & G. S (Eds.), *Public health: social context and action* (pp. 34-47). Poland: Open University Press.

Scarborough, P., Bhatnagar, P., Wickramasinghe, K. K., Allender, S., Foster, C., & Rayner, M. (2011). The economic burden of ill health due to diet, physical inactivity, smoking, alcohol and obesity in the UK: an update to 2006-07 NHS costs. *J Public Health (Oxf), 33*(4), 527-535.

Scarborough, P., & Steven, A. (2008). The north-south gap in overweight and obesity in England. *International Journal of Nutritional Science, 100*(3), 677-684.

Scheers, T., Philippaerts, R., & Lefevre, J. (2012). Patterns of physical activity and sedentary behaviour in normal-weight, overweight and obese adults, as measured with a portable armband device and an electronic diary. *Clinical nutrition 31*, 756-764.

Schifter, D. A., & Ajzen, I. (1985). Intention, perceived control, and weight loss: an applicationof the theory of planned behaviour. *Journal of personality and social psychology*, 843-851.

Schutz, H. K., & Paxton, S. J. (2007). Friendship
quality, body dissatisfaction, dieting and disordered eating in adolescent girls. *Br J Clin Psychol, March* (46), 67-83.

Scott, J., & Marshall, G. (Eds.). (2009). Oxford: Oxford University Press.

Seaman, S. R. a. W., I.R. (2013). Review of inverse probability weighting for dealing with missing data. *Stat Methods Med Res, 22*(278). doi:10.1177/0962280210395740

Secretary of state for health. (1998). *Our healthier nation: a contract for health*. Retrieved from London:

Seidell, J. C., & Flegal, K. M. (1997). Assessing obesity: classification and epidemiology. *British Medical Bulletin, 53*(2), 238-252.

Sen, A. (1992). *Inequality reexamined*. the United States of America: Harvard University Press.

Sengupta, A., Angeli, F., Syamala, T. S., Dagnelie, P. C., & Schayck, C. P. V. (2015). Overweight and obesity prevalence among Indian women by place of residence and socio-economic status: contrasting patterns from 'underweight states' and 'overweight states' of India. *Social Science & Medicine, 138*, 161-169.

Sherwood, N. E., & Jeffery, R. W. (2000). The behavioral determinants of exercise: implications for physical activity interventions. *Annu. Rev. Nutr, 20*, 21-44.

Shetty, P., & James, W. P. T. (1994) Body mass index – a measure of chronic energy deficiency in adults. In. Rome: Food and Agriculture Organization of the United Nations.

Shields, M., Gorber, S. C., & Tremblay, M. S. (2008). Estimates of obesity based on self-report versus direct measures. *Health Rep., 19*(2), 61-67.

Shoneye, S., Johnson, F., Steptoe, A., & Wardle, J. (2012). A qualitative analysis of black and white British women's attitudes to weight and weight control. *Journal of Human Nutrition and Dietetics, 24*, 536-542.

Sichieri, R., Coitinho, D.C., Leao, M.M., Recine, E. and Everhart, J.E. (1994). High Temporal, Geographic, and Income Variation in Body Mass Index Among Adults in Brazil. *Am J Public Health, 84*(5), 793-798.

Sichieri, R., & de Moura, E. C. (2009). A multilevel analysis of variations in body mass index among adults, Brazil, 2006. *Revista De Saude Publica, 43*, 90-97.

Sidik, S. M., & Rampal, L. (2009). The prevalence and factors associated with obesity among adult women in Selangor, Malaysia. *Asia Pac Fam Med, 8*(1). doi:10.1186/1447-056X-8-2

Siegrist, J., & Marmot, M. (2006). Introduction. In S. J & M. M (Eds.), *Social inequalities in health: new evidence and policy implications* (pp. 1-26). Great Britain: Oxford University Press.

Silventoinen, K., Rokholm, B., Kaprio, J., & Sørensen, T. I. (2010). The genetic and environmental influences on childhood obesity: a systematic review of twin and adoption studies. *International Journal of Obesity, 34*(1), 29-40.

Silverman, D. (1984). Going private: ceremonial forms in a private oncology clinic. *Sociology, 18*(2), 191-204.

Silverman, D. (1985). *Qualitative methodology and sociology: describing the social world*. Aldershot: Gower.

Sim, H. C. (2011). Coping with change - rural transformation and women in contemporary Sarawak. *Critical Asian Studies, 43*(4), 595-616.

Sim, T. T., & Khan, T. H. (2014). Reimaging Iban longhouses in urban Context: a study in Sarawak, Malaysia. *Scottish Journal of Arts, Social Sciences and Scientific Studies, 18*(1), 3-11.

Singer, J. D., & Willet, J. B. (2003). *Applied longitudinal data analysis: modeling change and event occurence*. New York: Oxford University Press.

Singh, J. S., & Mukherjee, H. (1993). Education and national integration in Malaysia: stocktaking thirty years after independence. *International Journal of Educational Development, 13*(2), 89-102.

Smith, D. E. (1987). *The everyday world as problematic: a sociology for women*. Boston: Northeastern University Press.

Smith, D. E. (1990). *The conceptual practices of power: A feminist sociology of knowledge*. Boston: Northeastern University Press.

Smith, M. J. (1998). *Social science in question*. London: The open university.

Smith, T. W. (1991). *An Analysis of Missing Income Information on the General Social Surveys*. Retrieved from http://gss.norc.org/Documents/reports/methodological-reports/MR071%20An%20Analysis%20of%20Missing%20Income%20Information%20on%20the%20GSS.pdf

Smith, K.J. (2003) Minority language education in Malaysia: four ethnic communities' experiences. International Journal of Bilingual Education and Bilingualism 6(1): 52-65

Snape, D., & Spencer, L. (2003). The foundation of qualitative research. In J. Ritchie & J. Lewis (Eds.), *Qualitative Research Practice: A Guide for Social Science Students and Researchers* (pp. 1-23). London: Sage Publications Ltd.

Snijders, E. A. B., & Bosker, R. J. (2012). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. London: Sage Publications Ltd.

Snijders, T., & Bosker, R. (1999). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. London: Sage Publications.

Sobal, J., Hanson, K. L., & Frongillo, E. A. (2009). Gender, Ethnicity, Marital Status, and Body Weight in the United States. Obesity (Silver Spring) 17(12), 2223-2231

Sobal, J., Rauschenbach, B., & Frongillo, E. A. (2003). Marital Status Changes and Body Weight Changes: a US Longitudinal Analysis. Social Science & Medicine, 56(7), 1543-1555

Sobal, J., & Stunkard, A. J. (1989). Socioeconomic status and obesity: a review of the literature. *Psychol Bull, 105*(2), 260-275.

Sobal, J. (2005). Social Consequences of Weight Bias by Partners, Friends, and Strangers. In K. D. Brownell, R. M. Puhl, M. B. Schwartz, & L. Rudd (Eds.), *Weight bias: Nature, consequences, and remedies* (p. 150–164). Guilford Publications.

Solar, O., & Irwin, A. (2010) A conceptual framework for action on the social determinants of health. Social Determinants of Health Discussion Paper 2. In, *Policy and Practice*. Geneva: World Health Organization.

SoltØft, F., Hammer, M., & Kragh, N. (2009). The association of body mass index and health-related quality of life in the general population: data from the 2003 Health Survey of England. *Qual Life Res 18*(10), 1293-1299.

Spiegel, A. (2010). Becoming an Activist: The Activists' Trajectories. In *Contested Public Spheres: Female Activism and Identity Politics in Malaysia* (pp. 59-100). Germany: VS Research.

Spinillo, A., Capuzzo, E., Piazzi, G., Ferrari, A., Morales, V., & Di Mario, M. (1998). Risk for spontaneous preterm delivery by combined body mass index and gestational weight gain patterns. *Acta Obstet Gynecol Scand, 77*(1), 32-36.

Stafford, M., Brunner, E. J., Head, J., & Ross, N. A. (2010). Deprivation and the development of obesity a multilevel, longitudinal study in England. *Am J Prev Med., 39*(2), 130-139.

Stanley, L., & Wise, S. (1983). *Breaking out: feminist consciousness and feminist research*. London: Routledge & Kegan Paul.

Stansfeld, S. A. (2006). Social support and social cohesion. In M. Marmot & R. G. Wilkinson (Eds.), *Social determinants of health* (pp. 148-171). Great Britain: Oxford University Press.

Stanton, D., & Stewart, A. J. (1995). *Feminism in the academy*. Ann Arbor: University of Michigan Press.

Stephens, C. (2008). *Health promotion: a psychosocial approach*. Maidenhead: Open University Press.

Sternfeld, B., Ainsworth, B. E., & Quesenberry, C. P. (1999). Physical activity patterns in a diverse population of women. *Preventive medicine, 28*(3), 313-323.

Stewart, A. J. (1994). The women's movement and women's lives: linking individual development and social events. In A. Lieblich & R. Josselson (Eds.), *The narrative study of lives: exploring identity and gender* (pp. 230-250). Thousand Oaks, CA: Sage.

Stommel, M., & Schoenborn, C. A. (2009). Accuracy and usefulness of BMI measures based on self-reported weight and height: findings from the NHANES & NHIS 2001-2006. *BMC Public Health, 9*(421). doi:10.1186/1471-2458-9-421

Story, M., Kaphingst, K. M., Robinson-o-Brien, R., & Glanz, K. (2008). Creating healthy food and eating environments: policy and environmental approaches. *Annual review of public health, 29*, 253-272.

Stride, C. (2008). *Training Courses: Multi-level Modeling Using SPSS*. UK.

Striegel-Moore, R. H., Dohm, F.-A., Kraemer, H. C., Taylor, C. B., Daniels, S., Crawford, P. B., & Schreiber, G. (2003). Eating disorders in black and white young women. *American Journal of Psychiatry, 160*(7), 519-529.

Striegel-Moore, R. H., Silberstein, L.R., & Rodin, J. (1986). Toward an understanding of risk factors for bulimia. *American Psychologist, 41*(3), 246–263.

Strien, T., Herman, C. P., & Verheijden, M. W. (2009). Eating style, overeating and overweight in a representative Dutch sample. Does external eating play a role? *Appetite, 52*(2), 380-387.

Stronks, K., Mheen, V. D., Looman, C. W. N., & Mackenbach, J. P. (1996). behavioral and structural factors in the explanation of socio-economic inequalities in health: an empirical analysis. *Sociology of health and illness, 18*(5), 653-674.

Stunkard, A. J., Harris, J. R., Pedersen, N. L., & McClearn, G. E. (1990). The body-mass index of twins who have been reared apart. *N Engl. J. Med, 322*, 1483-1487.

Stunkard, A. J., Sorensen, T. I., Hanis, C., Teasdale, T. W., Chakraborty, R., Schull, W. J., & Schulsinger, F. (1986). An adoption study of human obesity. *N Engl. J. Med, 314*, 193-198.

Subramanian, G. (2011). *Flexible Working Arrangements in Malaysia and Participation of Women in the Labour Force.* (Degree of Doctor of Philosophy). Victoria University of Wellington, New Zealand.

Subramanian, S. (2004). Multilevel methods, theory and analysis. In N. Anderson (Ed.), *Enclopedia of Health & Behaviour* (pp. 602-608). Thousand Oaks, CA.: Sage.

Subramanian, S. V. (2013a). Foreword. In D. Dorling (Ed.), *Unequal Health. The Scandal of Our Time* (First edition ed.). Bristol, UK: Policy Press.

Subramanian, S. V. (2013b). Multilevel Modelling. Retrieved from http://www.esourceresearch.org/eSourceBook/MultilevelModeling/1LearningObjectives/tabid/305/Default.aspx

Subramanian, S. V., Blakely, T., & Kawachi, I. (2003). Income Inequality as a Public Health Concern: Where Do We Stand? Commentary on “Is Exposure to Income Inequality a Public Health Concern?”. *Health Serv. Res.*, 153-167.

Subramanian, S. V., & Jones, K., et al. (2003). Multilevel methods for public health research. In I. Kawachi & L. Berkman (Eds.), *Neighborhoods and Health* (pp. 65-111). New York: Oxford Press.

Subramanian, S. V., & Kawachi, I. (2004). Income Inequality and Health: What have we learned so far? *Epidemiol Rev., 26*, 78-91.

Subramanian, S. V., Kawachi, I., & Smith, G. D. (2007). Income inequality and the double burden of under- and overnutrition in India. *J. Epidemiol Community Health, 61*(9), 802-809.

Subramanian, S. V., Perkins, J. M., & Khan, K. T. (2009). Do burdens of underweight and overweight coexist among lower socioeconomic groups in India? *Am J Clin Nutr, 90*, 369-376.

Subramanian, S. V., Perkins, J. M., Özaltin, E., & Davey Smith, G. (2011). Weight of nations: a socioeconomic analysis of women in low- to middle-income countries *American Journal of Clinical Nutrition 93*(2), 413-421.

Subramanian, S. V., & Smith, G. D. (2006). Patterns, distribution, and determinants of under- and overnutrition: a population-based study of women in India. *Am J Clin Nutr, 84*, 633-640.

Sugimura, M. (2007). *Universalization of primary education in the context of multi-ethnic society: the case of Malaysia*. In A. Yonemura (Ed.), *Universalization of primary education in the historical and developmental perspective* (pp. 305-333).

Sultana, A., & Noor, Z. (2011). Gender Perspective of Working Mothers' Challenges in Their Family. *Australian Journal of Basic and Applied Sciences, 5*(12), 727-731.

Sultana, A. M. (2014). Cross Sectional Study on Decision-making Power of Working and Non-working Women in Family Planning and Reproductive Health and Rights in Gombak, Malaysia *J Womens Health Issues 3*(2). doi:*10.4172/2325-9795.1000140*

Suratman, S. (2001). *Living Under One Roof: A Case of Study of Kadazandusun Households in Sabah*. Retrieved from: http://www.fas.nus.edu.sg/malay/documents/SurianiS%20-%20Living%20under%20one%20roof.pdf

Suriani, I., Shamsuddin, K., Latiff, K. A., Saad, H. A., Majid, L. A., & Othman, F. Voluntary Fasting to Control Post-Ramadan Weight Gain among Overweight and Obese Women. *SultanQaboos Univ Med J., 15*(1), e98-e104

Susan, T., & Caryl, N. (2007). Effect of a weight-loss program on mental stress-induced cardiovascular responses and recovery. *Nutrition, 23*(7-8), 521-528.

Suter, P. O., Shutz, Y., & Jequier, E. (1992). The effect of ethanol on fat storage in healthy subjects. *New england journal of medicine, 326*, 983-987.

Swami, V., & Tovee, M. J. (2005). Female physical attractiveness in Britain and Malaysia: a cross-cultural study. *Body Image, 2*, 115-128.

Sweet, S. A., & Grace-Martin, K. A. (2010). *Data analysis with SPSS: a first course in applied statistics*. US: Pearson Education.

Swinburn, B., Egger, G., & Raza, F. (1999). Dissecting Obesogenic Environments: The Development and Application of a Framework for

Identifying and Prioritizing Environmental Interventions for Obesity *Preventive Medicine, 29*(6 pt 1), 563-570.

Swinburn, B. A., Sacks, G., Hall, K. D., McPherson, K., Finegood, D. T., Moodie, M. L., & Gortmaker, S. L. (2011). The Global Obesity Pandemic: Shaped by Global Drivers and Local Environments. *The Lancet, 378*, 804-812.

Switankowsky, I. (2000). Dualism and its importance for medicine. *Theoretical Medicine and Bioethics 21*(6).

Syed, H. A. (2008). *Ethnic Relations in Malaysia*. Petaling Jaya: SIRD.

Sánchez-Vaznaugh EV, K. I., Subramanian SV, Sánchez BN, Acevedo-Garcia D. (2009). Do socioeconomic gradients in body mass index vary by race/ethnicity, gender, and birthplace? *Am J Epidemiol, 169*(9), 1102-1112. doi:10.1093/aje/kwp027

Tabachnick, B. G., & Fidell, L. S. (2014a). Cleaning up your act. In B. G. Tabachnick & L. S. Fidell (Eds.), *Using multivariate statistics* (6th ed. ed., pp. 94-151).

Tabachnick, B. G., & Fidell, L. S. (2014b). Multilevel Linear Modelling. In B. G. Tabachnick & L. S. Fidell (Eds.), *Using Multivariate Statistics* (pp. 837-916). UK: Pearson Education Limited.

Tan, A. K., Dunn, R. A., Samad, M. I., & Feisul, M. I. (2011). Sociodemographic and health-lifestyle determinants of obesity risks in Malaysia. *Asia Pac J Public Health, 23*(2), 192-202. doi:10.1177/1010539509359535

Tan, A. K., Yen, S. T., & Feisul, M. I. (2011). Determinants of body weight status in Malaysia: an ethnic comparison. *Int J Public Health*. doi:10.1007/s00038-011-0238-8

Tan, L. E. (2000). Chinese Schools in Malaysia: A Case of Cultural Resilence. In K. H. Lee & C. B. Tan (Eds.), *The Chinese in Malaysia* (pp. 228-254). Kuala Lumpur: Oxford University Press.

Tan, Y. S. (2012). Democratization of Secondary Education in Malaysia: Emerging Problems and Challenges of Educational Reform. *International Journal of Educational Development, 3*(1), 53-64.

Tan, Y. S. (2013a). Decolonization, Educational Language, Policy and Nation Building in Plural Societies: The Development of Chinese Education in Malaysia 1950-1970. *Journal of Educational Development, 33*(1), 25-36.

Tan, Y. S. (2013b). The British educational policy for the indigenous community in Malaya 1870–1957: Dualistic structure, colonial interests and Malay radical nationalism. *International Journal of Educational Development, 33*(4), 337-347.

Tan, Z. Y., & Yim, H. S. (2009). Weight status, body image, perception and physical activity of Malay housewives in Kampung Chengkau Ulu, Negeri Sembilan. *International Journal of Advancement Science and Arts, 1*(1), 35-45.

Tashakkori, A., & Teddlie, C. (1998). *Mixed methodology: combining qualitative and quantitative approaches*. Thousand Oaks, CA. Sage.

Tavassoli, A. A., Gharipour, M., Khosravi, A., Kelishadi, R., Siadat, Z. D., Bahonar, A., . . . Sarrafzadegan, N. (2010). Gender differences in obesogenic behaviour, socioeconomic and metabolic factors in a population-based sample of Iranians: the IHHP study. *J Health Popul Nutr, 28*(6), 602-609.

Teachman, J. (2016). Body weight, marital status, and changes in marital status. *J Fam Issues, 37*(1), 74-96. doi:10:1177/0192513X13508404

Teixeira, P. J., Going, S. B., Houtkooper, L. B., & al., e. (2006). Exercise motivation, eating, and body image variables as predictor of weight control. *Med Sci Sports Exerc, 38*(1), 179-188.

Teixeira, P. J., Patrick, H., & Mata, J. (2011). Why we eat what we eat: the role of autonomous motivation in eating behaviour regulation. *Nutrition Bulletin, 36*(1), 102-107.

Teixeira, P. J., Silva, M. N., Coutinho, S. R., & al., e. (2010). Mediators of weight loss and weight loss maintenance in middle-aged women *Obesity (Silver Spring), 18*(4), 725-735.

Tew, Y. (2012). Beyond ''Asian Values'': Rethinking Rights. *CGHR Working Papers*

The Academy of Science (2013) Prioritizing Food Policy Options to Reduce Obesity in Malaysia: ASM Obesity Task Force Advisory Report 4/2013 Retrieved from http://www.youblisher.com/p/1055043-Prioritizing-Food-Security-Options-to-Reduce-Obesity-in-Malaysia/

The Academy of Medical Science (2017) Addressing the Global Health Challenge of Obesity in Malaysia. Kuala Lumpur: Malaysia. Retrieved from https://acmedsci.ac.uk/file-download/18861164

The World Bank. Data - Mortality Rate, Under-5 (per 1000 live births). Retrieved from http://data.worldbank.org/indicator/SH.DYN.MORT?page=1

The World Bank. Labor Force Participation Rate, female (% of female population ages 15+) (modeled ILO estimate). Retrieved from http://data.worldbank.org/indicator/SL.TLF.CACT.FE.ZS

The World Bank. Land Area (Sq. km). Retrieved from http://data.worldbank.org/indicator/AG.LND.TOTL.K2

The World Bank. Maternal Mortality Rate (Modeled Estimate, per 100000 live births). Retrieved from http://data.worldbank.org/indicator/SH.STA.MMRT

The World Bank. Measuring Inequality. Retrieved from http://go.worldbank.org/3SLYUTVY00

The World Bank. (2019). Overview. Retrieved from https://www.worldbank.org/en/country/malaysia/overview

The World Bank. (2015). Unemployment with Tertiary Education Female (% of Female Unemployed). Retrieved from http://data.worldbank.org/indicator/SL.UEM.TERT.FE.ZS?page=2

The World Bank. (2019). Upper middle income. Retrieved from https://data.worldbank.org/income-level/upper-middle-income

The World Bank. (2015). Land Area (sq. km). Retrieved from http://data.worldbank.org/indicator/AG.LND.TOTL.K2

The World Bank. Data: Malaysia. Retrieved from http://data.worldbank.org/country/malaysia

The World Bank. Data: United Kingdom. Retrieved from http://data.worldbank.org/country/united-kingdom

The Bar Malaysia. Marriage. Retrieved from http://www.malaysianbar.org.my/marriage.html

Then, S. (2015, 24 March 2015). Orang asli issues: access to education still difficult. *TheStar*. Retrieved from https://www.thestar.com.my/lifestyle/family/features/2015/03/24/orang-asli-issues-access-to-education-still-difficult#LK9Ig1hsmk2x5orj.99

Thimm, V. (2013). Education, Migration, Gender: Policies of Education in Malaysia and Singapore. *GSE Journal of Education*.

Thomas, J., Stewart, D.W., Lynam, I.M., Daley, C.M., Befort, C., Scherber, R.M., Mercurio, A.E., Okuyemi, K. S. (2009). Support needs of overweight African American women for weight loss. *Am J Health Behaviour, 33*(4), 339-352.

Thompson, A. L. (2013). Intergenerational impact of maternal obesity and postnatal feeding practices on pediatric obesity. *Nutr Rev., S55-61*(71 Suppl). doi:10.1111/nure.12054.

Thompson, I. E., Melia, K. M., Boyd, K. M., & Horsburgh, D. (2007). *Nursing Ethics*. UK: Churchill Livingstone.

Todd, N. R., Allen, N. E., & Javdani, S. (2012). Multilevel modeling: method and application for community-based research. In L. Jason & D. Glenwick (Eds.), *Methodological approaches to community-based research* (Vol. xxii, pp. 167-185). Washington, DC. US: American Psychological Association.

Tomiyama, J. A., Dallman, M. F., & Epel, E. S. (2011). Comfort food is comforting to those most stressed: evidence of the chronic stress response network in high stress women. *Psychoneuroendocrinology*, 1513-1519.

Tones, B. K. (1986). Health education and the ideology of health promotion: a review of alternative approaches. *Health education research, 1*, 3-12.

Tong, J. K.-C., & Turner, B. S. (2008). Women, piety and practice: a study of women and religious practice in Malaysia. *Contemporary Islam, 2*(1), 41-59.

Torres, S. J., & Newson, C. A. (2007). Relationship between stress, eating behaviour and obesity. *Nutrition, 23*(11-12), 887-894.

Tovee, M. J., & Cornelissen, P. L. (1999). The mystery of human beauty. *Nature, 399*, 215-216.

Tovee, M. J., & Cornelissen, P. L. (2001). Female and male perceptions of female physical attractiveness in front-view and profile. *British Journal of Psychology, 92*, 391-402.

Townsend, P. (1979). *Poverty in the United Kingdom*. Harmondsworth: Penguin.

Townsend, P., & Davidson, N. (1982a). *Inequalities in health*. Great Britain: Richard Clay Ltd.

Townsend, P., & Davidson, N. (1982b). *The Black Report*. Great Britain: Penguin Group.

Tremblay, A., Wouters, E., Wenker, M., St-Pierre, S., Bouchard, C., & Despres, J.-P. (1995). Alcohol and a high-fat diet: a combination favoring overfeeding. *American Journal of Clinical Nutrition, 62*, 639-644.

Trusts, T. E. R. (2012). *Washing the Tigers: Addressing Discrimination and Inequality in Malaysia* (2). Retrieved from London: http://www.equalrightstrust.org/ertdocumentbank/Malaysia%20CR%201.pdf

Turner, B. (2004). The Social Construction of Knowledge. In *The New Medical Sociology: Social Forms of Health and Illness* (pp. 191-229). The United States of America: W.W.Norton & Company, Inc.

Ulijaszek, S. J. (2012). Socio-economic status, forms of capital and obesity. *J Gastrointest Can*. doi:10.1007/s12029-012-9366-5

Ulijaszek, S. J., Rayner, M., Potter, C. M. P., Bertens, M. G. B. C., Spencer, E. A., Allender, S., McPherson, K. (2008). Multidisciplinary obesity research: a local strategy for breaking new ground.

Uljana, F. (2010). Historical perspectives on Erklaren and Verstenhen: Introduction. In F. Uljana (Ed.), *Historical perspectives on Erklaren and Verstehen (Archimedes)* (pp. 1-14). Dordrecht: Springer.

Umberson, D. (1992) Gender, Marital Status and the Social Control of Health Behaviour. *Soc Sci Med*. Apr. 34(8): 907-917

UNDP. Study and Review of The Socio-Economic Status of Aboriginal Peoples (Orang Asli) in Peninsular Malaysia for the Formulation of a National Development Plan for the Orang Asli. Retrieved from http://www.my.undp.org/content/malaysia/en/home/operations/projects/poverty_reduction/75636_OrangAsli.html

UNDP. (2008). *Malaysia Nurturing Women Enterpreneurs*. Retrieved from Kuala Lumpur: http://www.my.undp.org/content/dam/malaysia/docs/WomenE/UNDP_Malaysia_NurturingWomenEntrepreneurs_publication.pdf

UNDP. (2006). *Malaysia: HDI values and rank changes in the 2013 Human Development Report*. Retrieved from http://hdr.undp.org/sites/default/files/Country-Profiles/MYS.pdf

UNDP (2019) MDG 2 Achieve universal primary education. Retrieved from http://www.un.org.my/upload/mdg2.pdf

UNDP (2019) Human development reports. Retrieved from http://www.hdr.undp.org/en/data

UNESCO. (2011). *Secondary Education Regional Information Base: Country Profile - Malaysia*. Retrieved from: http://uis.unesco.org/sites/default/files/documents/secondary-education-regional-information-base-country-profile-for-malaysia-en.pdf

United Nations Malaysia and Economic Planning Unit Malaysia (2015) Malaysia Millennium Development Goals Report 2015. Retrieved from http://un.org.my/upload/undp_mdg_report_2015.pdf

Usfar, A. A., Lebenthal, E., Atmarita, Achadi, E., Soekirman, & Hadi, H. (2010). Obesity as a poverty-related emerging nutrition problems: the case of Indonesia. *Obes Rev, 11*(12), 924-928. doi:10.1111/j.1467-789X.2010.00814.x

Vahratian, A. (2002). Prevalence of Overweight and Obesity among Women of Childbearing Age Results from the 2002 National Survey of Family Growth. *Matern Child Health J. 13*(2), 268-273.

Van Manen, M. (1990). *Researching lived experience: human science for an action sensitive pedagogy*. Abany, NY: State University of New York Press.

van Manen, M. (1997). *Researching lived experience: Human science for an action sensitive pedagogy*. London, ON, Canada: Althouse Press.

van Melis-Wright, M., & Stone, D. (1993). Psychological variables associated with respondents' sensitivity to income questions – a preliminary analysis: 1124-1129

Van Stralen, M. M., de Vries, H., Mudde, A. N., Bolman, C., & Lechner, L. Determinants of initiation and maintenance of physical activity among older adults: a literature review. *Health Psychol Rev, 3*(2), 147-207.

Vandenbroeck, I. P., Goossens, J., & Clemens, M. (2007). Building the obesity system map. Foresight tackling obesities: future choices

Vartanian, L. R., Herman, C. P., & Wansink, B. (2008). Are we aware of the external factors that influence our food intake? *Health psychology, 27*, 533-538.

Verduin, P., Argawal, S., & Waltman, S. (2005). Solution to obesity: perspective from the food industry. *American Society for Clinical Nutrition, 82*(1), 2595-2615.

Villamor, E., & Cnattingius, S. (2006). Interpregnancy weight change and risk of adverse pregnancy outcomes: a population-based study. *The Lancet, 368* (9542), 1164-1170.

Visscher, T. L. S., & Seidell, J. C. (2001). The Public Health Impact of Obesity. *Annual Review of Public Health, 22*, 355-375

Volland, B. (2012) The effects of income inequality on BMI and obesity: Evidence from the BRFSS. In, *Economics and Evolution*. Germany.

Wadden, T. A., & Phelan, S. (2002). Assessment of quality of life in obese individuals. *Obesity Research 10*, 50s-57s.

Wade, A., & Koutoumanou, E. (2011). *Introduction to regression*. Centre for Paediatric Epidemiology and Biostatistics, UCL. London.

Wagstaff, A., & van Doorlaer, E. (2000). Equity in health care finance and delivery. In A. J. Culyer & J. P. Newhouse (Eds.), *Handbook of health economics*. Amsterdam: Elsevier.

Wagstaff, D. A., Kranz, S., & Harel, O. (2009). A preliminary study of active compared with passive imputation of missing body mass index values among non-Hispanic white youth. *Am J Clin Nutr, 89*, 1025-1030.

Wainwright, D. (2009). The changing face of medical sociology. In W. D (Ed.), *A sociology of health* (pp. 1-18). London: Sage.

Wan, Y., Xu, R., Feng, H., Zhou, Y., Zhang, X., Lu, L., Tan, T., Jiang, Y., Chen, Z. and Wu, Y. (2015) Is parental body weight related with their children's overweight and obesity in Gao Hang Town, Shanghai? *Asia Pac J Clin Nutr.* 24(3): 509-514

Wang, J., Thornton, J. C., Russell, M., Burastero, S., Heymsfield, S., & Pierson, R. N. (1994). Asians have lower body mass index (BMI) but higher percent body fat than do Whites: comparisons of anthropometric measurements. *Am J Clin Nutr, 60*.

Wang, J., Xie, H., & Fisher, J. H. (2012). *Multilevel models: application using SAS*. Germany: Higher education press and Walter de Gruyter GmbH & Ko. KG, Berlin/Boston.

Wang, M. C., Kim, S., Gonzalez, A. A., MacLeod, K. E., & Winkleby, M. M. (2007). Socioeconomic and food-related physical characteristics of the neighbourhood environment are associated with body mass index. *J Epidemiol Community Health, 61*(6), 491-498.

Wang, Y., & Beydoun, M. A. (2007). The Obesity Epidemic in the United States—Gender, Age, Socioeconomic, Racial/Ethnic, and Geographic Characteristics: A Systematic Review and Meta-Regression Analysis. *Epidemiologic Reviews, 29*(1), 6-28.

Wang, Y., Chen, H. J., Shaikh, S., & Mathur, P. (2009). Is obesity becoming a public health problem in India? Examine the shift from under- to overnutrition problems over time. In *Obes Rev* (Vol. 10, pp. 456-474). England.

Wang, Y., & Chen, X. (2011). How much of racial/ethnic disparities in dietary intakes, exercise, and weight status can be explained by nutrition- and health-related psychosocial factors and socioeconomic status among US adults? *J Am Diet Assoc, Dec;111*(12), 1904-1911.

Wanless, D. (2001). *Securing our future: taking a long-term view, an interim report*. Retrieved from London:

Ward, H., Tarasuk, V., Mendelson, R., & McKeown-Eyssen, G. (2007). An exploration of socioeconomic variation in lifestyle factors and adiposity in the Ontario Food Survey through structural equation modeling. *Int J Behav Nutr Phys Act., 4*(8). Doi:10.1186/1479-5868-4-8

Wardle, J., Chida, Y., Gibson, E. L., Whitaker, K. L., & Steptoe, A. (2010). Stress and adiposity: a meta analysis of longitudinal studies. *Obesity, 19*(4), 771-778.

Wardle, J., Guthrie, C., Sanderson, S., Birch, L., & Plomin, R. (2001). Food and activity preferences in children of lean and obese parents. *Int J Obes Relat Metab Disord., 25*(7), 971-977.

Wardle, J., & Johnson, F. (2002). Weight and Dieting: Examining Levels of Weight Concern in British Adults. *International Journal of Obesity 26*, 1144-1149.

Wardle, J., Waller, J., & Jarvis, M. J. (2002). Sex differences in the association of socioeconomic status with obesity. *American Journal of Public Health, 92*(8), 1299-1304.

Wareham, N. (2007). Physical activity and obesity prevention. *Obesity Reviews, 8*(Suppl.1), 109-114.

Warwick-Booth, L., Cross, R., & Lowcock, D. (2012). *Contemporary health studies: an introduction*. Cambridge: Polity.

Watson, K. (2011). Education and colonialism in Penisular Malaysia. In J. K. P. Watson (Ed.), *Education in the third world* (pp. 88-107). Great Britain: Routledge.

Weber, L. (2004). A conceptual framework for understanding race, class, gender, and sexuality In S. N. Hesser-Biber & M. L. Yaiser (Eds.), *Feminist perspectives on social research* (pp. 121-139). New York: Oxford University Press.

Weber, L., Hancock, T., & Higginbotham, E. (1997). Women, power, and mental health. In S. Ruzek, V. Olesen, & A. Clark (Eds.), *Women's health: complexities and differences* (pp. 380-396). Columbus: Ohio State University Press.

Welch, N., Hunter, W., Butera, K., Willis, K., Cleland, V., Crawford, D., and Ball, K. (2009). Women's work. Maintaining a healthy body weight. *Appetite, 53*, 9-15.

Wen, M., & Kowaleski-Jones, L. (2012). The built environment and risk of obesity in the United States: Racial-ethnic disparities. *Health and Place, 18*, 1314-1322.

Whitaker, K. L., Jarvis, M. J., Boniface, D., & Wardle, J. (2011). The Intergenerational transmission of thinness. *Arch Pediatr Adolesc Med, 165*(10), 900-905.

Whitehead, M., & Dahlgren, C. (1991). What can we do about inequalities in health? *The Lancet, 338*, 1059-1063.

Whitehead, M., & Dahlgren, G. (2007). The concepts and principles for tackling social inequities in health. (414).

WHO. 10 Facts on Obesity Retrieved from https://www.who.int/features/factfiles/obesity/en/

WHO. (2018). Double burden of malnutrition. Retrieved from https://www.who.int/nutrition/double-burden-malnutrition/en/

WHO. (2016). Dengue and severe dengue. Retrieved from https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue

WHO. (1995). *Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee*. Retrieved from Geneva, Switzerland: http://whqlibdoc.who.int/trs/WHO_TRS_854.pdf

WHO. (2000). *Obesity: Preventing and Managing the Global Epidemic.* Retrieved from Geneva, Switzerland: http://libdoc.who.int/trs/WHO_TRS_894.pdf

WHO. (2011). Waist Circumference and Waist-Hip Ratio: report of a WHO Expert Consultation, Geneva, 8 – 11 December 2008

WHO. (2012). Obesity and overweight. Retrieved from https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

WHO Expert Consultation. (2004). Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *The Lancet, 363*(9403), 157-163.

WHO Western Pacific Office. POPULATION of women by child-bearing age group and country (in thousands). Retrieved from http://www.wpro.who.int/publications/databases/childbearing_age.pdf?ua=1

WHO. (2013). BMI Classification. Retrieved from http://apps.who.int/bmi/index.jsp?introPage=intro_3.html

WHO. Development of a strategy towards promoting optimal fetal growth. Retrieved from http://www.who.int/nutrition/topics/lbw_strategy_background.pdf?ua=1

WHO. Feto-maternal nutrition and low birth weight. Retrieved from http://www.who.int/nutrition/topics/feto_maternal/en/

WHO. Projections of mortality and causes of death, 2015 and 2030. Retrieved from http://www.who.int/healthinfo/global_burden_disease/projections/en/

WHO. Social determinants of health: Key Concepts. Retrieved from http://www.who.int/social_determinants/thecommission/finalreport/key_concepts/en/

WHO. (1995). *Physical Status: The Use and Interpretation of Anthropometry: Report of a WHO Expert Committee*. Retrieved from Geneva, Switzerland: http://whqlibdoc.who.int/trs/WHO_TRS_854.pdf

Wilkinson, J. Y., Ben-Tovim, D. I., & Walker, M. K. (1994). An insight into the personal and cultural significance of weight and shape in large Samoan women. *Int J Obes Relat Metab Disord, 18*, 602-606.

Wilkinson, R. (1996). *Unhealthy societies: the afflictions of inequality*. London: Routledge.

Wilkinson, R. (2000). Deeper than neo-liberalism: a reply to David Coburn. *Social science and medicine, 51*, 997-1000.

Wilkinson, R. G. (1994). The epidemiological transition: from material scarcity to social disadvantage. *Daedalus, 123*(4), 61-77.

Wilkinson, R. G. (1996). *Unhealthy societies: the afflictions of inequality*. London: Routledge.

Wilkinson, R. G. (1997). Socioeconomic determinants of health: health inequalities: relative or absolute material standards? *BMJ, 314*, 591-595.

Wilkinson, R. G., & Pickett, K. (2009). *The spirit level: why more equal societies almost always do better*. London: Penguin Books Ltd.

Wilkinson, R. G., & Pickett, K. E. (2006). Income inequality and population health: a review and explanation of the evidence. *Soc. Sci. Med., 62*(7), 1768-1784.

William, S. L., & French, D. P. (2011). What are the most effective intervention techniques for changing physical activity self-efficacy and physical activity behaviour and are they the same? *Health education research: theory and practice, 26*(2), 308-322.

Williams, G., & Popay, J. (2001). Lay health knowledge and the concept of the lifeworld. In G. Scambler (Ed.), *Habermas, critical theory and health* (pp. 25-44). London: Routledge.

Williamson, D. F., Madans, J., Pamuk, E., & Flegal, K. M. (1994). A prospective study of childbearing age and 10-year weight gain in US white women 25 to 45 years of age. *Int. J. Obes Relat Metab, 18*, 561-569.

Wilson, T. D. (2002). Alfred Schutz, phenomenology & research methodology for information behaviour research. *The New Review of Information Behaviour Research*, 194-240.

Wing, R. R., Matthews, K. A., Kuller, L. H., Meilahn, E. N., & Plantinga, P. L. (1991). Weight gain at the time of menopause. *Archives of Internal Medicine, 151*(1), 97-102.

Wolfe, W. S., Sobal, J., Olson, C. M., & Frongillo, E. A. (1997). Parity-associated body weight: modification by sociodemographic and behavioural factors. *Obesity Research, 5*(2), 131-141.

Wong, Y. S., Shalini, S., Liana, M. F., Amera, W.W.N., Naqiuddin, M. M., . . . Zaleha, M. I. Nutrient intake pattern of vegetarians and non-vegetarians in Kuala Lumpur, Malaysia. . *Pak J Nutr 12*, 371-376.

Wood, A. M., White, I. R., & Thompson, S. G. (2004). Are missing outcome data adequately handled? A review of published randomized controlled trials in major medical journals. *Clin Trials, 1*(368). doi:10.1191/1740774504cn032oa

Wright, E. J., & Whitehead, T. L. (1987). Perceptions of body size and obesity: a selected review of the literature. *J community Health, 12*(2-3), 117-129.

Wye, C.-K., & Ismail, R. (2012). Labour Market Structure in Malaysia: Pre- and Post- Market Gender Comparison. *International Journal of Academic Research in Business and Social Sciences, 2*(10), 259-283.

Xu, Y., & Wang, F. (2015). Built environment and obesity by urbanicity in the U.S. *Health & Place, 24*, 19-29.

Yancey, A. K., Lesile, J., & Abel, E. K. (2006). Obesity at the crossroads: Feminist and public health perspectives. *Signs, 31*(2), 425-443. doi:10.1086/491682

Yancey, A. K., Leslie, J., & Abel, E. K. (2006). Obesity at the crossroads: feminist and public health perspectives. *Signs, 31*(2), 425-443.

Yang, T. Y., Cairns, B. J., Allen, N., Sweetland, S., Reeves, G. K., Beral, V., & Study, o. b. o. t. M. W. (2012). Postmenopausal endometrial cancer risk and body size in early life and middle age: prospective cohort study. *Br J Cancer* doi:10.1038/bjc.2012.229

Yasin, R. F. B. F., & Jani, M. S. (2013). The Positive Role of Polygamy in REducing Women Socio-Related Problems in Malaysia. *American International Journal of Social Science, 2*(3), 72-82.

Yates, A., Edman, J., & Aruguete, M. (2004). Ethnic differences in BMI and body/self-dissatisfaction among Whites, Asian subgroups, Pacific Islanders, and African-Americans. *J Adolesc Health, 34*(4), 300-307.

Yeoh, E. K. K. (2006). Ethnic coexistence in a pluralistic campus environment. *GeoJournal, 66*(1), 223-241.

Yong, J. (2017) The gender gap in Malaysian public universities: examining the 'lost boys'. Journal of International and Comparative Education 6(1). Retrieved from doi:10.14425/JICE.2017.6.1.0116

Yoo, S., Cho, H.-J., & Khang, Y.-H. (2010). General and abdominal obesity in South Korea, 1998-2007 Gender and socioeconomic differences. *Preventive Medicine, 51*(6), 460-465. doi:10.1016/j.ypmed.2010.10.004

Yoon, K.-H., Lee, J.-H., Kim, J.-W., Cho, J. H., Choi, Y.-H., Ko, S.-H., . . . Son, H.-Y. (2006). Epidemic obesity and type 2 diabetes in Asia. *The Lancet, 368*(9548), 1681-1688.

Yu, Y. (2011). Educational differences in obesity in the United States. *Obesity Journal, 20*. doi:10.1038/oby2011.307

Yuan, Y. C. Multiple imputation for missing data: concepts and new development. Retrieved from http://www.ats.ucla.edu/stat/sas/library/multipleimputation.pdf

Yucel, R. M. (2008). Multiple imputation inference for multivariate multilevel continuous data with ignorable non-response. *Philos Trans A Math Phys Eng Sci., 366*(1874), 2389-2403.

Yucel, R. M., He, Y., & Zaslavsky, A. M. (2011). Gaussian-based routines to impute categorical variables in health surveys. *Stat Med., 30*(29), 3447-3460.

Yun, S., Zhu, B.-P., Black, W., & Brownson, R. C. (2006). A comparison of national estimates of obesity prevalence from behavioural risk factor surveillance system and the national health and nutrition examination survey. *International Journal of Obesity, 30*, 164-170.

Zamawe, F. C. (2015). The implication of using NVivo software in qualitative data analysis: evidence-based reflection. *Malawi Med J. (*1), 13-15.

Zhang, L., & Liao, T. F. (2013). *Multilevel effects of socioeconomic status and income inequality on obesity among Chinese adults*. Paper presented at the Population Association of America 2013 Annual Meeting Program, New Orleans, LA.

Zhang, Q., & Wang, Y. (2004a). Socioeconomic inequality of obesity in the United States: do gender, age, and ethnicity matter? *Social Science and Medicine, 58*, 1171-1180.

Zhang, Q., & Wang, Y. (2004b). Trends in the association between obesity and socioeconomic status in U.S. adults: 1971-2000. *Obesity Research, 12*(10), 1622-1632.