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# Understanding how weight management programmes can best support adolescents with overweight or obesity to achieve a healthy weight

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

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This PhD is dedicated to my dad Laurie and brother Martin. I hope I continue to make you both proud. Rest in peace.

## 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 been submitted in any previous application for any degree.

The work presented (including data generated and data analysis) was carried out by the author except in the cases outlined below:

### **List of data provided and/or analysis carried out by collaborators.**

*Chapter 2, Phase 1 (Qualitative systematic review):* I designed the protocol, designed and ran the searches; I performed the initial screening and screening of all full-text articles; Dr Oyinlola Oyeboode (OO), Dr Lena Al-Khudairy (LA-K) and Dr G.J. Melendez-Torres (GJMT) screened a third each, sharing second reviewer responsibilities. I extracted data and performed quality assessment for all studies; Data extraction and quality assessment by a second reviewer was performed equally by OO and LA-K (50% each). I synthesised extracted data and performed CERQual; both were audited by GJMT. I wrote the first draft of the manuscript; LA-K, OO and GJMT reviewed the manuscript.

*Chapter 3, Phase 2 (Re-analysis of a quantitative systematic review):* I coded all conditions. OO, LA, GJMT acted as the second reviewer and coded a third each. I completed the QCA analysis, which was audited by OO. QCA models and interpretation were discussed with OO and GJMT.

*Chapter 4, Phase 3 (Primary qualitative research):* I carried out all interviews. LA-K and I conducted a pilot online focus group. Interview and focus group guides were reviewed by LA-K and GJMT. I undertook thematic analysis, which was reviewed by OO. I wrote the first draft of the manuscript for stage 2 (qualitative enquiry with stakeholders); this was reviewed by OO, LA-K and GJMT.

*Write-Up of the Thesis:* The writing is my own, but each chapter has been commented on by OO, LA-K and GJMT.

Parts of this thesis have been published by the author:

### **List of publications including submitted papers**

#### ***Journal articles:***

- Jones, H.M., Al-Khudairy, L., Melendez-Torres, G.J. & Oyebode, O. (2018) Viewpoints of adolescents with overweight and obesity attending lifestyle obesity treatment interventions: a qualitative systematic review. *Obesity Reviews*.
- Jones, H.M., Oyebode, O., Melendez-Torres, G.J., Al-Khudairy, L. (2019) Stakeholders views of adolescent weight management programmes: a qualitative study. *Perspectives in Public Health*. Submitted.

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- Jones, H.M., Al-Khudairy, L., Melendez-Torres, G.J. & Oyebode, O. Understanding how best to support overweight and obese adolescents to achieve a healthy weight. Warwick Medical School Research Student Symposium. 22<sup>nd</sup> May 2018, University of Warwick.
- Jones, H.M., Al-Khudairy, L., Melendez-Torres, G.J. & Oyebode, O. (2017) P93 What are the views of overweight and obese adolescents (12–17yrs) attending lifestyle treatment interventions: a qualitative systematic review. *Journal of Epidemiology and Community Health*, 71: A93-A94. Society for Social Medicine Annual Meeting, September 2017, University of Manchester (Poster presentation).
- Jones, H.M., Al-Khudairy, L., Melendez-Torres, G.J. & Oyebode, O. (2017). Viewpoints of overweight and obese adolescents attending lifestyle obesity treatment interventions: a qualitative systematic review. *The Lancet*, 390: S50. PH Science conference, November 2017, London (Poster presentation).
- Jones, H., Melendez-Torres, G. J., Al-Khudairy, L. & Oyebode, L. (2016) *What are the views of overweight and obese adolescents (12-17yrs) attending lifestyle treatment interventions: a qualitative systematic review*. [online] Available from: [http://www.crd.york.ac.uk/PROSPERO/display\\_record.php?ID=CRD42016039588](http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42016039588) (Protocol)

# Abstract

## **Background**

Obesity in adolescence is alarming. Current guidance recommends adolescents with overweight or obesity attend a family-based multi-disciplinary weight management programme. However, the evidence base regarding the views of adolescents who have attended these weight management programmes, is limited. Understanding the views of adolescents is necessary for planning and developing future interventions and their components. The primary aim of this PhD was to increase understanding of how weight management programmes might best support adolescents with obesity to achieve a healthy weight.

## **Methods**

This PhD was approached by conducting three research phases: 1) a qualitative systematic review exploring the views of adolescents with overweight or obesity attending lifestyle treatment interventions; 2) Re-analysis of a quantitative systematic review to identify intervention components and combinations of components that lead to effectiveness; 3) Primary qualitative research exploring the perspectives of adolescents and community stakeholders involved in a weight management programme in Wolverhampton.

## **Results**

Combined findings from these three phases suggest that adolescents should attend an induction session prior to beginning a weight management programme. In addition, programmes should include support around emotional and psychological well-being. Programme design should be tailored to the adolescent age group and individual, and should recognise the value of professional, family and peer support. The views of young people, as well as stakeholders involved in the care of adolescents with obesity, should be considered when designing and developing WMPs for adolescents in the future.

## **Conclusions**

By pairing qualitative research with what we already know regarding effectiveness, engagement and obesity levels may be improved in the adolescent population. Incorporating the practical delivery of physical activity, alongside professional support, including emotional well-being, should be considered when designing and developing WMPs for adolescents with obesity in the future.

## Abbreviations

ADP	Air-displacement plethysmography
BHF	British Heart Foundation
BIA	Bioelectrical Impedance Analysis
BMI	Body Mass Index
BSREC	Biomedical and Scientific Research Ethics Sub-Committee
CCC	Coventry City Council
CLAHRC	Collaboration for Applied Health Research and Care
CT	Computerised Tomography (CT)
CVD	Cardiovascular disease
DXA	Dual X-ray absorptiometry
HL	Hearty Lives
HSE	Health Survey for England
HRA	Health Research Authority
MRI	Magnetic resonance imaging
MVPA	Moderate to Vigorous Physical Activity
NDNS	National Diet and Nutrition Survey
NCMP	National Child Measurement Programme
NHANES	National Health and Nutrition Examination Survey
NHS	National Health Service
NICE	National Institute of Health and Care Excellence
NIHR	National Institute for Health Research
PA	Physical Activity
PH	Public Health
PHE	Public Health England
QCA	Qualitative Comparative Analysis
RCT	Randomised Controlled Trial
REC	Research Ethics Committee
SES	Socio Economic Status
SMART	Specific, Measurable, Achievable, Realistic Timebound
T2DM	Type 2 Diabetes Mellitus
WHtR	Waist-to-height ratio
WHR	Waist to hip ratio
WCC	Wolverhampton City Council
WHO	World Health Organization
WMP	Weight Management Programme

# Chapter 1. Thesis introduction and background

## 1.1 Chapter outline

Chapter 1 starts with an overview and structure of this thesis. This is followed by a literature review covering the background to adolescent obesity. The physical and psychosocial effects of obesity on adolescents are also considered as well as the many potential causes of this multi-factorial disease. Obesity treatment options are introduced and the issues with engagement in these interventions are highlighted. This leads onto the purpose of this PhD and finally the methodology.

## 1.2 Overview and rationale

This PhD aims to understand how best to support adolescents with overweight or obesity to achieve a healthy weight within a weight management programme (WMP). The idea for this PhD was generated within the National Institute for Health Research (NIHR) Collaborations for Leadership in Applied Health Research and Care (CLAHRC) West Midlands. The need to build on evidence synthesis work from randomised controlled trials (RCTs) of lifestyle interventions for the treatment of adolescents with overweight or obesity was identified. Specifically, understanding the factors that prevent or aid achieving a healthy weight in this group and identifying appropriate obesity treatment strategies for this age group.

My particular interest in adolescent obesity stems from my professional background as a Public Health (PH) Nutritionist. Most relevant was my role at Wolverhampton City Council (WCC) where I was involved in the coordination and delivery of a WMP for children and adolescents (2-18 years). From working on this programme, I became acutely aware of the greater complexities that came when working with adolescents compared to younger children. Not only this, but the resources and services available and general focus were lacking for the adolescent age group. With this in mind, I was driven to focus on research that would have an effect on adolescent obesity treatment intervention design and delivery both locally to the West Midlands and to the wider UK.

## 1.3 Structure of this thesis

Chapter 1 provides a literature review which focuses on the key issues related to the research topic of adolescent obesity. This includes an overview of adolescent obesity in the UK and other high-income countries as well as adolescent treatment intervention and issues with engagement. The thesis then leads into three original research study phases:

1) a qualitative systematic review (Chapter 2) 2) re-analysis of a quantitative systematic review (Chapter 3) 3) primary qualitative research (Chapter 4). Each phase is reported individually, with methods, results and discussion sections. Chapter 5 then brings together all three phases in an overall discussion including implications for research, policy and practice. A summary of the structure of this thesis can be seen in Table 1.1.

**Table 1.1 Thesis structure**

Chapter Number	Chapter	Summary of Chapter
1	Thesis introduction and background	<ul style="list-style-type: none"> <li>• Literature review</li> <li>• Purpose of the PhD</li> <li>• Methodology and rationale</li> </ul>
2	Phase 1: A qualitative systematic review:	A qualitative systematic review exploring the viewpoints of adolescents with overweight or obesity attending WMPs.
3	Phase 2: Re-analysis of a quantitative systematic review	Re-analysis of a quantitative systematic review to identify pathways to effectiveness and ineffectiveness for adolescent WMPs, using Qualitative Comparative Analysis (QCA).
4	Phase 3: Primary qualitative research	The perspectives of adolescents and relevant community stakeholders involved in a WMP in Wolverhampton.
5	Discussion	<ul style="list-style-type: none"> <li>• Synthesis of key findings</li> <li>• Implications for research, policy and practice</li> <li>• Reflexive account</li> <li>• Conclusions and original contributions to research</li> </ul>

## 1.4 Literature review

### 1.4.1 Introduction – what is the problem?

Obesity is widely observed as a significant PH issue. Defined as excessive fat accumulation that may lead to impaired health (World Health Organization, 2016a), obesity was once thought to be a high-income country issue; however, obesity across low and middle income countries is rising (Popkin & Slining, 2013). Systematic reviews show that adult obesity is a strong risk factor for many diseases including cardiovascular disease (CVD),

hypertension, type 2 diabetes mellitus (T2DM) as well as many cancers (Guh et al., 2009; Marmot et al., 2007; Bhaskaran et al., 2014). These diseases are the leading cause of mortality worldwide, responsible for 71% of all deaths globally (World Health Organization, 2018). In addition, obesity in adulthood is associated with depression, reduced quality of life and life satisfaction (Jackson et al., 2015; Luppino et al., 2010; Ul-Haq et al., 2013).

#### 1.4.2 Prevalence and trends of child obesity in the UK and worldwide

Not only is obesity causing concern in adulthood, but a third of UK children are overweight or obese (van Jaarsveld & Gulliford, 2015). Worldwide, the prevalence of children (2-19 years) who are overweight or obese has increased by 47.1% between 1980 and 2013, with 23.8% and 22.6% of boys and girls, respectively, being overweight or obese in 2013 (Ng et al., 2014). Current rates in the UK are even higher. The National Child Measurement Programme (NCMP) which measures approximately one million school children in England annually, shows that 34.3% of Year 6 children are overweight or obese (NHS Digital, 2018a). Data from the Health Survey for England (HSE), an annual nationally representative sample including approximately 2000 children per year, shows that 30% of children aged 2-15 years are classed as overweight or obese (NHS Digital, 2018b). The HSE, although covering a smaller sample, includes a wider age range (2-15 years) compared with the NCMP (4-5 years and 10-11 years) and trend data goes back further in time. These figures are only slightly lower than those in the USA. The National Health and Nutrition Examination Survey (NHANES) examines a nationally representative sample of approximately 5,000 people annually in the United States. The latest data from NHANES showed that 35.1% of children and adolescents aged 2-19 years were overweight or obese (National Center for Health Statistics, 2018).

#### 1.4.3 Obesity in adolescence

The World Health Organization (WHO) classifies adolescence as the stage in growth and development occurring between the ages of 10 to 19 (World Health Organization, 2016b). Adolescence is characterised by more time spent in environments outside of the home, besides increased independence from parents. In addition, the importance of peer groups is increased (Watts et al., 2015). Adolescence is also a stage where progression of obesity is likely. Results from a prospective cohort study of 1520 adolescents in Australia, who were followed-up for 10 years from the age of 14, showed substantial changes in weight status with the prevalence of having a Body Mass Index (BMI) equal to or more than 25

increasing by 65% between mid-adolescence and the age of 24 (Patton et al., 2011). Furthermore, findings from a longitudinal study which followed 555 participants from the age of one to 18 years, with a follow up at 35 years, showed a good prediction at the age of 13 and an excellent prediction at the age of 18 in respect of overweight at the age of 35 (Guo & Chumlea, 1999).

#### 1.4.4 Obesity related outcomes in adolescents

##### 1.4.4.1 *Physical*

Childhood obesity is a strong risk factor for many diseases and many physical effects of obesity in adulthood are now seen in children and adolescents. Data from observational studies highlight the rising prevalence of T2DM in adolescents and CVD risk factors such as hypertension and hyperlipidaemia (Freedman et al., 2007a; Haines et al., 2007). A systematic review (37 included studies) investigating global prevalence rates of T2DM amongst children and adolescents found that, in Europe, the highest prevalence rate was reported in the UK, amongst 15-19-year-olds, with 9 per 100,000 adolescents diagnosed (Farsani et al., 2013). In addition to CVD risk factors, sleep apnoea is thought to occur in 60% of obese children globally (Narang & Mathew, 2012).

##### 1.4.4.2 *Psychosocial*

Obesity during adolescence is associated with psychosocial consequences such as low self-esteem and self-worth as demonstrated in qualitative research involving interviews and focus groups with adolescents (Reece et al., 2016). In addition, body dissatisfaction and eating disordered behaviours such as dieting, bingeing and fasting, are more common in children who are overweight or obese (Harriger & Thompson, 2012). Bullying is also common alongside experiencing rejection from peers (Pont et al., 2017). This is especially concerning as a systematic review showed 80% of obese adolescents remain obese into adulthood (Simmonds et al., 2016) where both these physiological and psychosocial factors persist (Fenner et al., 2013).

#### 1.4.5 Measurements and definitions of obesity

One of the complexities associated with obesity is how it is measured. A high body weight is typically associated with adiposity; however, consideration of weight alone is an inadequate obesity measure due to its correlation with height. Several measures of weight in relation to height exist including Rohrer's Ponderal Index and Benn's Index, however, the most commonly used measure is the BMI (Sweeting, 2007).

#### *1.4.5.1 BMI*

The BMI is a universally used population-level anthropometric measurement of excess weight. The WHO define the BMI as weight in kilograms divided by height in metres, squared ( $\text{kg}/\text{m}^2$ ) (World Health Organization, 2016a).

##### *1.4.5.1.1 Adults*

For adults, a BMI equal to or more than  $25 \text{ kg}/\text{m}^2$  is classed as overweight, whilst obesity is defined as having a BMI of  $30 \text{ kg}/\text{m}^2$  or more. Severe obesity is defined as having a BMI greater than or equal to  $40 \text{ kg}/\text{m}^2$  (NHS, 2016).

##### *1.4.5.1.2 Children*

Measuring a child's BMI is more complicated as sex and age need to be considered. A child's centile or z score can be calculated and used to check against defined thresholds for the child growth reference being used; The UK90 growth reference is currently the preferred option in the UK (Dinsdale et al., 2011). A BMI z score indicates how many units of standard deviation a child's BMI is above or below an average BMI value for a child's sex and age group (Dinsdale et al., 2011). In terms of centiles, a threshold above the 85<sup>th</sup> centile for population monitoring and above the 91<sup>st</sup> centile for clinical assessment is defined as overweight. For obese classification the centile will be above the 95<sup>th</sup> centile for population monitoring and above the 98<sup>th</sup> centile for clinical assessment (Dinsdale et al., 2011).

##### *1.4.5.1.3 Limitations of the BMI*

Although cost effective and relatively easy to calculate (Daniels, 2009), the BMI has been criticised for not assessing distribution of body fat (Simmonds et al., 2016) as it cannot distinguish between fat and fat free body weight components (Sweeting, 2007). Nonetheless, the BMI has been shown to be a reasonable measure of overweight particularly at higher levels of adiposity. Its use in epidemiological studies is therefore more appropriate than estimating fat mass at an individual level (Sweeting, 2007). Other methods for assessing fat mass can be categorised into four main groups: anthropometric (waist circumference, waist-to-height ratio, waist to hip ratio, skin fold), scanning (magnetic resonance imaging, computerised tomography, dual-energy x-ray absorptiometry), bioelectrical impedance analysis and density-based methods (hydrodensitometry, air displacement plethysmography).

#### *1.4.5.2 Anthropometric methods*

##### *1.4.5.2.1 Waist circumference*

In 2014, the National Institute for Health and Care Excellence (NICE) advised that waist circumference should be considered in addition to BMI in adults with a BMI less than 35 kg/m<sup>2</sup> (NICE, 2014a). This is because central obesity is linked to greater health risks compared to total obesity which is typically assessed by the BMI (Schneider et al., 2010). A waist circumference greater than 94cm in men, and 80cm in women is used to assess someone at risk of many chronic diseases (NICE, 2014b). Using the BMI as a singular measure would result in 25% of the UK population being misclassified as a healthy weight. These misclassified individuals may therefore not feel the need to look after their health (Ashwell & Gibson, 2014). However, the NICE guidance for children is different in that measuring waist circumference is not recommended as a routine measure. It may, however, provide information on the risk of developing long-term health problems (NICE, 2014a).

##### *1.4.5.2.2 Waist-to-height ratio (WHtR)*

The WHtR is a relatively new anthropometric index which came about in the 1990's (Hsieh & Yoshinaga, 1995). A WHtR of more than 0.5 is used as a global boundary value, which simply implies that our waist should be less than half of our height (Ashwell & Gibson, 2016). Results from several meta-analyses have shown this index to be superior to BMI and waist circumference for measuring cardio-metabolic risk factors in adults (Ashwell et al., 2012; Lee et al., 2008; Savva et al., 2013). Use of the 0.5 boundary value has been shown to identify more people at early risk of health issues than using a combination of BMI and waist circumference (Ashwell & Gibson, 2016). However, the WHtR has not been evaluated in children and adolescents until recently. In contrast to adults, in children the WHtR, although not superior to, does have a similar discriminatory power to waist circumference and BMI, and significantly better power when screening for elevated triglycerides (Lo et al., 2016). Results of a meta-analysis which included 30 observational studies of children under the age of 18 recommended the inclusion of WHtR as a screening tool along with BMI and waist circumference due to its convenient and interpretable design where only a tape measure is needed (Lo et al., 2016). A study of 2498 children aged 5-17 years of age, taken from the Bogalusa Heart Study (longitudinal USA based study) concluded that both BMI-for-age and WHtR were able to identify children with CVD risk factors. However, the simplistic nature of assessing WHtR was, again, appreciated

(Freedman et al., 2007b). With this in mind, it has been suggested that NICE should investigate how they can include WHtR in future guidance (Ashwell & Gibson, 2016).

#### *1.4.5.2.3 Waist to hip ratio (WHR)*

In adults, a larger WHR indicates an increased amount of abdominal fat (Sweeting, 2007). However, it is vulnerable to measurement error (Lee et al., 2008) and compared to waist circumference, it does not perform as well in children in assessing fat mass (Sweeting, 2007). In addition, WHR has been shown to be outperformed by WHtR in predicting obesity in male and female adolescents (Bacopoulou et al., 2015).

#### *1.4.5.2.4 Skin-fold*

A skin-fold measurement is commonly used in epidemiological studies to measure body fat due to its inexpensive and simple nature. Measurements can be used in equations to give an approximation of body fat or be simply used as an absolute value (Wohlfahrt-Veje et al., 2014). Accuracy of skinfold thickness in the prediction of body fat percentage was evaluated in a representative sample of 372 Swiss children aged 6-13 years. This study showed that skinfold measurements were a better predictor of body fat percentage compared to either BMI and waist circumference used together or in isolation (Kriemler et al., 2010). These results have been supported more recently by data from a longitudinal cohort of 2647 Danish children aged 0-14 years. Results showed that, in healthy weight children, percentage body fat measured by skin-fold correlated positively with dual X-ray absorptiometry (DXA) and more so than BMI or waist circumference (Wohlfahrt-Veje et al., 2014). Nonetheless, only 2% of children included in the study by Kriemler et al., (2010) were obese and only healthy weight participants were investigated by (Wohlfahrt-Veje et al., 2014). In general, skin fold measurements are not recommended routinely for obese children. This is partly due to higher measurement errors at increased levels of adiposity (Kriemler et al., 2010).

#### *1.4.5.3 Scanning methods*

##### *1.4.5.3.1 Magnetic resonance imaging (MRI)*

Using a magnetic field and radio wave antenna, the MRI sends signals to and from the body. These signals are used to create internal images (Sweeting, 2007) and can measure specific fat deposits such as visceral and subcutaneous abdominal fat (Samara et al., 2012). However the use of MRIs is limited due to the length of time for acquisition and

image analysis (Micklesfield et al., 2012). MRIs are also very expensive and use is limited to the research environment (Sweeting, 2007).

#### *1.4.5.3.2 Computerised tomography (CT)*

As with MRI, CT scans create high resolution cross-sectionals internal images (Sweeting, 2007). CT works by x-rays being taken of the body at different angles (Sweeting, 2007). However, in addition to being expensive, a CT scan will expose an individual to ionised radiation that can be harmful (Pearce et al., 2012).

#### *1.4.5.3.3 Dual X-ray absorptiometry (DXA)*

The use of DXA is widely recognised as an accurate measure of body fat (Wohlfahrt-Veje et al., 2014) and is seen as the gold standard for measuring body composition (Colley et al., 2015). DXA works by detecting a series of low energy x-ray beams which are transversely scanned over the body. These x-ray beams are absorbed differently depending on the different tissues they encounter e.g. bone, fat (Sweeting, 2007). This assessment tool for body fat percentage is a reliable and valid measure, however carries a high cost and delivers a small amount of radiation (Colley et al., 2015). In addition, although this method is appropriate for a range of ages (Sweeting, 2007) some children cannot be scanned by DXA due to being too large (Wells et al., 2012). As with all the scanning methods, DXA's use is limited to research settings (Sweeting, 2007). Therefore, other methods, such as Bioelectrical Impedance Analysis are often used.

#### *1.4.5.3.4 Bioelectrical Impedance Analysis (BIA)*

BIA is a non-invasive body composition assessment method which provides reasonable accuracy at a minimal cost (Colley et al., 2015). This method estimates, through impedance, total body water. Prediction models are then used to calculate fat free mass (Wan et al., 2014). A safe electrical current is passed through the body through conductors that are typically placed on the hands and feet of a subject. BIA works on the principle of electric currents passing more easily through body fluids in muscle and blood compared to fat where the electric currents encounter resistance due to the low water content (Sweeting, 2007). A cross-sectional study of 169 adolescents aged 12-17 showed a positive correlation between DXA and percentage body fat. This highlighted BIA as a less expensive and easier alternative to DXA for assessment of body fat in obese adolescents (Colley et al., 2015). Wan et al., (2014), in a study including 66 overweight and obese adolescents, also found BIA to be a potentially useful tool for capturing body composition at a population level but inaccurate at an individual level due to a significant

overestimation of fat free mass when compared to DXA. This highlights the need for more studies that compare BIA to DXA. Nonetheless, although BIA may be less sophisticated than the scanning methods detailed previously, its quick, simple and portable nature support its use, particularly with large samples (Sweeting, 2007).

#### *1.4.5.5 Density based methods*

##### *1.4.5.5.1 Hydrodensitometry*

Hydrodensitometry, or underwater weighing, involves weighing a subject whilst submerged in a large water tank after they have maximally expired (Fosbøl & Zerahn, 2015). Once the density of a human subject is known, from the measured body weight and volume, then using an equation, the relative proportions of fat free mass and fat mass can be approximated (Sweeting, 2007). This method which is limited to a research setting may be unsuitable for children as it requires the subject to submerge themselves and hold their breath (Sweeting, 2007).

##### *1.4.5.5.2 Air-displacement plethysmography (ADP)*

Air-displacement plethysmography offers a more practical alternative to hydrodensitometry as it is suitable for a broader selection of individuals (Fosbøl & Zerahn, 2015). The person is seated in a measuring chamber where the volume of air displaced by the person inside the chamber is measured (Fosbøl & Zerahn, 2015; Sweeting, 2007). Good agreement has been shown between ADP and hydrodensitometry in healthy weight adults as well as obese adults and children in terms of body density (Demerath et al., 2002; Ginde et al., 2005; Noreen & Lemon, 2006).

#### 1.4.6 Socio-demographic risk factors for child and adolescent obesity

##### *1.4.6.1 Socioeconomic status*

Socioeconomic status (SES) is a term used to identify a person's status based on characteristics such as income, education, occupation and where they live (Public Health England, 2014). Socioeconomic inequalities in childhood obesity are evident across a number of different measures of deprivation (Public Health England, 2014). In general, socioeconomically disadvantaged children within industrialised countries are at greatest risk of obesity (Wang & Lim, 2012). A systematic review of 23 UK based longitudinal and cross-sectional studies found that a low head of household occupational social class, low maternal education and higher working hours among parents were obesity risk factors in children (El-Sayed et al., 2012). SES may also affect food access, food consumption and

activity opportunities (Frederick et al., 2014). In the early 1990's the Avon Longitudinal Study of Parents and Children birth cohort study was set up and 14,541 UK pregnant mothers were recruited. Data from teenagers who attended the year 13 clinic of this cohort study, showed that deprivation was the largest contributor to fast-food exposure (Fraser et al., 2011). This may be due to a higher number of fast-food outlets in lower SES areas paired with the perception that energy-dense foods from takeaways are more filling and affordable than healthy foods (Estrade et al., 2014; Fraser et al., 2010).

#### *1.4.6.2 Ethnicity*

92% of the UK population is white. The remaining 8% belong to other ethnic groups, the largest of which is Indian, followed by Pakistani, Mixed, Black Caribbean, Black African and Bangladeshi (El-Sayed et al., 2011). However, it should be noted that there is greater ethnic diversity among children. For example, within England and Wales, data from the latest census in 2011 shows that 31.1% of people with mixed ethnicity were aged 10 years or under (highest percentage for this age range amongst all ethnic groups) compared with 10.7% of white people (lowest percentage in this age range out of all ethnic groups) (Office for National Statistics, 2018). Data from the latest NCMP in the UK shows that obesity prevalence, measured by BMI, is significantly higher than the national average in Black or Black British groups (reception 14.8%, Year six 29% obese) and Asian or Asian British ethnic groups (reception 9.9%, Year six 24.8% obese) (NHS Digital, 2018a). However, a systematic review found little agreement in the 29 included cross-sectional and longitudinal studies in terms of which ethnic groups in the UK are most at risk of obesity (measured using various obesity metrics) except that Chinese children seem to have a lower obesity risk compared to Caucasians (El-Sayed et al., 2011). It must be noted however, that this systematic review did not consider NCMP data. In addition, El-Sayed (2011) discussed a sexual dimorphism where South Asian boys and Black girls have an increased risk of obesity, whilst South Asian girls and Black boys have a decreased risk when compared with White children. In the UK, eating and physical activity (PA) behaviours vary greatly depending on religion, culture, geography and socio-economic status which all play a part in the complex association between obesity and ethnicity (Gatineau & Mathrani, 2011).

#### *1.4.7 Causes of obesity*

The accumulation of excess body fat occurs due to food and drink consumption exceeding energy expenditure. The Foresight report (Government Office for Science, 2007) recognised the multifactorial nature of obesity and described it as a 'complex web of

societal and biological factors that have, in recent decades, exposed our inherent human vulnerability to weight gain' (Government Office for Science, 2007). With energy balance at its core, the Foresight report presented an obesity system map, which included over 100 variables that either directly or indirectly impact on energy balance. These variables were divided into seven main themes as shown in Figure 1.1 and will be discussed further in relation to adolescence.

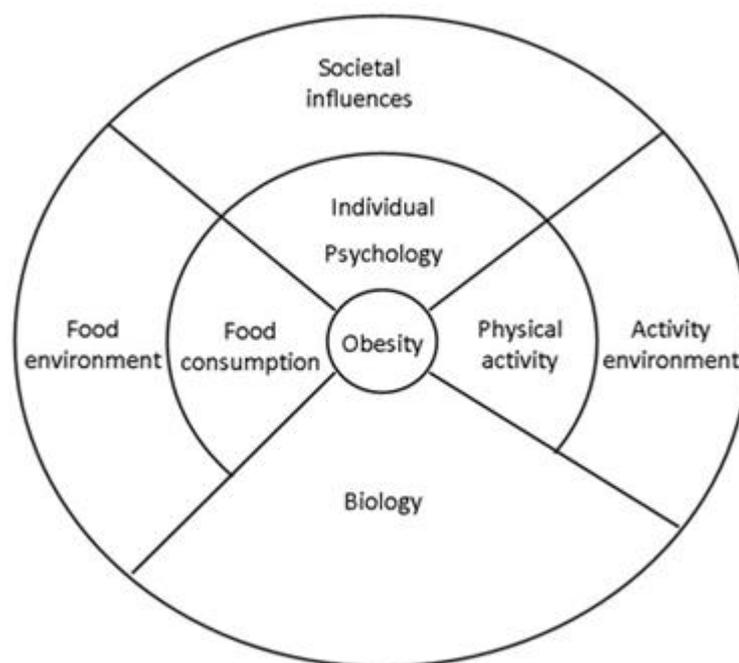


Figure 1.1 Foresight systems map (Public Health England, 2017)

#### 1.4.7.1 Biology

In the 1970's and 1980's obesity related research focused on why a small number of the population were obese. It was a common belief at this time that an individual's metabolism was to blame for obesity (Prentice, 2007). This notion was eradicated when findings showed that an obese person actually has a higher Basal Metabolic Rate than a lean person (James et al., 1978; Prentice et al., 1986). Since this point, research into the biological determinants of obesity have shifted towards appetite control and genetics. Genetic predisposition plays an important role in body weight variation, accounting for 40-74% of inter-individual BMI variation (Farooqi & O'Rahilly, 2007; Riveros-McKay et al., 2019). Several studies of families and twins over the years have confirmed this link (Farooqi & O'Rahilly, 2007; Stunkard et al., 1986; Sørensen et al., 1989). Research into the purpose of genes has helped to identify genetic defects, hormonal pathways and feedback loops. Genetic defects, for example, mutations in the melanocortin 4 receptor, tend to

have an impact on appetite control centres in the brain which impair satiety, leading to a difficulty in overcoming the drive to eat (Farooqi et al., 2003). Adipose tissue also plays a vital role in appetite regulation. Adipose tissue, both brown and white, are made up of adipocytes (fat cells). Brown adipose tissue is responsible for generating body heat whilst white adipocytes, in addition to storing energy, secrete several major adipokines, such as leptin (Kopelman et al., 2010). Leptin, in addition to other adipokines, function together with gastrointestinal peptides, such as ghrelin, to send signals to the brain in order to regulate energy intake and appetite (Spruijt-Metz et al., 2010). Leptin inhibits food intake via the hypothalamus in the brain. Its main function is to increase intake of food; when body fat is low leptin levels decrease so hunger is stimulated. As body fat increases, leptin secretion is stimulated, satiety is increased and an individual's drive to eat is reduced and the body reaches equilibrium once again (Government Office for Science, 2007). However, many obese people are resistant to leptin thus food intake is not inhibited (Bloom, 2007). Ghrelin is the only established peripheral orexigenic hormone, one that stimulates appetite, which plays a major role in feeding initiation; levels of ghrelin rise sharply before a meal and fall within one hour (Small & Bloom, 2004).

Leptin and ghrelin are also linked to sleep timing, quality and duration. Sleep is regulated by two body systems, the sleep/wake homeostasis and the circadian body clock (National Sleep Foundation, 2016). These two body systems assist in regulating energy homeostasis as sleep appears to have an inhibitory effect on ghrelin, whilst a good circadian rhythmicity, resulting from good quality sleep can elevate and stimulate leptin, the satiating adipocyte (Morselli et al., 2012). A longitudinal cohort study of >5000 females aged 14-21 years found that those who slept less than 5 hours a night had a significant increase in BMI over a year compared to those sleeping for more than 8 hours a night (Berkey et al., 2008). This is supported by results of a meta-analysis of 600,000 participants, 30,000 of which were children. Results showed an increased risk of obesity for children who were short sleepers (OR 1.89 (95% CI 1.46-2.43,  $p < 0.0001$ , 12 studies)) (Cappuccio et al., 2008). A more recent systematic review of 22 studies and results of a bias-adjusted meta-analysis ( $n=11$ ) also concluded that children and adolescents, from diverse ethnic and socioeconomic backgrounds, who sleep for a shorter duration have twice the risk of becoming overweight or obese compared to those sleeping for longer durations (Fatima et al., 2015).

Our internal circadian body clocks regulate periods of wakefulness and tiredness through the day. Most adults' circadian clocks promote sleepiness between 2-4am and 1-3pm. If

sufficient sleep is gained, these dips are less forceful. A problem occurs in adolescents, when changes to the circadian rhythm occur due to puberty related changes (Richardson et al., 2017). The circadian rhythm tends to shift which creates difficulty in trying to sleep before 11pm (National Sleep Foundation, 2016). The National Health Service (NHS) recommend that adolescents need, on average, 9 hours of sleep per night (NHS Choices, 2015). However, with early school start times, frequently this is not the case with teenagers averaging between 7-7.5 hours of sleep per night (Hansen et al., 2005; Wolfson & Carskadon, 1998). Results of a meta-analysis of data from 20 different countries (including the UK), which included over 92,000 adolescents with an average age of 14 years, highlighted that sleep duration decreases as adolescents get older. In addition, girls tend to sleep more than boys with Europeans sleeping more than Americans and Asians (Olds et al., 2010). Any efforts to prevent or reduce obesity in adolescents may benefit from a focus on improving sleep duration.

Obesity is clearly a complex biological system and many individuals may have poorly tuned appetite control systems. This alongside an environment with excessive amounts of energy-dense foods and drinks, is leading to a positive energy balance and therefore obesity (Government Office for Science, 2007).

#### *1.4.7.2 Food consumption*

Data from the latest National Diet and Nutrition Survey (NDNS), which assesses the diet of the general UK population (aged  $\geq 1.5$  years), shows that only 8% of 11-18-year-olds meet the 5-A-Day recommendations for fruit and vegetables (Public Health England, 2018a). Mean intake of free sugars provided 14.1% of energy for this age group which exceeds recommendations of no more than 5% of all dietary energy coming from free sugars (Public Health England, 2018a). As behaviours shaped in the adolescent period underpin lifelong patterns of behaviour, these data are of particular concern (Fenner et al., 2013).

Meeting dietary recommendations is not only an issue in the UK. Data from the NHANES dietary survey, highlights that 14-18-year-olds in the US are also consuming a high amount of added sugar (National Center for Health Statistics, 2017). Children in other developed countries including Australia and Denmark are not meeting dietary recommendations. Australian children are typically consuming too little fruit and vegetables (Australian Bureau of Statistics, 2018), whilst Danish children are exceeding recommendations for saturated fat and added sugar (Pedersen et al., 2015).

#### *1.4.7.3 Food environment*

The current environment has an excessive amount of energy-dense foods and drinks on offer, which is leading to a positive energy balance and therefore obesity (Government Office for Science, 2007). An increase in availability of fast-food has been implicated as a contributing factor in the obesity epidemic. The UK market for fast-food, takeaway and home-delivery reached a value of £10.13bn in 2009 with total sales values increasing year-on-year (Keynote, 2015). Takeaway foods, although cheap, are often high in saturated and trans fatty acids, sugar and sodium (Davies et al., 2016; Dunford et al., 2010). In addition, fast-food consumption is associated with an increase in total energy intake (Rosenheck, 2008), higher BMI (Braithwaite et al., 2014; Fraser et al., 2011) and higher consumption of unhealthy foods in teenagers (Fraser et al., 2011). Data from a large UK birth cohort of 3620 13-year-olds showed that increased exposure to unhealthy, energy dense foods at home increased the number of visits to fast-food outlets which, in turn, was linked to a higher BMI (Fraser et al., 2011). This same study also highlighted that unhealthy food consumption appears to displace healthy food choices; teenagers were less likely to eat fruit and vegetables when they ate frequently at fast-food outlets (Fraser et al., 2011). Fast-food appears to be particularly popular among adolescents worldwide. An international cross-sectional study involving 36 countries, showed that over 50% of the adolescent age group consume fast-food frequently (once or twice per week) or very frequently (3 or more times per week) (Braithwaite et al., 2014). A further cross-sectional study involving 810 11-13-year-olds showed that 65% of adolescents reported purchasing food from fast-food outlets; the likelihood of buying from these outlets increased to at least once per week if the outlet was less than 1km from the home neighbourhood. In addition, high density of fast-food outlets near both adolescents' home and schools increase fast-food purchasing (He et al., 2012).

Schools form a large part of the food environment for adolescents. Although the latest school food standards were introduced by the Government in 2015 (see policy section 1.4.8), academies created between 2010 and 2014 are not legally obliged to comply with these standards (Dimbleby & Vincent, 2013). In a telephone survey of 100 randomly selected academies in England, academies were found to be selling more unhealthy snacks at break times, with over 75% selling sugar-sweetened drinks (Dimbleby & Vincent, 2013). In a qualitative study exploring how the school environment in Canada shapes food choices, adolescents also perceived their schools to have many less healthy temptations (Watts et al., 2015). A representative sample of 4,322 adolescent students in the US

showed that more students chose unhealthy snacks and beverages instead of lunch in schools where vending machines were available, even when healthy lunch options were available (Park et al., 2010). Not only can the school food environment lead to a poor diet, but among middle school children (mean age 13 years) in the US, availability of unhealthy energy dense and low nutrient food in vending machines is associated with a higher BMI (Fox et al., 2009). In state schools within the UK, vending machines are not allowed to sell sweets, crisps or fizzy drinks (Dimpleby & Vincent, 2013), however, there are other unhealthy options outside of the school environment. A school-based longitudinal survey of adolescents living in the south east of London highlighted an increase in the number of takeaways and convenience shops within 400m of schools between 2001 and 2005. Although effects were small, this study provided evidence that an adolescent's diet may be influenced by the food environment surrounding secondary schools (Smith et al., 2013).

Access to healthy food may be influential in achieving a healthy diet and therefore reduced obesity rates (Morland et al., 2006). A systematic review investigating the built environment and obesity highlighted increased access to supermarkets, opposed to smaller convenience stores, as an obesity reduction strategy. Smaller convenience stores are seen as more expensive and have poorer quality produce (Lovasi et al., 2009). Reducing the cost of fruit and vegetables has also been linked to an improved diet (Waterlander et al., 2013) and reduced BMI in children (Morrissey et al., 2014; Sturm & Datar, 2005). A 6 month RCT within Dutch supermarkets showed significantly greater purchases of fruit and vegetables as a result of a 50% price discount compared with control (Waterlander et al., 2013).

#### *1.4.7.4 Physical activity*

PA is essential for maintaining a healthy BMI range across the life course (Elgar et al., 2005). Data from a longitudinal study of 3345 adolescents show that for each weekday that normal weight adolescents took part in PA they decreased their odds of adulthood overweight by 5% (Menschik et al., 2008). PA can also reduce the risk of CVD (Li & Siegrist, 2012), T2DM (Aune et al., 2015), hyperlipidaemia, hypertension and improve bone density (Janssen & LeBlanc, 2010). In addition, PA can reduce breast cancer risk (Spruijt-Metz et al., 2010; Wu et al., 2013) and improve psychological and social health outcomes in children and adolescents (Eime et al., 2013), including improvements in depression (Janssen & LeBlanc, 2010).

PA guidelines for children aged 5-18-years in the UK include engaging in moderate to vigorous PA (MVPA) (such as jogging, football and swimming) for upwards of 60 minutes per day (Dobbins et al., 2009). The number of boys and girls reaching these recommendations in England fell between 2008 and 2012 with the greatest declines being seen in 13-15-year-olds. In 2008, 28% of boys and 14% of girls were meeting recommendations in England. Currently, only 14% and 8% of boys and girls are meeting these PA guidelines, respectively (Townsend et al., 2015).

The most up-to-date PA recommendations also emphasise reducing time spent being sedentary. A systematic review of observational studies (n=17) highlighted a positive association with sedentary behaviours and weight gain in children (Prentice-Dunn & Prentice-Dunn, 2012). This may include playing computer games and watching TV (Melnik et al., 2007). Additionally, a cross-sectional analysis of 21, 053 students (mean age 14.4) in the Netherlands showed that sedentary behaviour is associated with social media use (Mérelle et al., 2017). Furthermore, screen time has been shown to have an adverse effect on sleep. A systematic review, of mainly observational studies (n = 67), found a significant association between sleep problems, categorised by shortened sleep duration and delayed bed times, and screen time in 90% of included studies (Hale & Guan, 2015). Screen usage included computers, video games, television and mobile devices. Television produced the least adverse association with sleep outcomes which concurs with previous hypotheses that more passive screen time (television) is less detrimental than interactive screen time (computer use) (Gradisar et al., 2013; Pieters et al., 2014). This may be due to television viewing being less personal compared to internet chatting and mobile phone use. In addition, TV screens tend to be further away from the adolescent compared to computers and mobile phones. Being further away from the light of a screen may have a smaller effect on melatonin suppression and the sleep/wake cycle (Pieters et al., 2014). There is a clear link with screen time, sleep deprivation and risk of obesity as discussed previously in section 1.4.7.1 (Berkey et al., 2008; Cappuccio et al., 2008; Fatima et al., 2015; Hale & Guan, 2015).

#### *1.4.7.5 Activity environment*

##### *1.4.7.5.1 Community activity environment*

Having access to recreational facilities in the local environment can have a positive effect on PA levels. For instance, parks have been shown to be an important factor in promoting PA. Data from over 4000 adolescents from the US highlighted that having access to a safe

park was positively linked to regular PA in adolescents living in urban areas (Babey et al., 2008). This being said, an Australian observation study of 4756 park visitors, showed only 32% of 13-20-year-olds engaged in MVPA when visiting parks (Veitch et al., 2015). This conflicting evidence highlights the need for a greater understanding of park characteristics, especially in the UK, and how they may influence activity levels in adolescents. Veitch et al., (2016) interviewed 99 adolescents to identify key features of a park that may facilitate or prevent PA using photographs on a purpose built computer application. The images that resulted in the highest scores in response to how likely they would want to be active in the park included physically challenging equipment such as large slides, swings and zip wires (Veitch et al., 2016). This highlights the importance of considering adolescent views when designing park features.

Traffic calming measures in the UK can lead to small observed increases in short and long-term cycling and walking activity (NICE Public Health Collaborating Centre - Physical Activity, 2006). Traffic within 150m of the home has also been linked to a higher BMI in boys and girls (Jerrett et al., 2010). This is supported by a systematic review of 15 mainly cross-sectional studies, which highlighted a positive association with heavy traffic and obesity in older children (Dunton et al., 2009). This association may be as a result of traffic creating an intimidating environment for both parents and children, preventing walking or cycling nearby (Jerrett et al., 2010). Low perceived neighbourhood safety has been associated with 21% reduced odds of being physically active, in adolescents (n = 4020, 14-18 years) (Lenhart et al., 2017). This study, based in the USA, used cross-sectional data from the 2015 Pennsylvania State and Philadelphia City Youth Risk Behaviour Survey, a biennial, self-administered school-based survey of US high school students.

#### *1.4.7.5.2 School and home activity environment*

Due to the substantial amount of time that children spend in the school environment, ensuring the physical characteristics of the school environment are targeted is essential. A systematic review with 15 included studies highlighted the need for policies that improve equipment and space in the school activity environment in addition to allowing school yard access at weekends in order to combat childhood obesity (Dunton et al., 2009). A cross-sectional study of 16471 secondary school students across 130 schools in Norway showed that boys had 2.69 times (95% CI = 1.21-5.98) and girls 2.90 times (95% CI = 1.32-6.37) higher odds of being more physically active during break times when there was a larger number of outdoor school facilities (Haug et al., 2008). The home activity

environment is also an important factor and has been shown to play a more central role in influencing children's activity levels compared to the local community environment (Crawford et al., 2010). This is largely linked to the role of the parent, discussed further in section 1.4.7.6. Generally, research tends to suggest that characteristics of the physical environment can shape obesity related behaviours in children and adolescents.

#### *1.4.7.6 Individual psychology*

Parents play an important role in children's behaviour, with much of this role being influenced by differing parenting styles. Four parenting types have been described: authoritarian (high demand, low responsiveness), authoritative (establish rules but more responsive), permissive (undemanding, nurturing and communicative) and uninvolved (few demands, low responsiveness, detached) (Zahra et al., 2014). In a large sample of Canadian children aged 6-11 years (n=18,551), those with authoritarian parents were more likely to be obese, compared with authoritative parents (Kakinami et al., 2015). Furthermore, Jago et al., (2011a) in a cross-sectional survey of 792 children in the UK found that higher levels of PA was associated with maternal permissive parenting compared to authoritative parenting. Maternal logistic support, e.g. providing transport and enrolling in activities, was also linked to girl's activity levels, with paternal logistic support associated with boy's PA levels. Another cross-sectional study of 76 children in the US also reported that children of permissive parents were most active (Hennessy et al., 2010). From a nationwide cohort of adolescents and young adults in the USA (n=6382), those with high family functioning and high quality of relationships with their mother and father were less likely to participate in unhealthy weight-related behaviours such as fast food intake and physical inactivity (Haines et al., 2016). Parenting practices have also been studied relating to restrictive food practices, however research investigating this area has provided conflicting evidence with some studies finding control to be detrimental to children's eating behaviours and others finding control to be of benefit (Birch et al., 2003; Dickens & Ogden, 2014; Loth et al., 2013).

Jago et al., (2012) analysed data from 2965 families with children aged 3-10-years who took part in a 10 month cross-sectional study. This study in Portugal found that a child's TV viewing time throughout the week was strongly associated with parental viewing time. Children's dietary intake is also associated with parental intake with qualitative research identifying poor family food practices as an influence on obesity in the UK (Reece et al., 2016). Furthermore, a systematic review of 58, mainly cross-sectional, studies explored

the environmental correlates of dietary behaviours linked to obesity. The majority of studies took place in North America and Europe and found positive associations between parental and child intake of fat, and fruit and vegetables. Additionally, associations were found between parent and sibling intake with adolescent's energy and fat intake (Van Der Horst et al., 2007). Family support is also related to increased PA levels (Beets et al., 2010; Erkelenz et al., 2014; Morrissey et al., 2015).

In addition to the role of the parent, an individual's mental health may influence obesity. Depression and individual psychosocial stressors (academic performance, future life goals and overall perception of stress) have been positively associated with childhood overweight or obesity (Gundersen et al., 2011). Psychosocial household stressors such as mental and physical health problems of the carer or parent, financial strain, and neglect have also been seen as a promoting factor in the development of obesity (Gatineau & Dent, 2011).

#### *1.4.7.7 Societal influences*

In 2014, £256 million was spent by the UK food industry in advertising and marketing unhealthy foods (Scientific Advisory Committee on Nutrition, 2015). This can have a particularly detrimental impact on behaviour and health, particularly in children. A mixed methods review investigated the role of marketing strategies of sugary food in behaviour changes (Ells et al., 2015). 29 of 45 included studies focused on children and five took place in England. Included studies were of moderate quality overall. Findings, which were consistent, showed that new, e.g. online advertising, and old, e.g. TV, methods of marketing were influential in terms of food choice, consumption and preference in children. The effectiveness of other types of marketing in influencing sugary food and drink intake, including the use of characters and spokespeople, advergames (a combination of advertising and online gaming), branding and product size, was highlighted. Discounts and product placement in supermarkets can also significantly impact purchasing behaviours in both adults and children, such as the use of end of aisle displays (Ells et al., 2015).

#### *1.4.8 Policy*

In 1992, the UK government released the Health of the Nation strategy (Department of Health, 1992). This was the first attempt by the government to strategically improve the health of the nation and included an obesity target for adults (Oyebode & Mindell, 2013).

Obesity was beginning to be recognised by higher-level government. Over the years since this strategy, numerous documents have been developed, all with the aim of halting the growing issue of obesity. Obesity was a core feature in the Chief Medical Officers annual report in 2002, this time with a focus on adults and children (Department of Health, 2003). In early 2008, the focus was on childhood obesity with the publication of *Healthy Weight, Healthy Lives* (HM Government, 2008). When *Healthy Weight, Healthy Lives* was evaluated two years on (HM Government, 2010) the rise in childhood obesity appeared to have halted with *Change4Life* (social marketing campaign run by the Department of Health) and the NCMP being praised. Even though results were promising for children under 11-years, obesity amongst teenagers and adults was still high. This led to *Healthy lives, Healthy People: A Call to Action on Obesity* (HM Government, 2011) which aimed to move beyond the focus of children and adapt a life course approach.

In October 2015, Public Health England (PHE) released key recommendations to impact on the childhood obesity epidemic (Tedstone et al., 2015). This was followed by *Childhood obesity: a plan for action* (HM Government, 2016), which detailed plans for an industry levy on sugary soft drinks besides launching a sugar reduction programme, challenging the food and drinks industry to voluntarily reduce sugar in a variety of products aimed at children by at least 20% by 2020. Unfortunately, two aspects of the PHE report were omitted from the government's child focussed obesity strategy (*Childhood obesity: a plan for action*): food and drink marketing and advertising (HM Government, 2016). These key omissions did not go unnoticed by health experts (The Guardian, 2016; Royal College of Physicians, 2016), who agreed that several actions, including restrictions on advertisements and marketing, implemented in a parallel nature are key. In 2018, the Government released Chapter 2 of *Childhood obesity: a plan for action* (HM Government, 2018). As well as plans for a calorie reduction programme, this instalment contained plans to reduce the marketing and promotion of foods high in fat, sugar and salt, including the banning of price promotion offers, such as buy one get one free, and unhealthy foods on offer at checkouts. Both chapters of the report also highlight the importance of healthy school food. In January 2015, the Government introduced a new set of school food standards. These standards ensure children are provided with a healthy balanced meal that will provide them with the energy and nutrients they require to do well at school (Department for Education, 2016). Unfortunately, only 43% of children are choosing school dinners; many go outside of the school, bring in a packed lunch or consume snack foods bought at morning break (Dimpleby & Vincent, 2013). It is a common misconception

that a packed lunch is the healthiest option, only 1% of packed lunches examined in 1294 8-9-year-olds across 89 schools in the UK meet nutritional standards (Evans & Cade, 2017). Additionally, the importance of education and enabling health professionals to support families and raise awareness to the public was emphasised. It is therefore important that more approaches to prevent and reduce childhood obesity are developed.

#### 1.4.9 Interventions to prevent childhood obesity

A UK cohort of 25639 men and women who were followed up over 10 years showed that adults gain about 0.2kg annually (Golubic et al., 2013). This trend is also demonstrated in adolescence (Patton et al., 2011). This may be due to unhealthy PA and dietary behaviours established in childhood and adolescence, which have been shown to track into adulthood (Craigie et al., 2011). Modifying these behaviours early on in life may lead to healthier weight related behaviours in adult life, thus preventing the development of obesity and its psychosocial and physiological health sequelae. Therefore, obesity prevention programmes are vital. In 2015, NICE published guidelines for preventing excess weight gain for adults and children after weaning age (NICE, 2015). Recommendations include establishing and maintaining PA and healthier dietary habits. Advice is given to parents and carers to eat meals as a family, encourage enough sleep, and being active at every opportunity. A Cochrane review investigated the effectiveness of obesity prevention programmes in children and found robust evidence to support the effect of childhood obesity prevention programmes on BMI (Waters et al., 2011). Nonetheless, results were recommended to be interpreted with caution due to unexplained heterogeneity and publication bias. Promising initiatives included a healthy school curriculum, increased PA and improved nutritional quality of food at school, plus support for parents and teachers. More recently, a systematic review of obesity prevention interventions for children and adolescents that included 56 studies, concluded that school-based interventions combining PA, diet and a home component were most effective at preventing obesity (Bleich et al., 2018). This adds to the evidence from previous systematic reviews highlighting the effectiveness of school-based interventions for the prevention of obesity in children and adolescents (Wang et al., 2015).

#### 1.4.10 Interventions to treat childhood and adolescent obesity

WMPs aim to help individuals who are overweight or obese. They can focus on diet, physical activity or behaviour change in any combination and aim to reduce an individual's energy intake and/or increase physical activity. These programmes are often run by the

public, private or voluntary sectors and are just one part of a wide-ranging approach to obesity treatment (NICE, 2013a; NICE 2014b). Throughout this thesis the term WMP is used interchangeably with the terms obesity treatment intervention, obesity treatment programme and weight management intervention.

Although obesity prevention programmes show promising results, the need for effective obesity treatment programmes is still great. In a pathway modelling study using data from the HSE, Viner et al., (2018) identified a mismatch between children and young people (2-18 years) eligible for obesity treatment and service use. Only 23% of children and young people with obesity eligible for support in the early stages of the obesity pathway, including lifestyle WMPs, (Stages 1-4, Table 1.2) were found to access services. This mismatch was seen particularly amongst deprived adolescents. In addition to reluctance to access support, another potential reason for the low numbers of young people accessing care is the availability or accessibility of obesity treatment services. NICE guidance on weight management services for overweight and obese children recommends a family-based multi-disciplinary programme, combining diet, activity, and behaviour change strategies with measurements being taken up to a year after the programme has been completed. NICE also recommend the importance of a programme being developed by a multi-disciplinary team of professionals including a registered nutritionist/dietician, PA specialist, behaviour change expert, psychologist and paediatrician. A flexible approach to how the programme is delivered, in terms of one-to-one or group, time of day, venue, and range of programmes depending on the child's age and stage of development, is encouraged (NICE, 2013a). A Cochrane review of childhood obesity treatment intervention effectiveness reviewed 64 randomised-controlled trials (mean age of participants 12.5-years), two of which were conducted in the UK (Luttikhuis et al., 2009). A favourable effect on child adiposity at the end of the programme or follow-up was reported. This review suggests a family-based lifestyle intervention with combined dietary, PA and behaviour components as being potentially beneficial. Nonetheless, long-term outcomes recorded after 12 months were limited (Luttikhuis et al., 2009). This review also recognised a gap in research assessing weight management interventions for the adolescent age group. Other systematic reviews of obesity treatment interventions have since been conducted but do not focus on the adolescent age group specifically (Ho et al., 2012; Peirson et al., 2015) or have only focused on PA and exercise interventions (Ruotsalainen et al., 2015). The next Cochrane review update of childhood obesity treatment was therefore split by age group and included a review focusing on 12-17 year

olds (Al-Khudairy et al., 2017). This systematic review included 44 RCTs with 4781 participants in total. Interventions included in this review took place in a variety of settings including schools, community and health care settings. Thirty-four of the included interventions were multi-disciplinary and 10 were single component interventions, with five focusing only on diet and the remaining five on PA. Of those that reported mode of delivery, 14 trials delivered the intervention individually, 19 in a group format and 10 had a mixture of both group and individual sessions. In addition to variation in content, there were variations in duration (six weeks to two years) and follow-up (six to 24 months) of interventions. Nonetheless, low-to-moderate quality evidence was found that supports the use of multi-disciplinary interventions to reduce BMI and weight in adolescents with overweight or obesity. Twenty-eight studies reported on BMI, which was on average 1.18 kg/m<sup>2</sup> less in the treatment group when compared to the control. Average weight loss was 3.67kg less in the treatment group compared to control in the 20 studies that reported weight as an outcome. This review also adds to the evidence base that weight loss is maintained in trials with longer follow-ups of 18 to 24 months.

A Cochrane review into surgery for the treatment of obesity in children and adolescents, found that laparoscopic gastric banding resulted in increased weight loss (34.6kg, 95% CI 30.2-39.0) compared to a multi-disciplinary programme (3.0kg, 95% CI 2.1 to 8.1). However, this systematic review only included one RCT with 50 Australian adolescents, which highlights the need for future studies in this area. (Ells et al., 2015). In addition, although this one RCT showed laparoscopic gastric banding to be more effective than a multi-disciplinary WMP, surgery comes with risk of serious complications and mortality (Selvendran et al., 2018).

#### *1.4.10.1 Obesity pathway for managing children and young people who are overweight or obese*

Given the high levels of obesity highlighted in section 1.4.2 (Prevalence and trends of child obesity in the UK and worldwide), a coordinated and comprehensive approach to childhood obesity treatment is needed. Therefore, NICE has created a pathway for managing children and young people who are overweight or obese as seen in Figure 1.2. This pathway is described in more detail in Table 1.2.

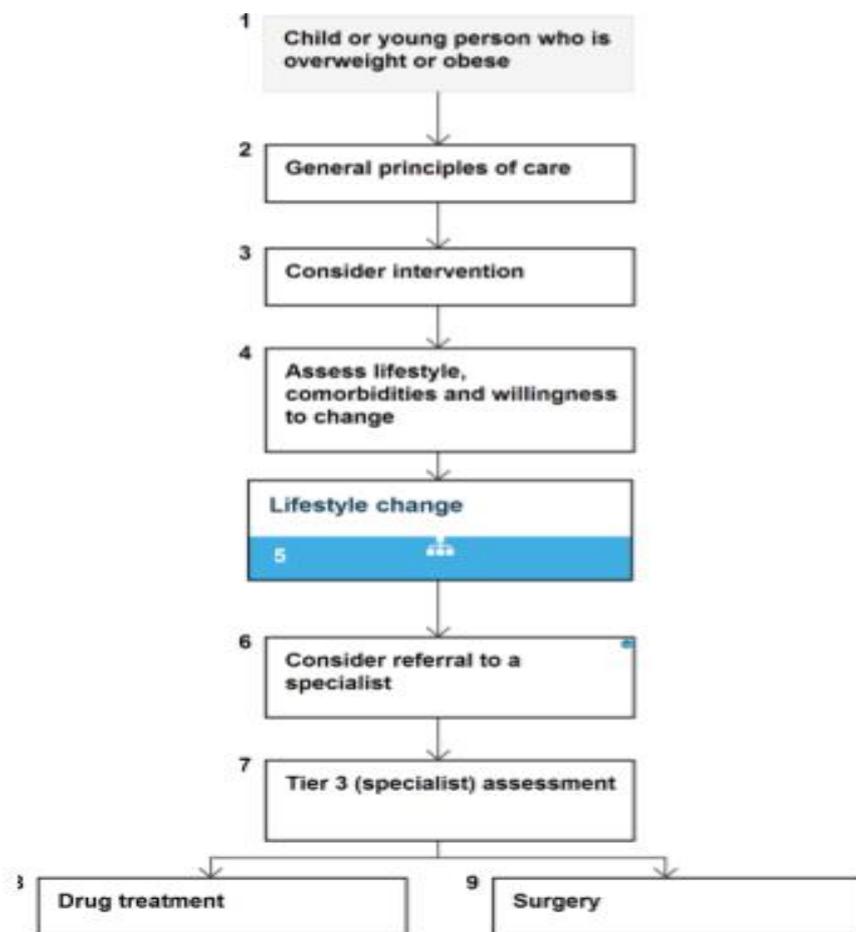


Figure 1.2 NICE Pathway: Obesity management in children and young people (NICE, 2019)

**Table 1.2 Pathway: Obesity management in children and young people (NICE, 2019)**

Stage of pathway	Description of pathway
<b>1. General principles of care</b>	The start of the pathway, which involves creating a tailored, supportive environment to enable lifestyle changes by the child and their family.
<b>2. Consider intervention</b>	Children over the 91 <sup>st</sup> centile for BMI would be considered for clinical intervention.
<b>3. Assess lifestyle, comorbidities and willingness to change</b>	An initial assessment would be carried out regarding lifestyle, comorbidities and willingness to change. If an individual were not ready to make changes at this point, they would be offered the chance to return in the future when they are ready or able to discuss their weight and are able to make lifestyle changes. Information on the benefits of healthy eating, PA and losing weight would be given.
<b>4. Lifestyle change</b>	If appropriate, an individual may then take part in a lifestyle intervention, with a multi-disciplinary option being the treatment recommended on best evidence. This stage would typically be an example of a Tier 2 level service. A person's individual preference, BMI and comorbidities should be taken into account.
<b>5. Consider referral to a specialist</b>	Referral to a specialist may be considered for overweight or obese children who have complex needs or significant comorbidities.
<b>6. Tier 3 (specialist assessment)</b>	At Tier 3, or specialist, assessment, a child who is overweight or obese will have their comorbidities and possible causes for their excess weight assessed. This may include measurements of blood pressure, lipids and glucose profile. If this stage is not successful, the final stage of the pathway would be drugs or surgery; however, neither are generally recommended for children.
<b>7. Drug treatment</b>	If a child, over the age of 12, has severe psychological or physical comorbidities then orlistat (obesity treatment drug) may be given for a 6-12-month trial with regular reviews by a multi-disciplinary team with appropriate expertise. Drugs would not be recommended for children under the age of 12.
<b>8. Surgery</b>	Surgery is also generally not recommended for children but in exceptional circumstances, such as a child with a BMI of 35 and over with recent onset of T2DM, bariatric surgery may be considered if the child has achieved or nearly achieved physiological maturity. Bariatric surgery would be classed as a Tier 4 service.

*1.4.10.2 Engagement in obesity treatment interventions*

Despite recommendations for adolescents to attend multi-disciplinary WMPs, engagement is generally poor. Nobles et al., (2018) refer to engagement as a term that

encompasses treatment initiation, dropout, attrition, retention and adherence. Engagement is essential for the individual as increased participation is associated with increased weight loss (Miller & Brennan, 2015). Not only for the individual, but engagement is a critical factor influencing the internal and external validity of research findings. For commissioners and practitioners, engagement may also affect the cost-effectiveness of a WMP (Miller & Brennan, 2015; Nobles et al., 2018). It is therefore of real concern that WMPs only recruit between 0.5 and 1.5% of the childhood population (NICE, 2013b). In addition, attrition ranges from 8-83% (Dhaliwal et al., 2014; Skelton & Beech, 2011). Nonetheless, research into WMPs for adolescents has tended to focus on effectiveness and outcomes rather than engagement. Research that has investigated attrition from WMPs has paid attention to pre-intervention participant characteristics such as gender, ethnicity and age, however these have been shown to be poor predictors of dropouts (Nobles et al., 2016). Other ways of assessing attrition have involved qualitative methods to gather reasons for attrition from participants (Kitscha et al., 2009; Skelton et al., 2012; Skelton et al., 2016). However, the evidence base in terms of attrition from obesity treatment programmes that focus on adolescents, and not younger children, is limited and has not been synthesised. In a Cochrane review of diet, PA and behavioural interventions for the treatment of overweight and obesity in adolescents, attrition ranged from 34-100% (Al-Khudairy et al., 2017). However, 16 out of 44 included studies did not report attrition sufficiently. Therefore, only limited conclusion can be drawn in regard to attrition in this age group currently. Understanding factors that have an influence on adolescent engagement can be used in the development of future WMPs targeting this age group.

### 1.5 Conclusion and purpose of this PhD

The above literature review has set out the complex problem of adolescent obesity. Whilst childhood obesity rates appear to be stabilising in England, rates in adolescents (11-15 years) are still high and show an upward trend (van Jaarsveld & Gulliford, 2015). The current recommendations are for obese adolescents to attend a family-based multi-disciplinary weight management service (NICE, 2013a). Cochrane reviews have shown that lifestyle programmes can be effective in reducing the number of overweight and obese adolescents (Luttikhuis et al., 2009; Waters et al., 2011; Al-Khudairy et al., 2018; Ells et al., 2018). However, due to the quantitative nature of these reviews, we do not know why these programmes are effective. Despite the large proportion of adolescents

being overweight or obese, recruitment rates are poor and attrition is high. Given the immediate and long-term physical and psychosocial risk factors associated with adolescent obesity and the limitations identified, this PhD aims to contribute to the evidence regarding how best to support this age group in terms of lifestyle obesity treatment interventions. In particular, this PhD was concerned with improving the evidence base of adolescent and stakeholder viewpoints relating to these interventions, as well as gaining a greater understanding of specific intervention components. By gaining a better understanding of these factors, it is hoped that this PhD will develop important implications for future intervention development, in addition to having an impact on effectiveness and engagement.

## 1.6 Methodology and rationale

### 1.6.1 Research objectives and questions

The primary aim of this PhD was to increase understanding of how WMPs can best support adolescents with obesity to achieve a healthy weight. To achieve this, four research objectives were set:

- 1) Synthesise and explore the views of adolescents with overweight or obesity that have attended lifestyle obesity treatment interventions.
- 2) Understand the conditions and combinations of conditions of adolescent weight management interventions that form pathways to effectiveness and ineffectiveness.
- 3) Explore the views and experiences of adolescents attending a weight management intervention in the West Midlands, including the barriers and facilitators to achieving a healthy weight.
- 4) Explore the views of stakeholders involved with adolescent weight management interventions to consider the policy and practical implications of objectives 1-3.

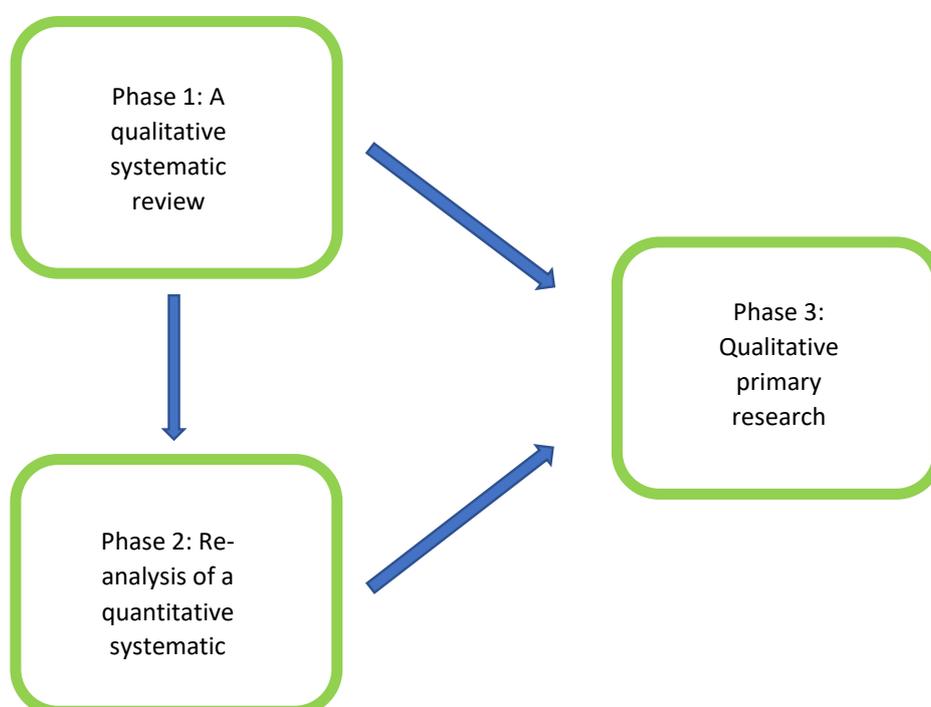
Based on these objectives the following research questions were developed:

- What are the views of overweight or obese adolescents (12-17 years) attending lifestyle obesity treatment interventions?
- Which conditions and combinations of conditions of adolescent lifestyle obesity treatment interventions form the pathways to intervention effectiveness and pathways to ineffectiveness?

- What are the barriers and facilitators to achieving a healthy weight for overweight or obese adolescents taking part in a lifestyle treatment intervention in the West Midlands?
- What are overweight or obese adolescents' experiences of attending an obesity lifestyle treatment intervention in the West Midlands?
- What are the reasons for adolescents with obesity not engaging with obesity lifestyle treatment interventions in the West Midlands?
- What are stakeholder views of lifestyle obesity treatment interventions for adolescents in the West Midlands?
- What are stakeholders' views of the policy and practical implications of findings from a qualitative systematic review and interviews with adolescents with overweight and obesity?

### 1.6.2 Research approach

An iterative approach was taken with findings from phase one (chapter 2) and phase 2 (Chapter 3) informing phase 3 (Chapter 4), highlighted by Figure 1.3. The changes to this research approach and rationale are given in section 5.9.



**Figure 1.3 Diagram of the PhD**

### 1.6.3 Rationale for research approach

#### *1.6.3.1 Phase one: Qualitative systematic review*

It was known from preliminary electronic searches conducted at the outset of this PhD, several qualitative studies had been published which explore adolescent views of attending lifestyle obesity treatment interventions (Holt et al., 2005; Morinder et al., 2011; Reece et al., 2016). However, it is not easy for policy makers, commissioners or those in practice to locate, evaluate and synthesise all these available data. As far as could be identified, a systematic review addressing the views of adolescents who have attended a lifestyle treatment intervention had not been conducted. Systematic reviews create comprehensive and unbiased accounts of the literature through exhaustive searches of studies in a replicable and rigorous manner (Bryman, 2012). A systematic review is important for bringing together primary studies to gain an understanding of what works to help inform practice and policy (Seers, 2015). Bringing together research evidence in this way provides trustworthy results to research questions (Thomas & Harden, 2008). Additionally, moving from islands of knowledge to overarching understandings can improve generalisability and transferability of findings (Nye et al., 2016). In phase 1 of this research (Chapter 2), a qualitative evidence synthesis was conducted. Qualitative research can give a more in depth understanding of participant perception (Butler et al., 2016) and has a central role to play in evidence-based healthcare. Quantitative systematic reviews are well placed to look into the effectiveness of an intervention, however, taking a qualitative approach can help to address questions from healthcare professionals that cannot be answered quantitatively, such as identifying obstacles to change and what really is important for the patient (Butler et al., 2016; Munn et al., 2014). Unlike outcome evaluations, qualitative studies focus on meanings and experiences and thus provide a different way of understanding and can complement the interpretation of quantitative research.

#### *1.6.3.2 Phase two: Revisiting a quantitative systematic review of adolescent obesity treatment*

Although reviews of qualitative research are useful in their own right, findings from qualitative syntheses can also be used in parallel to findings from quantitative synthesis (Noyes & Lewin, 2011). A systematic review of diet, PA and behavioural interventions for the treatment of overweight and obesity in adolescents aged 12-17 years, gives an expert understanding of the effectiveness of these intervention (Al-Khudairy et al., 2017). This

Cochrane review is part of a series of updates of childhood obesity treatment trials (Colquitt et al., 2016; Ells et al., 2015; Loveman et al., 2015) and included RCTs of lifestyle intervention for the treatment of adolescent overweight and obesity aged 12-17 years. This review concluded that multi-disciplinary interventions are effective in the treatment of adolescents who are overweight or obese. With the inclusion of 44 completed RCTs and 50 ongoing trials, this systematic review is also of high quality and power. Cochrane reviews have been shown to produce high quality assessment and evidence synthesis (Alper et al., 2015). However, the standard Cochrane quantitative approach to systematic reviews has limitations in that it focusses on effectiveness, and only secondarily on possible moderators of effect. For example, Al-Khudairy et al., (2017) did record participant views as a secondary outcome, however only quantitative studies were included. It does not allow for complex questions to be answered, nor does it allow for the multiple causal pathways, interactions or outcomes of a complex intervention to be synthesised (Noyes et al., 2016). This therefore means that policy makers and those planning interventions are likely to pick components of interventions without taking into account participant views (Candy et al., 2013).

Using a mixed methods approach (QCA), trials included in this Cochrane review of lifestyle interventions for adolescent obesity were reanalysed with findings from the qualitative systematic review of views of overweight or obese adolescents attending lifestyle treatment interventions to support interpretation of included studies. Further justification for using QCA is given in Chapter 3, section 3.2.

#### *1.6.3.3 Phase three: Primary research*

Research that explores adolescent and professional stakeholder views of WMPs in the UK, at both a local and national level, is limited. As key members involved in the functioning of these programmes, their views should not be overlooked. Through a qualitative enquiry, phase three aims to advance knowledge of stakeholder and adolescent views of WMPs. Phase 1 (Chapter 2) has been used to inform interview and focus group guides for this phase of the research to investigate the findings further at a local level in Wolverhampton, part of the West Midlands. The Hearty Lives (HL) WMP of which this phase is centred, is a home-based intervention involving children and adolescents, who are overweight or obese, and their families. This WMP has been targeted because of its mission to prioritise adolescents with obesity (See section 4.3.2 for more details of the HL programme). In addition, the researcher had previous involvement working on this WMP prior to starting this PhD. This resulted in key links being established which may have

helped in the recruitment and design of this research phase. Chapter 5, section 5.9 describes this further.

A qualitative approach has been taken as it can provide an in-depth understanding from the perspectives of participants (Green & Thorogood, 2014). Additionally, qualitative research is well suited to maintaining the content and complexities of data and allows for discovery of central themes (Atieno, 2009). A more detailed rationale, including the use of qualitative methods, is discussed in Chapter 4.

#### 1.6.4 Philosophical and theoretical foundations

This research adopted a pragmatist orientation, where practical approaches were followed using the most appropriate combination of methods to address the research questions (O'Reilly & Kiyimba, 2015). An example of this was taking a qualitative approach to gather adolescent and stakeholder views in Chapter 4.

Elements of a naturalism orientation will also be applied. By using qualitative methods, such as interviews, the researcher is interested in accessing participants' world views, rather than the researchers. Taking this approach means that the researcher is more interested in everyday, real life rather than ideal situations (Green & Thorogood, 2014). It is possible that the previous professional experience of the researcher, in adolescent lifestyle obesity treatment interventions, may have led to preconceived ideas that could influence interpretation of adolescent views. However, with this interest and experience the researcher is sensitive to the depth and importance of the topic and the wider implications on PH. To overcome this and in order to ensure validity, principles of reflexivity were carried out by being sensitive and critical to the role of the researcher in the research process (Pope & Mays, 2000).

This research will be underpinned by social-ecological frameworks of health behaviour (McLeroy et al., 1988; Stokols, 1996). Social-ecological frameworks of health behaviour posit that outcomes are not only influenced by individual level factors but also by the larger environmental contexts in which individuals reside (Ohri-Vachaspati et al., 2015). These frameworks suggest that there are five interrelated levels that affect health behaviour including the individual, interpersonal, institutions/organisation, community, and societal structures and systems. A social-ecological framework has been chosen as a reminder that obesity is a complex multifactorial issue.

For the purpose of this PhD, a socio-ecological framework will be defined as follows:

- **Individual:** characteristics of an individual that influence behaviour change, such as socioeconomic status, knowledge, attitudes, personality traits, perceived free time
- **Interpersonal** – informal and formal social network and support systems, e.g. family, friends and professionals
- **Organisational** – formal and informal organisations, including educational, occupational and social institutions and what these organisations do to support behaviour change. This could include workplace interventions or development of community fitness facilities. For this PhD aspects of WMPs and analytical themes relating to the WMP content and delivery will be mapped the SEF within this section.
- **Community** – the relationships and social networks between community organisations, institutions, and neighbourhoods. Perception of safety, park and recreation facilities would also come under this section as well as the obesogenic food environment.
- **Societal** – Local and national public policy influences, including allocation of resources regarding WMP development and implementation.

Findings from chapters 2 and 4 have been mapped to the SEF and can be seen in Table 2.6 (Chapter 2) and Table 4.1 (Chapter 4). Regardless of epistemological stance, quality, otherwise known as rigour, has been of utmost importance in each phase of this PhD. Terms such as reliability and validity are typically associated with quantitative research. Validity can be viewed as the integrity or appropriateness of methods used, including tools and processes, and how accurately findings reflect the data. Reliability refers to the exact replication of processes and results (Leung, 2015). It can be argued that validity and reliability can be applied to qualitative research, however the meaning ascribed to these terms, as well as how they are assessed, may be different. For example, assessing reliability in qualitative research is more challenging, and repeatability of exact results may not be possible (Carcary, 2009; Noble & Smith, 2009). Therefore, reliability in qualitative research relates more to ensuring that data is not misrepresented and/or the researcher has not been careless during data collection and analysis (Carcary, 2009). Enhancing reliability in qualitative research can be demonstrated through procedural transparency, consistency in data collection and analysis, auditing and reflection (Carcary, 2009; Grosseohme, 2014). Various ways of improving validity, often referred to as credibility in qualitative research (Pope & Mays, 2006), have been suggested. These

include respondent validation, clear accounts of data collection and analysis, reflexivity and incorporating a wide range of different perspectives (Grossoehme, 2014; Pope & Mays, 2006).

Principles of both reliability and validity, as applied to qualitative research, have been ensured throughout this PhD and approaches to ensure quality in this, mostly qualitative, PhD are expanded on in more detail in individual chapters (2-4). A summary of the application of these principles are shown in Table 1.3.

#### 1.6.5 Research governance and funding statement

This PhD was funded through the NIHR CLAHRC West Midlands. Research ethics approval was obtained for phase 3 of this PhD from the University of Warwick's Biomedical and Scientific Research Ethics Sub-Committee (BSREC) (REGO-2018-2149 AM01) in June 2018 (Appendix 1).

#### 1.7 Chapter summary

This chapter aimed to lay the foundations for this PhD by giving an overview and introduction to the challenge and complexities of adolescents with obesity. The literature review included in this chapter gives an outline of current obesity treatment options for adolescents as well as insight into the challenges of engagement. From identifying gaps in the evidence base, research questions were developed that have been used to form the three main phases of this PhD (Chapters 2-4). The justification for the chosen research design is also given; these are expanded upon in Chapters 2-4.

Chapter 2 will report phase 1 of this PhD, a qualitative systematic review exploring adolescent views of WMPs.

**Table 1.3 Principles of validity and reliability applied in this PhD**

<b>Chapter</b>	<b>Application of validity</b>	<b>Application of reliability</b>
Chapter 2	<ul style="list-style-type: none"> <li>• Clear account of data collection and analysis procedure using a systematic method.</li> <li>• Participant perspectives clearly presented with rich detailed quotes offered.</li> <li>• Two reviewers involved at initial screen, full-text screen, data extraction and quality assessment stages.</li> <li>• Analysis audited by a second reviewer.</li> <li>• CERQUal quality assessment tool used and audited by a second reviewer.</li> </ul>	<ul style="list-style-type: none"> <li>• Quality assessment tool included reliability ratings.</li> <li>• Protocol registered with PROSPERO and a systematic process was adhered to throughout.</li> <li>• Qualitative memos were written by the researcher throughout the synthesis to document decisions, record thoughts and reflect.</li> <li>• Constant comparison method applied as part of thematic synthesis.</li> </ul>
Chapter 3	<ul style="list-style-type: none"> <li>• Coded by two reviewers. Reviewed by a third when necessary.</li> <li>• Clear accounts of data collection and analysis.</li> </ul>	<ul style="list-style-type: none"> <li>• Clear and transparent procedure described, including how quantitative trials were selected and the six steps of QCA.</li> <li>• Auditable memos were created by the researcher alongside analysis.</li> </ul>
Chapter 4	<ul style="list-style-type: none"> <li>• Clear accounts of data collection and analysis.</li> <li>• Reflexive account of researcher's previous involvement in the WMP in question described.</li> <li>• A draft version of this chapter for publication was provided to stakeholders to allow member checking.</li> <li>• Clear presentation of stakeholder perspectives, supported by rich quotes.</li> </ul>	<ul style="list-style-type: none"> <li>• Constant comparison method applied as part of thematic analysis.</li> <li>• Clear and transparent procedure applied.</li> </ul>
Overall	<ul style="list-style-type: none"> <li>• Triangulation of using three studies to contribute to answer the overall question of this PhD</li> </ul>	<ul style="list-style-type: none"> <li>• A detailed reflexive account of the overall PhD process (section 5.9)</li> </ul>

## Chapter 2. Viewpoints of adolescents with overweight or obesity attending lifestyle obesity treatment interventions: a qualitative systematic review

### 2.1 Chapter outline

This chapter reports on a qualitative systematic review exploring the viewpoints of adolescents with overweight or obesity that have attended a lifestyle WMP. The findings of this review have been used to inform phase 2 (Chapter 3) and phase 3 (Chapter 4) of this research.

This qualitative systematic review was published in 2018 (Jones et al., 2018). The final manuscript draft can be seen in Appendix 2.

### 2.2 Introduction

Obesity is widely observed as a significant PH issue. A third of children in England are affected by overweight or obesity (Van Jaarsveld & Gulliford, 2015). Worldwide, the prevalence of children (2-19 years) with overweight or obesity has increased by 47.1% between 1980 and 2013 (Ng et al., 2014). WHO classifies adolescence as the stage in growth and development occurring between the ages of 10 to 19 (World Health Organization, 2016b). Adolescence is a stage where progression of obesity is likely to occur (Patton et al., 2011). Observational studies highlight the rising prevalence of T2DM in adolescents with obesity and CVD risk factors such as hypertension and hyperlipidaemia (Freedman et al., 2007a; Haines et al., 2007). In addition to CVD risk factors, sleep apnoea is thought to occur in 60% of children affected by obesity globally (Narang & Mathew et al., 2012). Obesity during adolescence is also associated with psychosocial consequences such as low self-esteem, self-worth and bullying (Curtis et al., 2008; Martin et al., 2011). This is especially concerning as a recent systematic review showed 80% of adolescents with obesity remain affected by obesity into adulthood where both these physical and psychosocial factors persist (Fenner et al., 2013). The current recommendations in England and Wales are for adolescents with obesity to attend a family-based multi-disciplinary WMP (NICE, 2013a). Multi-disciplinary refers to programmes that focus on a combination of healthy eating, PA and behaviour change. Cochrane reviews have shown that lifestyle programmes can be effective in reducing adiposity (Al-Khudairy et al., 2017; Luttikhuis et al., 2009; Waters et al., 2011). However, due to the quantitative nature of these reviews, we do not know why these programmes are effective in reducing adiposity or why they

only successfully recruit between 0.5 and 1.5% of the eligible population (NICE, 2013b). For those children that do attend obesity interventions attrition ranges from 8-83% (Dhaliwal et al., 2014; Skelton et al., 2011). This is of concern, as increased participation is associated with more successful outcomes (Miller & Brennan, 2015). By learning from adolescents that have attended WMPs, improvements can be made that may help reduce attrition and improve recruitment rates, and therefore weight management. Qualitative research can give a more in-depth understanding of participant perception (Butler et al., 2016) and has a central role to play in evidence-based health care. A qualitative approach can help to address questions that cannot be answered quantitatively, such as identifying obstacles to change and what is important for the participant (Munn et al., 2014). A synthesis of qualitative research focusing on the experiences of adults attending weight management interventions has been completed (Garip & Yardley, 2011), however, systematic reviews that help us decide how to treat obesity in adolescents is limited. While adolescent experiences, along with child, parent and professional views of child and adolescent obesity have been synthesised (Lachal et al., 2013; Rees et al., 2014), to the authors knowledge this is the first review to solely examine adolescent views of weight management interventions.

### 2.3 Study aims

This review aims to examine the viewpoints of adolescents with obesity who have attended a weight management intervention in studies that present qualitative data.

### 2.4 Methods

The protocol for this qualitative systematic review has been registered with PROSPERO (registration # CRD42016039588) (Jones et al., 2016).

#### 2.4.1 Search strategy

Published literature was identified primarily by searching MEDLINE and Embase through the OVID platform, PsycINFO and ASSIA through the ProQuest platform, CINAHL through the EBSCOhost platform, and Web of Science. Electronic databases were searched from inception to July 2016. These databases represent the fields of health, psychology and social science. To identify further studies, reference lists of included studies and relevant systematic reviews were screened. Three key journals were manually searched: International Journal of Behavioral Nutrition and PA, Adolescent Obesity and, PH. A specialist librarian was consulted to refine the search strategy twice prior to the searches being conducted. The research question, and therefore search terms, were developed

based on the SPICE approach (see Table 2.1). The SPICE approach is an appropriate method for formulating research questions within qualitative evidence syntheses (Booth, 2006). Its components are setting (S), perspective (P), intervention (I), comparison (C), evaluation (E). Search terms for the primary database search included concepts for obesity, views, adolescents, diet, activity and behaviour. ‘Views’ were defined as experiences, opinions, attitudes, satisfaction and preference. Search limits included human studies. A pilot search was carried out to identify any adjustments that may have been needed; search terms were adapted to different databases accordingly (Appendices 3-7). There was no limit on language or year of study to ensure all possible papers related to the theme were identified. The search string as run in MEDLINE is given in Table 2.2. The searches were re-run in July 2018.

**Table 2.1 Research question based on SPICE approach (Booth, 2006)**

<b>SPICE</b>	<b>Description</b>
<b>Setting</b>	Any
<b>Perspective</b>	Overweight and obese adolescents aged 12-17 years. To include studies with a wider age range as long as they have a mean age of 12-17 years.
<b>Intervention</b>	Lifestyle interventions for the treatment of overweight or obesity. Diet, PA and/or behavioural interventions in either a multi-disciplinary or single approach.
<b>Comparison</b>	N/A
<b>Evaluation</b>	Views and experiences.

#### *2.4.1.1 Inclusion criteria*

This systematic review had the following inclusion criteria, derived from the research question (see Table 2.1): (i) studies must have used qualitative methods for data collection (e.g. in-depth or semi-structures interviews, and/or focus groups) and analyses (e.g. thematic analysis), (ii) adolescents with overweight and obesity participating in lifestyle interventions with the primary aim of treating obesity, (iii) mean age of 12-17 years at time of the study commencing (to align with the age range used in the Cochrane adolescent obesity treatment review series). Studies with a wider age range were included if the mean age was 12-17 years, (iv) single or multi-disciplinary lifestyle interventions (dietary and/or PA and/or behavioural element), in any setting, (v) any methods of delivery, e.g. group, one-to-one, home-based were included besides those investigating weight loss and/or weight loss maintenance, (vi) full text articles only.

**Table 2.2 MEDLINE search**

Number	Searches	Results
1	Exp Obesity/ or obes* .mp.	242564
2	overweight.mp. or exp Overweight/	183771
3	body weight.mp. or exp Body weight/	485372
4	body mass index.mp. or exp Body mass Index/	159627
5	1 or 2 or 3 or 4	632007
6	Patient satisfaction.mp. or exp Patient Satisfaction/	79798
7	exp Attitude/ or attitude*.mp.	337234
8	exp Attitude to Health/	340049
9	exp Patient Preference/	4663
10	preference*.mp.	109573
11	view*.mp.	338314
12	experiences*.mp.	127567
13	opinion*.mp.	82517
14	qualitative research.mp. or exp Qualitative Research/	33475
15	6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14	782304
16	diet.mp. or exp Diet/	381891
17	nutrition.mp.	171014
18	PA.mp. or exp Motor Activity/	258395
19	exp Exercise/ or exercise.mp.	294114
20	health behavio?r.mp. or exp Health Behaviour/	144927
21	behavio?r change.mp.	7749
22	health promotion.mp. or exp Health Promotion/	72529
23	exp Behavior/ or behavio?r.mp.	1765389
24	Behavio?r therapy.mp. or Behavior Therapy/	61092
25	exp Counseling/ or counsel?ing.mp.	91413
26	nutritional support.mp. or exp Nutritional Support/	43024
27	social support.mp. or exp Social Support/	67467
28	16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27	2549921
29	exp Adolescent/ or adolescen*.mp.	1792851
30	teen*.mp.	22855
31	youth.mp.	44165
32	young person*.mp.	2669
33	young adult*.mp.	577014
34	29 or 30 or 31 or 32 or 33	2072001
35	5 and 15 and 28 and 34	5627
36	Limit 35 to humans	5553

#### 2.4.1.2 Exclusion criteria

(i) Children under 12 years or adults over 18 years, (ii) adolescents who were a healthy weight (>2<sup>nd</sup> to <85<sup>th</sup> percentile), pregnant or breastfeeding, (iii). Interventions aiming to treat adolescents with a medical cause for obesity (E.g. Prader Willi syndrome), (iv) conference abstracts, (v) no qualitative data. Three exclusion criteria were not originally set out in the protocol but added later: (vi) adolescents with an eating disorder, (vii)

adolescents with severe long-term mental health conditions, e.g. schizophrenia, (viii) studies where participants had not experienced an actual programme as it was felt that views of what adolescents think they want from an intervention may be different if they have actually attended an intervention. Exclusion criteria (vi) and (vii) were set because these groups may require more specialist intervention.

#### 2.4.2 Study selection

For screening, titles and abstracts of the identified records were assessed in EndNote by the researcher (HMJ) following a pre-defined checklist based on the inclusion and exclusion criteria mentioned in sections 2.4.1.1 and 2.4.2.2 (Appendix 8). A random 10% sample of records (n=2000) was assessed independently by a second reviewer (OO, LA-K) (n=1000 each). Random selection was conducted by generating 1000 random numbers in Microsoft Excel for each reviewer. The corresponding record number was then reviewed using EndNote. However, only seven studies out of 33 that were included by the second reviewer were in agreement with the 1<sup>st</sup> reviewer. Due to low agreement (21.2%) all titles and abstracts were screened by a second reviewer independently (LA-K, GJMT, OO) using Rayyan text mining computer software (see Figure 2.1). Having at least two reviewers reduces study selection bias and error, and therefore increases trustworthiness (Butler et al., 2016). Records were only excluded at this point if title and abstracts were clearly not relevant.

For formal inclusion/exclusion, full texts were retrieved for any papers that were potentially relevant. The inclusion/exclusion form was piloted initially with a number (n=3) of studies by one reviewer (HMJ). Full-texts were then evaluated by two independent reviewers (HMJ who read all full texts; LA-K, GJMT, OO who reviewed a third each) against the pre-defined inclusion and exclusion checklist that was developed for this review (Appendix 8). If a paper was excluded after reading the full text, a reason for exclusion was listed and any differences in opinions were resolved by a third reviewer (LA-K, GJMT, OO).



Figure 2.1 Rayyan systematic review web application (Ouzzani et al., 2016)

#### 2.4.3 Data extraction

A data extraction form was developed specifically for this review using Google Forms and piloted on a number ( $n = 3$ ) of studies. Data extraction was carried out by two independent reviewers (HMJ, LA-K, OO). Any disagreements were resolved through discussion. Items included on the data extraction form are shown in Table 2.3. Where information was not given in the study, e.g. mean age, authors were contacted. If authors did not respond within 3 months they were contacted again. If there was still no response, studies were excluded with the reason listed as 'no response from study author' (See Figure 2.4).

#### 2.4.4 Quality assessment

There is much debate around quality assessment in the field of qualitative research (Thomas & Harden, 2008), even whether it should be performed at all (Seers & Toye, 2012). Quality assessment was performed for this review, alongside data extraction, to ensure that studies were methodologically sound and to avoid reaching conclusions that relied mostly on low quality studies. There is continuing debate over the most suitable tool for critical appraisal of qualitative research (Butler et al., 2016). In this case, methodological quality was assessed by criteria developed by the Evidence for Policy and Practice Information and Coordinating Centre (EPPI-Centre) for reviews of school-based

interventions (See Table 2.4 for criteria) (Bonell et al., 2013; Shepherd et al., 2010). This tool was chosen as it assessed the extent to which the study privileged adolescent experiences. This tool also assessed the strength of sampling, data collection and analysis, whether the findings were supported by data, as well as breadth and depth of findings. Guidance for undertaking quality assessment is shown in Appendix 9. Based on the criteria listed, the studies were rated as low, medium or high in terms of trustworthiness and reliability of findings. Studies were also rated low, medium or high in terms of usefulness for this review. Two reviewers assessed quality independently (HMJ, LA-K, OO). Any disagreements were resolved through discussion.

There was no plan to exclude methodologically weak studies, as there was a possibility of disregarding valuable insights. Studies with weak methodology may offer insights that are not present in other studies. Therefore, a balance between methodological flaws and relevance of findings is needed (Hannes, 2011). Studies rated high, in terms of trustworthiness and reliability, were analysed first, with those rated as low being analysed last.

#### 2.4.5 Assessment of confidence in the review findings

The Confidence in the Evidence from Reviews of Qualitative research (CERQual) approach was utilised to summarise the confidence in the findings across studies (Lewin et al., 2015). Confidence can be described as the “extent to which the review finding is a reasonable representation of the phenomenon of interest” (Lewin et al., 2015:5). The CERQual approach provides researchers with the ability to gauge how much emphasis to give to an individual review finding. This is based on four key components: methodological limitations of included studies, relevance of the included studies to the review question, coherence of the review finding, and adequacy of the data contributing to a review finding (Lewin et al., 2015). For the first component, methodological limitations were assessed through a critical appraisal tool detailed previously (Bonell et al., 2013; Shepherd et al., 2010). For the second, relevance could be indirect, partial or uncertain and relates to how applicable the primary study is to the review question (Lewin et al., 2015). The third component, coherence, involved the degree to which a clear pattern across study findings could be identified. If convincing explanations for variations in data could not be developed, then less confidence would be placed in the review finding (Rashidian et al., 2013). The fourth component of CERQual is adequacy of data, which is related to the richness and quantity of data (Lewin et al., 2015). After assessing each of the four

components, overall confidence of findings, in this case analytical themes, were judged as high, moderate, low or very low by one reviewer (HMJ) and audited by a second reviewer (GJMT).

#### 2.4.6 Synthesis

Data were analysed using thematic synthesis as described by Thomas and Harden (2008). This method of qualitative synthesis arranges qualitative evidence for intervention development as well as practice-based relevance (Nye et al., 2016). Its iterative and inductive nature was chosen for its ability to identify themes in a structured way (Noyes & Lewin, 2011).

One of the strengths of thematic synthesis is that it brings together characteristics from both meta-ethnography and grounded theory. Thematic synthesis uses the 'constant comparison' method of grounded theory (Glaser & Strauss, 2017), whilst stage three of thematic synthesis, where analytical themes are generated, can be compared to 'third order interpretations' as used in meta-ethnography (Noblit & Hare, 1988). The development of both these descriptive and analytical themes also involve 'translation'; another method used in meta-ethnography. Thematic synthesis also looks more at the differences in participants and context of the primary studies, to see if differences in perspectives can be explained (Barnett-Page & Thomas, 2009). The inductive nature of thematic synthesis is another reason why a more deductive method, such as Framework synthesis, was not used. Framework synthesis employs an *a priori* framework, leading the results to be framed by background material. This was not appropriate for this review, to ensure that pre-conceptions based on the researcher's prior professional experience with adolescent WMPs did not affect the results.

Full texts were exported to NVivo version 11. Thematic synthesis was completed by one reviewer (HMJ) and audited regularly by a second reviewer (GJMT, OO). Thematic synthesis took the form of three stages detailed below:

Stage 1) Developing descriptive codes: findings (both participant and researcher quotes) from each primary study included were coded line by line. Sentences had at least one code applied to them and were categorised using several codes if appropriate (i.e.: where a sentence was relevant to more than one code). Meaning and content of sentences were examined through this process. As the number of codes grew, the first reviewer (HMJ) looked for similarities and differences between codes. This stage enabled the reviewer to consider whether findings translated between studies. As familiarity with the codes and

data grew, data were then coded into pre-existing descriptive codes if the meaning was the same between studies.

Stage 2) Developing descriptive themes: this stage involves analysing the codes by meaning and organising into categories. New themes were created to capture the meaning of clusters of descriptive codes. An example is given below in Figure 2.2. For instance, two descriptive codes, 'Driven by preventing health sequelae' and 'preference for focusing on health rather than weight loss' were grouped together to create the descriptive theme 'driven to reduce weight to improve health'.

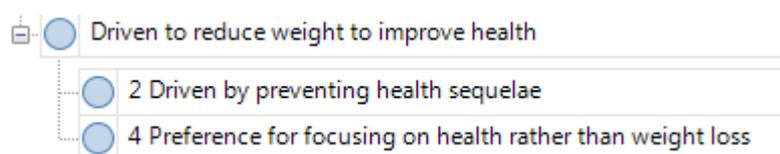


Figure 2.2 Example descriptive theme development in NVivo

Stage 3) Generating analytical themes: each descriptive theme was explored in depth and similarities and differences between other themes were noted. Similar descriptive themes were grouped together and developed into analytical themes. This final analytical stage began to move away from the primary studies with the aim of generating original explanations. An example of generating the analytical theme 'concise, practical and prescriptive support wanted' is given below (Figure 2.3). The descriptive codes 'adolescents want a prescriptive diet' and 'preference for a strict daily regime of mealtimes and exercise' were grouped together to form the descriptive theme 'adolescents want prescriptive diet and exercise regime', whilst the descriptive codes 'concise messages and concrete strategies', 'impractical messages are not liked' and 'preference for practical tips in messages' were grouped together to form the descriptive theme 'practical and concise messages delivered in an intervention'. Both these descriptive themes were then brought together to form the analytical theme 'concise, practical and prescriptive support wanted'.



Figure 2.3 Example of analytical theme development in NVivo

Analytical themes were developed with barriers and facilitators to obesity interventions in mind, as well as intervention implications. This was so the findings could be used to create recommendations for intervention development. This was a particularly useful approach when working through initial descriptive codes that were not strong enough on their own and did not fit naturally with other codes to create descriptive themes. Through this process, weaker codes, those that were supported by less evidence, were grouped together with stronger descriptive themes to aid development of analytical themes. An example of where these weaker codes were grouped alongside descriptive themes to develop an analytical theme is with the initial codes ‘adolescents want more PA sessions’ as part of an intervention and ‘desire for more PA at school’. Supporting data within these codes were reassessed. The first included data on PA booster sessions used in the maintenance period of an intervention. The latter, relating to PA in schools, was also an important factor in the maintenance period after an intervention had finished. Although both codes had a different context both recognised and contributed to the analytical theme ‘longer-term support’, an important aspect to consider when implementing an intervention.

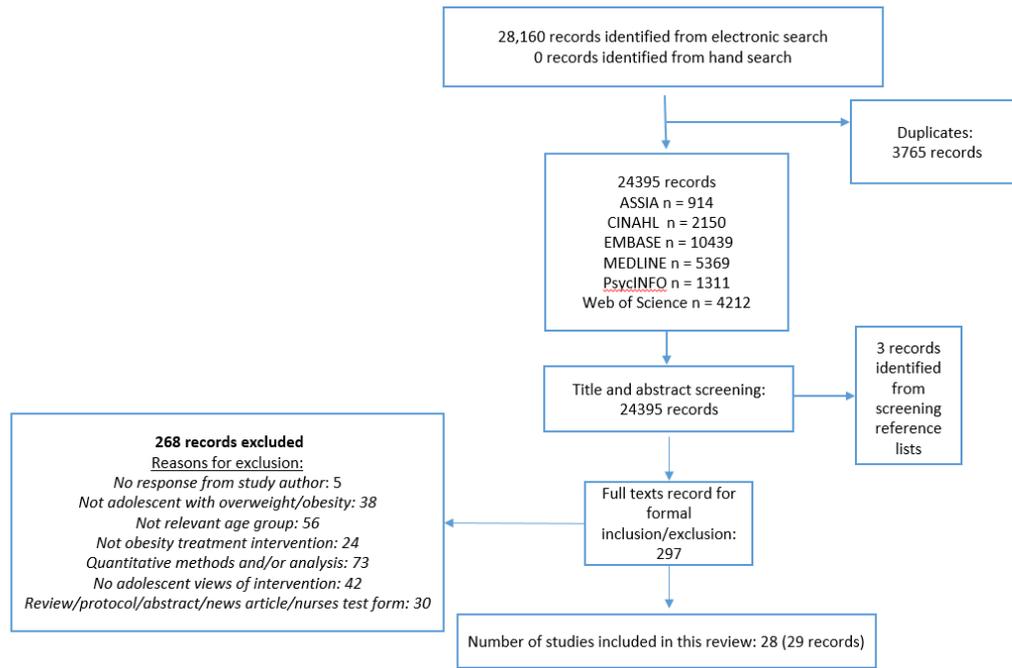
Qualitative memos were written by the researcher (HMJ) throughout the synthesis to record thoughts, reflect on the process and articulate interesting observations. Memos were created initially after analysing three included studies. Details were written around what new descriptive codes emerged as well as what codes strengthened already existing codes. Due to the large number of descriptive codes that arose through stage one of the thematic synthesis process (see results section 2.5.4), codes were printed out and were

consolidated manually. Meanings of codes were checked by returning to data regularly to ensure they were being interpreted correctly.

## 2.5 Results

### 2.5.1 Study characteristics

After removing duplicates, 24,395 citations were screened (title and abstract), with 297 full texts evaluated for formal inclusion/exclusion. Twenty-eight studies (29 records) were then included in the qualitative synthesis (See Figure 2.4). The included studies represent views of 735 adolescent, 662 of which were identifiable by gender (41.0% male, 58.9% female). Nine studies were from the UK, eight from the USA, four from Australia, four from Europe, two from Canada and one from China. Twenty-four of the studies were of multi-disciplinary interventions (Alm et al., 2008; Banks et al., 2014; Campbell-Voytal et al., 2018; Engstrom et al., 2016; Hemetek et al., 2015; Hester et al., 2009; Holt et al., 2005; Howie et al., 2016; Jogova et al., 2013; Li et al., 2016; Melnyk et al., 2007; Morinder et al., 2011; Nguyen et al., 2014; Owen et al., 2009; Peeters et al., 2012; Reece et al., 2016; Rudolf et al., 2006; Smith et al., 2014a; Smith et al., 2014b; Twiddy et al., 2012; Watson et al., 2016; Woolford et al., 2010; Woolford et al., 2012a; Woolford et al., 2012b). Three studies examined single-component PA interventions (Daley et al., 2008; Riiser et al., 2018; Staiano et al., 2012) and one was a single-component dietary intervention (Hammar et al., 1971). Seven studies had a technology element to the intervention (e.g. web-based, text or email support, photos, exergame) (Jogova et al., 2013; Nguyen et al., 2014; Riiser et al., 2018; Smith et al., 2014a; Staiano et al., 2012; Woolford et al., 2010; Woolford et al., 2012a). Features of interventions, including direct provision of PA or a peer element are shown in Table 2.3.



**Figure 2.4 COREQ flow diagram of search results**

**Table 2.3 Characteristics of included studies**

<b>Author (Date)</b>	<b>Aims</b>	<b>Features</b>	<b>Country</b>	<b>Population</b>	<b>Data collection methods</b>	<b>Data analysis methods</b>
<b>Alm (2008)</b>	To examine the reasons for managing weight, to investigate the barriers and facilitators to achieving behaviour goals, and assess how a behaviour coach affects the goal-setting process of inner-city adolescents with obesity in a weight management program	MC	USA	Adolescents with overweight/obesity (n=18) Male: 6 (33%) Female: 12 (67%) Mean age: 14.9 years	Semi-structured telephone interviews	Constant comparative method
<b>Banks (2014)</b>	To examine families' reasons for engaging with, or disengaging from, a child weight management clinic	MC, G	UK	Adolescents with overweight (n = 17) 11-16 years old Completers' and withdrawers	Semi-structured interviews	Analysed thematically
<b>Campbell-Voytal (2018)</b>	1) To describe the perspectives of African American adolescents and caregivers on participating in an evidence-based weight loss trial; 2) Explore experiential differences of adolescents-caregiver dyads who achieved adolescent weight loss compared to those who did not	MC	USA	Adolescents with Obesity (n=136) Male: 42 (31%) Female: 94 (69%) Mean age: 13	Semi-structured interviews	Content and thematic analysis
<b>Daley (2008)</b>	To explore the experiences of participants who were randomised to an exercise therapy intervention	S, PA	UK	Adolescents with overweight (n=25) Male: 9 (36%) Female: 16 (64%) Mean age: 13 years	Semi-structured interviews	Thematic approach
<b>Engström (2016)</b>	To explore adolescents' and young adults' motivation for attending group-based obesity treatment and social and	MC, PA, G	Norway	Adolescents with obesity (n=14)	Focus group interviews	Systematic text condensation (method

	environmental factors that can facilitate or hinder lifestyle change.			Male: 7 (50%) Female: 7 (50%) Age: 13-17 years		for thematic cross-case analysis)
<b>Hammar (1971)</b>	Which method of treatment for obesity (dietary, counselling or group) resulted in the best weight loss over time. Also, to evaluate clinic experience	S, G	USA	Young people with overweight/obesity (n= 65) Male: 17 (26%) Female: 48 (74%) Mean age 14.8 years	Questionnaires . Additional face-to-face meeting or telephone inquiry with a clinic nurse if necessary	Frequency counts and statements
<b>Hemetek (2015)</b>	To optimise therapy measures in the treatment of children and adolescents with obesity	MC, PA, G	Germany	Adolescents with overweight (n=7) Male: 4 (57%) Female: 3 (43%) Mean age: 14.6 years	Interviews	Qualitative context analysis
<b>Hester (2009)</b>	To uncover qualitative accounts of intervention impact from young people with obesity after attending a residential weight-loss camp	MC, PA, G	UK	Adolescents with overweight (n=5) Male: 3 (60%) Female: 2 (40%) 14-16 years old.	Semi-structured interviews	Inductive analysis.
<b>Holt (2005)</b>	Examined children's perceptions of attending a residential paediatric weight-loss camp	MC, PA, G	UK	Adolescents with overweight (n= 15) Male: 9 (60%) Female: 6 (40%) Mean age: 13.65 years	Semi-structured interviews	Micro-analysis and constant comparative method.
<b>Howie (2016)</b>	To identify practical strategies for practitioners implementing interventions in community settings by exploring	MC, PA, G	Australia	Adolescents with overweight/obesity (n=37)	Qualitative interviews and focus groups	Thematic analysis

	experiences of adolescents with overweight or obesity				Age: 12-16 years		
<b>Jogova (2013)</b>	A process evaluation of the Living Green, Healthy and Thrifty (LiGHT) program: a novel virtual child obesity management program	MC	Canada	Adolescents with overweight/obesity (n = 28) Male: 14 (50%) Female: 14 (50%) Mean age: 14.3 years	Semi-structured interviews, focus group and survey with open-ended questions	Thematic analysis for post intervention groups	
<b>Li (2016)</b>	To investigate the operations of a weight loss camp for children in China and to explore the experiences and perceptions of children in relation to these camps	MC, PA, G	China	Adolescents with overweight/obesity (n=19) (2 participants were a 'normal' weight) Male: 9 (47%) Female:10 (53%) Mean age: 12.4 years	Ethnographic techniques (field observation) and semi-structured interviews	Thematic analysis	
<b>Melnyk (2007)</b>	a) Determine feasibility of implementing the interventions b) obtain feedback c) examine the preliminary efficacy of the programme on the adolescents' weight	MC, PA, G	USA	Adolescents with overweight/obesity (n=23) Male: 19 (83%) Female: 4 (17%) Mean age 15.9 years	Questionnaire (including open-ended)	Not stated	
<b>Morinder (2011)</b>	To describe adolescents' perceptions of obesity treatment.	MC, PA, G	Sweden	Adolescents with obesity (n = 18) Male: 6 (33%) Female: 12 (67%) Mean age: 15 years	Semi-structured interviews	Phenomonographic approach	

<b>Nguyen (2014)</b>	1) Report findings from the process evaluation of the Loozit programme including adolescent perception of the programme 2) provide recommendations for future trials	MC, PA, G	Australia	Adolescents with overweight/obesity (n=14) Mean age: 14.1 years	Evaluation forms and telephone interviews	Qualitative items identified and coded
<b>Owen (2009)</b>	To explore childrens' and parents' views and experiences of attending a hospital-based childhood obesity clinic	MC	UK	Children with obesity (n = 11) Male: 5 (45%) Female: 6 (55%) Age: 5-18 years	Interviews	Thematic analysis
<b>Peeters (2012)</b>	To investigate adolescents' experiences during their participation in the HEARTY RCT	MC, PA, G	Canada	Adolescents with overweight/obesity (n= 44) Male: 23 (52%) Female: 21 (48%) Mean age: 16.7 years	Semi-structured telephone interview	Content analysis
<b>Reece (2016)</b>	To explore the adolescent experience of living with obesity and their engagement with obesity treatments	MC, PA, G	UK	Adolescents with overweight/obesity (n = 12) Male: 4 (33%) Female: 8 (67%) 11-16-year olds	Interviews and focus groups	Framework method
<b>Riiser (2013)</b>	To describe the process of development and evaluation of usability of a web-based program for increasing PA in adolescents who are overweight	S,	Norway	Adolescents with overweight/obesity (n = 15) 12-16-year olds	Observation, questionnaire and focus group	Content analysis
<b>Rudolf (2006)</b>	To ascertain if the programme was successfully implemented, impact on	MC, PA, G	UK	Adolescents with overweight/obesity (n=20)	Semi-structures	framework analysis

	children and their families and the outcome on the health of the young people involved				Male: 14 (70%) Female: 6 (30%) Mean age: 12.2 years	interviews & focus groups	
<b>Smith (2014a)</b>	To explore the opinions of adolescents who are overweight and their parents regarding the use of text messages support during the maintenance period following an intervention	MC, PA, G	Australia		Adolescents with overweight/obesity (n = 12) Male: 1 (8%) Female: 11 (92%) Mean age 14.3 years	Focus groups	Thematic analysis
<b>Smith (2014b)</b>	To identify key individual, family and community enablers/barriers to the implementation of a multi-disciplinary family-centred intervention for adolescents who are overweight	MC, PA, G	Australia		Adolescents with overweight/obesity (n = 44) Male: 21 (48%) Female: 23 (52%) 12-16 years old	Focus groups and interviews	Thematic analysis
<b>Staiano (2012)</b>	To investigate effects of cooperative versus competitive exergame play during an intervention with youth with overweight or obesity	S, PA, G	USA		Adolescents with overweight/obesity (n = 31) Male: 16 (52%) Female: 15 (48%) Mean age: 16.2 years Also asked drop outs reasons for withdrawing	Individual interviews	Thematic analysis
<b>Twiddy (2011)</b>	The aim of the present qualitative study was to explore the views of the key stakeholders involved in child WMP	MC, PA, G	UK		Children with overweight/obesity (n= 23) Male: 13 (57%) Female: 10 (43%)	Semi-structured interviews & focus groups	Template analysis

				9-18-year olds (15 were 12- 18 years old) Range of completers and drop outs		
<b>Watson (2016)</b>	To explore children's accounts of their experiences of MEND	MC, PA, UK G		Adolescents with overweight/obesity (n = 14) Male: 8 (57%) Female: 6 (43%) Mean age: 12.6 years	Semi structured interviews	Interpretative Phenomenological Analysis (IPA)
<b>Woolford (2010)</b>	Test the feasibility and acceptability of a computerised system to send tailored messages to the mobile phones of adolescents with obesity enrolled in a WMP	MC, PA, USA G		Adolescents with obesity (n = 20) Male: 13 (65%) Female: 7 (35%) Mean age: 14 years	Survey and semi-structures interview	Unclear
<b>Woolford (2012a)</b>	Explore the Photovoice method to improve engagement and retention among adolescents with obesity enrolled in an intensive weight management program	MC, PA, USA G		Adolescents with obesity (n = 23) Male: 5 (22%) Female: 18 (78%) Mean age: 14 years	Photovoice and semi-structured interviews	Thematic analysis
<b>Woolford (2012b)</b>	To explore participants' perceptions of the MPOWER program	MC, PA, USA G		Adolescents with overweight/obesity (n = 25) Male: 4 (16%) Female: 21 (84%) 12-18-year olds	Semi-structured phone interviews	Thematic analysis

G = group programme with peer element; PA = direct provision of physical activity; MC = multi-component programme; S = single component programme

### 2.5.2 Quality assessment

In terms of trustworthiness and reliability, 11 studies were of high quality, 13 demonstrated medium quality and four demonstrated low quality. In terms of usefulness for this review, 12 studies were rated high, eight medium and eight low (Table 2.4). Sensitivity analysis was performed for study contribution (how many included studies contributed to each of the seven domains (see below) and study quality in terms of reliability and trustworthiness. Sensitivity analysis results were then combined to report the order of domains from most to least sensitive, in terms of quality and those with the greatest contribution of data.

### 2.5.3 Assessment of confidence

As described in section 2.4.5, the CERQual approach was used to assess the certainty of each review finding, grading each finding as either high, moderate or low certainty. 19 of the analytical themes were assessed to be of high certainty. Fourteen findings were assessed to be of moderate certainty and two of the findings were assessed to be of low certainty. Full CERQual results, including an explanation of CERQual assessments can be seen in (Table 2.5).

**Table 2.4 Quality assessment of included studies using criteria developed by the EPPI-Centre**

<b>Author (year)</b>	<b>Were steps taken to increase rigour in the sampling?</b>	<b>Were steps taken to increase rigour in the data collected?</b>	<b>Were steps taken to increase rigour in the analysis of the data?</b>	<b>Were findings of the study grounded in/supported by the data?</b>	<b>How did the findings of the study rate in terms of their breadth and depth?</b>	<b>To what extent did the study privilege the perspectives and experiences of children and/or young people?</b>	<b>Overall, what weight was assigned to this study in terms of reliability/trustworthiness of its findings?</b>	<b>What weight you assign the study in terms of the usefulness of its finding for this review?</b>
<b>Alm (2008)</b>	Yes, several steps were taken	Yes, a few steps were taken	Yes, a thorough attempt was made	Findings are fairly well grounded/supported	Good/fair breadth and depth	Somewhat	High	High
<b>Banks (2014)</b>	Yes, several steps were taken	Yes, several steps were taken	Yes, a few steps were taken	Findings are fairly well grounded/supported	Good/fair breadth and depth	A little	Medium	Medium
<b>Campbell-Voytal (2018)</b>	Yes, several steps were taken	Yes, a few steps were taken	Yes, a thorough attempt was made	Findings are fairly well grounded/supported	Good/fair breadth but very little depth	Somewhat	High	Medium
<b>Daley (2008)</b>	Yes, several steps were taken	Yes, a few steps were taken	Yes, a few steps were taken	Findings are well grounded/supported	Good/fair breadth and depth	Somewhat	High	High
<b>Engström (2016)</b>	Yes, a few steps were taken	Yes, several steps were taken	Yes, a thorough attempt was made	Findings are well grounded/supported	Good/fair breadth but very little depth	Somewhat	High	Medium

<b>Hammar (1971)</b>	Yes, several steps were taken	Yes, a few steps were taken	Unclear	Limited grounding/support of findings	Limited breadth or depth	A little	Low	Low
<b>Hemetek (2015)</b>	Yes, several steps were taken	Yes, a few steps were taken	Yes, a few steps were taken	Findings are fairly well grounded/supported	Good/fair breadth and depth	A lot	Medium	High
<b>Hester (2009)</b>	Yes, several steps were taken	Yes. A thorough attempt was made	Yes, a few steps were taken	Findings are well grounded/supported	Good/fair breadth and depth	A lot	High	Medium
<b>Holt (2005)</b>	Yes, several steps were taken	Yes. A thorough attempt was made	Yes. A thorough attempt was made	Findings are well grounded/supported	Good/fair breadth and depth	A lot	High	High
<b>Howie (2016)</b>	Yes, a few steps were taken	Yes. A thorough attempt was made	Yes. A thorough attempt was made	Findings are fairly well grounded/supported	Good/fair breadth but very little depth	Somewhat	High	High
<b>Jogova (2013)</b>	Yes, a few steps were taken	Yes, a few steps were taken	Yes, a few steps were taken	Findings are fairly well grounded/supported	Good/fair breadth but very little depth	Somewhat	Medium	Medium
<b>Li (2016)</b>	Yes, a few steps were taken	Yes. A thorough attempt was made	Yes, a few steps were taken	Findings are well grounded/supported	Good/fair breadth but very little depth	Somewhat	Medium	High
<b>Melnyk (2007)</b>	Yes, several steps were taken	Yes, a few steps were taken	Unclear	Limited grounding/support of findings	Limited breadth or depth	A little	Low	Low

<b>Morinder (2011)</b>	Yes, several steps were taken	Yes, several steps were taken	Yes, several steps were taken	Findings are well grounded/supported	Good/fair breadth and depth	A lot	High	High
<b>Nguyen (2014)</b>	Yes, a few steps were taken	Yes, a few steps were taken	Yes, a few steps were taken	Limited grounding/support of findings	Limited breadth or depth	A little	Medium	Low
<b>Owen (2009)</b>	Yes. A thorough attempt was made	Yes, a few steps were taken	Yes, several steps were taken	Findings are fairly well grounded/supported	Good/fair breadth but very little depth	A little	Medium	Medium
<b>Peeters (2012)</b>	Yes, a few steps were taken	Yes, several steps were taken	Yes, several steps were taken	Findings are fairly well grounded/supported	Good/fair breadth but very little depth	Somewhat	Medium	High
<b>Reece (2016)</b>	Yes, a few steps were taken	Yes, several steps were taken	Yes, several steps were taken	Findings are well grounded/supported	Good/fair breadth but very little depth	Somewhat	Medium	High
<b>Riiser (2013)</b>	Yes, several steps were taken	Yes. A thorough attempt was made	Yes, a few steps were taken	Limited grounding/support of findings	Good/fair breadth but very little depth	Somewhat	Medium	Low
<b>Rudolf (2006)</b>	Yes, several steps were taken	Yes, several steps were taken	Yes, several steps were taken	Findings are fairly well grounded/supported	Limited breadth or depth	A little	Medium	Low
<b>Smith (2014a)</b>	Yes. A thorough attempt was made	Yes. A thorough attempt was made	Yes. A thorough attempt was made	Findings are well grounded/supported	Good/fair breadth but very little depth	A lot	High	High

<b>Smith (2014b)</b>	Yes, several steps were taken	Yes, a thorough attempt was made	Yes, a thorough attempt was made	Findings are fairly well grounded/supported	Good/fair breadth but very little depth	A little	High	Medium
<b>Staiano (2012)</b>	Yes, several steps were taken	Yes, a few steps were taken	Yes, a few steps were taken	Limited grounding/support of findings	Limited breadth or depth	A little	Low	Low
<b>Twiddy (2011)</b>	Yes. A thorough attempt was made	Yes, several steps were taken	Yes, several steps were taken	Findings are fairly well grounded/supported	Limited breadth or depth	A little	Medium	Low
<b>Woolford (2010)</b>	Yes. A thorough attempt was made	Yes, several steps were taken	Unclear	Limited grounding/support of findings	Limited breadth or depth	A little	Low	Low
<b>Woolford (2012a)</b>	Yes, several steps were taken	Yes, several steps were taken	Yes, several steps were taken	Findings are well grounded/supported	Good/fair breadth but very little depth	Somewhat	Medium	Medium
<b>Woolford (2012b)</b>	Yes. A thorough attempt was made	Yes, a few steps were taken	Yes, several steps were taken	Findings are fairly well grounded/supported	Good/fair breadth but very little depth	A little	Medium	High
<b>Watson (2016)</b>	Yes, a few steps were taken	Yes. A thorough attempt was made	Yes. A thorough attempt was made	Findings are well grounded/supported	Good/fair breadth and depth	A lot	High	High

Table 2.5 CERQual evidence profile

Summary of review finding	Studies contributing to the review finding	Methodological limitations	Coherence	Adequacy	Relevance	CERQual assessment of confidence in the evidence	Explanation of CERQual assessment
<b>1. The importance of a weight management intervention being tailored to the adolescent age group, as well as the individual</b>	Banks et al., 2014; Holt et al., 2005; Morinder et al., 2011; Reece et al., 2016; Jogova et al., 2013; Smith et al., 2014a; Staiano et al., 2012; Woolford et al., 2010; Woolford 2012a; Woolford et al., 2012b.	Minor methodological limitations (4 studies with very minor/no methodological limitations, 3 studies with minor methodological limitations, 2 studies with moderate methodological limitations, 1 study with serious methodological limitations (unclear methods and analysis, not piloted)	No concerns about coherence	Minor concerns about adequacy (10 studies, only one offered rich and adequate data. 3 offered moderate data, overall offered moderately rich data)	Minor concerns about relevance (10 studies with partial relevance)	High confidence	Minor concerns about methodological limitations, adequacy and relevance. No or very minor concerns about coherence
<b>2. Adolescents should set person-centred</b>	Alm et al., 2008;	Minor methodological limitations (4 study	No concerns	Minor concerns about adequacy	No or very minor	High confidence	Minor concerns

<p><b>goals that are SMART and set with advice from a professional or family member</b></p>	<p>Campbell-Voytal et al., 2018; Engstrom et al., 2016; Hester et al., 2009; Howie et al., 2016; Nguyen et al., 2014; Owen et al., 2009; Peeters et al., 2012; Morinder et al., 2011.</p>	<p>with very minor/no methodological limitations, 3 with minor methodological limitations and 2 with moderate methodological limitations (Short telephone interviews, unclear if more than one researcher was involved in validation)</p>	<p>about coherence.</p>	<p>(9 studies contributed to this finding. Together offered moderately rich data. Although a more explanatory finding, data was moderately rich)</p>	<p>concerns about relevance (4 studies with partial relevance, 1 with uncertain relevance)</p>	<p>about methodological limitations and adequacy. No or very minor concerns about coherence and relevance</p>
<p><b>3. Adolescents did not express a preference for delivery method of an intervention (e.g. one-to-one or group setting)</b></p>	<p>Holt et al., 2005; Melnyk et al., 2007; Morinder et al., 2011; Woolford et al., 2012b.</p>	<p>Minor methodological limitations (2 studies with no/very minor methodological limitations, one study with moderate methodological limitations and one study with serious methodological limitations (short telephone interview,</p>	<p>No concerns about coherence</p>	<p>Serious concerns about adequacy (4 studies contributed to this finding offering thinly spread data)</p>	<p>No or very minor concerns about relevance (3 studies with partial concerns)</p>	<p>Moderate confidence Minor concerns about methodological limitations. No or very minor concerns about coherence and relevance. Serious concerns</p>

		No triangulation, analysis unclear)					about adequacy
<b>4. The majority of adolescents appreciated having anthropometric measurements taken regularly by health professionals throughout an intervention in a non-judgement manner</b>	Hammar et al., 1971; Morinder et al., 2011; Peeters et al., 2012; Woolford et al., 2012b.	Minor methodological limitations (One study with no/very minor methodological limitations. Two studies with moderate methodological limitations, one with serious methodological limitations (Short telephone interviews, limited information on methods and analysis)	No concerns about coherence.	Minor concerns about adequacy (Only 4 studies contributed to this finding but together offered moderately rich data)	No or very minor concerns about relevance (3 studies with partial relevance)	High confidence	Minor concerns about methodological limitations and adequacy. No or very minor concerns about coherence and relevance
<b>5. Adolescents expressed a preference for consistent and regular sessions as part of an intervention.</b>	Alm et al., 2008; Melnyk et al., 2007; Morinder et al., 2011; Nguyen et al., 2014; Owen et al., 2009; Peeters et al., 2012; Twiddy et al., 2012.	Moderate methodological limitations (2 studies with no/very minor methodological limitations, 2 with minor methodological limitations, 2 studies with moderate methodological limitations, 1 study with serious	No concerns about coherence.	Moderate concerns about adequacy (7 studies contributed to this finding. Thin-moderately rich data when combining data from all studies)	No or very minor concerns about relevance (2 studies with partial relevance, 1 with unclear relevance)	Moderate confidence	Moderate concerns about methodological limitations and adequacy. No or very minor concerns about coherence and relevance

			methodological limitations (no triangulation, short interview, unclear analysis)				
<b>6. Adolescents expressed appreciation for concise and practical evidence-based messages throughout an intervention. Lack of knowledge was highlighted prior to attending an intervention.</b>	Alm et al., 2008; Daley et al., 2008; Hammar et al., 1971; Hemetek et al., 2015; Hester et al., 2009; Jogova et al., 2013; Morinder et al., 2011; Owen et al., 2009; Reece et al., 2016; Smith et al., 2014a; Woolford et al., 2012b.	Minor methodological limitations (3 studies with no or very minor methodological limitations, 6 with minor methodological limitations 1 moderate methodological limitations, one study with serious methodological limitations (Short telephone interviews, unclear methods and analysis, unsure of second researcher involvement in validation)	Minor concerns about coherence (some concerns about the fit between the data form primary studies and the review finding)	Minor concerns about adequacy (11 studies contributed to this finding. Together moderately rich data)	Minor concerns about relevance (7 studies with partial relevance, 2 with unclear relevance)	Moderate confidence	Minor concerns about methodological limitations, coherence, adequacy and relevance

<b>7. The importance of intervention elements being delivered in a fun and active way was very important to adolescents.</b>	Howie et al., 2016; Watson et al., 2016; Woolford et al., 2012b.	No/very minor methodological (2 study with no/very minor methodological limitations, 1 study with moderate methodological limitations (not piloted, short telephone interviews)	No concerns about coherence.	Minor concerns about adequacy (Only 3 studies but the data was rich for this more descriptive finding)	No or very minor concerns about relevance (3 studies with partial relevance)	High confidence	No or very minor concerns about methodological limitations, coherence and relevance. Minor concerns about adequacy
<b>8. Receiving support from professionals was important to overweight/obese adolescents</b>	Alm et al., 2008; Daley et al., 2008; Hammar et al., 1971; Hester et al., 2009; Holt et al., 2005; Li et al., 2016; Morinder et al., 2011; Nguyen et al., 2014; Owen et al., 2009; Peeters et al., 2012; Reece et al., 2016;	Minor methodological limitations (3 studies with no/very minor methodological limitations, 7 studies with minor methodological limitations, 4 studies with moderate methodological limitations, 1 study with serious methodological limitations (not piloted, short interviews, weak description of	No concerns about coherence.	No or very minor concerns about adequacy (15 studies offering rich data to support this finding)	Minor concerns about relevance (9 with partial relevance, 1 with unclear relevance)	High confidence	Minor concerns about methodological limitations and relevance. No or very minor concerns about coherence and adequacy

	Riiser et al., 2013; Rudolf et al., 2006; Twiddy et al., 2012; Woolford et al., 2012b.	methods and analysis, Unsure if second researcher involvement in validation of findings, no triangulation)						
<b>9. Family support was important to adolescents to help maintain motivation, especially when family members joined in behaviour change efforts. Lack of parental knowledge was highlighted as a barrier to adolescent weight loss</b>	Alm et al., 2008; Campbell-Voytal et al., 2018; Engstrom et al., 2016; Hester et al., 2009; Howie et al., 2016; Jogova et al., 2013; Li et al., 2016; Melnyk et al., 2007; Morinder et al., 2011; Peeters et al., 2012; Reece et al., 2016; Smith et al., 2014b; Watson et al., 2016;	Minor methodological limitations (7 Studies with no/very minor methodological limitations, 5 with minor methodological limitations 2 with moderate methodological limitations and 1 study with serious methodological limitations (no triangulation, analysis unclear in parts, short telephone interviews)	No concerns about coherence	No or very minor concerns about adequacy  (15 studies supported this finding and together offered rich data)	Minor concerns about relevance  (9 with partial relevance, 1 with uncertain relevance)	High confidence	Minor concerns about methodological limitations and relevance. No or very minor concerns about coherence and adequacy	

	Woolford et al., 2010; Woolford et al., 2012b.						
<b>10. Peer support gave adolescents a sense of belonging and acceptance by allowing them to talk to those in a similar position to themselves. Peer support also provided ongoing motivation.</b>	Alm et al., 2008; Engstrom et al., 2016; Hammar et al., 1971; Hester et al., 2009; Holt et al., 2005; Jogova et al., 2013; Li et al., 2016; Melnyk et al., 2007; Morinder et al., 2011; Peeters et al., 2012; Reece et al., 2016; Smith et al., 2014a; Smith et al., 2014b; Staiano et al., 2012; Watson et al., 2016; Woolford et al., 2012a;	Minor methodological limitations (7 studies with no or very minor methodological limitations, 5 with minor, 2 with moderate and 3 with serious methodological limitations (unclear methods and analysis, short interviews, unclear of researcher contribution to validation of findings)	No concerns about coherence	No or very minor concerns about adequacy  (17 studies, together offering moderately rich data)	Minor concerns about relevance  (10 with partial relevance, 1 with unclear relevance)	High Confidence	Minor concerns about methodological limitations and relevance. No or very minor concerns about coherence and adequacy

	Woolford et al., 2012b.						
<b>11. Supportive relationships between adolescents and professionals, family or friends were key adolescents engaging with weight management interventions</b>	Alm et al., 2008; Daley et al., 2008; Engstrom et al., 2016; Peeters et al., 2012; Woolford et al., 2012b.	Minor methodological limitations (2 study with no or very minor methodological limitations, 2 with minor and 2 studies with moderate methodological limitations (short interviews)	No concerns about coherence	Moderate concerns about adequacy  (6 studies supporting this finding. Together moderately rich data)	No or very minor concerns about relevance  (3 studies with partial relevance, 1 with unclear relevance)	Moderate confidence	Minor concerns about methodological limitations. No or very minor concerns about coherence and relevance. Moderate concerns about adequacy
<b>12. Adolescents spoke of prior fears of attending an intervention that related to preconceptions about the intensity of exercise, type of food on offer and how they would be treated by other adolescent attendees.</b>	Daley et al., 2008; Engstrom et al., 2016; Hester et al., 2009; Holt et al., 2005; Rudolf et al., 2006; Smith et al., 2014b; Woolford et al., 2012b.	No or very minor methodological limitations (3 studies with no/very minor methodological limitations, 3 studies with minor methodological limitations, 1 study with moderate methodological limitations. Short telephone interview,	No concerns about coherence	No or very minor concerns  (7 studies contributed to review finding. Rich data to support this finding)	Minor concerns about relevance  (6 studies with partial relevance)	High confidence	Very minor or no concerns about methodological limitations, coherence, adequacy. Minor concerns about relevance

			uncertainty of how many researchers involved in validation of findings, short face-to-face interviews)				
<b>13. Exposure to unhealthy foods makes it difficult for adolescents to opt for healthy choices and therefore lose weight.</b>	Engstrom et al., 2016; Howie et al., 2016; Li et al., 2016; Woolford et al., 2012a.	Minor methodological limitations (2 study with no/very minor concerns, 2 with minor concerns (short telephone interviews)	Minor concerns about coherence (some concerns about the fit between the data from the primary study and the review finding	Moderate concerns about adequacy  (4 studies with moderately rich data)	No or very minor concerns about relevance  (3 studies with partial relevance)	Moderate confidence	Minor concerns about methodological limitations and coherence. Moderate concerns about adequacy and no or very minor concerns about relevance
<b>14. Convenience factors such as the weather, time, transportation, family and school commitments are potential barriers to adolescents</b>	Daley et al., 2008; Howie et al., 2016; Li et al., 2016; Nguyen et al., 2014; Peeters et al., 2012; Smith et al.,	Minor methodological limitations (2 study with no/very minor methodological limitations, 3 studies with minor methodological limitations, 3 studies	No concerns about coherence	No or very minor concerns about adequacy  (8 studies supporting – rich data supporting this fairly	No or very minor concerns about relevance  (5 studies with partial relevance)	High confidence	Minor concerns about methodological limitations. No or very minor concerns

<b>engaging with an intervention.</b>	2014a; Woolford et al., 2012a; Woolford et al., 2012b.	with moderate methodological limitations (not piloted, short interviews, no triangulation).		descriptive finding)			about coherence, adequacy and relevance
<b>15. Female adolescents were concerned with how they looked when taking part in PA, as well as how safe they felt in the activity environment</b>	Alm et al., 2008.	Minor methodological limitations (not piloted, short interviews)	No concerns about coherence	Moderate concerns about adequacy  (1 study supporting this finding but moderately rich data to support this more descriptive finding)	No or very minor concerns about relevance  (unclear relevance from only contributing study)	Moderate confidence	Minor concerns about methodological limitations. Moderate concerns about adequacy. No or very minor concerns about coherence and relevance
<b>16. Adolescents spoke of being fearful of being told off if they didn't lose weight which led to feelings of guilt, failure and shame. Adolescents were also ashamed of attending interventions and</b>	Alm et al., 2008; Banks et al., 2014; Morinder et al., 2011; Peeters et al., 2012; Smith et al., 2014a; Smith et al., 2014b.	No/very minor methodological limitations (3 studies with no/very minor methodological limitations, 3 with minor methodological limitations (short interview, uncertainty of how many	No concerns about coherence	Minor concerns about adequacy  (Six studies supporting this finding which together offer moderately rich data)	Minor concerns about relevance  (3 studies with partial relevance, 1 with unclear relevance)	High confidence	No or very minor concerns about methodological limitations and coherence. Minor concerns

<p><b>did not want others to know they were attending. These feelings were reported during an intervention and in the maintenance period following an intervention.</b></p>		<p>researchers involved in validation)</p>					<p>about adequacy and relevance</p>
<p><b>17. Recognising individual's readiness to change is important, as adolescents are not always willing to make changes. Sometimes they take part in interventions to please others, such as family or professionals.</b></p>	<p>Engstrom et al., 2016; Hammar et al., 1971; Li et al., 2016; Morinder et al., 2011; Owen et al., 2009.</p>	<p>No/Very minor methodological limitations (1 study with serious methodological limitations, 2 with minor methodological limitations and 2 study with no/very minor methodological limitations (weak methods and analysis)</p>	<p>No concerns about coherence</p>	<p>Moderate concerns about adequacy (5 studies supporting this finding offering thin-moderate data)</p>	<p>No or very minor concerns about relevance (4 studies with partial relevance)</p>	<p>Moderate confidence</p>	<p>No or very minor concerns about methodological limitations, coherence and relevance. Moderate concerns about adequacy</p>
<p><b>18. It is important that adolescents can access PA facilities free or for little cost, however the cost of food was unimportant to adolescents</b></p>	<p>Jogova et al., 2013; Owen et al., 2009; Peeters et al., 2012; Smith et al., 2014b; Woolford et al., 2012a.</p>	<p>Minor methodological limitations (2 studies with no/very minor methodological limitations, 2 with minor methodological limitations and 1 study with moderate</p>	<p>No concerns about coherence</p>	<p>Minor concerns about adequacy (5 studies supporting this finding together offering moderately rich</p>	<p>No or very minor concerns about relevance</p>	<p>High confidence</p>	<p>Minor concerns about methodological limitations and adequacy. No or very minor</p>

		methodological limitations (short telephone interviews)		data for this fairly descriptive finding)	(2 studies with partial relevance)		concerns about coherence and relevance
<b>19. Adolescents enjoy learning about healthy eating</b>	Hester et al., 2009; Howie et al., 2016; Melnyk et al., 2007; Morinder et al., 2011; Woolford et al., 2012b.	Moderate methodological limitations (2 study with no/very minor methodological limitations, 1 study with minor methodological limitations, 1 study with moderate methodological limitations, 1 with serious methodological limitations (short telephone interviews, no triangulation, unclear methods and analysis)	No concerns about coherence	Serious concerns about adequacy (Supported by 5 studies offering thin data)	No or very minor concerns about relevance  (2 study with partial relevance)	Low confidence	Moderate concerns about methodological limitations. No or very minor concerns about coherence and relevance. Serious concerns about adequacy
<b>20. Adolescents appreciated variety in what PA they undertake</b>	Banks et al., 2014; Daley et al., 2008; Holt et al., 2005; Li et al., 2016; Owen et al., 2009;	Minor methodological limitations (3 studies with no or very minor methodological limitations, 5 with minor, 2 with moderate	No concerns about coherence.	No or very minor concerns about adequacy (Supported by 11 studies together offering	Minor concerns about relevance	High confidence	Minor concerns about methodological limitations and relevance. No or very

	Peeters et al., 2012; Smith et al., 2014b; Staiano et al., 2012; Watson et al., 2016; Woolford et al., 2012a; Woolford et al., 2012b.	methodological limitations and 1 with serious methodological limitations (unclear methods and analysis short interviews)		moderately rich data)	(6 studies with partial relevance)		minor concerns about coherence and adequacy
<b>21. Adolescents are motivated by being able to achieve and complete a PA session. This sense of accomplishment is important so activities must be challenging yet achievable.</b>	Campbell-Voytal et al., 2018; Engstrom et al., 2016; Hammar et al., 1971; Jogova et al., 2013; Li et al., 2016; Woolford et al., 2012b.	Moderate methodological limitations (2 studies with no/very minor methodological limitations, 2 study with minor methodological limitations, 1 study with serious methodological limitations, 1 study with moderate methodological limitations (short telephone interview, unclear methods and analysis)	No concerns about coherence.	Minor concerns about adequacy (6 studies supporting this finding together offering moderate richness)	No or very minor concerns about relevance (5 studies with partial relevance)	Moderate confidence	Moderate concerns about methodological limitations. Minor concerns about adequacy. No or very minor concerns about coherence and relevance

<p><b>22. Adolescents enjoy taking part in PA, with fun being an important element. Adolescents gain a sense of accomplishment from taking part in PA.</b></p>	<p>Alm et al., 2008; Daley et al., 2008; Engstrom et al., 2016; Hemetek et al., 2015; Hester et al., 2009; Holt et al., 2005; Howie et al., 2016; Nguyen et al., 2014; Owen et al., 2009; Peeters et al., 2012; Woolford et al., 2012a; Woolford et al., 2012b.</p>	<p>Minor methodological limitations (3 study with no/very minor methodological limitations, 6 with minor methodological limitations 3 moderate methodological limitations (short interviews, lack of triangulation unclear methods)</p>	<p>No concerns about coherence</p>	<p>No or very minor concerns about adequacy  (12 studies supporting this finding together offering rich data)</p>	<p>Minor concerns about relevance  (6 studies with partial relevance, 2 with unclear relevance)</p>	<p>High confidence.</p>	<p>Minor concerns about methodological limitations and relevance. No or very minor concerns about coherence and adequacy</p>
<p><b>23. Some adolescents learnt to enjoy PA for the first time, partly due to being given an opportunity to try something new.</b></p>	<p>Daley et al., 2008; Hemetek et al., 2015; Hester et al., 2009; Owen et al., 2009; Peeters et al., 2012; Reece et al., 2016;</p>	<p>Minor methodological limitations (6 studies with minor methodological limitations and 2 studies with moderate methodological limitations (short interviews, not</p>	<p>No concerns about coherence</p>	<p>Moderate concerns about adequacy  (8 studies supporting this finding offering thin data)</p>	<p>Minor concerns about relevance  (4 with partial relevance, 1 with unclear relevance)</p>	<p>Moderate confidence</p>	<p>Minor concerns about methodological limitations and relevance. No or very minor concerns about</p>

	Woolford et al., 2012a; Woolford et al., 2012b.	piloted, unclear methods, no triangulation)					coherence. Moderate concerns about adequacy
<b>24. A minority of adolescents did not enjoy PA; this mostly related to specific exercise equipment that was either uncomfortable or boring to the adolescent.</b>	Daley et al., 2008; Smith et al., 2014b.	Minor methodological limitations (1 study with minor methodological limitations and 1 study with no/very minor methodological limitations (short interviews)	No concerns about coherence.	Serious concerns about adequacy (2 studies offering thing data)	No or very minor concerns about relevance (2 studies with partial relevance)	Moderate confidence	Minor concerns about methodological limitations. Serious concerns about adequacy. No or very minor concerns about coherence and relevance
<b>25. Realistic weight loss expectations led to more successful outcome in terms of weight loss. Adolescents felt a sense of accomplishment from losing weight.</b>	Alm et al., 2008; Campbell-Voytal et al., 2018; Daley et al., 2008; Engstrom et al., 2016; Hammar et al., 1971; Hemetek et	Minor methodological limitations (2 studies with no/very minor methodological limitations, 7 studies with minor methodological limitations, 1 with moderate and 1 with serious methodological	No concerns about coherence	Minor concerns about adequacy (10 studies supporting this finding with thin-moderate richness as this is more of an explanatory finding)	Minor concerns about relevance (5 with partial relevance, 2 with unclear relevance)	High confidence	Minor concerns about methodological limitations, adequacy and relevance. No or very minor concerns about coherence

	al., 2015; Hester et al., 2009; Li et al., 2016; Peeters et al., 2012; Smith et al., 2014a.	limitations (unclear methods and analysis, no triangulation, short interviews)					
<b>26. Some adolescents struggled to transfer what they had learnt in an intervention into home life. Changing dietary habits, especially for the long-term was challenging.</b>	Alm et al., 2008; Hemetek et al., 2015; Hester et al., 2009; Holt et al., 2005; Li et al., 2016; Melnyk et al., 2007; Morinder et al., 2011; Reece et al., 2016; Woolford et al., 2012b.	Minor methodological limitations (2 studies with no/very minor methodological limitations, 5 with minor methodological limitations, 1 moderate and 1 study with serious methodological limitations (short interviews, unclear methods and analysis, no triangulation, only questionnaire)	Minor concerns about coherence (some concerns about the fit between the data from primary studies and the review finding)	Minor concerns about adequacy (9 studies supporting this finding with thin-moderate data)	Minor concerns about relevance (4 with partial relevance, 2 with unclear relevance)	Moderate confidence	Minor concerns about methodological limitations, coherence, adequacy and relevance
<b>27. A preference for interventions to be longer or to have more sessions was noted by adolescents, as well as more support in</b>	Alm et al., 2008; Daley et al., 2008; Hemetek et al., 2015; Hester et al., 2009; Howie	Minor methodological limitations (2 study with no/very minor methodological limitations, 6 studies with minor methodological	No concerns about coherence	No or very minor concerns about adequacy (12 studies supporting this finding that	Minor concerns about relevance (5 with partial relevance, 2	High confidence	Minor concerns about methodological limitations and relevance. No or very

<p><b>the maintenance period following an intervention. Adolescents were worried about and struggled with maintaining their weight after an intervention had finished.</b></p>	<p>et al., 2016; Li et al., 2016; Melnyk et al., 2007; Morinder et al., 2011; Nguyen et al., 2014; Peeters et al., 2012; reece et al., 2016; Woolford et al., 2012b.</p>	<p>limitations, 3 with moderate methodological limitations, 1 with serious methodological limitations (no triangulation, unclear methods, short interviews)</p>		<p>together offered rich data)</p>	<p>with unclear relevance)</p>		<p>minor concerns about coherence and adequacy</p>
<p><b>28. Although some adolescents reported health as a motivation for taking part in an intervention, the majority took part to lose weight.</b></p>	<p>Alm et al., 2008; Daley et al., 2008; Hammar et al., 1971; Hester et al., 2009; Holt et al., 2005; Morinder et al., 2011; Nguyen et al., 2014; Peeters et al., 2012; Twiddy et al., 2012; Woolford et al., 2012a;</p>	<p>Minor methodological limitations (2 studies with no/very minor methodological limitations, 5 with minor methodological limitations, 3 with moderate methodological limitations, 1 with serious methodological limitations (weak description of methods and analysis, short telephone interviews, no</p>	<p>No concerns about coherence</p>	<p>No or very minor concerns about adequacy (11 studies supporting this finding that together offer rich data)</p>	<p>Minor concerns about relevance (5 with partial relevance, 1 with unclear relevance)</p>	<p>High confidence</p>	<p>Minor concerns about methodological limitations and relevance. No or very minor concerns about coherence and adequacy</p>

	Woolford et al., 2012b.	triangulation, methods unclear in parts)						
<b>29. Many adolescents wanted to lose weight to improve their confidence and self-esteem and an increase in self-esteem was seen as a result of losing weight. There improvement in self-esteem was mostly associated with improving how they appeared physically.</b>	Alm et al., 2008; Daley et al., 2008; Engstrom et al., 2016; Hammar et al., 1971; Hester et al., 2009; Holt et al., 2005; Howie et al., 2016; Li et al., 2016; Morinder et al., 2011; Nguyen et al., 2014; Peeters et al., 2012; Reece et al., 2016; Woolford et al., 2012a.	Minor methodological limitations (4 studies with no/very minor methodological limitations, 6 with minor, 2 moderate, 1 with serious methodological limitations (unclear methods and analysis, short interviews, no triangulation)	No concerns about coherence	No or very minor concerns about adequacy  (12 studies supporting this together offering rich data)	Minor concerns about relevance  (7 studies with partial relevance, 1 with uncertain relevance)	High confidence	Minor concerns about methodological limitations and relevance. No or very minor concerns about coherence and adequacy	
<b>30. Adolescents viewed being a healthy weight as the route</b>	Alm et al., 2008; Daley et al., 2008;	Minor methodological limitations (2 studies with no/very minor	No concerns	No or very minor concerns about adequacy	Minor concerns	High confidence	Minor concerns about	

<p><b>to being accepted socially. This social acceptability was a driving motivation for many adolescents.</b></p>	<p>Hemetek et al., 2015; Hester et al., 2009; Holt et al., 2005; Peeters et al., 2012; Reece et al., 2016; Twiddy et al., 2012.</p>	<p>concerns, 5 with minor methodological limitations, 1 with moderate methodological limitations (short interviews, no triangulation, methods unclear in part)</p>	<p>about coherence</p>	<p>(8 studies supporting this finding together offering rich data)</p>	<p>about relevance (4 studies with partial relevance, 2 with unclear relevance)</p>		<p>methodological limitations and relevance. No or very minor concerns about coherence and adequacy</p>
<p><b>31. Male adolescents reported wanting to lose weight to improve their sporting and fitness performance.</b></p>	<p>Alm et al., 2008; Engstrom et al., 2016; Hemetek et al., 2015; Li et al., 2016; Peeters et al., 2012; Twiddy et al., 2012; Woolford et al., 2012a.</p>	<p>Minor methodological limitations (2 study with no/very minor methodological limitations, 3 with minor methodological limitations, 2 with moderate methodological limitations (short interviews, no triangulation, unclear methods in parts)</p>	<p>Minor concerns about coherence (some concerns about the fit between the data from primary studies and the review finding)</p>	<p>Minor concerns about adequacy 7 studies supporting this finding offering moderately rich data)</p>	<p>No or very minor concerns about relevance (3 study with partial relevance, 2 with unclear relevance)</p>	<p>Moderate confidence</p>	<p>Minor concerns about methodological limitations, adequacy and coherence. No or very minor concerns about relevance.</p>
<p><b>32. Adolescents do recognise their own responsibility in losing weight and display a strong</b></p>	<p>Alm et al., 2008; Hemetek et al., 2015; Morinder et</p>	<p>Minor methodological limitations (2 studies with no/very minor methodological limitations, 5 with</p>	<p>Minor concerns about coherence (some</p>	<p>Minor concerns about adequacy (8 studies supporting this</p>	<p>No or very minor concerns about relevance</p>	<p>Moderate confidence</p>	<p>Minor concerns about methodological limitations,</p>

<b>personal drive that motivates their weight loss</b>	al., 2011; Owen et al., 2009; Peeters et al., 2012; Reece et al., 2016; Twiddy et al., 2012; Woolford et al., 2012a.	minor methodological limitations and 1 study with moderate methodological limitations (lack of triangulation, short interviews, methods unclear in parts)	concerns about the fit between the data from primary studies and the review finding)	finding together offering moderately rich data)	(2 with partial relevance, 2 with unclear relevance)		coherence and adequacy. No or very minor concerns about relevance
<b>33. Adolescents use technology such as exergames, internet and photography with ease and find them acceptable.</b>	Jogova et al., 2013; Nguyen et al., 2014; Riiser et al., 2013; Staiano et al., 2012; Woolford et al., 2010; Woolford et al., 2012a.	Moderate methodological limitations (1 study with no/very minor methodological limitations, 1 with minor methodological limitations, 4 with moderate methodological limitations and 1 study with serious methodological limitations (unclear methods and analysis, short telephone interviews)	Moderate concerns about coherence (some concerns about the fit between the data from primary studies and the review finding due to two outliers)	Moderate concerns about adequacy (6 studies supporting this finding – mainly thin data)	No or very minor concerns about relevance (2 studies with partial relevance)	Low confidence	Moderate concerns about methodological limitations, coherence, adequacy. No or very minor concerns about relevance
<b>34. Adolescents like being able to log goals and PA through online</b>	Riiser et al., 2013; Staiano et al., 2012;	Moderate methodological limitations (1 study with serious	No concerns about coherence	Moderate concerns about adequacy	No concerns about relevance	Moderate confidence	Moderate concerns about methodologica

<p><b>programmes, especially when comparing activity to peers. Being able to track and reflect on progress through these online programmes as well as taking pictures was useful although this may be too time consuming to be completed regularly.</b></p>	<p>Woolford et al., 2012a.</p>	<p>methodological limitations, 1 with moderate methodological limitations and 1 study with minor methodological limitations (short telephone interviews, unclear methods and analysis)</p>		<p>(3 studies supporting this finding however together offer moderately rich data)</p>			<p>l limitations and adequacy. No or very minor concerns about coherence and relevance</p>
<p><b>35. Adolescents liked receiving motivational messages as part of an intervention as long as messages were practical, fun and not too formal.</b></p>	<p>Jogova et al., 2013; Nguyen et al., 2014; Smith et al., 2014a.</p>	<p>No or very minor methodological limitations (2 studies with very minor/no methodological limitations, 1 study with moderate methodological limitations (short telephone interviews)</p>	<p>No concerns about coherence</p>	<p>Moderate concerns about adequacy  (3 studies supporting this finding. Data is richer for the formality of messages part of finding but less so and quite thin for the practical/motivational part of the finding)</p>	<p>No or very minor concerns about relevance  (2 studies with partial relevance)</p>	<p>High confidence</p>	<p>No or very minor concerns about methodological limitations, coherence and relevance. Moderate concerns about adequacy.</p>

#### 2.5.4 Adolescent views

Analysis of the findings of each included study resulted in 184 descriptive codes. These descriptive codes were then grouped into descriptive themes, which then led onto the development of 35 analytical themes. These 35 analytical themes were broadly divided into seven domains that relate to lifestyle obesity treatment interventions: intervention content, support, barriers to attending a WMP and being healthy, PA vs diet, motivations, maintenance and technology. A network diagram of all domains and analytical themes is shown in Figure 2.5. Themes have been mapped across the various levels of a socio-ecological framework (See table 2.6). It can be noted that the existing literature on adolescent views is very focused at the individual level and societal factors were not emphasised. The analytical themes within each domain are presented below. Transcribed quotations have been chosen for their ability to highlight themes. Both participant and researcher quotes are presented.

Section 2.5.5 examines findings on intervention content, section 2.5.6 explores the importance of supportive relationships whilst section 2.5.7 highlights the barriers adolescents face not only with attending weight management interventions but being healthy. Section 2.5.8 explores the importance of incorporating both PA and diet education into an intervention and section 2.5.9 identifies the motivations behind adolescents attending interventions. Section 2.5.10 describes the difficulty of maintaining weight loss after an intervention has finished, and lastly, adolescents use of technology is examined in section 2.5.11.

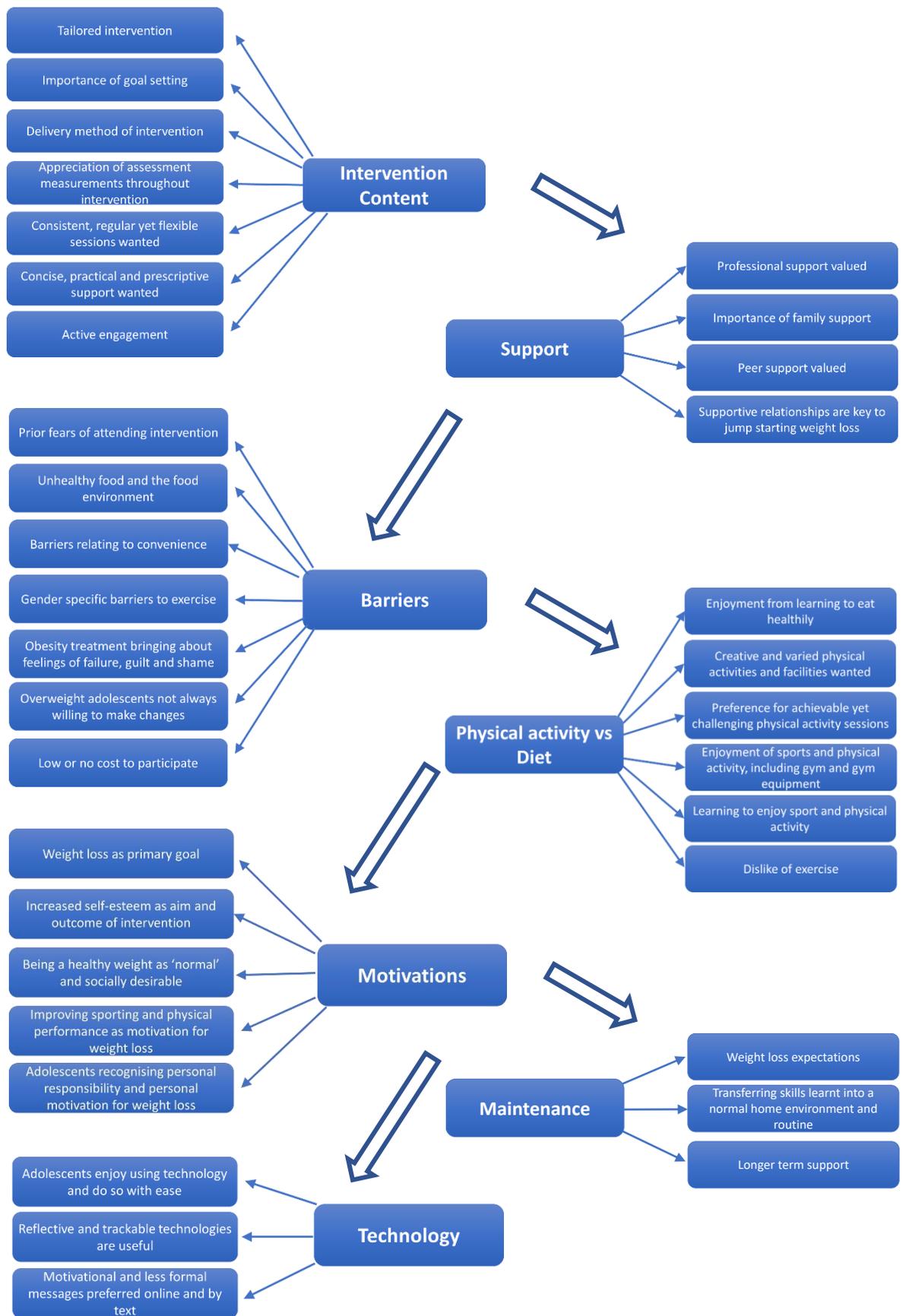


Figure 2.5 Network diagram showing domains and analytical themes

**Table 2.6 Analytical themes mapped to a socio-ecological framework**

<b>Individual</b>	<b>Interpersonal</b>	<b>Organisational</b>	<b>Community</b>	<b>Societal</b>
Prior fears of attending intervention	Professional support valued	Tailored intervention	Unhealthy food and the food environment	
Barriers relating to convenience	Importance of family support	Delivery method of intervention	Gender specific barriers to exercise (as part of this was to do with perceived safety of exercising outside (reported by females))	
Obesity treatment bringing about feelings of failure, guilt and shame.	Peer support valued	Appreciation of assessment measurements throughout intervention	Creative and varied physical activities and facilities wanted (relationships between organisations could provide this)	
Overweight adolescents not always willing to make changes	Supportive relationships are key to jump starting weight loss	Consistent, regular yet flexible sessions wanted		
Weight loss as primary goal		Concise, practical and prescriptive support wanted		
Increased self-esteem as aim and outcome of intervention (because the individual wants this to increase)		Active engagement		
Being a healthy weight as 'normal' and socially desirable.		Low or no cost to participate		
Improving sporting and physical performance as		Learning to enjoy sport and PA (because the WMP provided opportunities to		

motivation for weight loss		try new activities)		
Adolescents recognising personal responsibility and personal motivation for weight loss		Transferring skills learnt into a normal home environment and routine		
Adolescents enjoy using technology and do so with ease		Longer term support (this is needed at an intervention level but could also be facilitated through building relationships between different organisations who can all offer support in the maintenance phase)		
Reflective and trackable technologies are useful				
Motivational and less formal messages preferred online and by text				
Enjoyment from learning to eat healthily				
Preference for achievable yet challenging physical activity sessions				
Enjoyment of sports and PA, including gym and gym equipment				
Weight loss expectations				
Dislike of exercise				
Importance of goal setting				

### 2.5.5 Intervention content

Many aspects of the interventions were described by adolescents in the included studies. A total of 24 studies supported this domain (Alm et al., 2008; Banks et al., 2014; Daley et al., 2008; Engstrom et al., 2016; Howie et al., 2016; Hammar et al., 1971; Hemetek et al., 2015; Hester et al., 2009; Holt et al., 2005; Jogova et al., 2013; Melnyk et al., 2007;

Morinder et al., 2011; Nguyen et al., 2014; Owen et al., 2009; Peeters et al., 2012; Reece et al., 2016; Smith et al., 2014a; Smith et al., 2014b; Staiano et al., 2012; Twiddy et al., 2012; Watson et al., 2016; ; Woolford et al., 2010; Woolford et al., 2012a; Woolford et al., 2012b). Themes related to intervention content, such as, 'tailored intervention', 'importance of goal setting', 'delivery method of intervention', 'appreciation of assessment measurements throughout intervention', 'consistent, regular, yet flexible sessions wanted', 'concise, practical and prescriptive support wanted', and 'active rather than passive engagement leads to fun', will be described below with supporting quotes:

#### *2.5.5.1 Tailored intervention*

One factor that appears to be very important when planning and delivering an adolescent WMP is the necessity for that programme to be tailored to the individual. In addition, tailoring to different ethnicities and cultures, and to the specific age-group appear important (Banks et al., 2014; Holt et al., 2005; Jogova et al., 2013; Morinder et al., 2011; Reece et al., 2016; Smith et al., 2014a; Staiano et al., 2012; Woolford et al., 2010; Woolford et al., 2012a; Woolford et al., 2012b). This will now be discussed in relation to the programme structure and content, as well as in the use of technology.

Although not an issue that has arisen in many of the studies, it is likely in multi-cultural societies that interventions need to be tailored for the needs of different cultures. Evaluation of a web-based programme by 10-17 year olds and their families highlighted this:

*"A family requested that there may be culturally diverse food information on the website (e.g., South East Asian food recipes, discussion of how to include more vegetables in a culturally appropriate way not all cultures have "salad" as a part of their traditional diet)" (Jogova et al., 2013, p. 76).*

In a study that described adolescent's experiences of text message support through the maintenance period of an intervention (Smith et al., 2014a) the need for individual tailoring was presented in regard to when a message was received. No consensus was found that suggested adolescents preferred a specific time to receive their supportive text messages. There was also no consensus around preferred frequency of messages:

*"7 o'clock in the morning would be better for me because it's just before I go to school. It's when you check your phone" (Smith et al., 2014a, p. 6).*

*“No, no, no, no, no. If you text messaged me before school I would absolutely call you and go off at you because you ain’t texting me before school. I am a bad morning person and getting a text message from CAFAP would just blow it. It’s a teenager thing” (Smith et al., 2014a, p. 6).*

*“Fridays, so you get them before the weekend” (Smith et al., 2014a, p. 6).*

*“Weekends are more helpful” (Smith et al., 2014a, p. 6).*

This same study (Smith et al., 2014a), as well as another that involved text message support (Woolford et al., 2010), highlighted the need for text messages to be tailored to each individual:

*“Make them custom for each person, because each person does a different amount of each thing...So for the stuff that we already do, the text messages should be like different for everyone” (Smith et al., 2014a, p. 6).*

*“Personal relevance. In general, most people found the messages relevant to them personally. Beyond the fact that the messages addressed weight-related issues and all the adolescents were engaged in weight loss efforts, some participants indicated that the messages contained information pertinent specifically to them” (Woolford et al., 2010, p. 4).*

Another form of technology used in some of these included studies involved taking pictures. This again showed the need for tailoring. When adolescents were asked to take pictures of something active that they like to do, they were only likely to be motivated by a particular picture if it was something that they could relate to and a sport that they like:

*“participants indicated that if they were sent a text with pictures of a random sport, it would be less likely to prompt them to exercise than if they were to receive an image of their favorite sport specifically” (Woolford et al., 2012a, p. 233).*

*“Anytime I see a picture of someone playing basketball, I think of me playing basketball & I want to get up & play” (Woolford et al., 2012a, p. 233).*

Additionally, adolescents reported that they wanted to attend an intervention that was created with their age group in mind. Often interventions were designed for wider age ranges that were actually catered more for under 12's:

*"The clinics saw children who were referred between the ages of 5 and 16. With such a wide age range, some families expressed the view that the clinic was not age appropriate in terms of both the approach within the consultations and a feeling of being among different age groups in the waiting areas. This view was most often expressed by families with older children"* (Banks et al., 2014, p. 107).

*"Patient felt that it was aimed at a younger age group of children, and as she was now doing A levels (UK final secondary school exam) she felt she was outside the target group of the clinic"* (Banks et al., 2014, p. 107).

There was a strong feeling of lack of services aimed at the adolescent age group:

*"Discussing the availability of treatment, there was strong agreement that treatments tailored to this age group were limited (n = 6)"* (Reece et al., 2016, p. 902).

*"Not really. Not for like people our age, maybe older like Weight Watchers and stuff like that, but not for young people"* (Reece et al., 2016, p. 903).

One study involved home visits as an optional choice for adolescents and their families taking part in an intervention. Of those families that took advantage of this option, this tailored opportunity for advice in the home environment received positive feedback:

*"Well we took a walk and we talked about what I eat at home, and how I like portion myself at home, how I exercise at home, so that was helpful"* (Woolford et al., 2012b, p. 6).

*"Yeah . . . I liked that they were actually showing that they cared about what we were eating at home and stuff"* (Woolford et al., 2012b, p. 6).

#### 2.5.5.2 Importance of goal setting

The importance of a tailored intervention also stems into goal setting. Not only do goals need to be tailored to the individual, but also they should be SMART (specific, measurable, achievable, realistic, time bound). Many individuals that were successful with their goals set SMART goals with advice and support from a professional or family member:

*“...participants with coaches tended to mention more concrete goals than those without coaches. Participants reporting success stated that they set concrete goals and broke down large goals into smaller, more manageable ones with the aid of a coach, family member, nutritionist, or physician” (Alm et al., 2008, p. 282).*

*“Successful families praised the exercise specialist: he was described as having motivated adolescents and children to try new sports and exercises by setting realistic goals and using incentive sticker charts with the younger children” (Owen et al., 2009, p. 240).*

As well as ensuring goals are SMART, it important that the setting of goals are person centred, where the individual is at the core of the decision:

*“The obesity programme is understood as being flexible, adaptable and adjusted to personal needs. Recommendations and treatment goals are looked upon as realistic and viable, and prepared in negotiated agreement. Information about treatment strategies and results are valued as important, as well as the possibility to have different opinions and ideas. Further, to be confirmed, listened to, and recognised as unique is emphasised” (Morinder et al., 2011, p. 1002).*

Those that struggled with weight loss tended to not have set these SMART goals, highlighting their importance. This tended to be related to how specific or realistic a goal was:

*“In contrast, those who reported no success in changing behavior tended to maintain a vague concept of their behavior goals and to pursue goals in an all-or nothing manner—for example, pledging to “never” eat a specific food again or having a goal of exercising more with no identified activity or time” (Alm et al., 2008, p. 282).*

*“I tried to give up sugar. I stopped cold turkey. It was too hard. I couldn’t do it” (Alm et al.,*

2008, p. 282). This quote also reflects the theme 'Transferring skills learnt into a normal home environment and routine' (Section 2.5.10.2).

The importance of realistic goal setting and therefore achieving goals is a strong motivator for adolescents to continue in their weight loss efforts. This may be a solid reason why those that set SMART goals tend to succeed more than those that do not:

*"At 3- and 6-months into the trial, youth continued to report that achievement of results/goals, family supportive comments, and motivation/drive facilitated their participation"* (Peeters et al., 2012, p. 653).

*"because it makes you actually think about it and realise how much because you've got a goal, you've kind of had to work out how to reach that goal"* (Owen et al., 2009, p. 240).

#### 2.5.5.3 Delivery method of intervention

Of the five studies that discussed the delivery method of an intervention (Holt et al., 2005; Melnyk et al., 2007; Peeters et al., 2012; Watson et al., 2016; Woolford et al., 2012b), there was no consistency in preference amongst adolescents. Whilst some adolescents benefited from an individual relationship with professionals, a group setting offered peer support (discussed further in section 2.5.6.3):

*"We attempted to determine which setting was considered least valuable by participants but were unable to make this distinction. Both individual and group sessions appeared to offer unique benefits and seemed to be of equal importance to participants"* (Woolford et al., 2012b, p. 5).

Two studies mentioned the size of a group, with one adolescent favouring a large group, and the other favouring a smaller group:

*"If there's one person, you can play a small game, the more people there are you can play better games...it's a fun programme where you do games in unity and have lots of fun games.. .by myself, all of the things that I'm doing would actually be much more fun with more people...I really find it much more fun with more people"* (Watson et al., 2016, p. 415).

When adolescents were asked how they would design an exercise intervention, one adolescent commented:

*“Oh it would probably be in a group, only a small group though not too big, and I would have swimming in it” (Peeters et al., 2012, p. 655).*

Some adolescents appreciated home visits as discussed previously in the ‘tailored intervention’ theme (section 2.5.5.1), whilst one adolescent commented on their dislike of after school sessions:

*“One teen stated that after-school sessions were difficult” (Melnyk et al., 2007, p. 320).*

In the study by Holt et al. (2005), participants stayed away from their home for a 6-week camp style intervention. Many adolescents on this programme suffered from homesickness:

*“Fourteen participants said that they had to cope with ‘Homesickness’ at some point during the camp” (Holt et al., 2005, p. 227).*

*“Matthew was homesick and explained that he did not see his parents ‘for five weeks, which is, well it does not sound long but when you don’t see parents for five weeks, it’s like you don’t even recognize them. I couldn’t recognize them apart from the photos in my room” (Holt et al., 2005, p. 227).*

#### *2.5.5.4 Appreciation of assessment measurements throughout intervention*

Most adolescents from studies that included taking anthropometric measurements appreciated the regularity for these assessment methods. Many found this motivational and gave them a sense of safety, knowing that their health was being looked after:

*“However, regular medical examinations and laboratory tests provide a feeling of security, since someone is checking and controlling one’s health condition” (Morinder et al., 2011, p. 1004).*

*“you get checked if something is wrong... so it gets discovered...because they check almost everything... I wouldn’t have had all this if I hadn’t come here” (Morinder et al., 2011, p.*

1004).

*"I really liked it 'cause it kinda kept me accountable, and like for me to know I was going to be weighing in and so I kind of see. And if I had a gain, you know, I could think what I could improve on in the time in between"* (Woolford et al., 2012b, p. 6).

The way in which the measurements were taken and delivered by health professionals was also important. Adolescents from one study appreciated a non-judgemental and positive approach from professionals when measurement results were not in the direction wanted:

*"When discussing the weekly weight checks, adolescents and parents noted the importance of a non-judgmental approach to the process"* (Woolford et al., 2012b, p. 6).

However, a minority of adolescents, from only one study, did not appreciate the regularity of assessments:

*"Some participants appeared to find the testing and assessment measures as part of the trial cumbersome"* (Peeters et al., 2012, p. 655).

#### *2.5.5.5 Consistent, regular, yet flexible sessions wanted*

Adolescents commented mostly on their preference for regular and consistent sessions that resulted in more success and continued motivation. The need for keeping weight management at the forefront of their mind was important:

*"I think if you just leave it I think that when you fall by the wayside. I think you've got to keep coming on a regular basis so that you're, you know, you're thinking about it all the time"* (Reece et al., 2016, p. 902).

*"Participants reported greater success in following a regimented weight management program when receiving coaching on a consistent and regular basis"* (Alm et al., 2008, p. 281).

*"I'd rather it had been less of a gap and seen them more through that year, because I would have got more kicks up the bum, because I'm one of these people that well, I'm just*

*a standard teenager if I don't get told to do something, I'll sit here and I'm not going to do it, am I?"* (Owen et al., 2009, p. 239).

One adolescent also appreciated a flexible approach when unable to make a session. If they were unable to attend a session, an alternative option would be available:

*"If I know I can't make it . . . I can say so and we can find another solution"* (Morinder et al., 2011, p. 1003).

The optimum length of each individual session was only explored in one study included in this review. In this case, sessions were 60-90 minutes in length, including 20-30 minutes of PA:

*"All 6 teens responded that they were satisfied with the length of the sessions"* (Melnik et al., 2007, p. 319).

#### *2.5.5.6 Concise, practical and prescriptive support wanted*

There was mention of adolescents benefiting from and wanting a regulated routine, both for their diet and exercise:

*"The rehab-stay was described as a positive experience by all interview partners (IP), especially because of active factors like feeling as part of a group, a feeling of belonging and a strictly regulated daily routine. The daily routine has in part been experienced as a "clinical" setting (that is, not consistent with every-day life), but at the same time, together with regulated mealtimes and regular exercise, identified as a helpful factor for weight reduction"* (Hemetek et al., 2015, p. 4).

In addition, when asked to evaluate a dietary obesity intervention retrospectively, adolescents commented: *"Wanted but did not receive specific diet, pills, and exercises"* (Hammar et al., 1971, p. 51). This gives the impression of adolescents not wanting to take responsibility for their own weight management, contradictory to the theme 'Adolescents recognising personal responsibility and personal motivation for weight loss' (section 2.5.9.5) which will be discussed later.

Nonetheless, more data supported the use of concise and practical messages throughout interventions. Adolescents liked gaining knowledge and being informed of evidence-based concrete lifestyle messages, bringing the responsibility back to the individual:

*“I am a bit more fit now, like healthier because I know how much I am meant to exercise now” (Daley et al., 2008, p. 814).*

*“Another positive thing is that you are informed about just everything . . . you know how everything affects everything else and . . . like, you get information on if you eat this, what happens then, and so on” (Morinder et al., 2011, p. 1002).*

Many adolescents highlighted their lack of knowledge prior to taking part in an intervention and the importance of learning new information to help them with weight loss. In particular, this knowledge related to PA and diet:

*“I want to start exercising, but I don’t know what exercises to do” (Alm et al., 2008, p. 282).*

*“the main thing that I know about is things in food and all the bad things in food - half of that I never knew like when we did all the sugars in the drinks. I never knew any of that” (Hester et al., 2009, p. 4).*

Data from Watson et al., (2016) shows that adolescents do recognise when they have gained new knowledge:

*“Participants noticed they were changing through applying what they had learnt. This included differences in mindset, behaviours, and feelings” (Watson et al., 2016, p. 412).*

When text messages were sent to adolescents to support their maintenance period following an intervention, adolescents were more appreciative of practical messages that gave them simple ideas of changes they could implement into their daily schedule. This reiterates the importance of setting SMART goals described in the theme ‘Importance of goal setting’ (section 2.5.5.2). Impractical suggestions and those, which were not concise, were not appreciated:

*“Not really good. What’s wrong with it is (1) I don’t have an egg timer, (2) I don’t really plan on buying one, and (3) I don’t think that anyone would stay on the computer for [just] 30 minutes, I think they’d want to be on there for longer” (Smith et al., 2014a, p. 7).*

*“Having a healthy tip that you can actually do is good”* (Smith et al., 2014a, p. 7).

#### 2.5.5.7 Active rather than passive engagement leads to fun

It is clear that enjoyment and fun are of large importance to adolescents when attending an obesity treatment intervention (Howie et al., 2016; Watson et al., 2016; Woolford et al., 2012b). This sense of fun appears to be driven by allowing opportunities for hands on activities. This active engagement and general importance of fun has been highlighted in depth by Watson et al., (2016) not just in regards to exercise and learning about the diet, but also other classroom based learning. The importance of ensuring active engagement rather than passive is an important theme to recognise in intervention content:

*“Fun was an adjective used to describe the ‘exercises’, ‘activities’, ‘sports’ or ‘games’: Actually doing them, rather than taking a more passive stance (e.g., watching, waiting, or just talking about it). ‘Boring’ was used to describe the passive learning elements”* (Watson et al., 2016, p. 414).

The importance of fun in the design of an intervention is further reiterated. Fun seemed an important aspect to ensure that participants were not anxious about attending an intervention:

*“She [the exercise physiologist] was fun about it. She made sure we got a really good work out, but yet she would try to incorporate, you know, little fun activities, and she made it more than just going in to work out and sweat. She made it into more fun so that we would be interested in doing it”* (Woolford et al., 2012b, p. 4).

*“The word ‘fun’ was used spontaneously by twelve of the 14 participants, to describe both the programme as a whole as well as specific components”* (Watson et al., 2016, p. 411).

*“[MEND] was all fun. .not worrying at all”* (Watson et al., 2016, p. 413).

This sense of fun created an environment where it did not seem that learning was actually taking place. Sessions that were effortless and flowed were appreciated:

*“In response to being asked whether he learnt anything new from the activities, he said:*

(.) um, (.) well no not really. Not from the activities. 'Cause they were more of like a fun thing, not learning" (Watson et al., 2016, p. 413).

#### 2.5.6 Support

Data from this synthesis strongly highlights the importance of social support in adolescents being successful with their weight loss attempts, from professionals, family and peers. Each of these will now be discussed as a theme in addition to the importance of these relationships in jump-starting adolescents weight loss progress. 23 studies supported this domain (Alm et al., 2008; Campbell-Voytal et al., 2018; Daley et al., 2008; Engstrom et al., 2016; Hammar et al., 1971; Hemetek et al., 2015; Hester et al., 2009; Holt et al., 2005; Howie et al., 2016; Jogova et al., 2013; Li et al., 2016; Melnyk et al., 2007; Morinder et al., 2011; Owen et al., 2009; Peeters et al., 2012; Reece et al., 2016; Riiser et al., 2013; Smith et al., 2014b; Staiano et al., 2012; Twiddy et al., 2012; Watson et al., 2016; Woolford et al., 2012a; Woolford et al., 2012b).

##### 2.5.6.1 Professional support valued

This prominent domain of support is more heavily weighted in favour of support from professionals. From the amount of data coming from 15 included studies, professional support appears to be valued by adolescents, even more so than support coming from peers and family (Alm et al., 2008; Daley et al., 2008; Hammar et al., 1971; Hester et al., 2009; Holt et al., 2005; Li et al., 2016; Morinder et al., 2011; Nguyen et al., 2014; Owen et al., 2009; Peeters et al., 2012; Reece et al., 2016; Riiser et al., 2013; Rudolf et al., 2006; Twiddy et al., 2012; Woolford et al., 2012b). The friendly, fun and enjoyable nature of this supportive relationship was particularly welcomed by adolescents who appreciated professionals encouraging and positive attitude towards them:

*"Losing weight is hard, but my mom and coach believe in me. They are great and supportive. I need the support to keep me going"* (Alm et al., 2008, p. 281). This quote also reflects the theme 'Importance of family support', reported below (section 2.5.6.2).

*"the staff were brilliant. They are funny and they come at night-time and have pillow fights. They are nice to you and stuff"* (Holt et al., 2005, p. 228).

Adolescents appeared to value being given some personal attention by professionals. The feeling of finally being given the support they have needed and having someone to talk

to:

*"I felt like . . . at last someone is paying attention"* (Morinder et al., 2011, p. 1004).

This appreciation of professional support appears to be emphasised when that professional is experienced and specialises in childhood obesity. Adolescents felt comforted by this and it gave them a sense that they were not the only one who was overweight:

*"you can talk to someone about your situation . . . at the beginning it was like this "I am the only one . . . but these people (author's remark; clinic staff) meet people like you . . . many every day that are at least as ... um . . . overweight as you are..."* (Morinder et al., 2011, p. 1004).

Adolescents also appreciated a non-forceful approach from professionals and valued gentle encouragement when it came to activities:

*"All [staff] really friendly. They didn't force me to do anything they said, 'join in if you want to.' They give you encouragement to go out and do stuff. They won't push you, they won't make you do it, they like encourage us to go out and do it yourself"* (Holt et al., 2005, p. 228).

One aspect of professional support that adolescents valued highly was receiving support that focused on more than just weight loss. Adolescents highlighted wanting support that helped with factors such as self-esteem and well-being. Adolescents also described discovering decision-making tools, learning to cope with stress and an increase in confidence levels through attending interventions. This increase in confidence and self-discovery often appeared to mediate effectiveness:

Positive comments from adolescents who took part an intervention included *"helped to understand self and problems"* (Hammar et al., 1971, p. 51).

Responses from another study involving overweight adolescents aged 15- 18 years when asked how the programme was most helpful included: *"Getting tools to make the right decisions"* and *"learning how to cope with stress"* (Melnik et al., 2007, pp. 319-320).

Negative comments about participation in a weight management clinic experience from one study stated *'wanted help with problems other than weight'* (Hammar et al., 1971, p. 51). Similar data emerged from another study that described adolescents' perceptions of a paediatric obesity clinic in Sweden (Morinder et al., 2011) that show absence of a more personal relationship between adolescents and professionals can lead to feelings of neglect and frustration, which in turn can lead to the adolescent defying all recommendations:

*"I don't feel that they understand me as an individual . . . everybody's the same . . . sits in front of the computer and TV . . . swills down two liters of coke and crisps a day . . . - and so on . . . but it's not been like that for me . . . they've not understood my situation"* (Morinder et al., 2011, p. 1003).

*"I just sit there and agree and then when I get out of the door . . . to be frank . . . I don't give a shit about what they've said..."* (Morinder et al., 2011, p. 1003).

These comments come alongside a general desire from adolescents to work more closely with regular professionals, whether this be an individual professional or a team, in order to develop this deeper and more meaningful relationship:

*"I've quite a lot of many doctors . . . if I'd got one or two maybe I'd have got to know them better . . . and able to take their advice more seriously"* (Morinder et al., 2011, p. 1003).

#### 2.5.6.2 Importance of family support

Another avenue of support that appears to be valued highly by adolescents was that of their own family (Alm et al., 2008; Campbell-Voytal et al., 2018; Engstrom et al., 2016; Hester et al., 2009; Howie et al., 2016; Jogova et al., 2013; Li et al., 2016; Melnyk et al., 2007; Morinder et al., 2011; Peeters et al., 2012; Reece et al., 2016; Smith et al., 2014b; Watson et al., 2016; Woolford et al., 2012a; Woolford et al., 2012b). This support from family members gave adolescents continued motivation and encouragement to continue with their weight loss attempts:

*"They [family members] motivate me to go, and say I can do it, you know"* (Peeters et al., 2012, p. 653).

In a study using photovoice, when asked to take photographs of someone or something that supports them, adolescents recognised and appreciated the support they received from their families:

*"i took a picture of my mom because she always reminds me to exercise and says, 'Oh make sure you're eating healthy.' My mom's the only person who really helps me"* (Woolford et al., 2012a, p. 233).

Adolescents particularly found family supportive when they joined in with behaviour change efforts and valued the effect this had on bringing the family closer together:

*"We don't have much money, so I can't join a gym. My mom helped me to get around that. We take walks together almost every day"* (Alm et al., 2008, p. 281).

*"We talked about more positive stuff instead of negative, and encouraged each other to make healthy choices"* (Melnyk et al., 2007, p. 320).

Results from this synthesis clearly shows that family support throughout an obesity intervention can assist in providing a positive framework for behaviour change and providing important encouragement to make healthier choices. In particular, this encouragement appears to be coming more from the mother within families, highlighting this important family figure. Although family support was clearly appreciated, one adolescent from one study did highlight the embarrassment they felt when being observed by their parents during an activity:

*"Shamima at first found the activities 'embarrassing', because the parents were observing"* (Watson et al., 2016, p. 413).

Although adolescents benefited from positive family support, sometimes lack of knowledge from a parent around weight management, healthy eating and behaviour change caused a barrier to weight loss for the adolescent. This lack of family support appeared more common in those adolescents reporting no success. The absence of understanding and knowledge from family members can lead to frustration and despair and can create a sense of self-blaming.

*“My mom yells at me if I gain weight or eat junk food. It’s all my fault. She says I have no willpower” (Alm et al., 2008, p. 281).*

*“I was having [a camp style breakfast] and [parents] were like ‘what [are] you doing?...don’t talk rubbish you [didn’t] have that sort of stuff at camp – you wouldn’t have lost weight” (Hester et al., 2009, p. 5).*

#### *2.5.6.3 Peer support valued*

In addition to family and professional support, adolescents also benefited from support from their peers and valued this highly (Alm et al., 2008; Engstrom et al., 2016; Hammar et al., 1971; Hester et al., 2009; Holt et al., 2005; Jogova et al., 2013; Li et al., 2016; Melnyk et al., 2007; Morinder et al., 2011; Peeters et al., 2012; Reece et al., 2016; Smith et al., 2014a; Smith et al., 2014b; Staiano et al., 2012; Woolford et al., 2012a; Watson et al., 2016; Woolford et al., 2012b). This is noted in positive statements from adolescents:

*“I’d probably tell [friends] about some of the nice people that I’ve met and what it was like - overall really good. I’d probably tell my parents the same thing” (Hester et al., 2009, p. 4)*

*“Everyone bonds, it’s like it’s new. It’s weird but everyone becomes really close” (Reece et al., 2016, p. 902).*

Adolescents described being around their peers as a security blanket, allowing them to feel comfortable and confident. This suggests a group setting as preferable to adolescents, discussed previously in the theme ‘delivery method of intervention’ (section 2.5.5.3):

*“I don’t really like doing stuff alone, I like doing stuff with other people I feel safe and comfortable with...if I felt really excited and comfortable with those people I get really really excited and want to do it so much...because there’s lots of fun activities...I get interested” (Watson et al., 2016, p. 416).*

This peer support really gave adolescents with obesity a sense of belonging by allowing them to talk to adolescents in a similar position to them, sharing their struggles and issues. This feeling of acceptance is something they may not have experienced outside of the

intervention. Adolescents described being able to share feelings and talk with their peers in a positive manner:

*"I liked being able to talk in a group with the other people who were my age. . . Just how it wasn't just me who was struggling with losing weight at the time, it was more a bunch of other people and trying to find ways to come up with how to lose it and keep motivated"* (Woolford et al., 2012b, p. 5).

*"I like being around people who know exactly how you feel. If you're at home you can't really talk to anyone about your weight. I don't know why but when you come here you feel like you can talk to people. It's a lot easier to talk to people, to be around people. Everyone was in the same kind of situation, everyone knew what you were going through"* (Holt et al., 2005, p. 228).

Adolescents also commented on their initial goals and achievements in taking part that related to peer support and socialising. When asked about their goals for taking part in an intervention, one adolescent commented: *"Well obviously have more friends and things like that because at school there are people that are horrible and everything"* (Holt et al., 2005, p. 227). Whilst another study reported on positive aspects of the intervention was gaining an *"ability to get along with others"* (Hammar et al., 1971, p. 51).

Peer support was also appreciated outside of the intervention setting:

*"[My friends] help me and redirect me, like if i want to eat something bad they would give me an apple instead"* (Woolford et al., 2012a, p. 233).

Further supporting a group intervention, peer support was often mentioned in relation to exercise, with adolescents enjoying taking part in PA with other adolescents:

*"It's boring to work out alone"* (Peeters et al., 2012, p. 655).

Another aspect of peer support appreciated by some adolescents was that of competition, supporting the inclusion of PA as part of a WMP. Working alongside peers opened up opportunities to engage in competitive activities:

*"For some, it was not simply about engaging in activities with others, but being in*

competition with others. Lizzie recounted 'our team won', rather than recall of the name of the game or any other details. Matt enjoyed 'being in competition with the older ones' against the 'little ones'; it was fun because 'most of the time we either won or came second' (Watson et al., 2016, p. 416).

"We see who lifts more" (Peeters et al., 2012, p. 655).

#### 2.5.6.4 Supportive relationships are key to jump starting weight loss

Whether support came from professionals, family or friends, adolescents valued these relationships. This support was sometimes essential in kick-starting the adolescents on their weight loss journeys. Adolescents may not seek out interventions themselves highlighting the availability of, or lack of, weight management interventions as well as the importance of professionals communicating with overweight adolescents:

*"I decided to try to get in better shape, and because my mom introduced me to the program. I thought it would help my health and weight and, at the same time, help with the study as well"* (Peeters et al., 2012, p. 655).

*"Because I've reached the highest point of my weight—it wasn't too healthy and I went to the doctor one day and he thought it would be a good idea for me to join the program and see how I liked it and see if it would work with the thyroid problem that I have"* (Peeters et al., 2012, p. 652).

Whether support came from peers, professionals or family, adolescents gained a sense of approval and internal motivation from others appreciating their weight loss efforts, emphasising the importance of positive reinforcement:

*"[Friends and family said] you look healthier, you've done really good at that camp, you've lost loads of weight and I'm really proud of you. It felt like walking on the moon and made [me] really smile"* (Hester et al., 2009, p. 4).

#### 2.5.7 Barriers

This synthesis identified many barriers to engagement with WMPs as well as barriers to successful weight management. Overall, seven analytical themes were identified within this section: Prior fears of attending interventions, unhealthy food and the food

environment, barriers relating to convenience, gender specific barriers to exercise, obesity treatment bringing about feelings of failure, guilt and shame, overweight adolescents not always willing to make changes, and low or no cost to participate. This domain is supported by 21 studies (Alm et al., 2008; Banks et al., 2014; Daley et al., 2008; Engstrom et al., 2016; Hester et al., 2009; Holt et al., 2005; Howie et al., 2016; Jogova et al., 2013; Li et al., 2016; Melnyk et al., 2007; Morinder et al., 2011; Nguyen et al., 2014; Owen et al., 2009; Peeters et al., 2012; Reece et al., 2016; Rudolf et al., 2006; Smith et al., 2014a; Smith et al., 2014b; Watson et al., 2016; Woolford et al., 2012a; Woolford et al., 2012b). Each of theme will be described below with supporting quotes:

#### *2.5.7.1 Prior fears of attending interventions*

Adolescents from six of the included studies reported prior fears of attending an intervention (Rudolf et al., 2006; Hester et al., 2009; Woolford et al., 2012b; Smith et al., 2014b; Holt et al., 2005; Daley et al., 2008). Many of these worries related to the intensity of weight loss activities, type of food on offer or incorrect preconceptions. A selection of supporting quotes from these studies are given below:

*“I thought that we [would] be eating rabbit food and it’s actually . . . really good portions”* (Hester et al., 2009, p. 4).

*“I heard about an American camp where they make you do it [i.e. exercise and control diet] and that if you don’t want to do it they get angry and stuff, I was worried about that”* (Holt et al., 2005, p. 225).

These pre-conceptions stem from the interventions not being portrayed as fun, something that has been described earlier in the theme ‘active rather than passive engagement leads to fun’ (section 2.5.5.7) as an important element of an adolescent WMP. Some adolescents had prior worries about being bullied, group dynamics and not being accepted:

*“I was most worried about the people, what they’d be like, because at home, if you are fat then everyone laughs at you for it. I thought some people might be like that at camp as well”* (Holt et al., 2005, p. 226).

Additional worries related to previous experiences with health professionals and not having someone to attend with, reiterating the importance of family and/or peer support:

*“If you feel alone going there, that’s really bad”* (Smith et al., 2014b, p. 6).

*“The children expressed their initial reticence in attending, and a positive attitude towards the programme. They appreciated the approach taken by the health trainers and compared it with previous unsatisfactory encounters they had had with health professionals”* (Rudolf et al., 2006, p. 738).

#### 2.5.7.2 Unhealthy food and the food environment

One barrier that was highlighted by adolescents from a photovoice study (Woolford et al., 2012a) involved being exposed to an unhealthy food environment. Adolescents who were taking part in a multi-disciplinary WMP were asked to take pictures of something that makes it difficult to lose weight. The most common barriers were being surrounded by fast food restaurants and environments with unhealthy foods and drinks on offer:

*“I took a picture of a pop bottle because my dad drinks a lot of pop so it’s hard when i see him drinking it”* (Woolford et al., 2012a, p. 234).

*“I work at [a fast food restaurant] and there is soooo much good food around—cookies, chips, drinks. it’s hard to control myself some days but I’m getting a lot better at it”* (Woolford et al., 2012a, p. 234).

When exposed to healthier options, adolescents found this beneficial in aiding their weight loss. One study that involved pictures of healthier items gave adolescents encouragement to eat and drink more of these items:

*“it’s a picture of broccoli, it’s my favorite vegetable. i can eat it raw or boiled. if i saw this picture it would make me want to crave it”* (Woolford et al., 2012a, p. 233).

#### 2.5.7.3 Barriers relating to convenience

As perhaps expected, adolescents also faced barriers that were related to convenience, such as the weather, time, transportation as well as family and school commitments

*“Homework. I didn’t have time to think about it [the text messages] at all. I’ve got like five projects at the moment”* (Smith et al., 2014a, p. 7).

*“When prompted to discuss ways in which the exercise component could be enhanced, the most commonly mentioned problem was the distance that patients had to travel to attend sessions and the desire to have classes offered closer to their homes” (Woolford et al., 2012b, p. 5).*

The study by Peeters et al., (2012), investigated adolescent experiences and barriers of taking part in a multi-disciplinary intervention across various time points (3 weeks, 3 months, 6 months). Most barriers described, such as schoolwork commitments, general motivation and social obligations are mentioned across all three-time points. It is interesting to note that weather, is only mentioned as a barrier further into the intervention, at 3 and 6 months:

*“At 3- weeks, the most frequently endorsed barriers were scheduling conflicts with schoolwork (reported by 36%), lack of motivation (reported by 27%; eg, “I just didn’t feel like it; I didn’t have any motivation to get myself there”), and fatigue (reported by 20%)” (Peeters et al., 2012, p. 654).*

“

*At 3-months, participants found the following to be barriers: bad weather (32%), conflict with schoolwork (24%), and social obligation to family or friends (24%)” (Peeters et al., 2012, p. 654).*

*“It depends on if I have a lot of homework, if my parents can drive me there, weather” (Participant, 6-months)” (Peeters et al., 2012, p. 654).*

Adolescents do show an ability to problem solve and are able to come up with suggestions to overcome these everyday barriers of convenience. This highlights the importance of problem solving as part of a weight management intervention:

*“If I go straight from school it’s not hard at all to go, but if I get home and change and watch TV or go on the internet, like there’s no way I’m going to the gym (participant, 3-months)” (Peeters et al., 2012, p. 655).*

#### 2.5.7.4 Gender specific barriers to exercise

Gender specific barriers emerged from one study by Alm et al., (2008) included in this synthesis that investigated barriers and facilitators to achieving behaviour goals in a group of obese inner-city adolescents. Specifically, female adolescents spoke about their embarrassment of wearing sportswear, whereas this was not a worry for males. Female adolescents also reported exercising in front of men as a barrier to taking part in activity.

*“Many girls expressed embarrassment about wearing shorts, sweatpants, and other workout clothes, especially in the presence of males, thus inhibiting them from exercising. Most boys felt that their bodies were tolerable and were comfortable wearing exercise clothes”* (Alm et al., 2008, p. 281).

*“I hate gym class. I hate wearing shorts. I feel so embarrassed about how I look in shorts. (Female participant)”* (Alm et al., 2008, p. 281).

Additionally, female adolescents, and their parents, considered the safety of where they chose to exercise, whereas boys did not contemplate this:

*“I need someone to walk with me. My mom doesn’t want me walking around by myself. She says that she doesn’t trust the guys in the neighbourhood”* (Alm et al., 2008, p. 281).

*“I go to a park in the neighborhood with my friends and shoot hoops (Male participant)”* (Alm et al., 2008, p. 281).

#### 2.5.7.5 Obesity treatment bringing about feelings of failure, guilt and shame

Adolescents reported barriers to continuing with lifestyle obesity treatment interventions. Often adolescents commented on being fearful of being told off by a health professional for not losing weight and feeling like a failure. These feelings would lead to adolescents not continuing with the intervention, which led to feelings of guilt and shame. Four adolescents from two studies reported:

*“. . . that they [clinic staff] might scold you . . . you know they will not . . . but it feels like that”* (Morinder et al., 2011, p. 1005).

*“felt ashamed . . . because you said you would lose weight but instead you gained . . . felt*

*a bit embarrassed . . . and you could be sort of scared, like...”* (Morinder et al., 2011, p. 1005).

*“It was summer when I’d put on . . . like . . . five kilos . . . then I called and cancelled on my own . . . I really did not want to come . . . did not show the appointment letter to my mother”* (Morinder et al., 2011, p. 1005).

*“I stopped my diet because I wasn’t losing weight. It’s too hard for me to do. I don’t have what it takes to lose weight”* (Alm et al., 2008, p. 282).

*“Participants who reported no weight loss tended to view themselves as failures”* (Alm et al., 2008, p. 282).

Adolescents also commented on their feelings of shame and not wanting others to know they were attending an obesity treatment intervention. A sense of stigma and embarrassment was associated with attending obesity interventions:

*“Coming to the clinic is not something you want to tell your friends . . . I don’t know why but . . . you don’t want anyone to mention it . . . because then it might seem that you’ve failed in some way...”* (Morinder et al., 2011, p. 1005).

*“Some told their friends where they were going, others created alternative explanations such as having to go to the dentist. However, ‘cloaking’ their attendance was harder for older adolescent children”* (Banks et al., 2014, p. 107).

Attending obesity treatment interventions appeared to bring about a greater focus on weight, which in turn could lead to lower self-esteem:

*“I believe you think more about your weight coming here . . . you become more aware . . . friends that are not so aware of the problem or . . . who believe they are slim . . . they have good self-esteem...”* (Morinder et al., 2011, p. 1005).

These negative feelings can also be seen after an intervention when adolescents may struggle to maintain their weight loss. The importance of improving support longer-term

for adolescents WMPs, discussed in more detail in section 2.5.10.3, therefore stems further than just weight loss. This longer-term support is also importance for the mental health of adolescents:

*“When I left camp [having] lost weight and got to 105kgs I [was] confident about my weight. But now, I’m that exact same weight [again] but I’m unconfident about my weight. [e.g.] I got a phone call yesterday from a friend, ‘there’s a party up at college, do you want to...go?’ I said no I was busy, but I wasn’t, it’s because [weight regain] has a knock on effect on your confidence”* (Hester et al., 2009, p. 6).

#### *2.5.7.6 Overweight adolescents not always willing to make changes*

Honest accounts from some adolescents highlighted that adolescents were not always ready to make changes to their lifestyle. Some adolescents struggled to relate to poor health as a motivator as currently they were healthy other than their weight status. Adolescents appear not to be driven primarily by ill health but more by physical appearance. This will be discussed further under the ‘weight loss as primary motivation’ theme (section 2.5.9.1).

*“... right now it feels less important . . . but it is periodically . . . sometimes you can feel really fat and ugly . . . another day totally okay . . . but deep down I always want to lose weight”* (Morinder et al., 2011, p. 1005).

*“Not the most important thing . . . that is to say . . . it is very important . . . but still . . . I think . . . I’m not ill yet . . . and then I think . . . I can concentrate on other things first . . . - but still I want to . . . it is very important to lose weight because I don’t want to become ill because of my overweight...”* (Morinder et al., 2011, p. 1005).

Other adolescents were just unmotivated and not yet ready to make changes, suggestive of being in the contemplation stage of the transtheoretical model of health behaviour change (Prochaska and Velicer, 1997).

*“I probably could, somehow, fit it in, but it’s just, I really can’t be bothered. I want to, but, actually, I don’t at the same time. It’s like, I must go the gym, and then I don’t bother”* (Daley et al., 2008, p. 815).

Many adolescents also reported that their only motivation for taking part in lifestyle obesity treatment interventions and losing weight was to please others, such as health professionals and family:

*"I'm not doing this for myself...it has been like that a lot, I'm doing it for my father and mother and the hospital sort of . . . to . . . don't want a lot of criticism and stuff"* (Morinder et al., 2011, p. 1004)

*"...it went in one ear and out the other . . . I mean before . . . I didn't worry that much . . . I just came here because my parents wanted me to"* (Morinder et al., 2011, p. 1005).

#### *2.5.7.7 Low or no cost to participate*

The cost of engaging with an intervention or for taking part in PA was a clear consideration to families. Adolescents appreciated free access to exercise facilities, however when it came to the cost of food, this was not seen as important motivator or barrier to this age group. One study (Owen et al., 2009) reported on the views of adolescents and their families who were unsuccessful in their weight loss journey. Families attributed this to not being able to afford appropriate exercise facilities for their adolescent:

*"Others described the advice as being impractical due to the expense or lack of exercise facilities"* (Owen et al., 2009, p. 241).

In another study where adolescents received a free membership to a fitness facility for 6 months, adolescents were very positive about this opportunity:

*"At 3-months, participants continued to enjoy the free gym membership"* (Peeters et al., 2012, p. 655).

*"I just really wanted to start going to the gym and I heard that I could get a free membership so I'm like, o.k., why not?"* (Peeters et al., 2012, p. 652).

This view was reiterated elsewhere from adolescents taking part in an 8-week multi-disciplinary intervention in Australia:

*“Making a healthy lifestyle program available and accessible for all community members was an identified as an important enabler for recruiting adolescents and families. Participants recommended making the program free or very low cost to increase interest”* (Smith et al., 2014b, p. 8).

*“So you’re not forced to drop out for lack of money”* (Smith et al., 2014b, p. 8).

Adolescents in one study were unconcerned with budgeting for food, which was seen to be the responsibility of the parent:

*“Can you make a healthy breakfast for less than 3 dollars?” I don’t think people my age will really care about that.so I think some questions have to be more relevant to my age group”* (Jogova et al., 2013, p. 76).

*“Cost doesn’t matter to kids; we don’t care how much our parents spend on food. Parents should have that [information] it should be the parents’ responsibility. Kids don’t want this”* (Jogova et al., 2013, p.76).

#### 2.5.8 PA vs. Diet

A large majority of interventions included in this synthesis involved a PA element. Overall, PA was very well received within interventions. Themes that developed in this large section include ‘creative and varied physical activities and facilities wanted’, ‘preference for achievable yet challenging PA sessions’, ‘enjoyment of sports and PA, including gym and gym equipment’ and ‘learning to enjoy sport and PA’. As PA was not enjoyed by every adolescent, a theme labelled ‘dislike of exercise’ was also included. Although PA was spoken about more often than the diet element of interventions, adolescents did speak about their experiences of learning to eat healthily. This domain is supported by 19 studies (Alm et al., 2008; Banks et al., 2014; Campbell-Voytal et al., 2018; Daley et al., 2008; Engstrom et al., 2016; Hester et al., 2009; Holt et al., 2005; Howie et al., 2016; Li et al., 2016; Melnyk et al., 2007; Morinder et al., 2011; Nguyen et al., 2014; Owen et al., 2009; Peeters et al., 2012; Reece et al., 2016; Smith et al., 2014b; Staiano et al., 2012; Watson et al., 2016; Woolford et al., 2012a; Woolford et al., 2012b). Themes will now be discussed:

#### 2.5.8.1 *Enjoyment from learning to eat healthily*

Adolescents from three multi-disciplinary interventions (Melnik *et al.*, 2007; Hester *et al.*, 2009; Howie *et al.*, 2016) commented on the benefits of understanding the nutritional content of different foods and drinks as well as giving them a better awareness of what foods should be eaten in moderation:

*“Reasons why the participants believed that all teens should receive the program included: (a) it would open their eyes to all the junk food that they eat”* (Melnik *et al.*, 2007, p. 320).

*“I used to think there’s bad foods and there’s good foods - there’s not. There’s good foods and there’s foods that you shouldn’t have as often”* (Hester *et al.*, 2009, p. 4).

Additionally, adolescents appeared to prefer healthy eating related activities that were more practical and hands-on. These visual activities seemed to engage adolescents more than tasks that involved lots of writing:

*“I remember one particular one was cool where [the dietician] brought in different foods, different foods that people commonly eat, and then showed how much, like she had a stack of rubbery stuff and it represented the fat that was in like the cheeseburger or something. So I thought that was interesting because it was in your face, showing you what’s in the foods”* (Woolford *et al.*, 2012b, p. 4).

The element of having more practical and interactive activities is discussed in more detail within the theme ‘active rather than passive engagement leads to fun’ (section 2.5.5.7).

In addition to having a better awareness of the nutritional content of foods, adolescents also benefited from learning about changing dietary habits from attending interventions:

*“It were like activities and stuff, like... trying to change your food portions, swap like junk food for fruit and stuff”* (Reece *et al.*, 2016, p. 902).

However, in a study by Holt 2005, that involved a 6-week weight management camp away from the home environment, some adolescents found the dietary regime too far removed from what they had been used to eating at home:

*I really hated the food, really hated it because of I’m not so used to eating so healthy at*

*home. When I came to camp the food was a lot different. When I'm at home I have chips but when I come to camp it was like healthy food. I mean, I love unhealthy food . . . obviously that's why I went here anyway, but I'm a really picky eater, and if I don't like it I won't eat it . . . I'm not used to eating that stuff at home.* (Holt et al., 2005, p. 228)

#### *2.5.8.2 Creative and varied physical activities and facilities wanted*

Adolescents from six studies (Banks et al., 2014; Daley et al., 2008; Holt et al., 2005; Owen et al., 2009; Woolford et al., 2012a; Woolford et al., 2012b) described the importance of variety in order to keep PA fun. Variety was noted in terms of different physical activities as well as exercise facilities. This seemed important to adolescents to retain their interest and reduce the likelihood of dropping out of an intervention:

*"Yeah he [exercise practitioner] gave, well we got loads of places where we can go, well since I'm 16 now, there's quite a few places I can go to and get membership"* (Banks et al., 2014, p. 106).

*"13 participants commented positively about the 'Choice of Activities' that were available to them at the camp"* (Holt et al., 2005, p. 228).

Variety also was appreciated within certain sports, such as swimming. Being able to adapt exercises within an activity led to less boredom:

*"Instead of just going swimming you could swim differently and faster...you don't have to just do one length, get bored and get out, you can do a couple of lengths, all different strokes. Makes you lose lots of weight, but not falsely, it's enjoyable to do"* (Watson et al., 2016, p. 415).

This desire for variety in PA extends to the use of exergames (active video games), which was the focus of one study included in this synthesis (Staiano et al., 2012). Adolescents commented on enjoying listening to music whilst playing exergames as well as the setting of the games:

*"Another participant in the competitive condition said that he enjoyed the "pretty and relaxing" setting of the running game, which was on a virtual beach"* (Staiano et al., 2012, p. 816).

*“Participants were also motivated by listening to music during their workouts” (Staiano et al., 2012, p. 816).*

More interactive games seemed to be preferred, however lack of variety, over a period, led to adolescents becoming unstimulated, reiterating the importance of variation:

*“In contrast to the tennis target game, a female participant in the competitive condition said that she especially enjoyed the games that were “faster paced” and “more interactive” (Staiano et al., 2012, p. 817).*

*“Participants had limited control and choice over game play because all exergame routines were preassigned. Participants expressed boredom with playing the Wii Active exergame for multiple weeks and requested additional exergames to play instead” (Staiano et al., 2012, p. 816).*

#### *2.5.8.3 Preference for achievable yet challenging PA sessions*

Data from one single component PA intervention (Daley et al., 2008) and one multi-disciplinary intervention including PA (Woolford et al., 2012b) found that adolescents favoured activity that was challenging yet achievable. The sense of accomplishment was an important motivation for adolescents:

*“It wasn’t made too hard ... it was a challenge sometimes, but it was made fun for me to do ... it wasn’t like getting up in the morning and dread coming ... yeah I liked coming” (Daley et al., 2008, p. 812).*

*“They seemed to suggest it was fun and enjoyable because there were a variety of activities (including resistance training, which was very popular), the activities were things they could accomplish, and because team members performed the exercise with them” (Woolford et al., 2012b, p. 4).*

Adolescents also gained a feeling of accomplishment from exercising by seeing improvements in health:

*“I could see the benefits, like my heart rate going down, things like that, it was good to*

*know that it was making me more healthy and I enjoyed it really” (Daley et al., 2008, p. 814).*

Allowing adolescents rest breaks helped make the PA achievable. Being able to finish a workout had a motivational effect and kept adolescents engaged in the activity:

*“I’d come over, have a rest, have a drink and then, when we were going for, like, another one, I just relaxed a bit and I just went on to it [exercise equipment], but I didn’t feel right tired when I got back on to on [exercise equipment]” (Daley et al., 2008, p. 812).*

*“It was all right, cos if it had gone on longer then I think that wouldn’t have been able to do everything properly” (Daley et al., 2008, p. 812).*

It appears important to strike this balance right; with some adolescents, getting bored if physical activities were not hard enough:

*“A male in the competitive group commented that he visited the school’s weight room instead of the exergame sessions because he “felt the workouts were not going to give [him] the results [he] wanted in building muscle and losing fat” (Staiano et al., 2012, p. 816).*

Whilst for other adolescents, the physical activities were too intense:

*“Many participants found certain aspects of the exergame, such as the virtual obstacle course, to be too long and too challenging, which resulted in frustration and drops in attendance” (Staiano et al., 2012, p. 816).*

This theme also highlights the importance of tailoring the intervention to individual needs (see section 2.5.5.1).

#### *2.5.8.4 Enjoyment of sports and PA, including gym and gym equipment*

Most adolescents reporting on interventions that included a PA element commented on their enjoyment of taking part (Alm et al., 2008; Daley et al., 2008; Engstrom et al., 2016; Hemetek et al., 2015; Hester et al., 2009; Holt et al., 2005; Howie et al., 2016; Nguyen et al., 2014; Owen et al., 2009; Peeters et al., 2012; Woolford et al., 2012a; Woolford et al.,

2012b). Again, fun was seen as an importance element as reported in the theme 'active rather than passive engagement leads to fun' (section 2.5.5.7):

*"if I was to go and do sports at home it wouldn't be as much fun. I don't know how but they made it more fun"* (Holt et al., 2005, p. 228).

*"The exercise component of the program was the most popular among adolescents. They emphasized that the exercise sessions were valuable because they provided an intense workout, and because they were fun"* (Woolford et al., 2012b, p. 4).

Many adolescents enjoyed being able to use a gym facility in particular:

*"I really like the gym. I like the way that you can see the improvements on your body and you can feel them as well"* (Peeters et al., 2012, p. 655).

Other adolescents commented on their enjoyment of taking part in sports and other physical activities such as cycling and basketball:

*"I feel like I'm on top of the world when I'm riding my bike"* (Woolford et al., 2012a, p. 234).

*"I like the feeling I get when I'm running up and down the basketball court, like it's for a purpose. I'm not just doing it for fun but it's about helping me lose weight also"* (Woolford et al., 2012a, p. 234).

Both adolescents who reported enjoying the use of the gym as well as taking part in sports commented on the way that PA made them 'feel', both physically and mentally. Being able to feel the effects of exercise created that sense of accomplishment:

*"I feel more energetic even though I've used more energy, I feel I'm more energetic"* (Daley et al., 2008, p. 813).

*"I felt healthier and better and stuff and I felt like I had actually done something. Rather than going home and being a couch potato"* (Daley et al., 2008, p. 814).

#### 2.5.8.5 Learning to enjoy sport and PA

Not only did the data suggest that adolescents enjoyed PA, but for some adolescents this was a new form of enjoyment, with many learning to take part in PA and sport with enjoyment for the first time:

*“[I used to] think that exercise [was]... sort of like a torture. But when I went [to MEND] I find it nice and fun and I just thought exercise was basically just going with the flow”* (Watson et al., 2016, p. 413).

*“Yes I have really discovered new attributes in me, I have indeed developed a love for sport; therefore if it was possible I would just exercise all day now”* (Hemetek et al., 2015, p. 5).

Some adolescents were learning to enjoy activities that they had never had the opportunity to try before:

*“I recently got into hula hooping. it’s actually a lot of work to keep up; it’s something fun I like to do”* (Woolford et al., 2012a, p. 233).

Participants from one exercise intervention (Daley et al., 2008) felt that they were now more aware of the importance of exercise and its role in improving health and changing sedentary behaviours:

*“Yeah, cos it makes you look at it a different way to what you used to, cos some kids just think ‘Oh well it will go away”* (Daley et al., 2008, p. 814).

*“It gets you out of the house and not eating, and also exercise helps you and it can help you lose weight”* (Daley et al., 2008, p. 814).

#### 2.5.8.6 Dislike of exercise

There were only a few comments from adolescents in one study that suggested they did not enjoy the PA element of an intervention. This related more to individual preference for specific exercise equipment in a gym setting, with some adolescents finding the equipment either boring or painful:

*“several participants (n = 4) also made negative comments about the intervention, these*

*tended to be related to using specific pieces of exercise equipment in the exercise therapy room. One participant thought that exercise was boring” (Daley et al., 2008, p. 812).*

*“I didn’t like the bike it hurts” (Daley et al., 2008, p. 812).*

### 2.5.9 Motivations

It is important to try to understand what motivates adolescents to take part in obesity treatment interventions in order to improve attrition and recruitment rates. This synthesis identified six themes that start to give the reader a picture of what motivates adolescents, as well as what sustains and improves their motivations. The themes include ‘weight loss as primary motivation’, ‘increased self-esteem as an aim and outcome of intervention’, being a healthy weight as ‘normal’ and socially desirable’, ‘Improving sporting and physical performance as motivation for weight loss’, and ‘adolescents recognising personal responsibility and personal motivation for weight loss’. These themes are supported by 17 studies (Alm et al., 2008; Daley et al., 2008; Engstrom et al., 2016; Hammar et al., 1971; Hemetek et al., 2015; Hester et al., 2009; Holt et al., 2005; Howie et al., 2016; Li et al., 2016; Morinder et al., 2011; Nguyen et al., 2014; Owen et al., 2009; Peeters et al., 2012; Reece et al., 2016; Twiddy et al., 2012; Woolford et al., 2012a; Woolford et al., 2012b).

#### 2.5.9.1 Weight loss as primary motivation

Understanding adolescent’s primary motivations for taking part in an intervention is vital to improve engagement. Adolescents from nine out of the 24 included studies commented on weight loss being their primary goal for taking part in an obesity treatment intervention (Alm et al., 2008; Daley et al., 2008; Hammar et al., 1971; Hester et al., 2009; Holt et al., 2005; Morinder et al., 2011; Nguyen et al., 2014; Peeters et al., 2012; Twiddy et al., 2012):

*“They helped me to lose weight—that’s what I am here for” (Daley et al., 2008, p. 814).*

*“All 15 participants reported that ‘Weight Loss’ was their primary goal for attending the camp” (Holt et al., 2005, p. 226).*

*“The most commonly identified outcome expectation of the trial was weight loss, stated by approximately 40%” (Peeters et al., 2012, p. 652).*

*“To lose weight. That’s the main goal and it was the reason I went – to lose weight”*  
(Twiddy et al., 2012, p. 1312).

As mentioned previously, under the theme ‘overweight adolescents not always willing to make changes’ (section 2.5.7.6), adolescents are not always able to relate to poor health as a motivator. Although not the primary reason for motivating weight loss, some adolescents did appear to be driven to lose weight to prevent health sequelae.

*“Both genders mentioned wanting to prevent future medical conditions associated with being overweight”* (Alm et al., 2008, p. 280).

*“Other things could be more important than, or just as important as, weight reduction, for example feeling good and accepting oneself, being healthy and in good physical shape, having more self esteem, and not worrying about hospital visits and future diseases”*  
(Morinder et al., 2011, p. 1004).

*“...in a way to be healthier too . . . think more of yourself . . . how your body is functioning...”*  
(Morinder et al., 2011, p. 1004)

In some cases, being aware of preventing health sequelae was due to having family members with a health condition:

*“Being overweight is not healthy. I don’t want to have a heart attack like my grandmother”*  
(Alm et al., 2008, p. 281).

*“My dad has diabetes. I don’t want to have diabetes like him”* (Alm et al., 2008, p. 281).

Additionally, adolescents from one study expressed their preference for interventions to focus on the health element rather than purely on weight loss. This suggests that adolescent may be interested in more than just weight loss:

*“An unexpected finding from the interviews was parents’ and adolescents’ emphasis on the significance of intangible features of program participation. In particular, they highlighted the emotional support from providers and other participants, and the non-judgmental program tone focused on health rather than weight loss”* (Woolford et al.,

2012b, p. 5).

#### *2.5.9.2 Increased self-esteem as an aim and outcome of intervention*

Adolescents spoke about their desire to have greater confidence and self-esteem. This was related to their feelings generally, as well as their wish to feel accepted.

*"...it is to be able to be content with myself . . . feel that I am accepted . . . and that I accept myself at the same time . . . I think that is even more important actually..."* (Morinder et al., 2011, p. 1004).

*"Another indirect goal associated with losing weight was to 'Increase self-esteem', which was reported by five participants"* (Holt et al., 2005, p. 227).

This desire for greater confidence was often associated with physical appearance. This appeared to be a strong motivator for many adolescents:

*"I just wanted to like lose weight and be able to feel good in my clothes and stuff"* (Peeters et al., 2012, p. 652).

*"I really want to feel good about myself and look good. I want to wear cute clothes and bathing suits"* (Alm et al., 2008).

As a result of taking part in these interventions, many adolescents felt improvements in the way they viewed themselves, with confidence and self-esteem both appearing to be improved in relation to their feelings and appearance. Adolescents seemed to be happier within themselves:

*"I feel good about myself. I feel good that I'm actually doing something. It gives me a bit more energy and makes me more, like, awake"* (Daley et al., 2008, p. 813).

*"Many adolescents and parents found that the group programme had an impact on other areas of adolescents' lives, particularly increased self-confidence/self-esteem, and greater sociability"* (Nguyen et al., 2014, p. 208).

*"Well before I started coming to [WMP] and everything I weren't too happy with the way*

*I were, but then I came here and it were alright and I got better” (Reece et al., 2016, p. 902).*

As mentioned above, appearance was valued highly and many adolescents saw positive improvements in relation to this after attending an intervention:

*“My clothes fit better”; “My face is not as chubby” (Peeters et al., 2012, p. 655).*

*“Participants also reported that they felt their body shape had changed as a result of the intervention (n = 7): ‘I feel as if it’s definitely changing shape for the better, and I just feel a lot more confident’ (Daley et al., 2008, p. 815).*

This increase in self-esteem and confidence was often paired with a sense of achievement from all the efforts they had put into losing weight:

*“I feel pleased that I’ve actually done it. It’s like ‘yeah, I’ve done it” (Daley et al., 2008, p. 813).*

*“That you can achieve anything and there’s no reason to doubt yourself, what you’re doing and who you are, it makes you like stand up for yourself, if people pick on you, you just give them something back” (Daley et al., 2008, p. 814).*

In addition, this newly found confidence gave adolescents persistence and determination in achieving their goals, maintaining levels of motivation:

*“I’m very happy with the changes I’ve made. It makes me feel good about myself, like I can do this, but I have so much more weight to go” (Alm et al., 2008, p. 282).*

*“I’ve been doing it for a month already and I’ve lost 11lbs so that’s definitely kept me motivated. So that stuff is keeping me going because I know if I keep it up I’m just going to keep losing more weight” (Peeters et al., 2012, p. 653).*

*“That I can do a lot more, I’m capable of a lot more than I thought I was” (Daley et al., 2008, p. 814).*

#### 2.5.9.3 Being a healthy weight as 'normal' and socially desirable

Many adolescents viewed being a healthy weight as 'normal' and held this as the key to being accepted socially (Alm et al., 2008; Daley et al., 2008; Hemetek et al., 2015; Hester et al., 2009; Holt et al., 2005; Peeters et al., 2012; Reece et al., 2016; Twiddy et al., 2012). Normality, from the point of view of an adolescent in these studies suggested having a boyfriend and the ability to socialise and play with friends. This social desirability was often a driving motivator for adolescents:

*"Well my own wish was actually to be normal, and not to be excluded by others..."*  
(Hemetek et al., 2015, p. 3).

*"I'd have a boyfriend and more friends if I was thinner"* (Alm et al., 2008, p. 281).

*"I want to play with friends, get more out of breath and be the same as everyone else"*  
(Reece et al., 2016, p. 901).

As well as seeing weight loss as the key to social desirability, some adolescents felt that losing weight would reduce the bullying that they received outside of an intervention context and that would lead to being able to lead a normal and happy life:

*"lose weight and be happy at school, because I was getting bullied a bit for being bigger than other people"* (Holt et al., 2005, p. 226).

*"I just don't want to get bullied anymore, then I can lead a normal life"* (Reece et al., 2016, p. 901).

#### 2.5.9.4 Improving sporting and physical performance as motivation for weight loss

Another key weight loss motivator from adolescents emerged as wanting to improve their physical performance, both in terms of fitness and sports. This was particularly prominent with male adolescents:

*"I want to play football, so I need to improve my cardio and lose some weight to be speedier"* (Alm et al., 2008, p. 281).

*“I absolutely love sports but my favorite is basketball. I feel like if I got healthier, I would be able to be better at it”* (Woolford et al., 2012a, p. 233).

One adolescent was motivated to improve their muscle tone, which may be more related to aesthetic body desires rather than an improvement in sporting or physical performance:

*“I joined Bally’s to do weights. I’d like to be more toned”* (Alm et al., 2008, p. 281).

#### *2.5.9.5 Adolescents recognising personal responsibility and personal motivation for weight loss*

Adolescents highlighted a strong personal drive that motivated their weight loss (Alm et al., 2008; Hemetek et al., 2015; Morinder et al., 2011; Owen et al., 2009; Peeters et al., 2012; Reece et al., 2016; Twiddy et al., 2012; Woolford et al., 2012a). Successful adolescents appeared to experience a ‘light bulb’ moment that triggered this drive:

*“One’s own responsibility, determination and involvement, to achieve successful weight loss are emphasised as important as well as behavioural changes made by oneself. Personal empowerment, perceived control and a sense of competence to change the situation are present, despite possible weight gain.”* (Morinder et al., 2011, p. 1003).

*“I just made up my mind to lose weight...”* (Morinder et al., 2011, p. 1003).

*“It’s up to me, my drive to get there”* (Peeters et al., 2012, p. 653).

Sometimes this personal drive came from reminders of past negative experiences or not wanting to be overweight like other family members:

*“this is a picture that I have on my phone, of me, from a long time ago... Whenever I look at that picture, it reminds me to exercise, so I don’t go back to that”* (Woolford et al., 2012a, p. 233).

*“When I look at [my father] I see my entire dad’s side of the family, I want to be the one to break that chain (of being overweight)”* (Woolford et al., 2012a, p. 233).

This personal drive was in part due to adolescents realising their own responsibility in losing weight and following a healthy lifestyle. This is contradictory to previous sections discussed in this synthesis where adolescents want a prescriptive and regulated diet and exercise routine set by a professional (section 2.5.5.6). This recognition of responsibility was often brought about by attending an intervention or speaking to a health professional, as initially some adolescents had previously been in denial about their weight:

*“Summer camps and group treatments can be experienced as turning points for awareness of the importance of one’s own responsibility”* (Morinder et al., 2011, p. 1005).

*“my mother and others tried but it did not help until you really heard that this is life-threatening from doctors who really know . . . then it became motivating...”* (Morinder et al., 2011, p. 1005).

*“I believe you think more about your weight coming here...you become more aware...”* (Morinder et al., 2011, p. 1005).

One adolescent from one included study suggested that they felt their weight was someone else’s responsibility too, in this case their mothers:

*“I did not want it to be my mother’s fault...so I thought I must fix this now...”* (Morinder et al., 2011, p. 1005).

Adolescents spoke of a desire to lose weight to feel proud, which motivated their weight loss and personal drive:

*“They appeared to be motivated by a desire to feel pride in their ability to lose weight, to please the health care professionals and in some cases, to prove that they could succeed”* (Owen et al., 2009, p. 239).

Related to this personal pride and responsibility in losing weight, only two included studies mentioned anything to do with medical treatment as an aid to weight loss. Most adolescents that commented felt that this would not be an acceptable option:

*“Medication and bariatric surgery were mentioned briefly (n = 6) yet participants displayed*

*only limited awareness about what the treatments entailed. This perhaps reflects the widespread adoption of the notion of personal responsibility for weight status, the young people felt using these methods represented a form of ‘cheating’ and that they would prefer to do it (weight loss) for themselves (n = 3)” (Reece et al., 2016, p. 902).*

*“Sometimes they [obesity medication] don’t work so there’s no point in taking them. I’d rather do the work for myself so be proud of myself than taking tablets” (Reece et al., 2016, p. 902).*

The notion of personal responsibility for weight status continues with adolescents recognising the importance of a sensible weight loss:

*“I shouldn’t be losing the way I was then ... it’s not healthy to be losing [3.5 kg] a week” (Hester et al., 2009, p. 4).*

#### 2.5.10 Maintenance

Adolescents often spoke about their struggles with continuing with weight loss efforts as well as maintaining weight loss after an intervention had finished. This section will describe three key themes linked to maintenance: ‘weight loss expectations’, ‘transferring skills learnt into a normal home environment and routine’ and the general need for ‘longer-term support’. This domain is supported by 16 studies (*Alm et al., 2008; Campbell-Voytal et al., 2018; Daley et al., 2008; Engstrom et al., 2016; Hammar et al., 1971; Hemetek et al., 2015; Hester et al., 2009; Holt et al., 2005; Howie et al., 2016; Li et al., 2016; Melnyk et al., 2007; Morinder et al., 2011; Nguyen et al., 2014; Peeters et al., 2012; Reece et al., 2016; Woolford et al., 2012b*).

##### 2.5.10.1 Weight loss expectations

One factor that appeared to determine how successful adolescents were in continuing or maintaining weight loss post-intervention was related to their initial weight loss goals and expectations. Some adolescent appeared to have expected to lose weight quickly and to lose a large amount of weight:

*“Negative comments of intervention experience: wanted to lose weight faster” (Hammer et al., 1971, p. 51).*

*I thought that I will really lose now more than 10kg and then somehow return thin, but somehow yes...” (Hemetek et al., 2015, p. 4).*

Those that had achieved or exceeded their weight loss goals, potentially through setting more realistic initial weight loss goals, were more driven to continue with their weight loss after an intervention had finished:

*“I came expecting to lose [9.5 kg]. I’ve now lost almost [16 kg]. It’s been really good to exceed my expectations...I feel like there’s no stopping me” (Hester et al., 2009, p. 4).*

#### *2.5.10.2 Transferring skills learnt into a normal home environment and routine*

Many adolescents commented on life after an intervention and their struggles with adjusting to and transferring newly learnt skills and knowledge into everyday life (Alm et al., 2008; Hemetek et al., 2015; Hester et al., 2009; Holt et al., 2005; Li et al., 2016; Melnyk et al., 2007; Morinder et al., 2011; Reece et al., 2016; Woolford et al., 2012b). This is an important aspect to consider when considering the want for a prescriptive routine, detailed previously in the theme ‘concise, practical and prescriptive support wanted’ (section 2.5.5.6). With many interventions taking place in a clinical or artificial setting and with professional support being more regular, the transition from an intense intervention back to a normal routine can be difficult:

*“After the rehab the adjustment to the usual everyday life was difficult for the IP [intervention participant] and they felt overwhelmed by the foods on offer and their freedom. The greatest problems were in practicing physical activities and keeping to regular meals. Even successful IP, who, at the time of the interviews exercised regularly (mainly in sport clubs), complained that school and everyday life make it extremely difficult to exercise enough. School sport (PE) was not seen as sufficient PA by any IP. School and school meals were also mentioned as problematic in context with the kind and regularity of meals: Often there is no possibility to receive a hot meal at lunchtime and school buffets do not offer sufficient choice of foods” (Hemetek et al., 2015, p. 5). This quote also reflects the lack of school PA described in section 2.5.10.3 ‘Longer-term support’.*

*“I feel there’s lots of advice on how to do it . . . I mean what to do . . . many manuals and papers and stuff . . . but I don’t believe they have suggestions on how I can make it outside the hospital” (Morinder et al., 2011, p. 1003).*

*“I wasn’t doing it naturally like I thought I would. So I think I relaxed too much...with me it’s like a yo-yo and I have to control it” (Hester et al., 2009, p. 5).*

Adolescents also commented on the challenge of changing their eating habits for the longer-term. Reporting on one adolescent, one study highlighted the difficulty, after an intervention had finished, of these dietary habits being engrained into normal life; a sense that weight loss or weight loss maintenance was something that you may have to continually work, at and the frustration surrounding this:

*“I’d been losing [weight] and didn’t feel like I had to focus so much on it...I thought ‘I’ve been really good now surely I can’t spend the rest of my life spending as much focus on my weight as I have been doing.’ You shouldn’t have to work to lose weight...people manage to stay the same weight and they don’t really focus on it. They have their food...and they live their life” (Hester et al., 2009, p. 5).*

Other adolescents found the transition from intervention into real life easier and felt that they had learnt and remembered valuable skills and knowledge that could be carried out in a home environment:

*“Young people reported that positive camp impacts were continuing into ‘home life’, notably losing weight and/or maintaining weight loss, employing new skills and enjoying PA and eating healthily” (Hester et al., 2009, p. 3).*

*“It sounds a bit boastful...but I still know it all..what I [learned] at camp and all that. It’s still up there” (Hester et al., 2009, p. 5).*

#### *2.5.10.3. Longer-term support*

Several studies included in this synthesis noted comments from adolescents suggesting that they would have benefited from more sessions as part of an intervention and post-intervention (Alm et al., 2008; Daley et al., 2008; Hemetek et al., 2015; Hester et al., 2009; Howie et al., 2016; Li et al., 2016; Melnyk et al., 2007; Morinder et al., 2011; Nguyen et al., 2014; Peeters et al., 2012; Reece et al., 2016; Woolford et al., 2012b). Feedback from three interventions that lasted 6 weeks included:

*“Yeah, but then because it [WMP] stops after a bit doesn’t it, then I just like, fell back into what I was doing before, because it were only like, I can’t remember how long it were but it were short and I just fell back into what I were doing before”* (Reece et al., 2016, p. 902).

*“when I came back, I was actually very happy with my result. It wasn’t exactly my wished for result, but still it was already very close (...) because those 6 weeks were just not enough and one had the feeling that if one stops now, then everything was really for nothing”* (Hemetek et al., 2015, p. 5).

*One COPE teen reported that she was not satisfied with the amount of sessions, reporting that there were too few sessions* (Melnyk et al., 2007, p. 319)

One study involved a 75-minute weekly session held over 7 weeks. After this period, adolescents were allowed to attend 5 booster session which were held quarterly for another 22 months. These booster sessions contained approximately 20 minutes of PA. Adolescents on this programme gave the following feedback:

*“More than half of the participants had suggestions for improvement, including more PA/resistance training and more frequent booster sessions for adolescents”* (Nguyen et al., 2014, p. 208).

*“At 24 months, adolescents and parents who indicated they would have liked to receive extra help most commonly wanted more motivation or guidance and followup sessions, respectively”* (Nguyen et al., 2014, p. 208).

Even an intervention that lasted 8 weeks was seen as too short for one adolescent:

*“Make it longer so more weeks”* (Daley et al., 2008, p. 813).

Another study that provided support after a multi-disciplinary intervention (Hemetek et al., 2015) found that those participants that had been successful in losing weight through the initial programme found the additional post-intervention sessions positive:

*“In general the modules were experienced as “powersurge”, which confirmed them in their*

*behavioural change by successful IP” (Hemetek et al., 2015, p. 6).*

Whilst those that were unsuccessful felt the follow-on sessions lacked PA opportunities and did not motivate participants:

*“In contrast, unsuccessful IP report that the modules have not fulfilled their function of aftercare and weight maintenance for them. Different factors, like a lack in offers of physical activities, no motivational offers, no group feeling, boring contents and missing helps for implementation lead to frustration in unsuccessful IP (Hemetek et al., 2015, p. 6)”.*

This same study also reported on one successful adolescent who had maintained their weight loss for a year, which had led to ingrained lifestyle habits. This further reiterates the need for longer-term support:

*“because I have already kept my weight for almost a year now, and now I think to myself that it is actually ingrained in my rhythm, it now comes automatically as well, and one does not have to think about what one eats so much” (Hemetek et al., 2015, p. 5).*

Adolescents did express their concerns and worries about maintaining their weight loss after an intervention:

*“I don’t wanna go home. I’ll lose [weight] and it’ll all go back on in the winter ‘cos it always does” (Hester et al., 2009, p. 4).*

This may be due to their recognition of the challenge of losing weight as well as their recognition of individual responsibility, something that is discussed further in the theme ‘adolescents recognising personal responsibility and personal motivation for weight loss’ (section 2.5.9.5):

*“Even if you lose [0.5 kg] a week.. . [19 kg] in a year. You’ve still got 3 years until you’re ideal weight” (Hester et al., 2009, p. 4).*

*“It’s all been good and it’s all helped, they’ve taught us everything we need to know and*

*then it's just like us going out and doing it for ourselves" (Reece et al., 2016, p. 902).*

Many adolescents commented on their struggles with lacking motivation after an intervention had finished and relapsing back into old habits due to the amount of focus required post-intervention:

*"I could not exercise, and then I got lazy, I was more and more hungry, and then the portions became a little bigger again, and then there was also some in school and so on, yes, and this is how it went..." (Hemetek et al., 2015, p. 5).*

*"Ashley described the need to 'focus' a great deal of time and energy on maintaining healthy lifestyle behaviors" (Hester et al., 2009, p. 3).*

Some adolescents commented on the support they received from professionals and family members post-intervention, both positively and negatively. For some continued support from professionals was helpful:

*"I went to the dietician about four weeks later and since I [came] back from camp I'd lost [2 kg] ... in just three or four weeks. I thought 'I can do this'" (Hester et al., 2009, p. 4).*

Whilst for some, over time, professional support, in terms of taking part in PA was less important:

*"Over time, some youth stated that the trainers played little to no role in their participation: 20% of youth at 3-week, 32% at 3-month, and 58% at 6-months. At 6-months, example statements included "I don't need a trainer as much as I used to . . . I know what I need to do now"; "I don't see my trainer as often as I used to . . . but once in a while if she's there I'll talk to her and I'll just run over my work-out schedule, but I don't really use it (participants, 6-months)" (Peeters et al., 2012, p. 655).*

Professional support extends into schools. Adolescents also felt that PA was lacking in the school environment. Improving PA opportunities within schools will help to provide longer-term support for overweight and obese adolescents:

*“Gender differences emerged related to the reporting of PA, although both boys and girls revealed insufficient time devoted to physical education in school (typically 1 to 2 hours per week)” (Alm et al., 2008, p. 281).*

The importance of family support has been described previously in section 2.5.6.2. However, the importance of family support in the maintenance period is also important. This appeared to decrease over time:

*“Family support played an important role in affecting whether youth attended their gym sessions across all time points, although this number decreased slightly over time (eg, from 78% at 3-weeks; 68% at 3-months, to 58% at 6-months)” (Peeters et al., 2012, p. 653).*

*“One adolescent stated: “They don’t really encourage or discourage me anymore” (Peeters et al., 2012, p. 653) when discussing family influence and support.*

#### 2.5.11 Technology

Seven studies contained data that related to the use of technology in an intervention (Jogova et al., 2013; Nguyen et al., 2014; Riiser et al., 2013; Smith et al., 2014a; Staiano et al., 2012; Woolford et al., 2010; Woolford et al., 2012a). Technology in this instance, included telephone and electronic communication, web and online programmes, exergames and taking photographs. The three themes that are within this section include ‘Adolescents enjoy using technology and do so with ease’, ‘Reflective and trackable technologies are useful’ and ‘Motivational and less formal messages preferred online and by text’.

##### *2.5.11.1 Adolescents enjoy using technology and do so with ease*

Most studies using technology suggested that adolescents enjoyed their use (Jogova et al., 2013; Nguyen et al., 2014; Riiser et al., 2013; Smith et al., 2014a; Staiano et al., 2012; Woolford et al., 2010; Woolford et al., 2012a). Through observations and semi-structured telephone interviews, most adolescents gave the impression of using certain technologies, such as exergames, internet and taking photographs, with ease:

*“I liked the program, registrations are fun, I would like to continue to use it” (Riiser et al., 2013, p. 7).*

*“Observation during introduction of the program and the 2-week test period revealed that*

*the participants in the second usability test very quickly grasped the different functions of the program” (Riiser et al., 2013, p. 7).*

*“Most participants found the technical aspects of taking pictures and sending them as a text message from their phone to the research assistant very easy. Only one participant found it difficult to text the pictures, but that individual still gave a high rating to the idea of thinking about the questions and taking the pictures” (Woolford et al., 2012a, p. 232).*

#### *2.5.11.2. Reflective and trackable technologies are useful*

One study by Riiser et al., (2013) evaluated the usability of a web-based programme for increasing PA in overweight adolescents. Adolescents trialling this programme found inputting PA useful for tracking and reflecting on how much activity they were actually completing:

*“the program proves that I am more active than I think I am” (Riiser et al., 2013, p. 7).*

*“The adolescents in the second test found it easy and fun to keep track of amount and type of activities by observing the bar charts over time” (Riiser et al., 2013, p.7).*

Adolescents in this same study also valued and benefited from logging and inputting their PA goals:

*“it is easier to hold on to goals that I have written” (Riiser et al., 2013, p. 7)*

However, there was some concern that this form of technology would be too time consuming to be used as part of an intervention on a regular basis:

*“it takes some time and it is hard to remember to register, so I am not sure if I would have liked to use the program over time” (Riiser et al., 2013, p. 7).*

In addition, adolescents taking part in an exergame intervention (Staiano et al., 2012) enjoyed being able to compete against, and compare their progress with others, another way of tracking progress. This competitive element is further described within the ‘peer support valued’ theme (section 2.5.6.3):

*“Participants in the lunchtime and after-school competitive groups stated that they enjoyed the cardio exercises in which they could compare their progress with their partner’s, such as in the running exercise, where they could see their own character and*

*their partner's character on the screen and see how their own progress compared with their partner's progress" (Staiano et al., 2012, p. 817).*

Adolescents from one included study took part in a photovoice intervention that aimed to explore the types of images that obese adolescents find supportive during weight loss efforts. Taking pictures reminded adolescents of lessons learnt during an intervention as well as helping them to reflect on support systems and motivations such as family and friends, and weight related behaviours, such as spending too long on handheld media devices:

*"it kind of opened my eyes, to think of and thank my friends and family for supporting me and reminding me to get healthy" (Woolford et al., 2012a, p. 232).*

*"it made me realize I was spending way too much time on my iPod" (Woolford et al., 2012a, p. 232).*

#### *2.5.11.3 Motivational and less formal messages preferred online and by text*

Adolescents appeared to benefit from receiving encouraging messages online and by text to maintain motivation throughout a weight loss intervention:

*"Maybe like "Why did you choose to do this program? Remember those and keep going." I like that" (Smith et al., 2014a, p. 6).*

However, it is important that any messages remained informal. Practical and fun ideas were also well received:

*"They sound a bit rehearsed at times. A bit impersonal. Sometimes more casual...instead of Hi XX, it could be like Hey or Hey XX. More chatty. Because the ones that were being sent sound like for an adult. They're too formal" (Smith et al., 2014a, p. 6).*

*"Even me, I'm like 17 but I like interactive stuff. There's a lot of text and I don't want to read this. I want something fun to do" (Jogova et al., 2013, p. 76).*

As mentioned previously in section 'concise, practical and prescriptive support wanted' (section 2.5.5.6), it was also important to adolescents that these messages remained concise and practical.

## 2.6 Discussion

### 2.6.1 Summary of the findings

This review identified key themes which included ensuring adolescents receive a 'tailored intervention' that involves 'active engagement' to improve knowledge. There was no clear preference between group and one-to-one support, but adolescents appear to appreciate consistent and regular support. Additionally, support from professionals, family and peers was valued highly. Adolescents expressed 'prior fears of attending interventions'. Other barriers to attending a WMP and being healthy included cost, convenience and the temptations of an unhealthy food environment. WMP could also bring about feelings of failure which would prevent the adolescent continuing with a programme. 'Enjoyment of sport and PA' was evident and adolescents enjoyed learning about healthy eating. Managing expectations, helping adolescents transition from an intervention into the home environment and providing 'longer-term support' were all important for weight loss maintenance. Adolescents were strongly motivated to lose weight to improve body image, social desirability and self-esteem and did recognise their own responsibility in achieving this. Technology was seen as a positive inclusion to an intervention.

### 2.6.2 Situating within the wider literature

Adolescents described a clear desire for professional and peer support. These avenues of support were also identified in a systematic review of qualitative evidence that investigated components valued by adult weight management service users (Sutcliffe et al., 2018) Although no consensus was reached as to whether a group or one to one setting would be best for adolescents, the recognition of peer support as a security blanket suggests some element of group support would be beneficial. Having support from family members is widely recognised and is one of several NICE recommendations (NICE, 2013a). Additionally, family support has been highlighted as important to younger children as well, in a review of lifestyle WMPs (Burchett et al., 2018).

There is some discrepancy in what adolescents say they want from an intervention. Although support from professional, family and peers was discussed frequently, adolescents also placed great emphasis on their personal responsibility for achieving a healthy weight; identified previously in a qualitative systematic review on adolescents' general experiences of obesity (Rees et al., 2014). However, adolescents in this review have also stated preferences for receiving concise and prescriptive advice, which draws away from that personal responsibility. Additionally, the inflexible nature of a prescriptive

diet and exercise plan will make the transition period into the home after an intervention has finished more difficult, a finding that this review has highlighted. This further emphasises the need for longer follow-ups as part of a WMP, which has been identified in an overview of Cochrane reviews investigating interventions for the treatment of child and adolescent obesity (Ells et al., 2018). Finding the correct balance between personal responsibility and prescription is key. This concurs with the findings from a review of overweight adult's views who also noted this tension between dependence on the programme and autonomy (Garip & Yardley, 2011).

Linked with personal responsibility, personal accomplishment was highlighted as motivational factor within several themes in this review. Adolescents often gained a sense of accomplishment from taking part in PA. Additionally, adolescents were also motivated by achieving weight loss goals and weight loss, further reiterating the importance of setting SMART goals and realistic weight loss targets. This review also shows that with this personal responsibility also comes the feelings of failure and guilt if weight loss or maintenance is not achieved. This emphasis on personal responsibility has been supported previously in a methodologically robust qualitative systematic review (Rees *et al.*, 2014).

Being educated on healthy eating is an important aspect of any weight management intervention however, this review shows the overwhelming response from adolescents concerning being able to take part in PA. Although logistically this may be challenging, being able to offer adolescents a variety of PA options at a low or no cost is an important consideration for future WMP design.

Active engagement was valued highly by adolescents in this review, when learning about both healthy eating and PA. Similar views have been shown in younger children, who prefer practical and interactive experiences, rather than receiving didactic information (Burchett et al., 2018).

Understanding adolescent motivations towards weight loss and attending weight management interventions is clearly important for not only initiating adolescents into interventions but for improving attrition rates. Most adolescents included in this review were primarily motivated by weight loss rather than health improvements, although this was described by several adolescents. This primary motivation stemmed mostly from a social point of view. Adolescents felt that being a healthy weight was more desirable socially, and would lead to increased confidence, more friends and less bullying. This is

supported by another review which examined adolescent's views of obesity (Rees et al., 2014) that emphasised social consequences related to body size.

This review also recognised that a heavy focus on weight loss and working towards unrealistic goals could lead to lower self-esteem, perhaps due to this emphasis on personal responsibility. Adolescents described feelings of failure and guilt when their desired weight loss was not achieved or maintained; when designing interventions, it is important to find a balance between weight loss, health and psychosocial outcomes. Although longer-term support has been highlighted as significant for adolescent weight management interventions (Ells et al., 2018), this is not only from a weight management point of view. The impact of weight management on adolescent's mental health long-term is extremely important, recognising that these feelings of failure and guilt may increase during the period after an intervention has finished. Approaches that offer more than health education to adolescents and their families, is important.

The theme 'gender specific barriers to exercise' described body image concerns when taking part in PA, specifically from female adolescents. Although only explored by one study in this review, perhaps due to the nature of the review question, this has been shown to be a cause of reduced participation in sports previously (Slater & Tiggemann, 2011). Although body image concerns were highlighted less by adolescent boys in this review, other differences in gender were still highlighted. Adolescent boys appeared to be motivated by wanting to improve their sporting and PA performance, whereas this was not something mentioned by adolescent girls.

There was wide variation in dose among interventions included in this review. Whilst adolescents did not always comment on this, those that attended interventions that were 6-8 weeks in length were not deemed long enough by adolescents. This wide variation in dose (defined as intervention duration, number and length of sessions) has been reported elsewhere in a systematic review and meta-regression that aimed to understand the link between dose and outcome (Heerman *et al.*, 2017). This review was unable to detect a clear relationship between dose and weight-related outcomes due to the variation in reporting dose in primary studies as well as insufficient information being provided. Only one study in this review (Melnyk et al., 2007) explored the length of individual sessions highlighting a need for improved reporting and exploration of intervention dose.

This review also highlighted the use of technology in adolescent weight management interventions as something to be considered in a positive light for future designs.

### 2.6.3 Strengths and limitations

This is the first qualitative systematic review, of which the researchers are aware, that synthesises views of adolescents attending obesity interventions. There is growing recognition of the value of qualitative research, the synthesis of which can be used to inform policy and practice. This review included studies from eight developed countries (Table 2.3). Nine studies were UK based, giving a strong basis of generalisability to the UK at a time when there is an urgent need for targeted, evidence-based interventions for older children. As with all reviews, some relevant literature may have been missed. To reduce this risk, a sensitive and broad search of bibliographic databases was completed, supplemented by hand searching reference lists, relevant systematic reviews and key journals. This synthesis is further enhanced by having two reviewers involved at the initial screen, full-text screen, data extraction and quality assessment stages. In addition, analysis was audited regularly by a second reviewer (OO, GJMT). There were no limits on language reducing potential reviewing bias. Authors of potentially relevant studies were also contacted for clarity on inclusion criteria. Thematic synthesis was conducted by the first reviewer; all findings were discussed with a second reviewer. A limitation is that conference abstracts were not included, however these usually have limited data. Additionally, only four of the 28 included studies attempted to involve participants that had withdrawn from an intervention (Banks et al., 2014; Holt et al., 2005; Owen et al., 2009; Twiddy et al., 2012). Therefore, this review may be over represented with the views of adolescents that were fully engaged and motivated to take part in a WMP. Even when attempts were made to recruit withdrawers, those with negative experiences of an obesity intervention would have been less likely to engage.

### 2.6.4 Implications for research

With many of the included studies focusing on those that had taken part in an intervention, more research is needed to investigate the views of adolescents that have not engaged with, or withdrawn from, obesity interventions. More research is also needed that considers gender separate interventions.

### 2.6.5 Implications for practice

Results from this review have practical implications for current and future weight management interventions for adolescents. Ensuring that an initial assessment opportunity is given to adolescents may reduce their prior fears of attending by managing

expectations; ensuring appropriate goal setting throughout the intervention is also important.

Although widely recognised that a multi-disciplinary intervention is the most effective evidence-based option (Al-Khudairy et al., 2017; NICE, 2013a) for child and adolescent weight management, this review highlighted the importance of PA. Allowing adolescents an opportunity to try new and varied activities in a non-forceful manner may help to improve uptake into interventions and rates of attrition. Offering an opportunity to preview an example of a PA session as part of an initial assessment may reduce any prior worries further.

Obesity interventions should involve the whole family in certain elements, whilst allowing adolescents to create bonds with peers, offering an alternative avenue of support. Professionals should be on hand to provide valuable tailored advice, both health and mental well-being, in a structured and non-judgmental way that also allows autonomy to develop post intervention. Interventions may benefit from focusing on psychosocial elements of weight loss to improve maintenance and attrition rates. Offering longer-term support is essential; incorporating an element of technology into interventions may aid this.

## 2.7 Conclusion

This review gives a strong argument for ensuring adolescents views are considered to improve interventions that currently take place, as well as supporting adolescent obesity intervention development in the future. Incorporating the views of adolescents from many individual studies resulted in a comprehensive overview of potentially pertinent factors. Findings may inform local and national policy makers in the development of future interventions for adolescents with obesity. Developing interventions with adolescent views in mind may improve recruitment and attrition rates.

## 2.8 Chapter summary

This chapter reports on a qualitative systematic review of the literature exploring the viewpoints of adolescents with overweight or obesity attending lifestyle treatment interventions to improve these services in the future (Jones et al., 2018). The findings of this review have been used to inform interview guides for primary research in Chapter 4. In addition, this qualitative systematic review has been used to undertake a mixed method approach and will be reported in Chapter 3.

## Chapter 3. Re-analysis of a systematic review to identify pathways to effectiveness in WMPs for adolescents

### 3.1 Chapter outline

This chapter brings together findings from the qualitative systematic review reported in Chapter 2 and results from a quantitative review systematic review of diet, physical and behavioural interventions for the treatment of overweight or obese adolescents. This mixed methods approach focuses on intervention components identified by adolescent as being important with the aim of exploring why WMPs examined in the quantitative review are effective or not effective.

### 3.2 Introduction

Multi-disciplinary lifestyle WMPs are the recommended option for adolescents with obesity (NICE, 2013a), Al-Khudairy et al., 2017; Ells et al., 2018). WMPs can be characterised as complex interventions, those which are non-standard, and which may have diverse forms in different contexts (Petticrew, 2011). Despite considerable heterogeneity, a recent Cochrane review has shown that these multi-disciplinary interventions, which involve a combination of diet, PA and behavioural components, reduce measures of BMI and weight in adolescents with overweight or obesity (Al-Khudairy et al., 2017). Nonetheless, a quantitative approach to systematic reviews has limitations in that its focus is on effectiveness, and only secondarily on possible moderators of effect. It does not allow complex questions to be answered, nor does it allow for multiple causal pathways, interactions or outcomes of a complex intervention to be synthesised. In addition, by relying on quantitative synthesis only, policy makers and those planning interventions are likely to pick components of interventions without considering participant views (Candy et al., 2013) or understanding 'how' or 'why' these interventions are effective (Melendez-Torres et al., 2018).

To combat this, robust effectiveness evidence needs to be supplemented with evidence that considers the patient voice and focuses on understanding the pathways and critical components of WMPs that lead to effectiveness. The method chosen to undertake the task of understanding why some WMPs produce better results than others is QCA. This mixed methods approach brings together the strengths of both qualitative and quantitative research (Cooper & Glaesser, 2012). QCA is an innovative technique in mixed

methods research and has previously been used to understand variation in effectiveness of complex interventions related to drug therapy adherence (Candy et al., 2013). Additionally, QCA has been used to explore the pathways to effectiveness in successful community engagement strategies with disadvantaged expectant and new mothers (Brunton et al., 2014). In a worked example related to Brunton et al., (2014), Thomas et al., (2014a) also identified QCA as a promising method for synthesising evaluations of complex interventions where differences in the findings may be due to many factors. By understanding both pathways to high and low effectiveness, heterogeneity can be accounted for. QCA has also been used more recently to examine pathways to effectiveness for lifestyle WMPs for adults (Melendez-Torres et al., 2018), and young children (0-11 years) (Burchett et al., 2018) using user and provider views. Burchett et al., (2018) identified critical components that should be considered in WMPs for children under the age of 11 years, including the involvement of the whole family, practical experiences for both child and parents and enabling social support. In this chapter, QCA will be used to identify intervention components, and combinations of components, which are associated with intervention effectiveness for adolescents with overweight or obesity. This chapter was informed by Chapter 2, a qualitative systematic review investigating the views of adolescents with obesity that have attended a WMP (Jones et al., 2018). Findings from this qualitative systematic review were used to identify intervention conditions to explore a quantitative systematic review by Al-Khudairy et al., (2017) using QCA. This combined approach aimed to provide robust recommendations for service provision and patient care for adolescents with obesity.

### 3.3 Methods

A selection of trials evaluated in a Cochrane review of interventions for the treatment of overweight or obese adolescents that included diet, PA and behaviour change programmes compared to no treatment or usual care were chosen (Al-Khudairy et al., 2017). Out of the 44 RCTs, the 11 most effective and 11 least effective interventions were selected. Full details of these interventions are available in Table 3.1. Most and least effective interventions were chosen based on BMIz score change at longest follow-up. As BMI differs with age and sex in children and adolescents, BMI scores are transformed into a BMI z score (Vanderwall et al., 2018). Most effective interventions were chosen if the difference in BMI z score was at least -0.25. This was chosen as a minimum reduction in BMI z score of at least 0.25 has been shown to improve adiposity and metabolic health in adolescents with obesity (Ford et al., 2010a). A BMI z score change of -0.05 or less was

chosen to distinguish clearly between least effective interventions and moderately effective interventions as was completed by Burchett et al., (2018) in a QCA analysis of WMPs for children 0-11 years old. Using this approach, five most effective and nine least effective interventions were chosen from Al-Khudairy et al., (2017). Upon discussion, it was preferable to have more studies in total to aid analysis. Therefore, a different outcome was also included, mean difference for weight change (kg), to identify least and most effective interventions. In adults, evidence supports a moderate weight loss of 5%–10% to achieve improvements in metabolic function and health outcomes (Jensen et al., 2014; Magkos et al., 2016). However, for children the main aim is to consider BMI z score, and to manage overweight and obesity by making sustainable improvements in diet and activity levels rather than achieving an ideal weight. Therefore, the most effective interventions based on mean weight change were selected as those with the highest mean difference in weight loss, which was more than 4kg at longest follow-up. Least effective interventions were those where the mean difference in weight loss was less than -0.30kg. These figures were chosen as they allowed most and least effective interventions to be distinguishable from moderately effective interventions. Interventions with moderate effectiveness were excluded to be able to clearly differentiate between most and least effective interventions. Based on this selection process, 22 studies in total were selected from Al-khudairy et al., (2017), with an equal number of most effective (n=11) and least effective studies (n=11). Forest plots were created to show the difference in BMI z score (Figure 3.1) and weight change (Figure 3.2) at longest follow up for the most and least effective interventions. Three interventions classed as most effective on the basis of their point estimates, were actually not significantly better than control, taking into account uncertainty (confidence limits). Therefore, analyses were repeated excluding these three interventions as a sensitivity analysis.

The six stages of QCA, outlined by Thomas et al., (2014a) were then followed. Analyses were completed using Kirq software (Reichert & Rubinson, 2012) was then used to carry out QCA to try to identify combinations of WMP conditions, or features, which were related to the most and least effective interventions.

**Table 3.1 Intervention characteristics of most and least effective interventions**

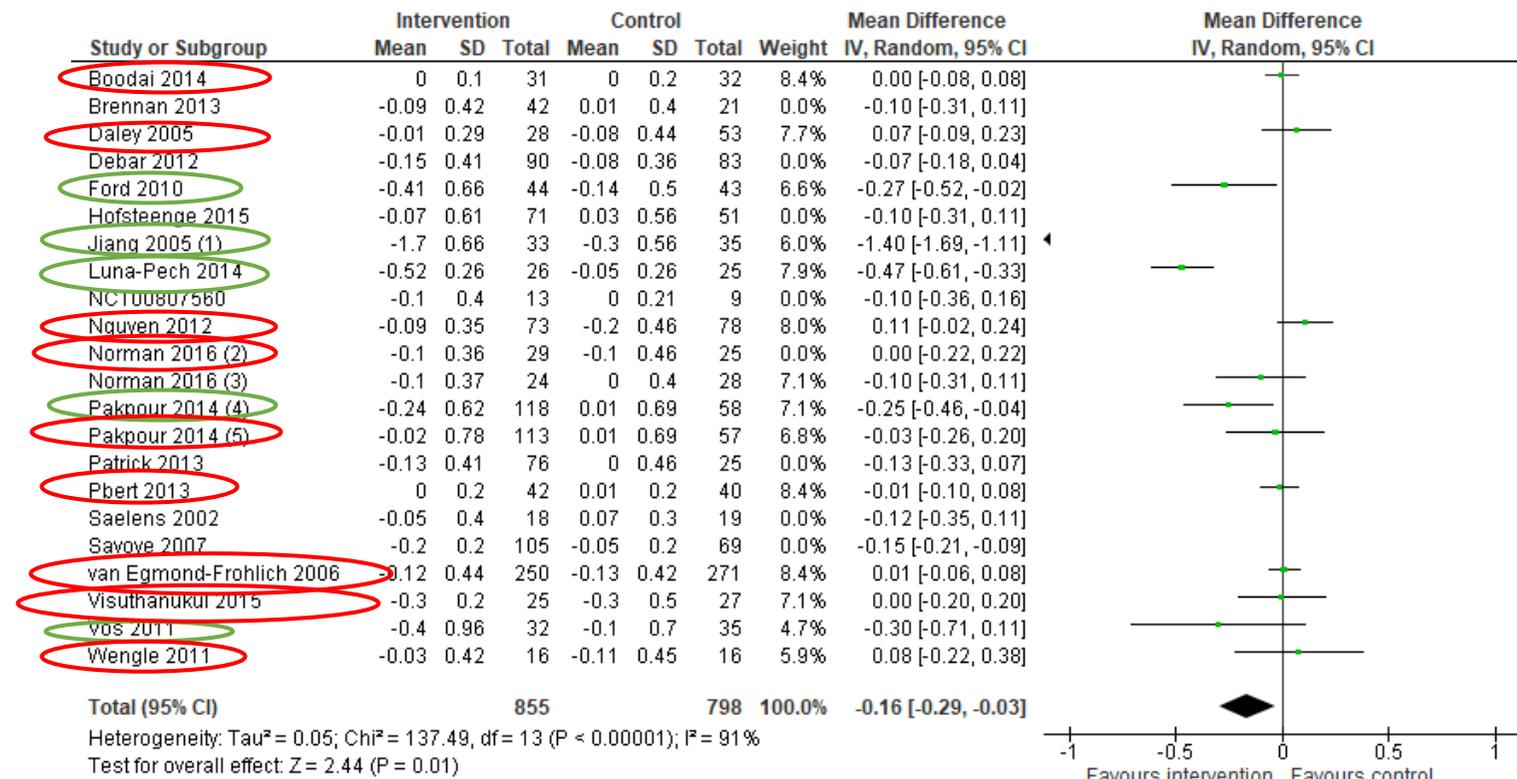
<b>Author (Date)</b>	<b>Description of intervention</b>	<b>Group/1:1 elements</b>	<b>Mean difference in BMIz/weight</b>	<b>Country</b>	<b>Age criteria</b>	<b>BMI eligibility criteria</b>
<b><i>Most effective interventions (change at least -0.25 BMI z score/4 kg)</i></b>						
<b>Brennan et al., (2013)</b>	A family based cognitive behavioural lifestyle programme targeting improved eating and activity habits. Individual sessions. 12 sessions over 4-6 months, weekly for first 10 weeks. Parent support optional	Group	-4.17 (kg)	Australia	11-19 years	Overweight or obese according to the international cut-off points for BMI in children
<b>Brownell et al., (1983) (1)</b>	Programme of behaviour modification, nutrition education, exercise instruction and social support. 16 weekly sessions (45-60 minutes). Groups of 5-8 participants. Mother and child met concurrently in separate groups	Group	-10.90 (kg)	USA	12-16 years	≥ 20% mean weight for age, gender and height
<b>Ford et al., (2010)</b>	Use of a mandometer, a computerised device providing real-time feedback during meals to slow down speed of eating and reduce total intake. Support from research nurse, dietitian and a clinician	1:1	-0.27 (BMIz)	UK	9-18 years	> 95 <sup>th</sup> centile
<b>Jiang et al., (2005)</b>	Focused on dietary behaviour modification involving the parents. A traffic light food item list was used, daily calorie requirements were discussed and advice on exercise was given. Monthly home visits.	1:1	-1.40 (BMIz)	China	12-15 years	Defined as weight for height ≥ 120%

<b>Luna-Pech et al., (2014)</b>	Normo-caloric diet programme based on individual energy needs calculated according to resting energy expenditure. Follow-up visits by a nutritionist. Follow-up visits every 2 weeks for 28 weeks	1:1	-0.47 (BMIz)	Mexico	12-16 years	≥ 95 <sup>th</sup> percentile
<b>Pakpour et al., (2015) (4)</b>	Motivational interviewing intervention focusing on improved eating and PA behaviour. 6 x 40-minute individual counselling sessions. Motivational interviewing with parent	1:1	-0.25 (BMIz)	Iran	13-18 years	≥ 95 <sup>th</sup> percentile
<b>Patsopoulou et al., (2017) (3)</b>	Activity intervention. 45 minutes, 3 days per week. Most activities were delivered as games to encourage participation. Mostly endurance type activities with attention to coordination and flexibility	Group	-7.70 (kg)	Greece	13-15 years	Overweight or obese as defined according to the Cole criteria
<b>Patsopoulou et al., (2017) (4)</b>	Diet and activity intervention. Activity training programme (see Patsopoulou et al., 2017 (3)) supplemental 15-minute group session attended by parents. Discussion with participants on the food pyramid, food choices, food labels, cooking, eating habits and controlling eating environments	Group	-9.60 (kg)	Greece	13-15 years	Overweight or obese as defined according to the Cole criteria
<b>Savoie et al., (2007)</b>	Bright Bodies weight management: nutrition/behaviour modification (Weekly 40-minute sessions). High intensity exercise sessions held twice a week. Diet component emphasised low fat, nutrient-dense foods of moderate portion size	Group	-6.10 (kg)	USA	8-16 years	> 95 <sup>th</sup> centile
<b>Schranz et al., (2014)</b>	6-month resistance training programme (3 x 75 minutes per week). Each session included a 10-	Group	-4.40 (kg)	Australia	13-17 years	Very overweight or

	minute warm –up, 60 minutes of resistance training and a 5-minute cool down					obese as defined according to the Cole criteria
<b>Vos et al., (2011)</b>	Family-based intervention including an individual consultation with a child psychologist and group intervention (8-10 participants). Educational topics included group bonds, nutritional information, energy balance, self-control techniques, coping strategies, self-image and relapse techniques	Group	-0.30 (BMIz)	The Netherlands	8-17 years	Overweight or obese as defined according to the Cole criteria
<b>Least effective interventions (Change less than -0.05 BMI z score/-0.30kg)</b>						
<b>Boodai et al., (2014)</b>	Low intensity group programme (6 x 1-hour sessions). Intervention groups split by gender. Delivered by a physician and dietitian. Sessions focused on reducing sedentary behaviour, diet, promotion of PA. Based on behaviour change techniques. 1 parent should have been present	Group	0.0 (BMIz)	Kuwait	10-14 years	> 95 <sup>th</sup> centile
<b>Brownell et al., (1983) (2)</b>	Programme of behaviour modification, nutrition education, exercise instruction and social support. 16 weekly sessions (45-60 minutes). Groups of 5-8 participants. Mother and child attended all treatment sessions and met together in the same group		-0.30 (kg)	USA	12-16 years	≥ 20% mean weight for age, gender and height
<b>Daley et al., (2005)</b>	1:1 exercise counselling intervention including knowledge and psychological skills and tools to sustain changes in exercise behaviour. 8 x 1-hr sessions, in addition to aerobic exercise	1:1	0.07 (BMIz)	UK	11-16 years	> 98 <sup>th</sup> centile

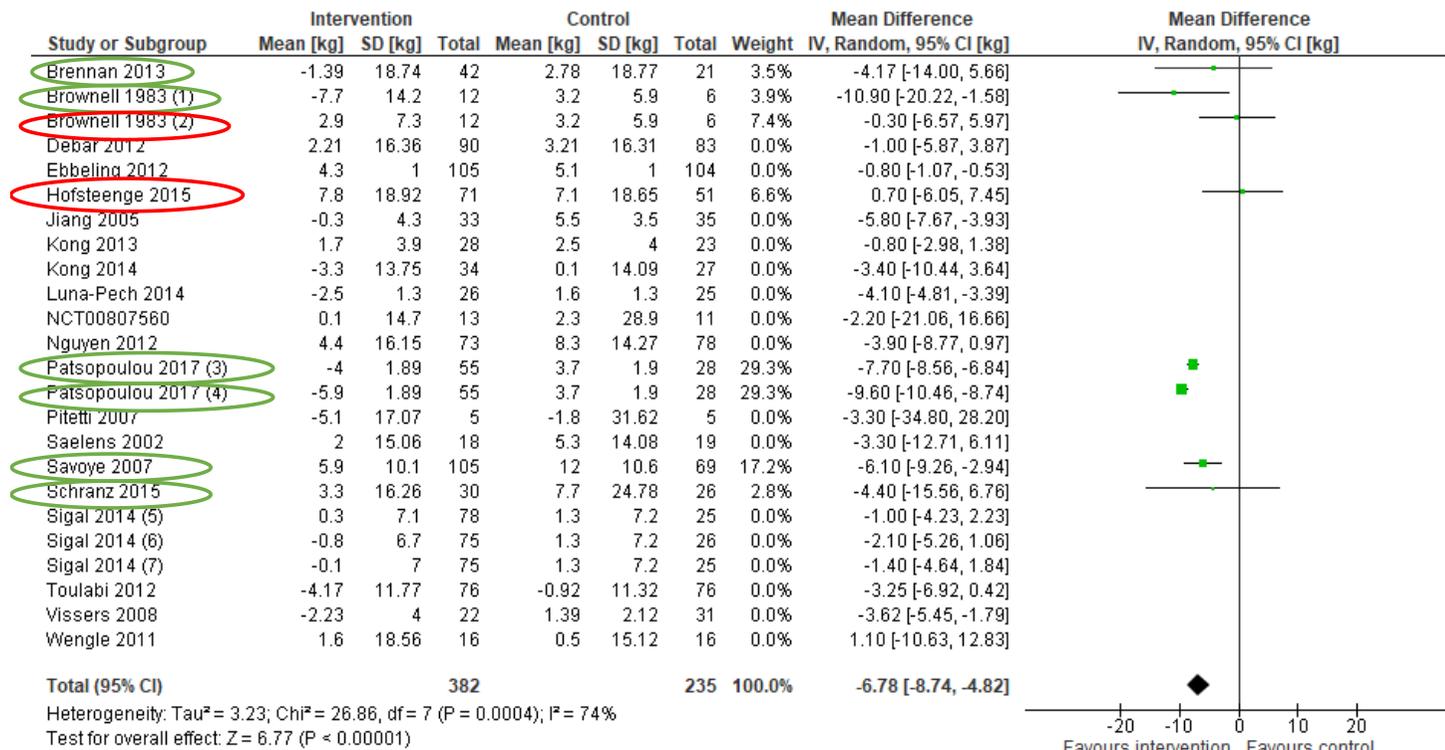
	modalities. Participants were asked to exercise for 30 minutes, 3 times per week for 8 weeks					
<b>Hofsteenge et al., (2013)</b>	Go4it Multi-disciplinary group intervention (7 x 90 min group sessions, every 2-3 weeks. Groups of 8-12 participants. Education on dietary behaviour PA and energy balance. CBR given. Support from dietitian, paediatrician and psychologist. Included 2 parental sessions	Group	0.70 (kg)	The Netherlands	11-18 years	Overweight or obese as defined according to the Cole criteria
<b>Nguyen et al., (2012a)</b>	Loozit healthy active lifestyle programme. Phase 1 (7 x 75 minutes): adolescent and parent week group sessions. Phase 2 (5 x 60 minutes): Adolescent only sessions containing new information and reinforcement of phase 1. Incorporated PA	Group	0.11 (BMIz)	Australia	13-16 years	BMI z score range 1.0-2.5
<b>Norman et al., (2016)</b>	Based on a combination of chronic care model and cognitive theory. Consisted of 3 x 4-month steps in clinic setting. The goal was for the adolescent to lose 4lb every 4 months. If the goal was not met, the step was repeated. If achieved, the participant moved to the next step of reduced intensity. Parent involvement optional	1:1	0.0 (BMIz)	USA	11-13 years	≥ 95 <sup>th</sup> percentile
<b>Pakpour et al., (2015) (5)</b>	Motivational interviewing intervention focusing on improved eating and PA behaviour. 6 x 40-minute individual counselling sessions. Motivational interviewing without parent	1:1	-0.03 (BMIz)	Iran	13-18 years	≥ 95 <sup>th</sup> percentile
<b>Pbert et al., 2013</b>	“Lookin’ Good Feelin’ Good” intervention. 6 x 18-29-minute 1:1 counselling sessions over 2 months to support key behaviour changes linked with	Group	-0.01 (BMIz)	USA	14-17 years	≥ 85 <sup>th</sup> centile

	diet and activity. Delivered by school nurses during the school day					
<b>Van Egmond-Frohlich et al., (2006)</b>	Behavioural education programme. Key items included guidance on fat-limiting mixed diet, promotion of PA and eating control	Group	0.01 (BMIz)	Germany	9-16 years	> 97 <sup>th</sup> centile
<b>Visuthranukul et al., (2015)</b>	Low-GI diet. Dietitian emphasised the selection of low-GI carbohydrates that fit Thai culture. Topics included portion size, principles of GI, cooking demonstrations and food labelling	Group	0.0 (BMIz)	Thailand	9-16 years	International Obesity Task Force cut-off corresponding to BMI of 30kg/m <sup>2</sup> in adulthood
<b>Wengle et al., (2011)</b>	Mentored behaviour change intervention. 1-day educational workshop for adolescent and family members followed by visits at 1,2,3 and 6 months which included nutrition and activity counselling. Met with a mentor in person for 1-2 hours per week. <sup>66</sup>	Group and 1:1 elements	0.08 (BMIz)	Canada	12-16 years	> 85 centile



**Footnotes**  
 (1) SDs imputed from other studies  
 (2) Girls  
 (3) Boys  
 (4) Motivational interviewing with parent  
 (5) Motivational interviewing no parent

**Figure 3.1 Forest plot of comparison: Adolescent obesity interventions (all) versus controls, longest follow-up, outcome: BMI z score change**  
 Most effective interventions are circled in green, least effective in red.



**Footnotes**

- (1) Mother + child separate
- (2) Mother + child together
- (3) Activity
- (4) Activity+Diet
- (5) Diet and resistance training
- (6) Diet, aerobics and resistance
- (7) Diet and aerobics

**Figure 3.2 Forest plot of comparison: Adolescent obesity interventions (all) versus controls, longest follow-up, outcome: Weight change (kg)**

*Most effective interventions are circled in green, least effective in red.*

### 3.3.1 Building the data table

The findings of phase one, a qualitative systematic review (Chapter 2) was used to structure the QCA. Based on the analytical themes that were developed through thematically synthesising studies included in this qualitative systematic review a coding framework was developed. This coding framework also included other key intervention features that had been identified previously as important for effectiveness in adult WMPs, such as energy goals set by the provider (Sutcliffe et al., 2016). The framework developed included 37 possible conditions of a WMP (see Table 3.2 for a list of all 37 conditions). The aim was to determine which conditions existed in the 11 most and 11 least effective interventions, based on BMI Z score and weight (kg) change. Therefore, the conditions were extracted from the 22 studies deemed most and least effective from the quantitative review by two reviewers independently (HMJ, GJMT, LA-K, OO). Disagreements were resolved by discussion or a third reviewer when necessary. A data table was then created using a binary code to identify whether a condition was present (1) or not present (0) in these interventions. The data table included an intervention on each row, with conditions in columns (See Table 3.3 for an example of binary coding). The full data table with all interventions and all 37 conditions can be seen in Appendix 10.

Table 3.2 Summary of conditions present in most and least effective interventions

Condition	Number of least effective studies with condition present	Number of most effective studies with condition present	Difference
Tailored to adolescent age group	8	9	1
Individually tailored support	8	9	1
<b>Goal setting by participant</b>	<b>10</b>	<b>6</b>	<b>4</b>
Weight loss goal set by participant	0	0	0
Energy/dietary goals set by participant	5	5	0
Weight loss goal set by provider	1	1	0
Energy/dietary goals set by provider	6	5	1
Practical and prescriptive support offered by professional	11	11	0
Direct delivery of PA by professional	3	4	1
Punishment	2	2	0
Consistent and regular support	10	10	0
Professional support	11	11	0
<b>High level of professional support</b>	<b>8</b>	<b>11</b>	<b>3</b>
Longer-term follow-up support	8	10	2
Follow-up support	6	7	1
Anthropometric measurements	9	10	1
Low cost PA	5	4	1
Variety of PA	3	5	2
Provision of achievable yet challenging PA	3	5	2
Gym	1	1	0
<b>Diet monitoring by participant</b>	<b>9</b>	<b>6</b>	<b>3</b>
Reflection	9	7	2
Autonomy	9	9	0
Active engagement	5	5	0
Transferring new knowledge into home environment	6	5	1
Problem solving	9	7	2
<b>Tailored problem solving</b>	<b>8</b>	<b>4</b>	<b>4</b>
Mental health support	4	3	1
Family support	9	7	2
Peer support	7	8	1
Healthy eating education	11	9	2
Readiness to change	2	3	1
Easing prior fears	2	3	1
Technology	3	3	0
Gender separate PA	1	1	0
PA goal setting	9	7	2
Weight loss as aim of intervention	10	10	0

Thirty-seven conditions was too great of a number to analyse and findings would be troublesome to interpret. The data table was therefore reviewed to see if any of the 37 conditions could be grouped together to form condensed conditions. This process was undertaken by one researcher (HMJ) and audited by a second (OO). This was more straightforward in some cases. For example, two conditions, 'tailored to adolescent age group' and 'individually tailored support' were combined to form the condensed condition 'perfectly tailored'. If an intervention was both tailored to the individual and the adolescent age group, then the condition 'perfectly tailored' was deemed present (1). A new condition 'PA' was created which combined the following original conditions: 'low cost PA', 'achievable yet challenging PA', 'variety of PA' and 'access to a gym'. The presence of at least three out of the four conditions in an intervention resulted in a present (1) result i.e. if an intervention increased access to PA for the participant, it scored '1'. From the views synthesis, the importance of professional support was clear. As the original data table contained many conditions relating to professional support, the decision was made to split this condition into two: 'professional support' and 'directiveness', a term developed by Melendez-Torres et al., (2018) in a QCA analysis of adult WMP. The term 'directiveness' in the study by Melendez-Torres et al., (2018) included four conditions: provider set energy, diet and exercise goals, as well as direct provision of PA. In this case, 'directiveness' included goals set by the participant and provider (general behaviour change, weight, diet/energy related goals), as well as 'practical and prescriptive support offered by professional', 'direct delivery of PA by professional' and 'punishment' for not achieving goals. If the provider aspects outweighed the participant goals, then the condition was present (1). 'Professional support' included the following original conditions: 'consistent and regular support', 'presence of professional support', 'high level of professional support', 'follow-up support' 'long-term follow-up support' ( $\geq 12$  months) and 'anthropometric measurements'. If all original conditions were present, a binary mark of '1' was allocated to the intervention. A new condition termed 'problem solving' was created, which combined 'transferring new knowledge into the home environment', 'problem solving' and 'tailored problem solving'. An intervention was given a code of '1' if all conditions were present.

Condensing other conditions were less straightforward. Considering the conditions 'diet monitoring by participant', 'reflection' and 'autonomy', all were linked to an individual's responsibility; a new condition 'responsibility' was therefore formed. 'Active engagement'

was also considered to play a role in the condition 'responsibility', however when added into the combination, almost half of all interventions which had previously been coded as '1' when the former three conditions ('diet monitoring by participant', 'reflection' and 'autonomy') were present, now were considered not to be present '0'. As this changed the results too dramatically, an intervention would be present with the condition 'responsibility', if three out of the four original conditions were present. To further justify this, 'diet monitoring by participant' and 'autonomy' were very similar conditions as 'autonomy' was often present in an intervention if an individual had been autonomous and completed a food diary themselves.

Consideration was also given to combining the conditions 'easing prior fears' alongside providing 'mental health support' to make a 'supporting emotional health' condition. This combined condition was only present in one out of all 22 studies. 'Easing prior fears' was also seen as subordinate to 'mental health support', as most interventions were classed as having 'easing prior fears' present if any amount of prior contact was had between the professional and participant before initiating the programme, however small. The decision was made to not include 'easing prior fears' with mental health support, however it was combined with 'assessing readiness to change' to create a new condition 'preparation'.

Throughout this process, the data table was explored to identify apparent differences between the most and least effective interventions. Additionally, 'contradictory cases' were also considered. These are conditions that do not clearly discriminate between most and least effective interventions. Based on this, the original condition 'technology' was removed as the term 'technology' was very wide ranging, from mandometers, to telephone calls. Future research recommendations based on technology as a component of a WMP are discussed further in Chapter 5 (section 5.5). In addition, 'gender separate PA' and 'weight loss as aim of intervention' were no longer to be included in the QCA analysis as they did not fit well with other combinations, as well as not offering any discriminatory power between most and least effective interventions. In addition, 'gender separate PA' was only present in two interventions, one most and one least effective. The presence of 'PA goals' was also not included as this combined PA goals set by both participants and providers therefore not contributing to 'directiveness'.

As with 'mental health support', 'family support', 'peer support' and 'healthy eating education' were also not condensed and remained as individual conditions, recognising their importance in a WMP.

In summary, 11 condensed conditions were established. The completed data table for these condensed conditions can be seen in Table 3.3.

### 3.3.2 Constructing truth tables

The focus then moved away from individual conditions and interventions in the data table (section 3.3.1) towards configurations, or combinations of conditions, to explore their links with the 11 most effective and 11 least effective interventions. This was done by constructing truth tables, which show selected conditions, all possible combinations of conditions, otherwise known as configurations, and the number of studies present in each configuration. The number of configurations represented by the most effective and least effective interventions were also indicated.

Even after condensing to 11 conditions, this was too large a number to include in one QCA model and to construct a truth table. Previous research has included between two and four conditions in QCA models (Burchett et al., 2018; Melendez-Torres et al., 2018). Based on discussion with two members of the supervision team (OO, GJMT), three models were created, in which theoretical pathways to effectiveness were considered possible (see Table 3.4). In order to make decisions about which conditions belonged in a model, how they might promote, obstruct or complement each other in terms of effectiveness was considered. Model 1 combined 'healthy eating education', 'mental health support' and 'PA', three key elements of an ideal WMP. Model 2 examined the support adolescents got from the programme, and included 'professional support', 'family support', 'peer support' and 'perfectly tailored'. Results from the qualitative systematic review highlighted all four conditions as important forms of support for adolescents taking part in a WMP. Model 3 involved conditions that noted the tension between dependence and autonomy including 'responsibility', 'directiveness', 'preparation' and 'problem solving'.

### 3.3.3 Checking the quality of the truth tables

The quality of the truth tables was then checked to ensure analysis would proceed satisfactorily. Firstly, the spread of studies amongst the different configurations was checked to assess how well represented each configuration was. For example, for model 1, there were eight possible configurations. It was important to see how clustered interventions were in these configurations. The truth table was then checked for

contradictory configurations, when configurations exist equally in both the most and least effective interventions.

To 'reduce' the truth table and utilise Boolean minimisation, contradictory configurations had to be resolved. Several lines of reasoning were taken to try and resolve these contradictions (Appendix 11). The first enquiry was only to include interventions using one outcome. For model 5, the majority of interventions representing the three contradictory conditions were included because of the BMI z score outcome. Additionally, BMI z score is a more appropriate measure of overweight and obesity for children and adolescents (Dinsdale et al., 2011). Because of this, the decision to remove interventions using weight (kg) as an outcome was investigated. However, this process only solved one out of three contradictory results. This one resolution only involved one intervention, so this line of enquiry was not used to resolve configurations. Consideration was also given to including only interventions that included a group element, as suggested by Melendez-Torres et al., (2018), however, this also did not resolve contradictory configurations. As peer support was a prominent theme that came out of the views synthesis (Chapter 2), only including interventions that had a 1:1 delivery format was not felt to be worthwhile. However, this idea was reasoned and although resolving two out of three configurations, these were both only based on one intervention. This avenue of enquiry, based on the above peer support reasoning, did not warrant pursuing further. Details of whether an intervention delivered in group or 1:1 format can be seen in Table 3.1. In order to analyse model 5 further, the decision was made to resolve contradictory configurations by assessing the weight of effective and ineffective interventions for each configuration. From this, the outcome was changed to either 'True' or 'False' in the direction of the majority, removing any contradictory outcomes allowing section 3.3.4, 'Boolean minimisation', to take place. These contradictory configurations are discussed further in both the results (section 3.4) and discussion (section 3.5).

#### 3.3.4 Boolean minimisation

After contradictory findings were checked and resolved, Boolean minimisation algorithms were utilised to analyse the truth tables to reach final solutions that defined pathways to effectiveness and ineffectiveness. Configurations were sought that had complete coverage as well as high consistency. When considering pathway to effectiveness, high consistency was when configurations did not include interventions that were least effective. High coverage entailed configurations that covered a large majority of most

effective studies based on BMI z score and weight (kg) change. Equally, when examining pathways to least effective interventions, high consistency was when configurations did not include the most effective interventions and complete coverage in this instance was when configurations covered as many of the least effective interventions as possible. Coverage and consistency results for 5 different models can be seen in Tables 3.4, 3.5, 3.6, 3.7 and 3.8.

#### 3.3.5 Consideration of 'remainders'

A common element of QCA, 'remainders' are logically possible combinations of conditions that lack empirical occurrences and are not represented by any interventions (Rubinson, 2016). This stage of QCA considered the potential outcomes of these configurations that were not present in any of the most effective and least effective interventions.

#### 3.3.6 Interpretation

The interpretation of the different solutions, in relation to the views synthesis, was then conducted in this final stage of QCA. Interpretation of conditions, configurations and models were discussed with two supervisors (OO, GJMT) to ensure they were grounded by a clear understanding of the qualitative systematic review.

**Table 3.3 Condensed conditions**

Intervention	Perfectly Tailored	Directiveness	Professional support	PA	Responsibility	Problem solving	Family support	Peer support	Healthy eating education	Preparation	Mental health support
Boodai	0	0	0	0	1	0	1	1	1	0	0
Pakpour (5)	1	0	0	0	1	0	1	1	1	0	0
Pbert	1	0	0	0	1	1	0	0	1	0	1
Van Egmond-Fröhlich	0	1	1	0	0	1	1	0	1	0	0
Daley	1	0	0	1	1	1	0	0	1	0	1
Nguyen (2012a)	1	1	1	1	0	0	1	1	1	0	1
Norman	1	1	1	0	1	1	1	0	1	1	0
Wengle	1	1	0	1	1	0	1	1	1	0	0
Visuthranukul	0	1	0	0	0	0	1	1	1	0	0
Hofsteenge	0	0	1	0	1	0	1	1	1	1	1
Brownell (2)	0	1	1	0	1	0	1	1	1	1	0
Ford	0	0	1	0	0	0	1	0	1	0	0
Jiang	1	1	0	0	1	1	1	0	1	0	0
LunaPech	1	1	0	0	0	0	0	0	1	0	0
Pakpour (4)	1	0	0	0	1	0	0	1	1	0	0
Vos	0	1	1	0	1	1	1	1	1	1	1
Brownell (1)	0	1	1	0	1	0	1	1	1	1	0
Patsopoulou (3)	1	1	0	1	0	0	0	1	0	0	0
Patsopoulou (4)	1	1	0	1	0	0	1	1	1	0	0
Savoie	1	1	1	1	0	0	1	1	1	1	1
Schranz	0	1	1	1	0	0	0	1	0	1	0
Brennan	1	0	0	0	1	1	1	1	1	1	1
<b>Total ineffective</b>	6	6	5	3	8	4	9	7	11	3	4
<b>Total effective</b>	7	8	5	4	5	3	7	8	9	5	3

**Table 3.4 QCA models**

Condensed condition	Model 1	Model 2	Model 3	Model 4
Perfectly tailored				
Directiveness				
Professional support				
PA				
Responsibility				
Problem solving				
Family support				
Peer support				
Health eating education				
Preparation				
Mental health support				

Yellow box = conditions included in model

### 3.4 Results

11 most effective and 11 least effective interventions were identified in 19 trials (Boodai et al., 2014; Brennan et al., 2013; Brownell et al., 1983; Daley et al., 2005; Ford et al., 2010b; Hofsteenge et al., 2013; Jiang et al., 2005; Luna-Pech et al., 2014; Nguyen et al., 2012a; Norman et al., 2016; Pakpour et al., 2015; Patsopoulou et al., 2017; Pbert et al., 2013; Savoye et al., 2007; Schranz et al., 2014; Van Egmond-Frohlich et al., 2006; Visuthranukul et al., 2015; Vos et al., 2011; Wengle et al., 2011). Two interventions from three trials were included in this analysis (Brownell et al., 1983; Pakpour et al., 2015; Patsopoulou et al., 2017). Full details of these interventions are available in Table 3.1.

The conditions used in each QCA model can be seen in Table 3.4. These three models and potential pathways to effectiveness and ineffectiveness will now be discussed. In addition, new lines of enquiry that arose after analysing these three models will be explained.

#### 3.4.1 Model 1: Key features of a multi-disciplinary WMP

Model 1 included three conditions that are key elements of a WMP for adolescents: healthy eating education, PA, and mental health support. The truth table that was created for this model highlighted eight possible configurations of conditions (Table 3.5). Firstly, the spread of studies was investigated, with five out of eight configurations represented by interventions. Four of these represented configurations had an even spread of between 2-4 interventions, however most interventions were clustered mainly around set 1, with 11 interventions representing this configuration. This configuration, that was heavily clustered, included interventions where healthy eating education was present but with no mental health support or PA. In terms of contradictory findings, all but one

configuration had contradictory findings (set 5, Table 3.5), with two of the most effective interventions having a PA element but no healthy eating education or mental health support, and none of the least effective interventions represented by the same configuration. The three remainders in this truth table included the configurations of PA, mental health support but no healthy eating education; none of the three conditions present; no healthy eating education or PA, but the presence of mental health support.

**Table 3.5 Model 1 truth table**

Set	PA	HE	MH	Most EF consistency (coverage)	Least EF consistency (coverage)	Con (YES/NO)	Total # of cases
1	False	True	False	0.45	0.55	YES	11 (5 most effective, 6 least effective)
2	False	True	True	0.50	0.50	YES	4 (2 most effective, 2 least effective)
3	True	True	True	0.33	0.67	YES	3 (1 most effective, 2 least effective)
4	True	True	False	0.50	0.50	YES	2 (1 most effective, 1 least effective)
5	True	False	False	1.00	0.00	NO	2 (2 most effective, 0 least effective)
6	False	False	True	-	-	-	0
7	False	False	False	-	-	-	0
8	True	False	True	-	-	-	0

PA = Physical activity, HE = Healthy eating education, MH = Mental health support, EF = effectiveness Con = contradictory

### 3.4.2 Model 2: Support

Model 2 included four conditions that linked together to form a support system for adolescents taking part in a WMP. These included professional support, family support, peer support, and the intervention being perfectly tailored. 16 configurations were present in this truth table (Table 3.6). 10 out of 16 configurations were represented by the most effective and least effective interventions with an even spread of between one and four interventions per configuration. Out of the 10 configurations that were represented by the data, five were contradictory. The five configurations without contradictory findings were not robust enough to draw conclusions as three of these configurations were only represented by one intervention, the other two configurations by two interventions. The six logical remainders in this truth table can be seen in Table 3.6.

**Table 3.6 Model 2 truth table**

Set	PT	PROS	FS	PS	Most EF consistency (coverage)	Least EF consistency (coverage)	Con (YES/NO)	Total # of cases
1	True	False	True	True	0.50	0.50	YES	4 (2 most effective, 2 least effective)
2	False	True	True	True	0.50	0.50	YES	4 (2 most effective, 2 least effective)
3	True	False	False	False	0.33	0.67	YES	3 (1 most effective, 2 least effective)
4	True	True	True	True	0.50	0.50	YES	2 (1 most effective, 1 least effective)
5	True	False	False	True	1.00	0.00	NO	2 (2 most effective, 0 least effective)
6	False	True	True	False	0.50	0.50	YES	2 (1 most effective, 1 least effective)
7	False	False	True	True	0.00	1.00	NO	2 (0 most effective, 2 least effective)

<b>8</b>	True	True	True	False	0.00	1.00	NO	1 (0 most effective, 1 least effective)
<b>9</b>	True	False	True	False	1.00	0.00	NO	1 (1 most effective, 0 least effective)
<b>10</b>	False	True	False	True	1.00	0.00	NO	1 (1 most effective, 0 least effective)
<b>11</b>	True	True	False	True	-	-	-	0
<b>12</b>	True	True	False	False	-	-	-	0
<b>13</b>	False	True	False	False	-	-	-	0
<b>14</b>	False	False	True	False	-	-	-	0
<b>15</b>	False	False	False	True	-	-	-	0
<b>16</b>	False	False	False	False	-	-	-	0

PT = Perfectly tailored PROS = Professional support, FS = Family support, PS = Peer support, EF = effectiveness, Con = contradictory

### 3.4.3 Model 3: Tension between dependence and autonomy

Model 3 included conditions that highlighted the tension between dependence on professional support and autonomy. Model 3 included four conditions: One reflected an individual's responsibility when taking part in a WMP, two reflecting an opposing condition of support from professionals during (directiveness) and before a WMP (preparation) and the last reflecting the need to move from professional support to problem solving outside of a WMP. 16 configurations were present in this truth table (Table 3.7), 12 of which were represented by interventions. There was a good spread of interventions with no major clustering of interventions. Four logical remainders were present in model 4. These combinations of conditions included the presence of directiveness, problem solving and preparation but no responsibility; No directiveness or responsibility but the presence of problem solving and preparation; No directiveness, responsibility, preparation and the presence of problem solving; finally, the presence of preparation but no directiveness, responsibility or problem solving. Although eight out of the 12 configurations did not have contradictory configurations, six of these were only

represented by one intervention and two configurations represented by two interventions. Results from this model, led to the development of a less diluted model of dependence versus autonomy.

**Table 3.7 Model 3 truth table**

Set	D	R	PSV	PRP	Most EF consistency (coverage)	Least EF consistency (coverage)	Con (YES/NO)	Total # of cases
1	True	False	False	False	0.60	0.40	YES	5 (3 most effective, 2 least effective)
2	False	True	False	False	0.33	0.67	YES	3 (1 most effective, 2 least effective)
3	True	True	True	True	0.50	0.50	YES	2 (1 most effective, 1 least effective)
4	True	True	False	True	0.50	0.50	YES	2 (1 most effective, 1 least effective)
5	True	False	False	True	1.00	0.00	NO	2 (2 most effective, 0 least effective)
6	False	True	True	False	0.00	1.00	NO	2 (0 most effective, 2 least effective)
7	True	True	True	False	1.00	0.00	NO	1 (1 most effective, 0 least effective)
8	True	True	False	False	0.00	1.00	NO	1 (0 most effective, 1 least effective)
9	True	False	True	False	0.00	1.00	NO	1 (0 most effective, 1 least effective)
10	False	True	True	True	1.00	0.00	NO	1 (1 most effective, 0 least effective)

<b>11</b>	False	True	False	True	0.00	1.00	NO	1 (0 most effective, 1 least effective)
<b>12</b>	False	False	False	False	1.00	0.00	NO	1 (1 most effective, 0 least effective)
<b>13</b>	True	False	True	True	-	-	-	0
<b>14</b>	False	False	True	True	-	-	-	0
<b>15</b>	False	False	True	False	-	-	-	0
<b>16</b>	False	False	False	True	-	-	-	0

D = Directiveness, R = Responsibility, PSV = Problem solving, PRP = Preparation, EF = effectiveness, Con = contradictory

#### 3.4.4 Model 4: Tension between dependence and autonomy (refined)

The decision to remove the conditions ‘problem solving’ and ‘preparation’. This was undertaken as it was felt that these two conditions may have diluted the two conditions which highlighted a clearer opposing view, that of professional ‘directiveness’ and personal ‘responsibility’.

As shown in Table 3.8, all four configurations were represented by interventions in this truth table. The spread of interventions representing these configurations was even for sets one to three (see Table 3.8) with only one intervention representing set 4. All but one configuration was contradictory. These contradictory configurations included the presence of both directiveness and responsibility, directiveness but no responsibility and lastly, no directiveness but responsibility was present. The one true configuration without contradictory findings was when both directiveness and responsibility were not present, however this configuration was only represented by one intervention. There were no logical remainders for this model.

**Table 3.8 Model 4 truth table**

Set	Directiveness	Responsibility	Most EF consistency (coverage)	Least EF consistency (coverage)	Con (YES/NO)	Total # of cases
1	True	False	0.62	0.38	YES	8 (5 most effective, 3 least effective)
2	False	True	0.29	0.71	YES	7 (2 most effective, 5 least effective)
3	True	True	0.50	0.50	YES	6 (3 most effective, 3 least effective)
4	False	False	1.00	0.00	NO	1 (1 most effective, 0 least effective)

EF = effectiveness Con = contradictory

As there were many contradictory findings across all 4 models, or not enough interventions to create strong findings to support clear pathways to the most effective or least effective interventions, the decision was made to return to the original 37 conditions to note how many conditions in total were present in the most effective and least effective interventions (see Table 3.2).

The difference between the presence of most conditions in the least and most effective interventions was negligible, demonstrating a lack of discriminatory power. Four of the original conditions did show slightly more discriminatory power between most and least effective interventions (see highlighted conditions in Table 3.2). These were: 'High level of professional support', 'tailored problem solving', 'goal setting by participant', 'diet monitoring by participant'. As these conditions were the only ones to show discriminatory power, they were then combined to create a new cross domain model (model 5) and were analysed in Kirq.

#### 3.4.5 Model 5: Cross domain

The truth table for model 5 created 16 possible configurations, seven of which were represented by interventions (Table 3.9). The spread of interventions was mostly even apart from clustering of interventions amongst one of the seven configurations (Set 1,

Table 3.9). This configuration that was represented by nine interventions (four most effective and four least effective), included the presence of all four conditions making up this configuration (High level of professional support, tailored problem solving, goal setting by participant, diet monitoring by participant). Nine out of the 16 configurations had logical remainders. Three of the seven configurations represented by the included interventions were contradictory. As stated in section 3.3.3 several lines of enquiry were followed to resolve these contradictory configurations without success. These contradictions were resolved by changing the outcome to true or false dependent on the balance of consistency. For example, set 1 in Table 3.9 had a contradictory result. The consistency result for most effectiveness was 0.44 and 0.56 for least effectiveness. To resolve this set, because the least effectiveness consistency was greater (0.56) than the most effectiveness consistency (0.44), the outcome was changed to 'false'.

Resolving these contradictions in the truth table for model 5, led to the identification of three possible pathways to effectiveness (See Figure 3.3). Pathway 1 was characterised by the presence of high level of professional support with no tailored problem solving, no diet monitoring or goal setting by the participant. Pathway 2 included a high level of professional support and goal setting by the participant, without tailored problem solving and diet monitoring by participant. Pathway 3 was characterised by a high level of professional support and diet monitoring by the participant but no tailored problem solving or goal setting by participants. Pathway 1 was the only pathway completely consistent, i.e.: where there were no least effective interventions with this configuration.

The analysis of model 5 also led to the development of four pathways to ineffectiveness (See Figure 3.4). Pathway 1 to ineffectiveness was the presence of all four conditions (Goal setting by participant, high level of professional support, tailored problem solving, diet monitoring by participant). The second pathway to ineffectiveness was characterised by the presence of goal setting and diet monitoring by the participant, as well as tailored problem solving, but no high level of professional support. Pathway 3 to ineffectiveness included the absence of diet monitoring by participant and presence of goal setting by participant, high level of professional support and tailored problem solving. Finally, pathway 4 included the presence of goal setting and diet monitoring by the participant and the absence of high level of professional support and tailored problem solving. Pathways 2, 3 and 4 were completely consistent, in that there were no most effective interventions with these configurations.

**Table 3.9 Model 5 truth table**

Set	GS	HPROS	TPSV	DM	Most EF consistency (coverage)	Least EF consistency (coverage)	Con (YES/NO)	Total # of cases
1	True	True	True	True	0.44	0.56	YES	9 (4 most effective, 5 least effective)
2	True	True	False	False	0.67	0.33	YES	3 (2 most effective, 1 least effective)
3	False	True	False	True	0.67	0.33	YES	3 (2 most effective, 1 least effective)
4	False	True	False	False	1.00	0.00	NO	3 (3 most effective, 0 least effective)
5	True	False	True	True	0.00	1.00	NO	2 (0 most effective, 2 least effective)
6	True	True	True	False	0.00	1.00	NO	1 (0 most effective, 1 least effective)
7	True	False	False	True	0.00	1.00	NO	1 (0 most effective, 1 least effective)
8	True	True	False	True	-	-	-	0
9	True	False	True	False	-	-	-	0
10	True	False	False	False	-	-	-	0
11	False	True	True	True	-	-	-	0
12	False	True	True	False	-	-	-	0
13	False	False	True	True	-	-	-	0
14	False	False	True	False	-	-	-	0
15	False	False	False	True	-	-	-	0
16	False	False	False	False	-	-	-	0

GS = Goal setting by participant, HPROS = High level of professional support, TPSV = Tailored problem solving, DM = Diet monitoring by participant, EF = effectiveness, Con = contradictory

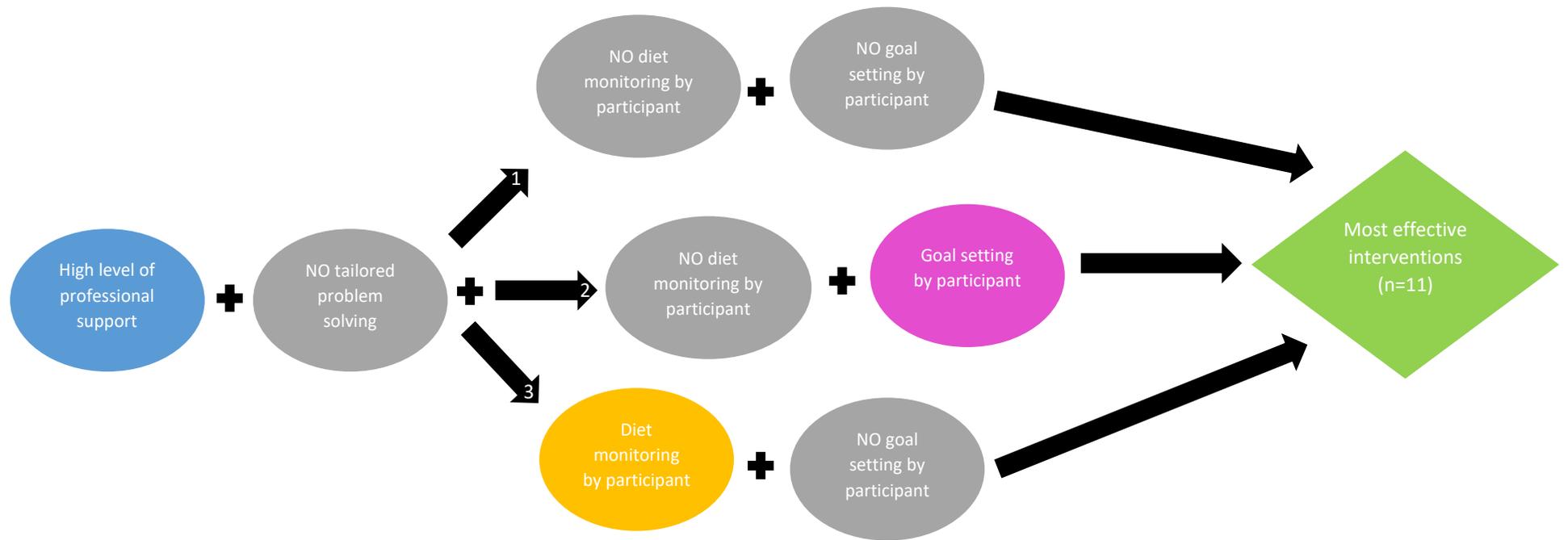


Figure 3.3 Pathways to effectiveness for model 5

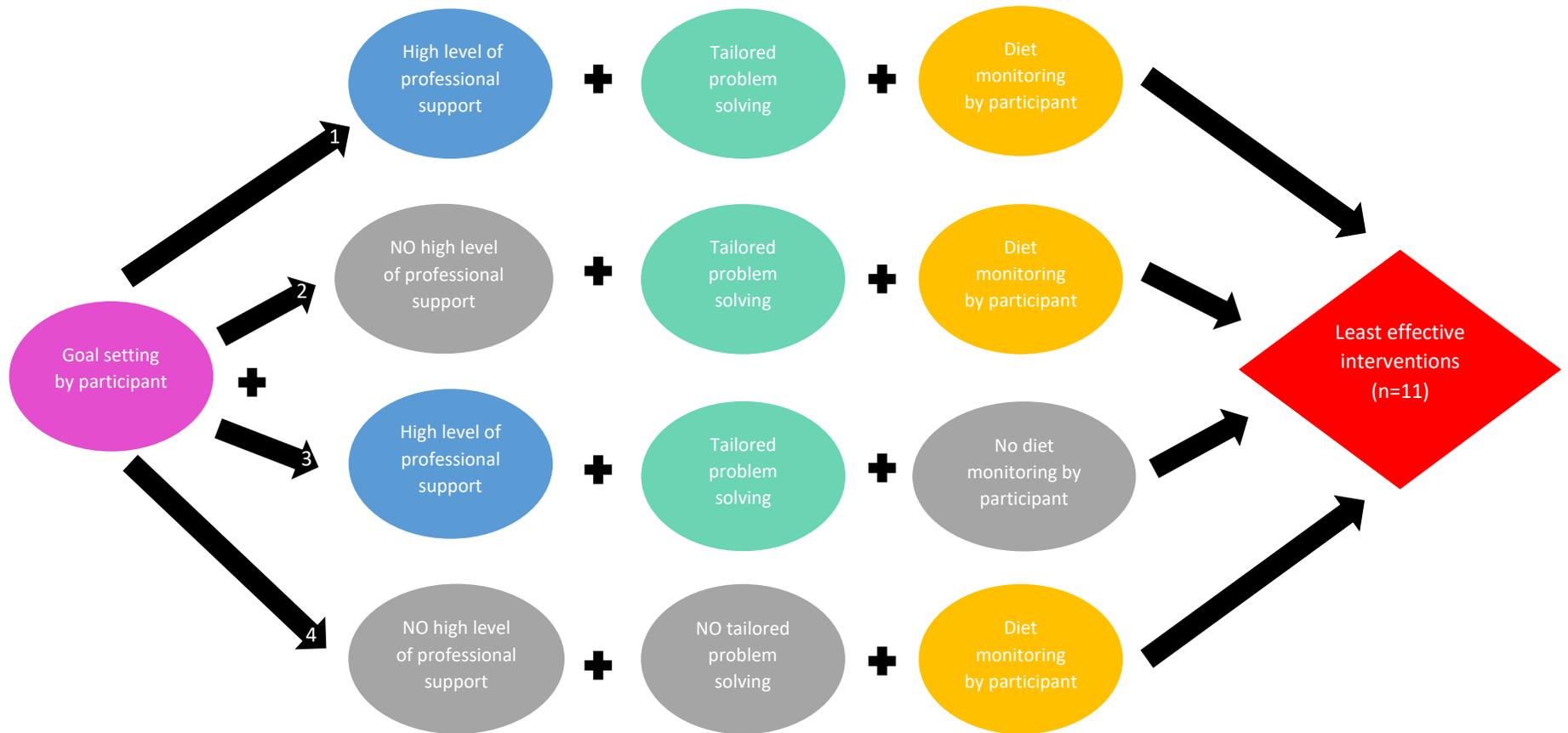


Figure 3.4 Pathways to ineffectiveness for model 5

### 3.4.6 Sensitivity analysis

Three interventions that were deemed most effective had non-significant point estimates (Brennan et al., 2013; Schranz et al., 2014; Vos et al., 2011) (See figures 3.1 and 3.2). All five models were therefore re-analysed with these interventions removed. Re-analysis did not affect the results meaningfully. The same number of contradictory configurations were present for models two, four and five. Models one and three had one less contradictory configuration, both with three in total.

## 3.5 Discussion

### 3.5.1 Summary of findings

The analysis for this chapter demonstrates that a high level of professional support is potentially essential to the effectiveness of a WMP. An intervention was classed as having a high level of professional support, in this analysis, when an intervention clearly described an in-depth relationship and interaction between participants and professionals. These interventions tended to include professional support that was either regular, in-depth and provided 1:1, had additional telephone support; more than one session of support per week or; if in a group setting, there was a large ratio of professionals to participants present. An example of an intervention with a high level of professional support was one with 12 individual sessions lasting 60 minutes. Sessions were conducted weekly for 10 weeks then reduced to fortnightly. As well as additional telephone support, there was also regular maintenance support (Brennan et al., 2013). An example of an intervention not classed as having a high level of professional support was one intended as a low intensity intervention with 6 group sessions delivered over a 24-week period (Boodai et al., 2014).

This analysis also highlighted that the absence of a tailored problem solving element in an intervention led to effectiveness. Tailored problem solving was identified as present in an intervention if the WMP provider worked with the adolescent to consider solutions to problems specific to their individual situation or context. An example of an intervention with tailored problem solving was one with six 40-minute individual motivational interviewing sessions (Pakpour et al., 2015). Motivational interviewing is a patient-centred style of counselling (Lindson-Hawley et al., 2015). If both the above findings were true of an intervention (presence of high level of professional support and absence of tailored problem solving) then whether diet monitoring or goal setting by participants were present or not was indifferent to effectiveness. The only discrepancy to this was if

both goal setting and diet monitoring by the participant were present, alongside the presence of a high level of professional support and the absence of tailored problem solving.

Whilst the most effective WMPs are characterised by these conditions, the pathways to least effective interventions did not directly mirror the pathways to most effective interventions. All pathways to least effective interventions were characterised by the presence of goal setting by the participant. Additionally, if both a high level of professional support and tailored problem solving were present then this created a pathway to ineffectiveness. The presence of tailored problem solving led to ineffectiveness in three out of four pathways and can therefore be suggested as a potential barrier to success in a WMP.

As QCA results are theory-generating rather than hypothesis-testing the purpose of these results are not to take them as conclusive but to use them as a starting framework by which effectiveness of WMPs can be understood more fully and therefore developed. These findings will now be discussed in relation to previous literature.

### 3.5.2 Situating within the wider literature

A high level of professional support was deemed a critical condition in all pathways to effective interventions. This support system has been identified as important previously by adult WMP service users (Melendez-Torres et al., 2018) and in phase one (Chapter 2) of this PhD (Jones et al., 2018). It is possible that the high level of support and regular contact that this QCA analysis highlighted as beneficial is more likely to create a relaxed and informal relationship as opposed to a professional that meets with an adolescent occasionally. A meta-regression investigating behavioural techniques and delivery mode on effectiveness of WMPs in adults showed that greater weight loss was associated with the provision of some contact with a dietitian (Hartmann-Boyce et al., 2014). The provision of instruction has also been associated with greater weight loss amongst adults with obesity elsewhere (Dombrowski et al., 2012). Additionally, in a survey of 1309 registered GP patients in the UK ( $\geq 18$  years), 30% of participants found advice from a primary care professional motivating (Evans et al., 2018). Social support can be described as the ability to use and shape a network of health professionals, as well as family and friends, for emotional support, information and encouragement (Spahn et al., 2010). The key strategy of social support, part of cognitive behavioural and social cognitive behavioural change theories, has been reported as an effective strategy to support

behaviour change in nutrition counselling and physical activity behaviours (Olander et al., 2013; Spahn et al., 2010).

All three pathways to effectiveness involved the absence of tailored problem solving. This contradicts much of the evidence that reports problem solving as a promising behaviour change technique (Brown et al., 2018; Gardner et al., 2016; Golley et al., 2011; Murawski et al., 2009; Spahn et al., 2010). Enabling participants to problem solve and cope in different situations is important for developing empowerment and the capability of making informed health related choices (Pearson, 2012). In a review of behaviour change strategies used to reduce sedentary behaviour in adults, 10 of 26 included studies involved problem solving techniques, eight of which noted this technique as a promising strategy (Gardner et al., 2016). Golley et al., (2011) investigated which behaviour change techniques were associated with effectiveness in interventions targeting parents to improve their child's weight status and dietary and/or physical activity patterns. This review found that 'prompt barrier identification', defined as identifying 'barriers to performing the behaviour and plan ways of overcoming them' (Abraham & Michie, 2008:26), was present more frequently in effective interventions. Having reflected and considered possible reasons for the contradictory result arising from this QCA analysis, one suggestion is that adolescents may be able to work through problems in theory but are unable to translate this into practice. Although there is no empirical data to support this, one example may include adolescents theorising how to choose a healthy meal at lunch time at school, but in practice they could be influenced by their peers, a common predicament in adolescence (Salvy et al., 2012). This theory of incorporating more practical support is supported by findings from a QCA analysis focusing on weight management interventions for overweight younger children (0-11 years). Findings from this analysis supported the use of practical experiences, showing children and parents how to change, rather than just suggesting what to change (Burchett et al., 2018).

The condition, goal setting by participants, was present in all four pathways that led to least effective interventions, but also present in one pathway to most effective interventions. Although not completely mirrored in both effective and ineffective pathways, these results do suggest participant goal setting as a WMP component to avoid. Possible reasoning for goal setting by participants being a barrier to success could be that adolescents are setting goals that are too easy or not SMART enough. Additionally, it could also be that, due to poor reporting, it was not possible to understand the detail of who was involved in setting these goals, whether this was completed in collaboration with a

professional or solely by the adolescent. Collaborative goal setting has been shown as a promising tool in adult weight management (Pearson., 2012; Samdal et al., 2017). Samdal et al., (2017) undertook a systematic review and meta-regression analysis examining the effect of behaviour change techniques on PA and healthy eating in adults with overweight or obesity. This review (n = 48) that included RCTs of behaviour change interventions of at least 12 weeks in length, found the use of goal setting was associated with better intervention effects. Furthermore, goal setting appears useful for helping prevent excess weight gain during pregnancy (Brown et al., 2012) and for supporting parents to engage with weight prevention and improvement of PA and nutrition behaviours in children (Golley et al., 2011). Additionally, in a QCA analysis of adult WMPs, provider led goal setting, including exercise, energy intake and weight goals, was a critical component in the most effective interventions (Melendez-Torres et al., 2018). Although no evidence came out of this QCA analysis to support provider led goal setting, this analysis did reject the use of participant led goals in WMPs for adolescents. This alongside the benefit of high level of professional support as critical to success warrants further investigation and a better understanding of provider led goals in adolescent WMPs.

Self-monitoring is when a participant is asked to keep a record of a specified behaviour (Abraham & Michie, 2008) and has been identified as a behaviour change strategy linked with cognitive behaviour theory and the transtheoretical model of behaviour change (Spahn et al., 2010). Diet monitoring by participants did not come to light in this analysis as a strong indicator towards either least or most effective interventions. This contradicts findings from systematic reviews documenting the importance of self-monitoring, including diet, in promoting weight loss in adults (Burke et al., 2011; Michie et al., 2009; Samdal et al., 2017; Semper et al., 2016). Findings from Semper et al., (2016) suggest that smartphone applications for personal diet monitoring are effective for adults with overweight or obesity. Nonetheless only six studies were included in this systematic review. Additionally, primary research has indicated self-monitoring as critical for successful weight control in adolescents with a mean age of 13 years (Germann et al., 2006a). Self-monitoring has also been identified as useful for weight loss maintenance (Akers et al., 2012; Thomas et al., 2014b).

### 3.5.3 Logical remainders

Nine out of 16 possible configurations in model 5 were identified as logical remainders, that is, configurations that were not represented by any included interventions (Table

3.9). Using the views synthesis alongside the pathways already established, these configurations were judged to determine whether each configuration would likely to lead to effectiveness or ineffectiveness. Three configurations were judged to lead to effectiveness and six to ineffectiveness. This was primarily due to the presence or absence of a high level of professional support in each configuration as the importance of professional support was one of the most dominant themes in the views synthesis.

A consideration for the reasoning behind such a high number of logical remainders in this model is the lack of variety amongst interventions. If there had been a greater variety of interventions included in this analysis, more configurations may have been represented, and therefore more possible pathways to most or least effective interventions. Commissioners, and those designing WMPs in practice, seek the best available information to inform their decision making. At present, as discussed in the introduction, this mostly relies on information from quantitative reviews of effectiveness. Carrying out more research that considers the critical components of WMPs and considers participant views may lead to more innovative interventions being implemented in practice.

Linking with this, in addition to three logical remainders, model 1 had many studies clustered around one configuration (Set 1, Table 3.5). 11 interventions represented this configuration which involved the presence of healthy eating education and absence of mental health support and PA. This highlights again the need for more innovative approaches that start to look beyond the standard format of WMPs and recognises the increasing need for emotional and mental health support identified in the views synthesis (Jones et al., 2018) and elsewhere (Russell-Mayhew et al., 2012).

#### 3.5.4 Strengths and limitations

This QCA brings together findings from a robust quantitative systematic review investigating the effectiveness of obesity interventions for adolescents (Al-Khudairy et al., 2017), and the first qualitative systematic review that has focused solely on adolescent views of WMPs (Jones et al., 2018). By using interventions included in the review by Al-Khudairy et al., (2017), results from the most up to date weight management interventions for adolescents have been used in this analysis. Other systematic reviews of WMPs have included interventions with wider age ranges, including younger children, which would have made the findings from this QCA less relevant to adolescents. BMI-z score and weight (kg) change were both used in this analysis to decide whether an intervention was effective or ineffective. Using two outcomes ensured there were enough

effective and ineffective interventions in equal measure to inform this analysis. It may have been preferable to focus on just one outcome, however as mentioned in the methods section, there were not enough ineffective or effective interventions, based on BMI-z score, highlighting a lack of WMPs focusing solely on the adolescent age group. This lack of WMPs focusing on the adolescent age group was also highlighted by three interventions that were classed as most effective based on their point estimates, but were not significantly better than control, taking into account uncertainty (confidence limits).

Deciding whether a condition was present or not was difficult. This was partly due to the poor reporting of interventions but also highlighted the subjective nature of creating a data table. To combat this, and a strength of this analysis, all conditions were coded by two reviewers independently (HMJ, OO, LA-K, GJMT), increasing the rigour of this research. Additionally, a third reviewer was brought in when necessary and auditable memos of decisions were also created alongside analysis. Conditions were calibrated to ensure all reviewers were interpreting the conditions in the same way.

Three trials examined two interventions which were included in this analysis (Brownell et al., 1983; Pakpour et al., 2015; Patsopoulou et al., 2017). For one trial both interventions were classed as most effective (Patsopoulou et al., 2017), whilst the other two trials had interventions in both the most and least effective categories (Brownell et al., 1983; Pakpour et al., 2015). In these two-armed trials, two studied interventions differed by one (Pakpour et al., 2015) or two conditions (Patsopoulou et al., 2017). One study did not differ in terms of conditions (Brownell et al., 1983) as the main difference between the two-arms of this intervention was whether a parent took part in a group session together with the adolescent or concurrently in separate groups. Either way family support was still present. Therefore, where the two arms were categorised as most and least effective, this meant that contradictions were introduced across all the other components, which contributed to the inability to distil pathways to effectiveness or ineffectiveness.

As noted previously, contradictory configurations in Model 5 were not able to be resolved through removing one outcome (weight (kg)) or from drawing on findings from the views synthesis (peer support). To 'reduce' this truth table in Kirq, to create pathways to effectiveness and ineffectiveness, contradictions were resolved by assessing the balance of interventions deemed as effective and ineffective. This may have had an impact on the pathways that resulted and is therefore a limitation of this study. Nonetheless these weightings, although only slight, did give some understanding of whether an intervention

component was beneficial or not, which was reflected in the pathways. Again, this issue may have been overcome with better reporting and greater variety of evaluated interventions.

A further limitation of this study is that quality assessment methods in QCA are not established, so the quality of studies was not considered in the models.

#### 3.5.5 Implications and recommendations for research and practice

As discussed in section 3.5.4 above, one potential reason why the truth tables for models 1 to 4 had contradictory findings is that critical components of interventions were not reported well enough, meaning finer details were not identified. An example of this is in model 1 and the inclusion of the condition, healthy eating education. As seen in Table 3.5, the condition healthy eating education was present in all four configurations that had contradictory findings. These four configurations that included the presence of healthy eating education alongside either the presence or absence of mental health support and PA, were represented by 20 out of the 22 interventions included in this analysis. If more information was reported on what was specifically delivered as part of healthy eating education, then it might have been possible to further discriminate between interventions which may have led to fewer contradictory responses. Access to intervention manuals would have helped give a clearer description of interventions and therefore aided coding. These could be submitted as supplementary materials when studies reporting effectiveness of interventions are submitted for publication. Issues surrounding poor reporting has been discussed elsewhere (Hoffmann et al., 2017; Klesges et al., 2012). An evidence synthesis of 77 research studies on behavioural treatment for child (2-18 years) obesity highlighted a lack of reporting on key generalisable and dissemination elements in all studies (Klesges et al., 2012).

Additionally, interventions should attempt to be more innovative in their approaches to add to the variety of interventions. This may aid future analyses in the field of WMPs.

### 3.6 Conclusion

This analysis identified potentially important components for adolescent WMPs such as a high level of professional support and the omission of tailored problem solving. Although more research is needed to investigate behaviour change techniques, such as self-monitoring and provider led goal setting, in adolescents with obesity, these findings are important considerations for future service design and delivery.

### 3.7 Chapter summary

This chapter reports on a mixed methods analysis bringing together findings from Chapter 2, a qualitative systematic review of adolescent's experiences of a WMPs and results from an effectiveness review of diet, physical and behavioural interventions for the treatment of overweight or obese adolescents. This chapter focused on specific intervention components and combinations of components that lead to effectiveness or ineffectiveness.

Chapter 4 reports on a primary research study with adolescents with overweight or obesity, and professional stakeholders that have been involved in a WMP in the West Midlands.

## Chapter 4. The perspectives of adolescents and relevant community stakeholders involved in a WMP in Wolverhampton

### 4.1 Chapter outline

This chapter reports on a primary research study with two qualitative enquiry stages: 1) adolescents who have attended a WMP called Hearty Lives (HL) in Wolverhampton and 2) relevant community stakeholders in Wolverhampton involved in the HL programme. The development of this research study has been informed by Chapter 2, a qualitative systematic review.

### 4.2 Introduction

The qualitative systematic review of adolescent viewpoints of lifestyle obesity treatment interventions (Jones et al., 2018), reported in Chapter 2, revealed potentially pertinent factors that should be considered when developing future interventions for adolescents with obesity. To investigate further, these findings have been used to inform this phase of the research at a local level in the West Midlands. The systematic review reported in Chapter 2 identified nine UK based studies, none of which were based in the West Midlands. In addition to this, many of the studies varied in delivery and setting, differing from the home-based HL WMP which was the focus of this study (See Section 4.3.2 for more details of the HL programme). For example, of the nine UK based WMPs, one was a single component exercise intervention lasting eight weeks (Daley et al., 2008), two were based on a 6-week weight management camp (Holt et al., 2005; Hester et al., 2009) and one was a multi-disciplinary intervention in a hospital clinic setting (Owen et al., 2009). The research presented in this chapter recognises a gap in the evidence base at a local level and aims to strengthen already established evidence at a national level regarding adolescent views of WMPs.

Furthermore, there is a need to gain a better understanding of stakeholder views on adolescent obesity treatment. To the authors knowledge, this is the first qualitative study in the UK of stakeholders' views that specifically focuses on WMPs for adolescents. As key members of the local professional community that either work directly with adolescents with obesity, or involved in commissioning or designing these WMP, the views of stakeholders in the development of WMPs should not be overlooked.

The overall aim of this PhD phase was to understand how best to support overweight and obese adolescents to achieve a healthy weight when attending a weight management intervention in the West Midlands. The qualitative research component reported in this chapter consists of two stages: qualitative data collection with adolescents who had attended the HL WMP in Wolverhampton (stage 1), followed by interviews with relevant community stakeholders in Wolverhampton (stage 2). This chapter will present the methods and findings, as well as a discussion of the similarities between both stages.

### 4.3 Setting the scene

#### 4.3.1 Wolverhampton

Wolverhampton is one of the 20% most deprived local authorities in England and the health of those living in Wolverhampton is, in general, worse than the England average. 26% of children living in Wolverhampton are from low income families (Public Health England, 2018b). Excess weight in adults in Wolverhampton (65.8%) is significantly worse than the average for England (61.3%) and this problem extends to children (Public Health England, 2018b). Latest data from the National Child Measurement Programme (NCMP) shows that in addition to an obesity issue with reception aged children, 42% of children in Year 6 (age 10-11 years) are overweight and obese. This is significantly higher than the national average of 34.3% and greater than the West Midlands regional average of 37.1% (NHS Digital, 2018a). Consequently, these figures highlight a need for a WMP in Wolverhampton that not only focuses on reducing levels of obesity but is targeted at more vulnerable children and young people, with the aim of addressing health inequalities. On the basis of these data, the programme of which this study is centred was developed and initiated. HL has since been de-commissioned.

#### 4.3.2 Hearty Lives

HL was a 6-week home-based WMP for children and adolescents between the age of 2-17 years and their families. The programme was part funded by the British Heart Foundation (BHF) and WCC, the latter of which was responsible for managing and delivering the programme. The programme was initially funded by the BHF (as part of a programme to reduce CVD and address health inequalities) and WCC jointly for a 3-year period, with WCC providing the funding for the programme for a further year. HL was delivered by a small team of four individuals. Three were responsible for the day to day delivery of the programme which was overseen by a project manager. Because of funding

cuts to PH, a large restructure of staff and teams within the department took place and the programme ceased at the end of 2017.

HL focussed on encouraging lifestyle behaviour change, using rewards to encourage participants. Although the programme altered its referral criteria at various points in its 4-year running period, the programme always prioritised adolescents (12-17 year olds) and vulnerable children who had involvement with social services. In particular, HL targeted Looked After Children (LAC), children on child protection plans (CP), children classified as a child in need (CIN) and children under an Early Health Assessment (EHA). This prioritisation worked by triaging adolescents or children involved with social services if there was a waiting list.

Programme components were tailored to the family's needs but typically included healthy eating education, food labelling, budgeting and meal planning, practical cookery, increasing PA and reducing sedentary behaviour, and healthy snack tasting; all were delivered in a home setting. Healthy eating education around fat, sugar and salt were delivered using visual and interactive tools which showed participants how much of each macro or micro nutrient was in commonly eaten unhealthy foods. Children and adolescents had the opportunity to gain rewards through achieving behaviour change goals, which were set collaboratively between participants and HL staff and reviewed at each appointment. These were primarily provided by the BHF, such as water bottles, dodge balls, wrist bands and bags. Once the programme was well established, referrals were accepted by all health and social care professionals. Most commonly referrals were made by school nurses, dietitians and family support workers within social care teams. Professionals were asked to explain the programme to families and assess readiness to change and motivation before referring into the programme. In the latter stages of the programme, a self-referral route was opened to adolescents (12-17 years). HL was a rolling programme with children continually being referred and recruited. After a 6-week period of weekly appointments lasting between 1-2 hours, follow-up appointments were conducted 3, 6 and 12 months after the 6-week period ended. Measurements such as height and weight were taken, and BMI calculated, at week 1, week 6 and at all three follow-up appointments (3, 6, 12 months). All appointments, including follow-up, and measurements took place in the home environment.

## 4.4 Methods

### 4.4.1 Ethical approval

Research ethics approval was obtained from the University of Warwick's BSREC (REGO-2018-2149 AM01) (Appendix 1).

### 4.4.2 Stage one: Adolescents

#### 4.4.2.1 Methodology

Stage one planned to use online focus groups or one-to-one telephone interviews with adolescents involved in the HL WMP in Wolverhampton.

#### 4.4.2.2 Objectives

To understand:

- The views and experiences of adolescents attending HL, a WMP in Wolverhampton.
- The reasons for not engaging in a WMP.
- The barriers and facilitators to adolescents achieving a healthy weight.

#### 4.4.2.3 Sampling

The initial plan was to have a homogenous focus group sample, with participants having similar characteristics, such as age and BMI change during the programme. The aim was to have four sets of online focus groups. Sets one and two would involve adolescent with overweight or obesity who had completed the six-week HL programme and who were successful or unsuccessful in reducing their BMI, respectively. If recruitment was successful and numbers allowed, the above focus group sets may have been split into those completing the 6-week programme but dropping out before the 12-month follow-up, and those that were followed-up for 12 months. Set three would include non-starters, those that were referred into the HL programme but did not start. Finally, the fourth focus group set would include drop outs. Drop outs were defined as those individuals who started the programme but dropped out before the six sessions were completed. As the views of younger adolescents may be different to older adolescents, each set would be split into two focus groups, one with 12-14 year olds and one with 15-17 year olds.

The sampling objective was to recruit 5-8 adolescents per focus group. This would mean recruiting approximately 64 adolescents in total, based on groups of eight. Small groups of this size may result in increased interaction (Green & Thorogood, 2014). A purposive sampling approach was to be used to recruit adolescents. This is a common sampling

method in qualitative research where participants are selected based on the likelihood that they will be able to generate relevant and useful data (Green & Thorogood, 2014).

#### *4.4.2.4 Recruitment*

Recruitment was aimed at adolescents who had been referred into the HL WMP in Wolverhampton. Adolescent recruitment was attempted through my links with the BHF HL programme delivered by WCC. This included the HL project manager, HL workers and other members of the PH team at WCC. Invites were sent out to all 12-17-year olds that participated or were invited to take part in the HL programme (n=168). Initial contact was made as follows:

- Information packs were prepared by the researcher. These packs contained:
  - a) a participant information sheet (PIS) for both adolescents (Appendix 12) and parents/main carer (Appendix 13), consent forms for adolescents (Appendix 14) and parents (Appendix 15) and a stamp-addressed envelope.
  - b) For those that dropped out of the programme or never started, a semi-structured questionnaire (Appendix 16) was also included along with the PIS and consent forms. This questionnaire was for those that decided not to take part in a focus group or an individual telephone interview. The aim of the semi-structured questionnaire was to capture data on reasons for not taking part in the HL WMP.

Participants were asked to send their questionnaire back to the researcher using an enclosed stamped-addressed envelope. Alternatively, participants could scan and email a copy of this questionnaire to the researcher or fill out an online version of the questionnaire. A URL was given on the questionnaire, which remained active for 6 weeks. The end date was given on the questionnaire. Bristol Online Surveys was used as Warwick has a site licence for this online survey platform and was approved by the Information Specialist Security at Warwick University.

Information packs (Appendices 12-16) were delivered to the PH department at WCC and were sent out (by a WCC employee) to 168 participants, who were referred to the HL programme, on the 20<sup>th</sup> March 2018. Those interested in taking part, or those that had additional questions, were asked to contact the researcher. Email and phone details of the researcher were provided on the PIS. Participants wanting to take part, were asked to post back a signed consent form using the stamped-addressed envelope. The consent form asked participants to provide a contact telephone number and email address.

Participants could also scan and send the consent forms and questionnaires back by email if preferred. Consenting participants were allowing the researcher access to their HL records held by WCC. This was important to gather demographic characteristics, such as age, weight and length of participation in the programme. The adolescent would then be allocated to an appropriate online focus group based on their age (e.g. focus group for 12-14-year olds who completed the 6-week programme and reduced their BMI). Participants would then be contacted and given details of the focus group arrangements, including log on details, time and date of the focus group, and ground rules prior to taking part in the focus group by email, post or phone.

#### *4.4.2.5 Funding*

Funding was provided by the CLAHRC West Midlands. This included postage costs for sending recruitment packs out and the cost of using the online focus group software. In addition, £5 high street vouchers were offered to adolescents as a token of appreciation for their time and input. Details of this token were written in the PIS (Appendices 12 & 13) in a manner that ensured the voucher did not distract from understanding the involvement required. Vouchers were posted out after data was collected. The aim was to over-recruit adolescents to allow for drop outs, which from personal and professional experience is likely in this age group.

#### *4.4.2.6 Data collection*

Focus groups were chosen as they are a good way of interviewing those who have had a similar experience. Focus groups can be used to facilitate expression of ideas that may not develop in an interview (Pope & Mayes, 2000). Online focus groups can facilitate dialogue between individuals and stimulate an honest discussion, as it provides a more comfortable environment for those that may be hesitant at contributing face-to-face (Lijadi & Van Schalkwyk, 2015). For example, those that have dropped out of a weight management intervention may not feel comfortable expressing their reasons in an individual interview but may be more open when they hear the views of others in a similar situation. Focus groups typically encourage open discussion and stimulate debate. Focus groups may not always be appropriate when discussing sensitive issues, such as obesity, however this is the reason for making each group homogenous in terms of age, BMI change and whether they attended or dropped out of the WMP. A further reason for opting for focus groups is from professional experience of this age group. Adolescents are likely to be more confident when interacting with peers in a similar situation to them and are therefore more likely to express their own views.

Online focus groups have the advantage of increasing participation from hard to reach groups, such as adolescents. They can overcome issues around recruitment, as they are a more convenient option for participants, with no need for travel (Tates et al., 2009). In addition, an online environment can also offer social equality as the ethnicity, nationality, gender and socio-economic status of an individual will be unknown to other participants.

Online focus groups are also advantageous to the researcher, in terms of cost and time saving. Responses can be automatically transferred to qualitative software for analysis, with no need for transcription. This can reduce the risk of transcriber error and improves the accuracy of data. Recruitment, travel and logistic expenses are also reduced (Tates et al., 2009). Another benefit of using online focus groups is that data from an individual may be removed prior to publication, if asked by the participant; however, in a face-to-face focus group this may be challenging due to the difficulty in distinguishing individual participants. Disadvantages of an online focus group include the need for access to the internet and a computer or mobile device.

Specifically, an asynchronous online focus group forum was planned. This mode allows participants to log into the focus group during a set period, e.g. over a week, and read and comment on posts at a time that is convenient for them. Allowing participants more time to answer questions increases reflection and brings about more considered responses that tend to be more detailed than those in synchronous online focus groups (Tates et al., 2009).

Meetings were held with the University of Warwick's IT department to investigate the most appropriate and secure online focus group software. An online focus group software called 'FocusGroupIt' was planned for this stage of the research (Foley, 2018). This secure discussion forum allowed anonymous profiles to be set-up, so participants would never be known to each other. Participants were also unable to contact each other, other than in the context of replying to each other in the focus group. As is the nature of asynchronous focus groups, participants could login whenever was most convenient for them, 24 hours a day, from a variety of devices (smartphone, computer, tablet). Transcripts could easily be exported to qualitative analysis software and the group could be archived once completed so participants would be unable to log in again.

Focus groups were to be run by the lead researcher (HMJ) who would post questions onto the focus group using a semi-structured focus group guide (Appendix 17). These questions were developed from the findings of a qualitative systematic review investigating the

views of overweight and obese adolescents attending WMPs (Chapter 2). Participants were asked to respond to these questions and to each other. In addition to the lead researcher, a moderator would also be present (LA-K). The moderator would not contribute to the discussion but would be there as an additional person to check how the focus group was progressing and monitor the content for any potential problems or signs of distress (see Appendix 18 for details on ethical considerations). Access to the discussion forum was limited to invited participants, who were provided with a unique link to access the group. They were given a username/ID to use to prevent their identification by other adolescents participating.

Each focus group would be open for one week eliminating time pressure and allowing considered responses from adolescents. Adolescents would be informed of the start and end date of their focus group after consenting to take part. Focus groups would be staggered over a period of one month. This would allow the adaptation of focus groups if lessons were learnt in the earlier focus groups. This could relate to technical issues or data collected.

Ground rules would be set at the beginning of the focus group. These rules included:

- Keeping their identity private. Adolescents were asked to ensure they did not include any personal information about themselves or anyone they knew, not to share their log in details with anyone and not discuss meeting up outside the online focus group.
- Be respectful of each other. Adolescents would be asked not to post rude, offensive, threatening, or aggressive comments. Racially offensive or homophobic remarks would not be tolerated.
- To remain on topic with the discussion.
- To remind participants that they were free to withdraw from the focus group/research at any time.

At the end of the weeklong focus group, the researcher would close the group, and participants would no longer be able to log in.

#### *4.4.2.7 Recruitment issues and protocol amendments*

Despite efforts to recruit adolescents, only one adolescent provided consent to take part in this study. To proceed with data collection, an amendment to the protocol to allow individual interviews was agreed and this was re-submitted to BSREC. Although an online

focus group was the preferred method of choice for this stage of the research, due to low recruitment, individual telephone interviews were also offered. Although one of the benefits of using focus groups is to facilitate expression of ideas as mentioned previously, individual interviews have the benefit of potentially bringing about more in-depth information from an individual. Additionally, a focus group would only be effective at stimulating debate and discussion if there are adequate numbers.

Once completed consent forms were received from both parent and adolescent, a telephone interview was arranged at a suitable time. After an overview of the research and introductions, the participant was asked if they were happy to be interviewed; a yes or no response was required. Questions from the semi-structured focus group guide were used (Appendix 17). Once consent was given, then an audio recording device continued to record the interview. After the interview, the participant was thanked for giving their time and reminded how they may get in touch with the researcher should they have any concerns or questions.

As only one adolescent volunteered to take part after sending out 168 recruitment packs on the 20<sup>th</sup> March 2018, a further 168 packs were re-sent 11 weeks after on the 7<sup>th</sup> June 2018. As described previously, a semi-structured questionnaire was also sent to participants. As part of the re-submission to BSREC, after issues with recruitment has been identified, this questionnaire was altered to contain questions that were more detailed and offered to any adolescent to complete, not just those that had not engaged with the programme. If they took part in HL but did not wish to take part in the focus group or telephone interview, they were asked if they would complete the semi-structured questionnaire (Appendix 19) and return to the researcher.

#### 4.4.3 Stage two: Stakeholders

##### *4.4.3.1 Methodology*

Stage two involved face-to-face or telephone interviews with key stakeholders in Wolverhampton. Stakeholders included those that had worked with overweight adolescents directly or those involved in the planning of adolescent weight management interventions.

##### *4.4.3.2 Objectives*

To understand:

- The policy and practical implications of findings from qualitative work (stage 1) with adolescents and a qualitative systematic review (Chapter 1).
- Stakeholder views of WMPs for adolescents with specific reference to HL.
- Stakeholder insights into why programmes are effective and how they can be made more effective.
- How the findings can be used to improve management and future development and delivery of adolescent WMPs locally.

#### *4.4.3.3 Sampling*

A purposive sampling approach was used to recruit HL service providers, commissioners and those referring adolescent into the HL programme, such as the school nursing service, social services and leisure services. It has been suggested that between 6 and 12 interviews is adequate, with few new findings occurring after 15 interviews (Green & Thorogood, 2014). Based on this, the aim was to conduct 10-12 interviews, or until data saturation.

#### *4.4.3.4 Recruitment*

Stakeholders were recruited through contacts within WCC departments. Contact was made initially by email or telephone. A consent form (Appendix 20) and PIS (Appendix 21) was emailed or posted to those expressing an interest. Participants were offered telephone or face-to-face interviews. An interview appointment was then arranged, either over the phone or by email, at a time and place convenient for the stakeholder.

#### *4.4.3.5 Data collection*

All interviews were carried out by one researcher (HMJ). HMJ had significant experience in WMPs and previous experience with qualitative methods. Due to this prior experience, the researcher was known to some stakeholders involved in this research.

Semi-structured interviews were chosen as they allow the researcher to have a set guide of topics and open-ended questions, allowing the interviewee to reply in an unstructured and open way (Pope & Mays, 2000). In addition, the interviewer is open to asking questions not included in the interview guide if an interviewee response warrants further exploration, allowing flexibility. This method keeps the research open to new concepts emerging that may be different to those previously predicted by the researcher (Pope & Mays, 2000). This method was chosen for stakeholders, as they may not have felt comfortable voicing issues in front of colleagues. In addition, a wide range of stakeholders who work with adolescents in different settings and contexts were recruited and

therefore may have had different experiences of working with adolescents. It would also have been difficult to arrange a time where all working stakeholders could be present during office hours in a single venue; individual interviews allowed flexibility from this point of view.

Participants were provided with the PIS and consent form, which was signed before the interview commenced. Participants were also given a shorter version of the interview guide, so they could familiarise themselves with the content prior to the interview. If the interview was undertaken over the telephone, verbal consent was also recorded. The participant was asked if they were happy to be interviewed; a yes or no response was required. If consent was given, then an audio recording device continued to record the interview. After the interview, participants were thanked for giving their time and reminded how they could get in touch with the researcher should they have any concerns or questions.

#### 4.4.4 Protocol amendments

The aim was for stakeholders to be interviewed after the qualitative research with adolescents so that any findings could be incorporated in the interview guide for stakeholders. This was so the policy and practical implications of findings from the qualitative work with adolescents could be discussed. Due to difficult and poor recruitment of adolescents, the interview guide was created using solely the findings from the qualitative systematic review (Chapter 2). Stakeholder interviews took place before stage one. The interview guide is shown in (Appendix 22).

#### 4.4.5 Piloting

All consent forms and participant information sheets were reviewed by two Patient and Public Involvement (PPI) representatives from the CLAHRC West Midlands and two family members aged between 12-17 years.

Feedback regarding the PIS from one 13-year-old, passed on by her mum, stated:

*'xxx says it is very understandable. She thinks anyone could understand it. She also said the £5 voucher is a great idea and would definitely convince her. Then she went into full on grammar queen mode and said you could do with some semicolons in your opening paragraph'.*

Regarding the consent form, the same, 13-year-old commented:

*'I fully understood but I feel some people would not; there is some vocabulary that could be a bit difficult for some people to understand e.g. Anonymity and a few words may be hard in the context given like satisfactorily and possibly saved securely.'*

This feedback related to the following statement in the consent form:

*'I understand that the information I give will remain confidential and that I will be given anonymity during the focus group and in any research reports.'*

This led to the statement being changed to:

*'I know that some of what I say in the online focus group/telephone interview may be included in the researchers' report, but that my name will not be given so no one will know who said it.'*

Another adolescent, aged 17 years, also commented on the PIS:

*'Reading it as a 17-year-old I understood all the information and the concept behind what was happening... the layout is easy to follow.'*

PPI representatives stated:

*'The documents are well laid out, use plain English avoiding unnecessary jargon, and are easy to understand.'*

*'They read very well and, as previously, I like your plain English style which is clear and easy to read.'*

The lead researcher (HMJ) and supervisor (LA-K) conducted a pilot/role-play of the online focus group to check the focus group guide and test for any technical or practical issues. Interview guides were checked by two members of the supervision team (LA-K, GJMT) and piloted prior to data collection. Interviews were continued until data saturation was reached.

#### 4.4.6 Analysis

Audio-recorded interviews were transcribed verbatim by APPEN (UK based transcription service). Transcripts were then exported into NVivo 11, a qualitative analysis software. Data from stakeholder and adolescents were then approached using inductive thematic analysis, separately. Thematic analysis was chosen as it reports the experiences of

participants and can reflect reality, one of the key objectives of this study. Thematic analysis is a process of identifying, analysing and recording patterns in data in addition to interpretation (Braun & Clarke, 2006). Themes were identified in an inductive way, without a pre-existing framework, ensuring the chosen themes are closely linked to data. Another reason for choosing thematic analysis was to reduce researcher preconceptions (HMJ). It is possible that the researchers previous professional experience in adolescent lifestyle obesity treatment interventions may had led to preconceived ideas that could have influenced interpretation of data. However, with this interest and experience the researcher is sensitive to the depth and importance of the topic and the wider implications on PH. To overcome this and in order to ensure validity, principles of reflexivity were carried out by being sensitive and critical to the role of the researcher in the research process (Pope & Mays, 2000).

In addition, themes were identified at a semantic level; the researcher did not look beyond what the participant had said but progressed the analysis from description to interpretation, where significance of the themes and patterns are theorised (Braun & Clarke, 2006). To ensure a deeper analysis of this qualitative data and not just simply coding the data, elements from the grounded theory approach, as described by Glaser and Strauss (1968), were used. One element used was open coding. Open coding involves questioning the transcript, line-by-line, ensuring all possible concepts are identified at an early stage (Green & Thorogood, 2014). Codes were identified by looking for repetition, metaphors, similarities and differences in the data. In addition, Glaser and Strauss (1968) suggest looking for *in vivo* codes; categories that participants use to describe the world (Green & Thorogood, 2014). Another tool used in grounded theory is that of constant comparison, where a close connection between conceptualisation and data is maintained throughout the analysis (Bryman, 2016). By using elements of grounded theory a more detailed account of the data was gathered, rather than just a list of key themes (Green & Thorogood, 2014).

Memos were written alongside data collection to increase reflection, enable changes to the interview guide and allow new concepts to be explored. Themes were reviewed by a member of the supervisory team (OO) to improve reliability. A draft version of this chapter for publication was provided to stakeholders to allow member checking as a way of validating the qualitative results.

## 4.5 Results

### 4.5.1 Participant characteristics

#### 4.5.1.1 Stage one

168 adolescents between the age of 12-17 years were invited to take part in this study. This included those that had completed the 12-month programme, those that had dropped out, either within the first 6 weeks of the initial programme, or follow-up, and those that were referred but never initiated the HL programme. Out of 168 adolescents that were invited, two adolescents took part in this study, one of which volunteered to take part after the second round of invites were sent. Both adolescents were females, 13yr 10 months and 12yr 4 months at the time of commencing the HL programme. Both are now aged 15 years. Both adolescent participants completed the initial 6-week HL programme, one completed all review appointments up to 12 months (A1); the other finished the programme after their 3 month review as they were no longer a resident of Wolverhampton (A2).

#### 4.5.1.2 Stage two

Eleven stakeholders were recruited to this study. Stakeholders were all females and included HL WMP workers (n = 2), School nurses (n = 3), dieticians (n = 2), HL manager (n = 1), PH Consultant (n = 1), PE and School Sport Partner Manager for WCC (n = 1), Health advisor (n = 1). A further 10 school nurses were contacted but did not take part. Two had retired or left the trust. The remaining eight did not respond. As data saturation had been reached after analysing 10 interviews, no further attempts to recruit participants was made.

### 4.5.2 Stage one: Adolescents

Out of the two adolescents that agreed to take part in this study, one took part in a telephone interview (A1) and the other completed the semi-structured questionnaire (A2) (Appendix 19). The telephone interview lasted 37 minutes. Thematic analysis led to the development of two categories: Intervention content and Support. A diagram of these categories, including 12 themes can be seen in Figure 4.1. Themes have been mapped onto a socio-ecological framework (see table 4.1). These categories and themes, along with transcribed quotations, are discussed below.

#### 4.5.2.1 Intervention Content

In this category seven themes that relate to the content of an intervention will be discussed. As well, adolescent's prior worries of attending a WMP and their thoughts on

measurements will be discussed. Views on emotional and psychological support, PA, practical hands on activities and goal setting will also be considered. Lastly, the use of technology within an intervention will be discussed.

#### 4.5.2.1.1 Prior worries

Adolescents spoke of uncertainty prior to taking part in the HL programme. There was a sense of excitement but also nervousness and embarrassment. Adolescents seem to be reassured once initiation of the programme had begun.

*'I was excited about becoming healthy, but a bit embarrassed and intimidated because of my weight/lifestyle'. (A2)*

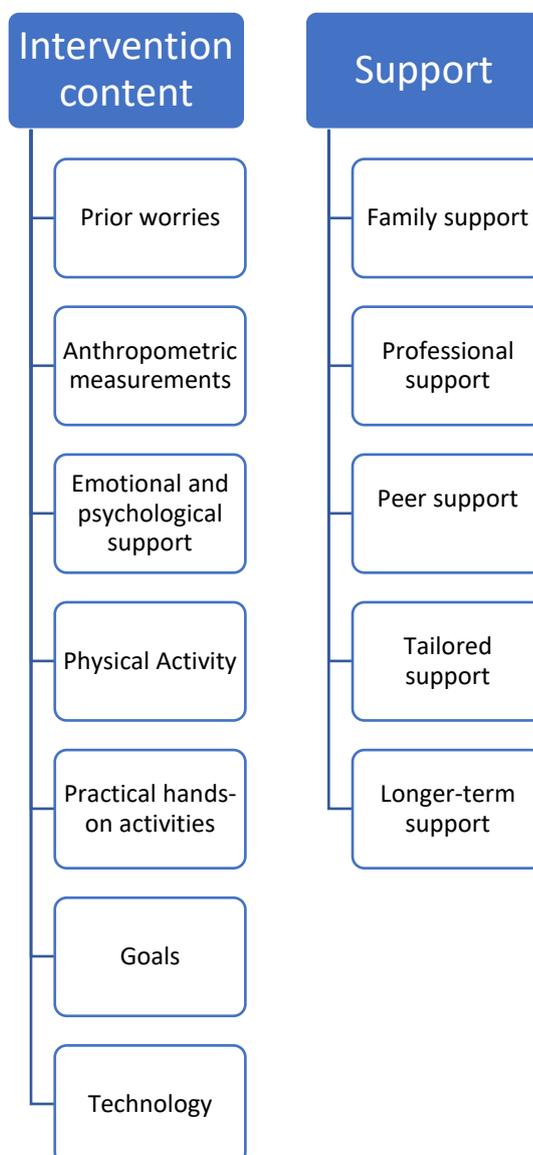


Figure 4.1 Thematic network diagram of adolescent categories and themes

**Table 4.1 Adolescent themes mapped to a socio-ecological framework**

Individual	Interpersonal	Organisational	Community	Societal
Prior worries	Family support	Emotional and psychological support		
Anthropometric measurements	Professional support	PA		
	Peer support	Practical hand-on activities		
		Technology		
		Goals (adolescents wanting rewards for achieving goals were described in this section)		
		Tailored support		
		Longer-term support		

*.5.2.1.2 Anthropometric measurements*

Anthropometric measurement taking is a key element of most WMPs. Adolescents involved in this study did not mind having their measurements taken. One adolescent commented on being able to calculate their BMI. Nervousness was felt initially for the first couple of HL sessions, but this eased as the sessions progressed. This uneasiness was partly due to not knowing how the HL worker would react if no weight has been lost, but also a worry the adolescent would be letting their family down if the desired result were not achieved. Preference was to be weighed in private away from the family.

*‘Yeah because like it was like in front of the family and like I was scared I’d put my family down if I didn’t reach my goal.’ (A1)*

*4.5.2.1.3 Emotional and psychological support*

Within the category ‘Intervention content’ the theme ‘Emotional and psychological support’ developed. Dissatisfaction with body image and insecurities around appearance were noted by adolescents. Focus on celebrities’ appearance, on social media sites, such as Instagram, was apparent. Additionally, one adolescent displayed frustration that they did not look like these icons, however, there was an understanding and recognition that body shapes and sizes vary. Adolescents spoke about motivations to take part in PA that were around body image. Health was not mentioned. In addition, one adolescent in this study wanted set exercises that would lead to a specific body shape, reiterating the need

for education and improved knowledge (see section 4.5.3.4.6 on 'Knowledge and Education' with the stakeholder results).

*'Like girls really want to look that way, like having an hour glass type of figure, having like nice yeah like, yeah if you know what I mean, like a nice bum and all that kind of stuff like. Because you see Kim Kardashian like looking that way or like all the Kardashians or some of the models on Victoria Secret and they have like, because like looking at Victoria Secret it's like one of these things that like you don't want to look at because like it's just not fair.'* (A1).

One adolescent spoke about how hard it was to lose weight as they were so used to eating certain foods. Worries about social pressure were mentioned. They felt that friends would comment if they changed or reduced the food they were eating. Pressures of school, including exams also made losing weight difficult.

*'Like...because like, it's like you're used to like eating like the wrong stuff and then like it gets to your head like oh I've been eating crisps, chocolate and all that and then like as soon as like, it's like you can't get off it because like in a way it's a bit of an addiction.'* (A1)

#### 4.5.2.1.4 PA

PA is important to consider in intervention content. In addition to thinking certain exercises would lead to a particular body shape, one adolescent girl was worried that too much strength based PA would lead to a muscular physique, which was not wanted. There was a fear of gaining too much muscle and the perception that those in the public eye with more curvy figures did not do strength-based activities. Although not directly providing PA, HL was praised for giving adolescents confidence to join other activity clubs and for helping them find activities that suited them. One adolescent felt they would only be comfortable exercising on their own if it was not in a public place and would have valued doing PA together with a professional or family member, if offered on the HL programme. One adolescent reported wanting activity to be tailored and intensity built up gradually.

*'It helped me understand how much I needed to exercise and I found activities that suited me.'* (A2)

#### 4.5.2.1.5 Practical hands on activities

Considering how activities are delivered is an important consideration of intervention content. Not only did adolescents report enjoying learning about healthy eating but liked

more practical hands on activities, such as cooking and trying new foods. Both adolescents remember learning how much fat and sugar was in certain foods using visual kits.

*'I think it was like the 5th or the 4th session and she was like telling us like this is so much sugar in a can of pop and so much sugar in a fruit juice and it was something like how much fat is in these types of foods that you're eating and then like I was like thinking like that's like so much fat in like, in like what a cheeseburger or something like that.'* (A1)

Adolescents also reported being conscious of how much money they spend on food as well as wanting support with planning meals. Education on both food budgeting and planning within an intervention may lend themselves to practical hands-on activities.

#### 4.5.2.1.6 Goals

Although there was only a vague recollection from one adolescent regarding goal setting, rewards for achieving goals was described as part of the category 'Intervention content'. These were mostly to encourage PA. Incentives for taking part were suggested, such as a PA outing to a trampoline park called 'airspace', as well as having an end of programme party for participants.

*'Yeah or like a going out, airspace or something like that, in a way a physical thing to do.'*  
(A1)

#### 4.5.2.1.7 Technology

Within the category 'Intervention content', different types of technology and their use in an intervention were discussed. Adolescents were asked their feelings about receiving support via text or email. This idea was welcomed if they were not too frequent, with one adolescent commenting: *'I'm always on my phone I wouldn't miss the message!'* (A1). This same adolescent also said they used Instagram frequently, and would happily join a group that involved other peers on a WMP. Facebook was not used. Videos of PA sessions that could be completed in the home environment, sent by email would have been appreciated.

*'Yeah like it's like I was saying Facebook like because I don't really use it but if it was like Instagram or like, yeah Instagram like having like a little group on Instagram.'* (A1)

#### 4.5.2.2 Support

In this category the themes family, professional and peer support will be discussed. In addition, the importance of tailored and longer-term support will be explored.

#### *4.5.2.2.1 Family support*

Family support was appreciated by both adolescents. One adolescent commented on how helpful it was to have the whole family involved and how it brought the family closer together. One adolescent spoke about their enjoyment and appreciation of taking part in PA with their family. Although family support was appreciated, including transport, responsibility for their weight was owned by the adolescent.

*'Yeah it was helpful to like, so it's the family getting involved it's what we can all do together as a family and like, what can we take part in and yeah...like that.'* (A1)

#### *4.5.2.2.2 Professional support*

Adolescents valued professional support on the HL programme. They appreciate being given ideas and clear explanations. Adolescents also valued the non-judgemental nature of staff. There was initial worry of being told off for not losing weight, but this eased once the adolescents realised how encouraging the HL worker was.

*'My mom and the worker as both supported me each visit and made me feel less intimidated.'* (A2)

One adolescent spoke about the importance of trust. This was not only related to the need to get to know and trust a professional, but also in terms of facilities and venues they visited. More trust was placed in a venue that was familiar to the adolescent.

*'I'd feel alright about it but like I think like I'd have to get to know them more because like trust issues or something like that.'* (A1)

Trust was also important when advertising WMPs. As well as a self-referral route being important for one adolescent, the other trusted the recommendation of her school nurse to take part.

#### *4.5.2.2.3 Peer Support*

One adolescent in this study spoke of the value of peer support. The idea of attending a group programme was appealing, especially attending with peers who were also overweight. This adolescent also spoke about not wanting to attend a leisure centre unless with a friend. The want to help others in a similar situation was also mentioned, suggesting that mentoring schemes mentioned in the theme 'peer support' within the stakeholder results (section 4.5.3.1.3), should be given more thought.

*'I don't go there but I wouldn't mind going there with like a friend or something like, yeah as long as I'm not on my own.'* (A1)

#### 4.5.2.2.4 Tailored support

As well as considering support from family, professionals and peers, delivery of a WMP must be tailored to the individual. One adolescent taking part in HL said they would not have minded taking part in a group programme. The other adolescent said that the home-based nature of the HL programme made her feel more comfortable and able to share ideas. One adolescent also commented that the timing of a session was important, with sessions straight after school being more appealing.

*'It made me feel more comfortable and safe, as I was in a familiar environment. It made it easier to talk/share things.'* (A2)

#### 4.5.2.2.5 Longer-term support

The length of support given to adolescents with obesity was also considered within the category 'support'. Both adolescents described their need for longer-term support from a WMP. The HL programme was deemed too short, with more visits within the home wanted. One adolescent wished she were still receiving support from the HL worker. Adolescents struggled to maintain behaviour changes after the programme had finished.

*'In my opinion I thought it was too short, because it didn't have a long-term effect on me – I found I became worse afterwards.'* (A2)

### 4.5.3 Stage two: Stakeholders

Interviews were on average 52 minutes (36 -74 mins). Three stakeholder interviews were completed face-to face (travel expenses paid by the CLAHRC West Midlands), the remainder were completed over the telephone (n = 7). One stakeholder did not take part in an interview but sent text responses to the brief interview guide, which was emailed to stakeholders. Analysis led to the development of five main categories: support, tailoring, policy level, intervention content and programme development. The category support (section 4.5.3.1) considers different types of social support including professional, family and peer. The second category, tailoring (section 4.5.3.2), reflects the reaction to the individual and the importance of a WMP being person-centred. The next category, policy level (4.5.3.3), discusses the relationship and involvement between WMP and other organisations, as well as the current financial situation within PH. The category intervention content (section 4.5.3.4) considers the components of a WMP that are delivered and finally, the category programme development (section 4.5.3.5) reflects on what should be considered in future WMP design, including recruitment. A network

diagram of all categories and themes can be seen in Figure 4.2. Themes have been mapped onto a socio-ecological framework (see table 4.3). Transcribed quotations have been chosen for their ability to highlight themes. Quotes have been given a code to show that they do not just come from one or two participants. These codes are explained in Table 4.2. Specific reference to the HL programme is mentioned throughout.

**Table 4.2 Stakeholder codes**

<b>Stakeholder code</b>	<b>Job role</b>
<b>S1</b>	HL WMP manager
<b>S2</b>	HL WMP worker
<b>S3</b>	HL WMP worker
<b>S4</b>	PH consultant
<b>S5</b>	School nurse
<b>S6</b>	School nurse
<b>S7</b>	PE and school sport partner manager for WCC
<b>S8</b>	Dietitian
<b>S9</b>	Health advisor
<b>S10</b>	Dietitian
<b>S11</b>	School nurse

**Table 4.3 Adolescent themes mapped onto a socio-ecological framework**

<b>Individual</b>	<b>Interpersonal</b>	<b>Organisational</b>	<b>Community</b>	<b>Societal</b>
Not motivated by long-term goals	Professional support	Tailor to age group and individual	Relationship between WMP and other organisations and professionals	Public health budget cuts and priorities
Anthropometric measurements	Characteristics of successful professional's support	Easing prior fears	School involvement	Tension between what is most effective and what is the most efficient
	Peer support	Weight loss vs health	Advertising (this theme talks about the importance of other agencies being informed about and promoting the service)	Adolescent insight needed (policy should recommend their involvement in design?)
	Family support	Emotional and psychological support goal setting		
	Responsibility	Knowledge and education		
		Physical activity		
		Practical hands-on activities		
		Technology		
		Longer-term support		

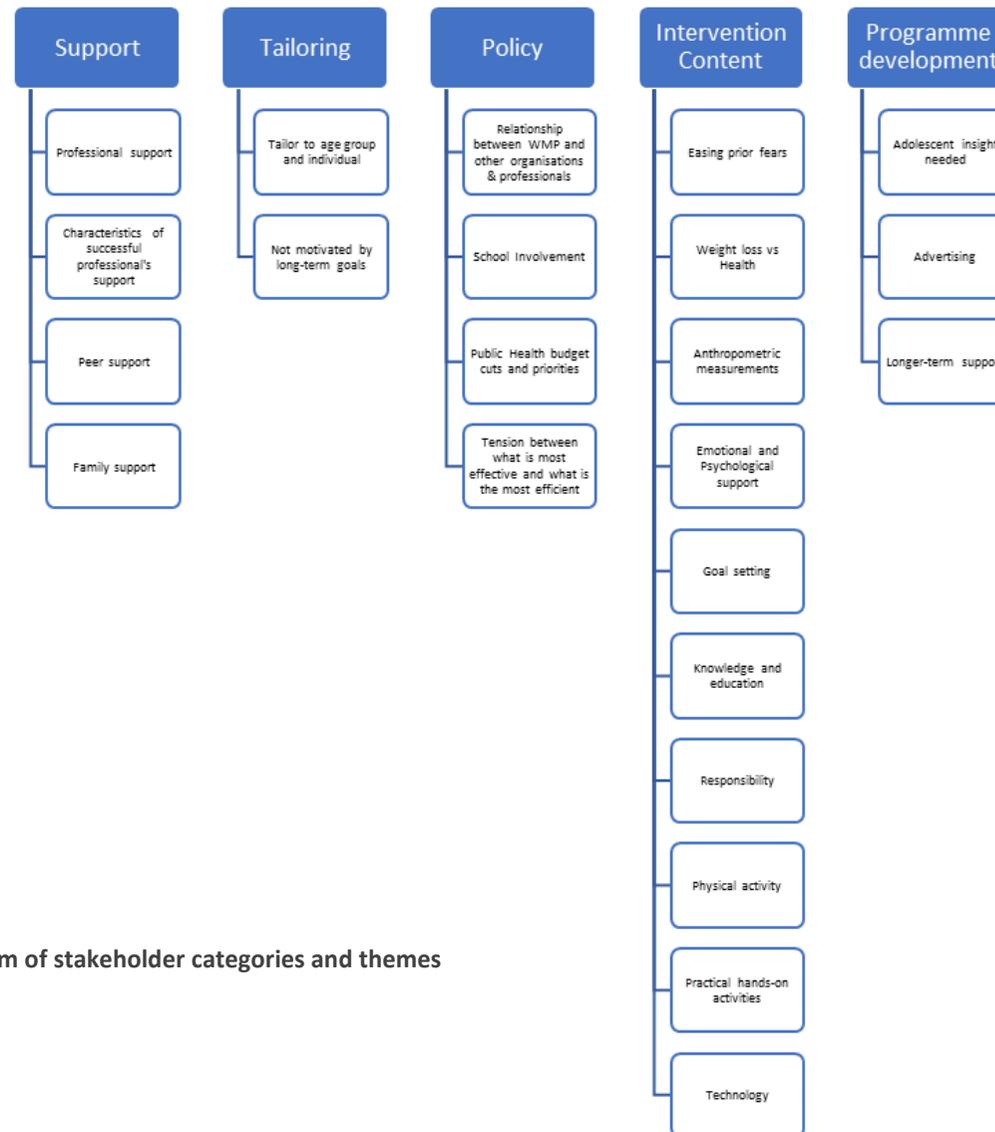


Figure 4.2 Thematic network diagram of stakeholder categories and themes

#### 4.5.3.1 Support

Data from this study highlights the importance of adolescents receiving support from professionals, as well as support from peers and family as part of a WMP.

##### 4.5.3.1.1 Professional support

Stakeholders commented on the importance of staff being qualified and experienced when working with adolescents with overweight or obesity. Dieticians and Nutritionists did not feel comfortable delivering PA to adolescents highlighting the importance of either receiving training or having a multi-disciplinary team, including PA specialists.

*'And I do believe that we need some, to have a good skill mix and, and multi skilled individuals.'* (S4)

Not only was it important for weight management staff to be knowledgeable in areas of nutrition and PA, being experienced in working with the adolescent age group in a supportive way was felt to be important, as well as being able to engage with parents. A worry from one stakeholder was that given the current financial constraints a less qualified workforce might be used.

*'I mean, that would be the ideal but certainly the way things are with regard to, sort of, financial limitations of local authorities, (inaudible) just get ... you know, you've got to look at a lesser, in a way a lesser, a lesser valuable workforce but, like, a lot like ... a bit sort of, a slightly ... I don't know how to put it. Likely less experienced, but, like, they might have, like, fewer qualifications in a particular area, but sort of they're not as able to, to provide support. So you might look at, sort of, health trainers, for example, as a, sort of a lower cost alternative.'* (S3)

Not only did stakeholders value a well-qualified weight management workforce, but adolescents did also. Experienced staff seemed to instil confidence in adolescents.

*'I think it does ... it, it might have instilled, sort of, confidence in a family and/or young person that they, you know, they really felt like the person they were seeing had the knowledge, had the expertise and experience, and that, you know, through their eyes they knew that, you know, they weren't the first family that I'd seen with, with these problems that they were experiencing. So I do think it, that it would help to boost and instil confidence when they know that that person has a, you know, particular background in that area.'* (S3)

#### 4.5.3.1.2 Characteristics of successful professional's support

Characteristics of successful professional's support was considered within the category of 'Support'. Stakeholders highlighted the importance of having a multi-disciplinary team involved with supporting adolescents with overweight or obesity. WMPs should involve nutrition and PA specialists, as well as input from a psychologist, whether this was for the development of the programme and/or in a delivery capacity. Although, HL did not have psychologist involvement, the team skills varied and specialist skills in PA and nutrition were praised by stakeholders. Stakeholders commented on the value of involving youth workers when working with adolescents. They were able to engage well with the adolescent age group, often displaying a different kind of relationship with the adolescent, compared to some of the health professionals involved at other levels.

*'But, but I don't, I don't know, I wish I knew what their secret was. I mean, I've spent a lot of time with youth workers working with young kids as well, and, you know, the only common approach I'd say, is that they're, they're very down to earth. You know, and they, and they know exactly what the young people get up to, you know, so but, yeah, I don't, I don't know what makes that relationship different.'* (S10)

Stakeholders also felt that adolescents engaged better with professionals that were seen as 'cool' and those that were more relatable. As well as youth workers fitting this description, feedback from adolescents to stakeholders involved with HL was that the staff delivering the programme also fitted this description.

*'So yes, they, the biggest plus was the relationship that they developed with the project worker with [HL worker] or [HL worker] or [HL worker] or whoever, that positive relationship because they, they all thought that you were cool. That was, that was the main one, that was the thing that stood out to me.'* (S8)

Stakeholders commented on adolescents valuing professionals who take a non-judgemental approach. The importance of using the right terminology not only to the adolescent if their weight had increased, for example, but also important that a non-judgmental approach is taken when speaking to parents/carers when raising the issue of their child's weight.

*'Yeah, I think there's so much judgement around being overweight in the health professional world, you know? 'Cause not all dieticians are non-judgemental about overweight children. And when you get a parent who is so defensive and being so full of*

*barriers my judgement of that parent is horrendous. So I think it is a very skilled area to work in because you have got to be non-judgemental at all times, even when you're told ridiculous things.'* (S8)

Stakeholders made a suggestion that adolescents value being treated like an adult. This included wanting to take part in adult activities as well as not being told what they should and shouldn't do.

*'We need to stop doing what I call the waggy finger. We need to stop wagging our fingers at them and, and try a different way 'cause it's not working at the moment. 'Cause the five fruit and veg thing doesn't work and that's being waggy finger, "You must do this, you must do that." And it doesn't work at all.'* (S7)

The importance of trust was highlighted by many stakeholders participating in this study. Stakeholders noted the importance of building rapport and trust with adolescents for them to engage in a WMP effectively.

*'And until you earn the trust, then you're not familiar with them people, those people and they just won't engage.'* (S5)

It appeared that HL was well received as adolescents and HL staff were able to build rapport through regular weekly 1-2-1 sessions in the home with the rest of their family:

*'And I could imagine there being real value to that, because over those six weeks, even though it was only six weeks, you're with those families for quite a long time each week, so you do build quite a good rapport and relationship with them.'* (S3)

Having other staff that adolescents already knew involved in a WMP would enhance this rapport but would also be useful when promoting the programme. It was felt that if the idea of attending came from a trusted individual, adolescents would be more likely to attend.

*'And, again, it's sort of tapping into those professionals that they are already comfortable with and they already have a trust with and influencing those professionals so that, you know, if they are ... if they feel, if they are positive and think that HL or something similar has real value, then it's got that sort of genuine element coming from someone who they trust.'* (S3)

As well as adolescents liking familiarity in terms of staff, stakeholders noted the increased likelihood of adolescents attending venues, for programmes or PA that the adolescent was familiar with already.

#### *4.5.3.1.3 Peer support*

Another theme within the category of 'Support' was peer support. The consensus among stakeholders was that adolescents valued the peer support that came with attending a group programme. This made adolescents feel like they were not the only ones struggling with their weight, which led to bonding and new friendships.

*'I think they made friends, I think that was the other feature.'* (S7)

*'People realise that they're not the only ones who are struggling. And you can build friendship groups and create almost a, a cooperative around healthy lifestyle factors.'* (S4)

Peer support appeared to be appreciated more when taking part in PA and is seen as a good way to promote attendance. Stakeholders commented on how self-conscious adolescents with obesity feel in a school physical education (PE) lesson; exercising as part of an intervention with those in a similar situation to them, made adolescents feel more comfortable. Stakeholders reported peer support was even more important with older children compared to young children, commenting on their preference to be non-reliant on their parents.

*'Yeah. I, I do actually think that one of the reasons that adolescents that are overweight don't take part in PA is because they're scared of what other people will think of them. So I suppose taking part in activities with a group of, of people that are similar to yourself ...'* (S2)

Stakeholders commented on the use of mentoring as part of a WMP. Stakeholders remarked that a mentor scheme would be a good way of mixing older and younger adolescents, who would not typically like to be grouped together. Stakeholders that had also worked with younger children on WMPs, had experience of older siblings attending and enjoying helping. It was felt that this age group are more likely to relate and talk to someone of a similar age to them, something to consider with staff delivering the programme.

*'The older teenagers won't necessarily want to be categorised with the, the younger ones, unless they were acting as a role model. So unless you, unless they'd already maybe attended a session and, and wanted to come to be a bit of, like a, a bit of a mentor to, to*

*younger people, then I, I don't necessarily think that it, it works very well to, to mix those age ranges.'* (S2)

Although peers seem to be valued within a WMP, outside of this environment, many adolescents with obesity struggle with peer pressure. Stakeholders commented on adolescents opting for certain foods based on what their friends were eating. One stakeholder observed the importance of teaching adolescents resilience in schools. Adolescents are also embarrassed about taking part in WMPs and do not want their peers to find out. Stakeholders reported adolescents being bullied because of their weight, with the belief that weight loss would lead to more friends. In addition, stakeholders reported pressures around body image on social media.

*'If you're in a peer group and with the group thing, it's very difficult for adolescents to think, "I'm going to be different from my peer, peer group." So, maybe that could be addressed by installing resilience through some of the training and programmes that are done in schools.'* (S4)

#### *4.5.3.1.4 Family support*

The importance of family support was highlighted by all stakeholders. It was felt that unless the family was on board, WMPs would not be effective and behavioural changes would be limited.

*'I really, really don't know because those that are engaged, it's usually, in my experience, 99% of those have engaged parents'* (S8)

The HL programme was praised for its family focus.

*'I think that the whole ethos of it was fantastic, because it seemed to be trying to get to know the family dynamics and get into the family situation. Not just delivering health education, but practical ideas for improving the whole lives of the whole family.'* (S6)

Stakeholders felt that educating the whole family would also lead to longer sustainable changes to lifestyle.

*'And not just targeting the child, it's actually appreciating the fact that children sat within a family. And if the child was obese it was quite likely that other individuals in the family were obese. So it's providing a family intervention. And I think that in itself was, was excellent way of approaching things. Because rather than speak to the person, the individual, you brought the family in and you worked together. So hopefully with the*

*withdrawal of individuals and once the programme had been, of the HL workers, once the programme had been completed, there were some sustainable gains from a family point of view.’ (S4)*

Adolescents may learn about healthy lifestyles in a programme or at school, but this would not help if not carried on in the home environment, a place where adolescents spend a large percentage of their time. Stakeholders spoke about the difficulty of engaging with some parents and found that adolescents took more responsibility and were more motivated to make changes if their parents/carers were also. Some stakeholders felt that the defensive nature of some parents was more of a barrier than trying to work with adolescents. If the parent were defensive, then the adolescent would be less receptive to making changes.

*‘It’s very different, H. Some are very open, and it’s totally dependent on the parents’ attitude. Some, some build up a level of trust, but again it’s all mirrored in the parents’ attitude. If the parent is open and willing to change, then the, then the teenager is. If the parent is defensive and, “You haven’t, your diet hasn’t worked for me,” or, “The GP doesn’t help,” or, “We’re all overweight.” Then the child, the teenager is very unreceptive.’ (S8)*

Stakeholders also noted the discrepancy between needing family and parental support but noting that parents have less influence and control over adolescents.

*‘But when children reach a certain age, you know, they get their, they get pocket money, they just take off and the parents ... and that was a real frustration for some parents, you know, they felt like they were, they were doing all they could do to promote a healthy lifestyle. But at the end of the day if their, you know, 15 year old wanted to go off with their friends and, you know, gorge on McDonald’s, then, you know, there’s only so much they could do. I suppose it does reach an age where, you know, as I said, you know, kids are, you know, young people are just going off and doing their own thing and the parents potentially have less influence.’ (S3)*

Stakeholders spoke about some parents giving the impression that they were providing enough support by just driving the adolescent to a WMP or to a leisure centre, for example. It was also reported that adolescents felt more comfortable attending with a trusted friend or member of the family.

*‘For some young people it is having a trusted person to go with. This can sometimes be a family member who is also motivated to lose weight also.’ (S11)*

Within a group setting, the need for separate sessions for adolescents and parents was important. Offering a multi-disciplinary model that included diet, PA and behaviour change was also valued.

*'But being able to perhaps, well, provide, you know, the opportunity to have that one-to-one support without the parents there, you know, I would never advocate cutting the parents out altogether, but having some sessions maybe, you know, like, after school with a young person, or if there was a group that might even be better, and then some sessions at home with the, with the parents.'* (S3)

*'I think that it depends on who's going to be attending those group sessions. So I think that in the home it worked well because we were working with every member of the family. Whereas, I think an adolescent in a group situation wouldn't necessarily want to be there with their parent or even a sibling.'* (S2)

#### 4.5.3.2 Tailoring

In addition to different types of social support available to an adolescent, it is important that support given is tailored to the individual. This category of 'tailoring' includes the themes 'tailoring to age group and individual' as well as the suggestion that adolescents are 'not motivated by long-term goals'.

##### 4.5.3.2.1 Tailor to age group and individual

Stakeholders recognised the need for WMPs to be tailored to the adolescent age group. It was recognised that adolescents need very different support compared to young children, including the resources used within a programme. A criticism of the HL programme was that resources were not always tailored for the adolescent age group.

*'So in terms of the advice and support, I think that was, that could be tailored in words to, to an adolescent person. But some of the, maybe some of the promotion and resources and materials that we used around it weren't.'* (S3)

All stakeholders recognised the need to ensure WMPs were split by age group, separating primary and secondary school ages. Ideally, there would be separate sessions for older and younger adolescents.

*'Yeah, they, they, they like to be with children of their own sort of age, there's no doubt about that.'* (S7)

Stakeholders commented on the practical difficulties of separating sessions by age, including staff, resources and small group numbers.

*'I mean, not ... you know, I don't think it would be easy. And you do need, you need a wider, you know, resource if you're going to provide weight management services across a wide age bracket. Obviously you need the capacity to be able to, to break up those age, those age groups, you know, which is, it would be easier for us as workers (?) to say, "Right, let's just bundle everybody into the same group, you know, let's get it all done one hour every week," or something.'* (S3)

Feelings among stakeholders was that adolescence was a difficult age group to work with. More consideration was needed when working with this age group, partly since habits may have already been formed.

*'But, yeah. It's, it's very hard and you do have to take a lot more time and considerate the individual as well. 'Cause they are young adults at the end of the day. So it's not, it's not as simple as just going and, and picking something up last minute for the store cupboard and going and thinking, "Oh, that'll be a good incentive." You've got to try and think about the person that you're working with.'* (S2)

*'...particularly thinking about the adolescent groups particularly, I mean, when you've got a very overweight adolescent, things have been going, you know, there have been habits formed for, you know, quite a long time and it's often a bit more complicated than, "Oh, you know, we just didn't know how to eat properly and we didn't realise that we were overeating." Yeah. So, so, yeah, you, we've, I mentioned before that, you know, there's ... it's, it's not just a knowledge thing but it's a real engrained behaviour issue.'* (S3)

Stakeholders reported finding younger children easier to work with.

*'I think, I think as a general rule, and obviously there are exceptions, as a general rule it was probably more straightforward working with a family with younger children, rather than a, than a, than an adolescent.'* (S3)

Additionally, WMPs need to be tailored to the individual, recognising difference in preferences and motivations for attending. Stakeholders highlighted the importance of staff having the skills to be flexible and tailor individual sessions, depending on the mood of the adolescent on the day, as well as tailoring the session to the family's needs, something that HL did well.

*'I think HL you know, sort of a positive of HLis that it did work with the family and it was tailored to the needs of the, of that specific family. So in some respects it did, you know, their priorities and their concerns and challenges.'* (S3)

As well as tailoring the programme to adolescents needs, stakeholders involved directly with the HL programme felt that incentives and rewards were important when working with adolescents with obesity but they must be tailored to their age group. The consensus was that more thought was needed when trying to plan incentives for adolescents and this process was not as easy as it is when finding appropriate rewards for younger children. Staff on the HL programme said, overall, the rewards that they had available to them were not tailored to the adolescent age group. It was important to find out what an adolescent would want as a reward.

*'I think the rewards, as part of the HL programme, was something that, that was constantly being reviewed and, and taken into consideration. I actually don't think that the rewards that were available to us, from the BHF especially, were suitable for adolescents. So, there was the odd water bottle and, and a few other little bits and bobs that, that seemed acceptable and, and a few teenagers seemed quite happy with it, but there were quite a lot of teenagers that would kind of laugh if you tried to give them a Frisbee ....something. A skipping rope. They wouldn't be impressed.'* (S2)

Another stakeholder felt that incentives were important before a WMP begun, to engage the adolescent in the first place. Stakeholders also noted that rewards and incentives work well as a way of increasing attendance. Stakeholders were also aware of parents using rewards within the home, which were activity based, rather than food rewards.

*'Engaging them in the first place young people need some incentives, but I don't know what that could be to get their initial engagement, I don't think that's needed forever, but sometimes it gets them to, to start, and when they're that ...I don't know what, let's see, I don't know whether it could sort of, vouchers or ...But I, I think often that some incentive is, is required, because if, especially the, the sort of, 15, 16 year olds, unless they've somebody), something that they, they tend to be reluctant to do much some of the time.'* (S10)

#### 4.5.3.2.2 Not motivated by long-term goals

This theme fits within the category 'tailoring' as it is another consideration when planning WMPs for adolescents. Stakeholders highlighted that adolescents are generally only

concerned with short-term outcomes. The risk of poor health in the long-term, e.g. T2DM, was not a concern to adolescents as they didn't believe it would happen to them. Health is often taken for granted by adolescents.

*'I don't think they particularly think about long-term what it's gonna do to their health. I think that it's pretty much in the, it's in the here and now isn't it ...how they feel at that time?' (S9)*

#### 4.5.3.3 Policy Level

In the category 'Policy level' the following key themes are discussed: 'relationship between WMP and other organisations and professionals', 'school involvement', 'PH budget cuts and priorities' and the 'tension between what is most effective and what is the most efficient'.

##### 4.5.3.3.1 Relationship between WMP and other organisations and professionals

Stakeholders spoke about the importance of having a self-referral option for adolescents. This was brought into HL near to the end of the programme, so although it was not a well-established option for adolescents, and it could have been promoted better, stakeholders felt this was a promising and important option to help empower adolescents.

*'But, again, it just (inaudible) the opportunity to take the situation into, into their own hands, rather than, you know, be led by someone else's opinions. It might make somebody feel a little bit more empowered, go, "Okay, now I wanna do something about this rather than somebody raising it with them.'" (S3)*

Those referring into HL appreciated the simple referral form and found it useful being able to send the form back either by post or email. Referrers (e.g. school nurses, dietitians) found it beneficial either to have seen the programme in action or to attend the regular steering group meetings held by the HL team. This gave referrers a greater understanding of the programme, which improved their ability to promote it to families. Referrers were also more likely to refer in once they had met the staff working on the programme. The majority of referrals into the HL programme came from school nurses off the back of measurements taken as part of the NCMP.

*'Yes, I think we felt very comfortable because we were, we went to the meetings, one of us went to the meetings, so we understood what the program was about. If we hadn't been to those meetings, we may not, we wouldn't have understood what the program was about, so we couldn't be so passionate about it 'cause we'd be making it up rather than*

*knowing that it was home visits and, yeah, yeah, yeah. So, I think for any referral process you need to know a lot about the program to be able to basically sell it, isn't it? Yeah, yeah. But we felt very comfortable because we'd got enough information.'* (S8)

Referrers really appreciated the strong relationship between themselves and the HL workers. They valued being able to attend the steering group and felt comfortable contacting the HL workers if they had any questions relating to the programme. Referrers particularly appreciated receiving feedback from the HL workers regarding the families that had been referred; good communication was respected.

*'So the feedback was brilliant for me, because this was the outcome. So yeah. But it was, it was straightforward. And it was, yeah, it was, it's good, good, good communication. I think that's what I'm trying to say.'* (S9)

Stakeholders spoke about the need for organisations to link together more. Sharing resources, including making a website that all professionals working with adolescents could use, was suggested. Particularly, networking with mental health and well-being services.

*'And I think that could be a piece of work to, to, sort of, have a website that could be shared. And I mean, it actually gives the opportunities for professionals to better network and link across organisational boundaries.'* (S1)

Using other professionals and organisations was noted as a way of gaining feedback from adolescents that had withdrawn from a programme. They may be more likely to give honest feedback to professionals with whom they had a good relationship.

#### *4.5.3.3.2 School involvement*

The theme 'school involvement' was explored within the category 'Policy level'. All stakeholders specified the need for schools to have more input with adolescent weight management. Stakeholders felt that schools should take more responsibility for educating adolescents on healthy eating and incorporate more cooking activities.

*'I think that we could do a lot more in, in schools. And I know that everyone's trying to shoehorn things into schools because they, they have young people captive for a vast majority of their lives, should I say, their (inaudible). But I think within a school setting it is possible to start, even from nursery, building into the curriculum issues around healthy lifestyle choices and the importance of PA. And working that right through to when children leave school and when they're in, in college. So I think the demise of some of the*

*issues around schools, was the changes in the curriculum, health economics being taken out, where children weren't cooking, the increased demands on academic achievement. And that reduced the participation in PA and, and group sports. So I think anything that we could do within a school setting would be really good in improving outcomes for children and young people.'* (S4)

However, linking to the previously described benefits of family involvement during any intervention it was recognised that any intervention within a school must somehow include the adolescent's family.

*'But then because they're not doing it with the home and the parents, you're not getting the, the sustained, the legacy (?) bit, because in the end when those kids go home, if the parents aren't on board of the whole concept, it breaks down.'* (S7)

Additionally, more responsibility needs to be taken by the schools for the food they provide; improvements in healthy options was noted.

*'You know, and with more and more schools turning into academies, they're ... the, like, the rules are kind of getting more and more lax. I mean, you know, you'd hear of schools, you know, the, the vending machines reappeared and, like, the Costa ... like, I think Costa opened in one of the schools at one point. And, you know, that just doesn't ... that just feeds an obesogenic environment.'* (S3)

*'... I think schools as well. Although the, the schools are supposed to have quite healthy, healthy dinners that are, the government have standards that they've set, which they should ideally follow. But I find a lot of them say that they follow it, and then when I'm actually, 'cause I do a lot of works with schools from the Diabetes point of view, when, when they actually go into schools it's nothing like what they say that have but... and it's, it's perfectly possible. Like, I had one child that used to have pizza with two brownies for lunch every day, and that was, you know, (inaudible). So I think schools as well, have a, a lot of room for improvement.'* (S10)

Stakeholders felt that as schools have a captive audience, it was an ideal setting to promote weight management services and help with recruitment.

*'I think perhaps being more out there and people knowing about them, because we know about them as school nurses and we try and advertise that when we talk to parents and we talk in schools. So whether they could do any assemblies in school. I know it's time consuming and they're a very small team, but it's getting yourself known out there.'* (S5)

Stakeholders felt that primary schools paid more attention to helping children achieve a healthy weight, and that more needs to be done in secondary schools for the adolescent age group. Some stakeholders also felt that schools could play a part in weight management maintenance after a WMP had finished. Additionally, using schools and teachers that adolescents trust as a way of gaining honest feedback about a programme.

#### *4.5.3.3.3 PH budget cuts and priorities*

PH budget cuts and priorities is an important consideration inside the category of 'Policy level'. Most stakeholders commented on the current financial situation of PH services that has led to a general lack of services and programmes aimed at supporting young people with weight management.

*'Unfortunately, PH became a victim of austerity when it moved into a local authority setting. So where previously we had discretion over the programmes that were being commissioned to address lifestyle issues, increasingly there's been a reduction in the budget that's been available. And unfortunately, weight management both for adults and children have been a victim of that.'* (S4)

There was a general feeling among stakeholders that the HL programme was very beneficial to families with overweight adolescents and children, and a sense of frustration that this programme had been decommissioned. Professionals were disappointed that a coordinated approach to weight management in Wolverhampton, which offered families variety, in terms of programmes and different locations, had ended. Those referring into HL were 'gutted' at having nowhere to refer children onto and those working directly on the HL programme were saddened that the clearly huge demand, recognised by waiting lists, for young people struggling with their weight was being ignored.

*'I don't think there even, I don't think there is a current state, because there isn't anything being delivered as far as I'm aware. So it, it, it is pretty bad, really, when you think of all of the children that were, that we worked with during the HL programme, it's clear that there is a huge demand for a service that, that supports young people that are struggling with their weight. But there clearly isn't anything available for them now.'* (S2)

*'And, and so we're asking our schools to put programmes on. But that's what you're getting, just getting programmes rather than a cohesive approach that is designed for the right client and tailored for what their need is. And, and that's what we had and that's what we lost.'* (S7)

The frustration around programmes like HL being cut, was because stakeholders involved in the programme, that worked directly with adolescents with obesity whether on the HL programme or in other areas of their lives, could see the benefit HL was having on that adolescent. HL had a very good reputation amongst other health professionals involved in the care of adolescents with obesity. Those referring in to HL also received positive feedback about the programme from participants.

*'I think my thoughts were quite consistent. In a way, it was a well-run program, great staff and they had great results.'* (S1)

Thoughts from stakeholders as to why HL in particular was decommissioned were that although the programme was effective for those taking part, this effect was not seen on a population level. This paired with limitations on recruitment due to the 1-2-1 home-based nature of the programme, did not make it 'sexy' enough for budget holders.

*'but budget holders would never fund something like that because there wasn't enough take up on it. It's the recruitment numbers the budget, the budget holders are looking for, isn't it?'* (S8)

In addition, current policy focus is on the early years. There was recognition amongst that working with children from an early age in terms of obesity prevention was very important. Nonetheless, stakeholders felt that there was a lack of services aimed at older children, with much more focus and funding going into the early years.

*'... and there seems to be a lot when children are young. So, I mean, most of the children's centres have gone now, but when we had the children's centres they were offering nurturing groups and cookery, cookery, you know cookery programmes for the families to follow and things like that. And then I think when the children become adolescents there doesn't seem to be so much there.'* (S6)

#### 4.5.3.3.4 Tension between what is most effective and what is the most efficient

Lastly within the category of 'Policy level', this theme explores the tension between effectiveness and efficiency of WMPs. Variety in terms of delivery mode of WMPs was spoken about in depth by all stakeholders. Many praised the home setting of the HL programme because of its ability to be tailored to each family as well as targeting hard-to-reach families.

*'So these are quite complex families and families that wouldn't necessarily always engage with mainstream services, with, with, like, a group setting. And so the fact that we worked*

*with them in the home, sort of, doing help to break down from obstacles that might have prevented participation.’ (S3)*

However, although the benefits of 1-2-1 programmes were recognised, particularly those in a home setting, several stakeholders felt that this option was not sustainable, time-efficient or cost-effective in the current financial situation within PH.

*‘But it, it, it wasn’t very time-efficient on our part, so, you know, all the time spent, you know, in one family’s house and all that travel time, it is more efficient to pull people together in a group setting. But then you’ve got the issue of not everybody wanting to attend a group.’ (S3)*

*‘...one to one programmes are brilliant, however, they are, I don’t think within this current system of austerity between both health and social care that they’re sustainable.’ (S4)*

Groups on the other hand offered a more cost-effective approach and were seen as a good way to increase adolescent’s self-esteem.

*‘The group setting I think is much better for children’s self, teenagers’ self-esteem and for that competitive element between parents. I’m not convinced that one to one is a tool effective for the teenager’s self-esteem.’ (S8)*

HL workers spoke of the difficulties of delivering PA within a 1-2-1, home session.

*‘I think ‘cause, because HL was in the family homes, it’s a little hard, it’s a bit harder to, to actually do activities and; one, to find the space to do it. Two, a lot of the time we were going there during the evenings where it was dark and it was cold. Some families didn’t have the physical space to do any activity. They didn’t have gardens, or if they did they were in a really bad state and you wouldn’t want, you wouldn’t want to go out there, never mind expect a child to go out and, and run around and do activity.’ (S2)*

Although a nurse working with special schools in Wolverhampton found a dietitian’s weight management 1-2-1 clinic more appropriate for the children in her care, both dietitians that were interviewed felt that a 1-2-1 programme in a clinic setting was not effective. This was mainly because of the infrequent appointments offered to participants, as well as a less relaxed environment.

*‘I think I, it, I thought it would, I always thought those sorts of programs in the community were more useful than what we could do in the hospital, to be honest.’ (S10)*

Nonetheless, most stakeholders felt that the best option was to be able to offer both group and 1-2-1 options to accommodate the differing needs of all adolescents and families wanting support.

*'Yeah. Well, I think in the ideal world a mixture, a mixture of them both. And that could be either, you know, speaking with the individual family and saying, "Okay, you know, we've got these two options. You can either enrol in our group or you can be seen one-to-one for the duration." Or whether there's an, there's an element of a bit of both. So, you know, you're, you're seen one-to-one maybe for appointment one in the home, and then perhaps there's a series of group interventions. And then perhaps, so that people have that opportunity to actually voice themselves more freely, a one-to-one appointment in the home. So I don't know, I think either of those formats would be useful maybe.'* (S3)

*'I think, I think a mixture, because I think you would, you will get some, some young people that, especially if they've got, like, they're really self-conscious, they wouldn't want to be in a group situation. But then I think you've got others that would thrive in a group situation, because, you know, they know it's not just them that's, that's, that's, you know, maybe got a weight issue, or ...I think it's a little bit of, you know, when you're with other people you can, you know, you can spur each other on, can't you? Give each other encouragement and ...I, I, I think a mixture.'* (S9)

#### 4.5.3.4 Intervention content

This large category will discuss ten themes that relate to the content of an intervention. It is important to note that components delivered as part of an intervention may be dictated by policy level considerations discussed in section 4.5.3.3.

##### 4.5.3.4.1 Easing prior fears

Stakeholders recognised that adolescents suffered from embarrassment or a lack of confidence prior to attending weight management interventions. Although some stakeholders mentioned that participants, whether adults or children, will always have prior worries, particularly around PA, until they actually experience it, suggestions to ease these feelings were documented.

*'Well, it's like anything, isn't it, if you don't know what it's gonna be like, then you're scared of it.'* (S6)

These included putting on taster sessions for adolescents. This was mainly linked to the PA element of a group intervention, whether this be taking part or viewing the session.

Stakeholders also suggested a promotional video for potential new participants to watch. This could be on a website or through social media and may include interviews with previous participants.

*'You, you could have a promotional site for the program where there might be clips on there of, video clips of what participants have done before and what people have said, participants have said. So, you know, I think people always do want information. Where would they go for information? I would imagine a website.'* (S1)

Having quotes from previous participants or enabling future participants to speak to previous participants was suggested.

*'I mean, in terms of when you're promoting the programme, you know, your, your written material might include, you know, quotes and things from other families saying you know, encouraging statements like that, like, "I thought she'd be bossy, but she was really supportive.'* (S3)

In addition, stakeholders emphasised the importance of speaking to adolescents and giving them as much information as possible prior to a programme starting, to ensure they are fully informed and know what to expect. This could be over the telephone or as a 1-2-1 individual session.

*'I suppose that's where, from the HL point of view, the one-to-one visits and conversations were really good. So, perhaps if you were going to go down the route of having a group intervention that would involve PA, that initial visit, so that they see a friendly face and they get to know you, and if you're the person that's going to be at that session as well, it makes it even better.'* (S2)

#### 4.5.3.4.2 Weight loss vs health

Another element of 'Intervention content' is whether a WMP should focus on health or weight loss. Stakeholders spoke about the importance of focusing on health within a WMP, even if weight loss was the adolescent's primary motivation for attending.

*'I think it doesn't really matter what the primary motivation is, once you've got them there you can sell the message of how losing weight does help to improve their, their, their health. I think adolescents, as well as some adults, are concerned about their appearance, so if their appearance is driving them into your (coughs) excuse me, into their, into your arena, once you've got them there, it's selling the health message.'* (S4)

#### 4.5.3.4.3 Anthropometric measurements

It is standard practice in WMPs to take anthropometric measurements of participants, including height and weight. Although there were some comments from stakeholders that suggested some adolescents did not like to be weighed or measured, this was the minority.

*'I've got a few girls that are probably, so, so 15, 16, that don't like being weighed, so we just approach that on an individual basis and usually we have success in getting their weight.'* (S6)

Stakeholders felt that most adolescents, either didn't mind, or liked being measured. Some were interested in logging the change in their BMI.

*'Most of the time. I think, I think I've only had, in the whole time working on the programme, I think I only had one child that refused to me, to have their measurements taken and he was a particularly disruptive child anyway. We knew that going into, when the referral came through. So, yeah. I think that, definitely, from that age range, the whole taking the weight, height and weight measurements was, was something that was well received rather than, you know, shunned.'* (S2)

*'And, they would get very happy and excited to know that their BMI had gone down.'* (S2)

Adolescents seemed to like modern technology that could calculate their BMI. Stakeholders noted the importance of making sure measurements were taken in an informal, sensitive and discreet manner, with no pressure placed on the individual.

#### 4.5.3.4.4 Emotional and psychological support

One of the most well supported themes within this category of 'Intervention content' was the importance of ensuring all WMPs for adolescents include support and education around emotional wellbeing, confidence and self-esteem. Stakeholders commented on how fragile adolescents were in terms of their self-esteem and confidence. Like many WMPs, HL did not include any psychological elements within the programme. With adolescences being a period of life with changing emotions and potential pressures, stakeholders suggested mental health support must be prioritised.

*'I think that just shows that their self-esteem is so fragile that that needs to be the number one priority in the program is to build, build the self-esteem of the teenager.'* (S8)

*'But children between the ages of 12 or 17 they're going through a lot of emotional and psychological changes and some of those they could be around body image. It's making sure that the messages that we, we give are positive messages that will help them to develop a healthier appreciation of who and what they are.'* (S4)

*'Yeah. I think there's definite ... there would be a real advantage to, to tying those two things in, so, you know, the confidence, the body image, the self-esteem, all those sorts of things in with the lifestyle messages. And, yeah, with, with the right training I think that's, that's more than possible and would have real benefit, you know, more, as you say, more so for the older children, young people.'* (S3)

*'This is why self-esteem and emotional health is a pivotal part of weight loss programmes.'* (S11)

*'To be honest I think that only way you can, I think it's essential as part of any weight management service to have psychology input as well. Or have a healthcare professional that's experience is in psychological technique, because there's, there's so many issues with, with self-esteem, bullying, self-harm, like, negative thinking, lack of confidence, a lack of motivation, and psychologists tend to be really good at (inaudible) giving, like solutions, focused therapy and motivational interviewing, and, and they've got things to help with the behaviour change...think also if there's something more serious you know that comes up, and more qualified to deal with it.'* (S10)

Stakeholders, in general, although appreciating the importance of incorporating some support around emotional well-being into a WMP, said they would not feel comfortable speaking to adolescents about this unless they completed specific training. There was worry that they may say the wrong thing to adolescents and make the situation worse. Stakeholders felt that staff involved in WMPs and those who knew the adolescent well, would be better placed to help adolescents with their emotional well-being, rather than referring them on to external organisations. This was due to the trust factor discussed previously within the theme 'Characteristics of successful professional's support'.

*'So you are in a real good ... you know, you're in a good ... you're well placed to raise some of those other issues, as you say, about confidence and self-esteem. So I think it's a really good platform, but it's just ensuring that the staff feel, you know, have the confidence ...to go about that and have the right, you know, resources and tools at their disposal.'* (S3)

Stakeholders spoke about how body conscious adolescents were. They felt appearance was more important to adolescents than wanting to improve their health. This seemed to be more apparent in adolescent girls, reiterating the need for psychological support.

*'Definitely for older children. I think that, I think that the whole image about not being able to wear skinny jeans and not being able to wear belly tops and all of that sort of thing definitely would come up. For the girls, especially.'* (S2)

Stakeholders highlighted that because of the worry about their body image, adolescents were mainly embarrassed when taking part in PA. Swimming was mentioned as an activity that was particularly off putting to adolescents.

*'But you know yourself when you're at the school it was like, "Oh, I don't want to see the boys." And for girls, young girls going through adolescents as well, starting to wear bras, body changes and puberty, they're embarrassed about it, especially in the swimming pool. So quite a few shy away from swimming.'* (S5)

#### 4.5.3.4.5 Goal setting

Including goal setting as part of an intervention was explored. Stakeholders spoke, overall, about the benefit of goal setting when working with adolescents.

*'Yeah, I think that setting goals was, was essential. Yeah, the, the goal setting was definitely helpful.'* (S3)

Goal setting was a prominent feature of the HL programme. Stakeholders felt that adolescents were generally receptive to goal setting and there was a sense of pride when a goal was completed. It was important that these goals were SMART and although the priority should be on letting the adolescent decide the goal, stakeholders suggested this should be done with support from their parent. An important factor in effective goal setting was that goals were reviewed regularly by a professional and progress was monitored.

*'It's so difficult, it's much better when they come up with their own goals, and the more engaged ones do. But we have lots who we can't engage. So then we set the goals, but it's much easier when the teenager sets the goals.'* (S8)

*'I think it works really well if there's continued involvement with them. I think when I'm doing it, and then I'm seeing them three months later it's not ...it's not so ... actually, again, it depends on how involved and positive the other family members are. So if someone, if*

*some of them come back and they've done brilliantly, and it's fab, and it's great and it's really positive. But some of them say, they do it for a week and then they lose motivation, so I think they need that continued involvement with somebody who's going to help motivate them.'* (S10)

Stakeholders acknowledged that families might only be able to make small changes; this may be all that is manageable for some families.

#### *4.5.3.4.6 Knowledge and education*

Within the category 'Intervention content', stakeholders spoke of the importance of education and improving knowledge around nutrition and PA. This was not only essential for adolescents, but also their parents. Adolescents have poor knowledge of food and nutrition, partly due to receiving mixed messages.

*'And I think it's poor knowledge of nutrition as well, even though there's a lot out there, and I kind of, 'cause I worked, in nutrition I always think it's obvious what's healthy and what's not healthy, but I think often there was like, no comprehension of what healthy, like, is, even though there's quite a lot of information out there. And there's, there's a lot of confusion because you see different things in the media, and, and different family members have different ideas over what's, like, healthy eating and what's not.'* (S10)

Stakeholders felt it was important for adolescents to understand the reasoning behind the health messages that are promoted. This may help adolescents to take more responsibility for their health and weight, empowering them.

*'It's ever so funny because we've really got to work in Wolverhampton, we've gone down the route of giving children lots and lots of activities and programmes, and staff. And we've forgotten in actual fact we need to teach them the reason why.'* (S7)

*'We've been so busy doing, getting them...like the daily mile, the concept of the daily mile is a lovely idea. But noticed unless they really understand the reason why they're doing it, it's pointless. The understanding is not there and we need to get back in.'* (S7)

Stakeholders felt that parents should also receive education on parenting skills. Cooking skills for both parents and adolescents was also deemed essential as well as allowing opportunities to try new foods.

*'I think the only thing I, I would say, and I've mentioned, I, I'm sure I'm not the only, you know, person that's noticed, I, I just, I just think, in this day and age, I think it, it's like, if*

*you look at generations of families and, and, and your adolescents now, I was shown how to, to cook you know, by my mum. And, and, and, and she was shown how to cook. And I think it, it sort of goes around in a family. And I think sometimes parents may not necessarily just have just basic skills on, on putting a meal together. And then, you know, it's difficult for young people to be able to have them skills as well. I think certainly for some of mine, because they might end up, as, as a looked-after child, they might end up being in supported housing. So they've, they've got no skills at all. So anything around how to, how to prepare a meal would be good.'* (S9)

#### *4.5.3.4.7 Responsibility*

In this category of 'Intervention content' an individual's responsibility when taking part in a WMP was also considered. The consensus amongst stakeholders was that adolescents need to take more responsibility for their health and their weight, but this should be shared responsibility with parents as well as schools. Some stakeholders felt that perhaps adolescents do not realise it is their responsibility so incorporating this learning into an intervention could be promising.

*'Well, definitely at, at school, and in terms of what they eat between meals and things, I think they have sole control over it. Over, over the meals themselves the parents are the ones that buy the food. Yeah. So, so I think they, they, it's going to be shared responsibility between the ... it can't be all one, or all the other.'* (S10)

#### *4.5.3.4.8 Physical activity*

Stakeholders' general impression was that adolescents with obesity enjoy taking part in PA when completed as part of a WMP. Stakeholders spoke of the importance of PA being fun and not like a traditional PE lesson.

*'Yeah, I don't think you can do what is considered normal PA, it's got to be something that is fun the whole time and they don't even realise they're doing it, sort of daft games really.'* (S8)

Helping adolescents to recognise that options for PA can include more than just sessions in the gym.

*'Yeah, I will agree. But also I think there's a real piece of work to be done about what is PA, 'cause people think PA is going to the gym or something like that. In actual fact, all we need to do with these kids is get people moving. And, and that's what they need to understand, you know, the fact is they, they could walk to school, but instead of walking,*

*you know, get off the bus a bit earlier. It's, it's education is the key. There's ways around being active physically which doesn't require burpees. And they need to be shown and understand that.'* (S7)

*'They need fun activities that they don't see as sport really, don't they?'* (S8)

Outdoor sessions were suggested, including boot camps.

*'And I think it's looking, it's what popular in the social media and trying to introduce it. And, like, they like ... but if you say you're doing an hour's hockey, no, or cricket, no. Something a bit different, a bit upbeat, something that they can perhaps put their style onto, boot camp type thing or something like that I think will be popular.'* (S5)

PA being tailored to the individual was seen as important and not making the sessions too strenuous to start with. PA has to be affordable and more free or subsidised activities for adolescents to take part in, in Wolverhampton, is needed. Easy access was also noted as an important factor to encourage attendance.

*'It's about being free, it's about easy access, it's about being able to get there.'* (S5)

Currently a lack of PA services for adolescents in Wolverhampton was noted by stakeholders. Free swimming was noted as an option for adolescents but as noted previously within the theme 'emotional and psychological support', stakeholder's felt this was not a popular option for adolescents with obesity.

*'Which is so hard because you did tell them about all the free activities, but of course those have mostly been cut apart from swimming which, and I'm so negative about swimming because these children and teenagers have such low self-esteem, how on earth are they gonna ever get to a swimming bath realistically.'* (S8)

Stakeholders spoke about how adolescents feel in terms of poor confidence and body image, which leads to embarrassment when taking part in PA.

*'I, I do actually think that one of the reasons that adolescents that are overweight don't take part in PA is because they're scared of what other people will think of them.'* (S2)

The potential benefit of linking in with schools more for PA, as well as youth teams. Although there was some concern that adolescents would not engage even if activities were subsidised or free, the overall thought was physical activities need to be affordable for adolescents and their families. One criticism of the HL programme was that it did not

provide direct provision of PA as part of the programme. This was felt to be a very important aspect of any WMP as often adolescents need a helping hand to kick start the engagement with PA as well as support and guidance. Gender specific sessions were felt to be a good option if resources were available and several stakeholders commented on the competitive nature of some adolescents when taking part in PA. A healthy level of competition, whether this was with family or friends, was motivating.

#### *4.5.3.4.9 Practical hands on activities*

Stakeholders spoke of the importance of using practical, hands-on activities when educating adolescents as part of a WMP. This theme is well located in the category 'Intervention content'. Visual and interactive activities, which were more creative than typical didactic teaching was favoured. Stakeholders were very positive about including interactive cooking activities within a WMP.

*'Well, I mean, I don't know if this works best, but I do think there, there might be some value in, like you say, not just ... you know, practical stuff's always a winner.'* (S3)

*'I mean, typically the things that young people preferred was the more practical element of the programme. So, for example, we would do a cooking session with them and they would enjoy that.'* (S3)

*'So we've taken fruit to try and we've, we've found quite a lot of games that you can play. We've, we use the Eat Well plate and the plastic food and you have to sort that. So it's things that they, they have to do and that ... or they'll make themselves up a healthy plate of food. It's got to be relevant and practical.'* (S6)

#### *4.5.3.4.10 Technology*

All stakeholders spoke about incorporating some sort of technology into a WMP. Email, text, or WhatsApp messages were suggested as useful tools to support and motivate both parents and adolescents throughout a WMP.

*'And, and support through, through messages, like, through text messages, I think that's a really good idea as well.'* (S9)

*'I think everybody likes encouragement, don't they? They like praise and encouragement. And so do young people. And they, they react well to it. So, you know, I think (inaudible) when we have done, like, you know, charts and reward charts. And I think technology, if, if, if a young person was getting, you know, a message to say, "Well done, keep going,"*

*that sort of thing, that, that might be, you know might be a good sort of prompt to, to keep them going.’ (S9)*

Many stakeholders suggested the use of an app, particularly for longer-term support to monitor progress. Apps were also suggested to continue motivation by allowing adolescents opportunity to earn points for continued behaviour change.

*‘And you mentioned earlier apps and young people are well into apps. So finding some way of pushing that kind of message through an application.’ (S4)*

*‘I like the idea of, of using apps. Because they’re a generation of very technologically competent young people.’ (S4)*

Apps were suggested as a good way to gain feedback on a programme, as adolescents would feel much more comfortable completing a form online, rather than on paper, highlighting their ability to use online or digital technology with ease.

*‘Because young people love technology, don’t they?’ (S9)*

Although confidentiality and privacy would need to be considered when using online technology, stakeholders agreed that some sort of online support really should be part of a WMP, although not alone, but paired with face-to-face support. Stakeholders commented on the use of social media platforms as a way of supporting and promoting WMPs.

*‘They love apps, anything like that, social media, you’ll, you’ll get them, you’ll grab them.’ (S5)*

Websites were also recommended but stakeholders commented on the need for commitment from staff to keep these up to date and to continue promoting them. HL had a Facebook page, but more could have been done to promote this. It seems that stakeholders felt that the idea of using technology in principle was something they should be using, but actually, it was not well utilised.

*‘And we had a Facebook group running alongside that, which admittedly wasn’t well-utilised.’ (S3)*

*‘So, I mean, we, we tried, like, the Facebook page with some up-to-date things but that didn’t really take off.’ (S1)*

Exergames such as dance mats and wearable technology such as Fitbits were recommended.

The negative impact of social media in terms of poor body image was noted. See section 4.5.3.4.4 on 'Emotional and psychological support'.

*'So I don't think things like Instagram help where, you know, there's loads of beautiful people, and looking beautiful all the time with like, four million followers. And, and at that age as well, the teenage age group it's all about selfies and appearance, isn't it, on...I, I, I really don't know how you can get around that except keep reassuring them that's not the most important thing ...you know, that appearance and being, being thin doesn't change who they are as a person, it's their ... but, you know, I can see why they'd think what, that that would be a primary driver.'* (S10)

#### 4.5.3.5 Programme development

The last category in this analysis is 'Programme development'. Themes included in this category relate to considerations when developing a WMP for adolescents. These should be considered in addition to intervention content.

##### 4.5.3.5.1 Adolescent insight needed

Stakeholders spoke about the need for gathering more insight from adolescents prior to developing WMPs. There was a sense that the focus is incorrectly more on gaining feedback after a programme, rather than gaining feedback prior to developing the programme.

*'But I think if you, if you're trying to design services...I mean, the other way of posing the question isn't, "Why don't you want what we've got on offer?" but to actually go out to your target audience and say, "What is it you want?" 'Cause I don't know how much time we spend getting the insight from the people that we think should want it. We're, sort of, doing it the wrong way round in a way.'* (S1)

Stakeholders also suggested that all adolescents should be spoken to gather insight, not just those that are overweight or obese. Those delivering the HL programme certainly felt that more could have been done to speak to adolescents in the development phase of the programme.

*'Well, I think just solely from what was said before, so we did seek some views of, of sort of the client group following the six weeks. But I think on reflection they could have been more almost in the development stage of, of setting up the programme. So, you know, we*

*came, me and my colleagues came into, into the post, you know, it wasn't, the service wasn't created, and we just, we worked really hard collectively to develop what we thought was gonna be valuable based on, on, you know, certainly on written evidence. But I think there might have been an opportunity to actually consult with the, you know, the service users themselves, maybe via school or focus group just to try and, you know, gain their, their views before we actually sort of had already created the, the programme, if that makes sense.'* (S3)

Stakeholders also felt that commissioners and PH teams were not the right people to be gaining insight from adolescents. This needs to take place between adolescents and staff that work closely with adolescents on a day-to-day basis, with whom they have a level of trust.

*'Go and speak to, to some of the people on the ground. Find organisations that can do that, that work for you so that you get true responses rather than, than the responses that people think that you want to hear. So, I think a lot of the times, people that work within PH and that commission these sorts of programmes aren't necessarily the right people to go out and ask the questions and won't necessarily know the right questions to ask.'* (S2)

Although gaining insight in the development phase of a programme has been highlighted as important, it is still vital to gather as much feedback after a programme has finished, or from those dropping out. Stakeholders noted difficulties with gaining feedback from adolescents that dropped out of programmes. Additionally, stakeholders stated it might be difficult getting honest answers from adolescents when parents were present or when the weight management staff themselves are asking for feedback.

*'We did but the parents were always there, so whether or not you'd get what they really think, you don't, you don't really know. And we can't ask the parents to go out of the room really.'* (S8)

Using staff that adolescents have a close relationship to outside of the WMP was recommended. Most feedback from the HL programme was gathered after the 6-week programme. Stakeholders felt that more feedback could have been gained at follow-up appointments as well.

*'I think making it very easy for them to feedback sort of, can be helpful. So like, in, when I worked in Wolverhampton, in one of the services there that I worked in we had a youth, like, a youth worker, actually what's now called a family support worker. And when*

*patients didn't come to clinic he would ring and ask them, so that he could ask them, you know, ask them live on the phone, basically, what, what's your issue with this. And he was kind of seen as, 'cause he was a, more of a youth worker type he was seen as separate from our team so they, they were quite honest with him.'* (S10)

#### *4.5.3.5.2 Advertising*

The importance of using the right advertising strategy when developing a programme is essential. The correct terminology when promoting WMPs and in the name of the programme itself was commented on by stakeholders. Although appearance is a big draw to adolescents, advertising in this way seemed a risky strategy. Something that incorporated both physical and emotional well-being in the title of the programme was suggested. The name HL was not well thought of among professionals, as it did not describe the programme well. Additionally, stakeholders felt the HL programme could have been promoted more.

*'And, and then looking at how you advertise the, the, the service. I mean, with HL I don't think we did as much as we, we might have done in terms of spreading the, the word about.'* (S3)

Stakeholders discussed the ideal places to promote WMPs. Social media was mentioned by several stakeholders, as well as school assemblies and parent's evenings, cafes and public transport. Word of mouth and peer recommendations were also stated as a reliable way of promoting WMPs. Most stakeholders said they found out about the programme through their line manager or through attending the HL steering group meeting, highlighting the value of this quarterly meeting. Stakeholders commented on the need for marketing to be on a national level, with initiatives like Change 4 Life having a greater focus on adolescents.

#### *4.5.3.5.3 Longer-term support*

Finally, within the category 'Programme development', the need to incorporate longer-term support in the development phase of a WMP is important. Most professionals commented on the need for longer-term support for adolescents taking part in weight management interventions. HL, although offering 12 months follow up support at 3 monthly intervals, was only a six-week programme; both the programme length and the follow-up period was felt by stakeholders to not be long enough to ensure new habits were solidified.

*'The groups need to go on for a long time for far more than a year to, to sustain real change I would think.'* (S8)

*'People slip back into their old habits, so they needed to be for longer 'cause my impression was that people did very well when they were fully engaged on the program. But when it went to three month and six month visits then their motivation decreased and they went, slipped back into their old eating habits. So my impression was it would've been great if there could have been involvement for longer.'* (S8)

*'I think the evidence base might indicate that, you know, even though it was an intense six weeks, there might be some value to having, having that being delivered for longer. But then it's, it's, it's a keen capacity sort of thing.'* (S3)

Dietitians that were interviewed felt that the infrequent nature of their clinics were ineffective (1 appointment ever three months).

*'I, I haven't been involved in any others other than those clinics. I, I find it kind of medicalises the, the, you know, the weight, but it doesn't ... I, I think they need more support than a clinic every now and then can give.'* (S10)

Stakeholders commented on integrating long-term support into other organisations and professionals. Examples given included GPs having a greater role in follow-up support, offering free gym or leisure centre passes or linking more with schools in the follow-up period, including the offer of after school activity clubs.

*'What we could do is, I mean GPs are supposedly keepers of population and health and within GP practices there are practice nurses and health care assistants. So ideally what every GP should know through the map of childhood ... childhood measurement programme what proportion of their practice population has children that are either overweight or obese. And there should be, just as there is a health check for adults over the age of 40 and there are well women and well men checks, there should be an annual check, I think, for children and young people. It used to happen at certain stages in schools, but that has changed. But, as I say, GPs are keepers of the population and there should be something within a primary care setting where there is a regular check-up for, particularly for children who are overweight and obese.'* (S4)

Although resources and funding were a known barrier, stakeholders suggested the use of an online app for longer-term follow-up support, also suggested in the theme 'Technology'.

*'Or you've got the app, if you have an app or something like that and you just send them all a quick text and just say, "How are you doing? How are things?" And you might say, "Actually we're having a new group get together, would you like to come back and talk to them about it?'" (S5)*

#### 4.5.4 Contrast between adolescent and stakeholder findings

Although only a small sample of adolescents were recruited, some interesting and clear similarities have developed through this analysis. Both participant groups recognised the importance of support from professionals, family and peers. In particular, the importance of trust in the adolescent-professional relationship was mentioned by both groups of participants. Additionally, both groups talked about adolescent's prior worries before taking part in a WMP. Adolescents spoke about feeling nervous before taking part and being reassured once a programme had begun, something that stakeholders recognised. The inclusion of psychological support as part of a WMP is evident from the way adolescents spoke about body image. Stakeholders were very aware of the fragility of adolescents' self-esteem and body confidence and felt that more support needed to be offered to adolescents to help them emotionally. Stakeholders were very enthusiastic about using more practical hands on activities with adolescents, such as cooking and food tasting sessions. Adolescents also spoke about their enjoyment of cooking as part of the HL programme and learning with more visual tools. There was consensus between stakeholders and adolescents that some form of technology, whether social media, text or email, would be well received in a WMP for adolescents. Additionally, both groups highlighted the need and want for longer-term support.

## 4.6 Discussion

### 4.6.1 Summary of findings

This study identified key themes that are important considerations for future WMPs, from both adolescents and stakeholders. Adolescents spoke of prior worries before attending the HL WMP and the need for psychological support, specifically around body image, was noted. Body image concerns extended into PA considerations. The importance of interactive activities was highlighted, as well as the use of technology within an intervention. Adolescents and stakeholders spoke of the value of support from professionals, family and peers. Additionally, stakeholders recognised the importance of a WMP being tailored to the adolescent. Policy level themes were discussed by stakeholders including the relationship between WMPs and other organisations, as well

as the tension between what is most effective and most efficient. This tension was mostly due to financial constraints. Stakeholders offered their thoughts on key intervention components and considerations for future programme development were noted e.g. advertising.

#### 4.6.2 Situating within the wider literature

This phase of the PhD identified key themes, which should be considered in the future when developing WMPs for adolescents with overweight or obesity. Stakeholders and adolescents with obesity recognised the importance of support from experienced professionals, family and peers, when developing and delivering a tailored WMP for adolescents. This corresponds with findings from other qualitative studies of stakeholders' perspectives towards child obesity treatment (Staniford et al., 2011). Although including the views of parents in addition to professionals and adolescents, this qualitative study, which focused on a WMP for younger children aged 7-13 years, highlighted the importance of social support in initiating and maintaining healthy behaviours. Stakeholders spoke of using adolescents as mentors within WMPs when discussing peer support. This has been suggested as a promising strategy amongst adolescent boys who, under supervision, organised and delivered PA sessions to peers at school, and promoted healthy eating at home (Lubans et al., 2011). Actively involving peers in a WMP may increase their sense of responsibility and motivation to engage.

There was agreement amongst stakeholders that longer-term support was needed for adolescents with obesity, but also recognition of the restraints on resources to enable this. Stakeholders felt that face-to-face support was still necessary, but suggestions included integrating follow-up support into schools and leisure services. This transition has also been suggested by Smith et al., (2014b) who undertook focus groups and semi-structured interviews with adolescents, parents and community stakeholders involved in an 8-week healthy lifestyle programme in Australia.

Additionally, the importance of easing prior worries about a programme is important to engage adolescents in the first place. This was highlighted by both adolescents and stakeholders involved in this study. Once engaged, stakeholders and adolescents recognised the need for the educational side of a programme to be practical and hands-on. This active engagement has been recognised elsewhere in a qualitative study of children's views of the MEND (Mind, Exercise, Nutrition, Do It!) programme (Watson et al., 2015). Additionally, the need to offer adolescents emotional and psychological

support within a WMP, in addition to nutrition and PA education was noted by both adolescents and stakeholders. The young people (11- 16 year olds) involved in community WMP in South Yorkshire also spoke of difficult emotions, such as low self-esteem, in relation to being overweight or obese (Reece et al., 2016).

There was consensus amongst stakeholders that community-based WMPs worked best, as opposed to clinical settings. Having a variety of delivery modes, such as group and 1-2-1, particularly in the home environment, were recommended. Not only was the home setting of HL praised in this study, other home-based WMPs have received positive feedback from adolescents (Woolford et al., 2012b). No difference between individual or group-based programmes in terms of their effectiveness has been found previously (Al-Khudairy et al., 2017), however, a combination approach may warrant further investigation.

More insight is needed from adolescents prior to developing programmes with more effort being put into advertising WMP's and investigating the most effective method for recruiting adolescents. Stakeholders commented on the need for marketing to be on a national level, with initiatives like Change4Life having a greater focus on adolescents. A systematic review of recruitment strategies into obesity prevention programmes for young adults (18-35 years) highlighted a lack of reporting in terms of recruitment procedures, cost and effectiveness. Marketing campaigns, including social marketing, were noted as promising approaches (Lam et al., 2016). Although studies investigating ways to successfully recruit adolescents with obesity in a WMP appear limited, Nguyen et al., (2012b) found newspapers and school newsletters as the most effective method for recruiting adolescents (13-16 years old) into a weight management RCT in Australia. In addition, although not focusing on adolescents with obesity, Jago et al., (2011b) through a qualitative enquiry of 11-12 year old girls, found that taster sessions, word of mouth and enjoyment maximised recruitment in an after school dance programme.

Stakeholders from this study noted that rewards and incentives worked well as a method for improving attendance. Stakeholders also mentioned parents going on to use reward mechanisms with the home. Activity rather than food-based rewards worked better with adolescents. This finding agrees with one adolescent in this study who suggested more practical outings would be preferred (see 'goals' theme, section 4.5.2.1.6).

Stakeholders agreed that WMPs for adolescents need to be more proactive at incorporating an element of technology. This is encouraging, as text-messaging and web-

based programmes have been positively reported previously (Jogova et al., 2013; Woolford et al., 2010; Woolford et al., 2012a).

As well as stakeholders commenting on WMP components and what works well within an intervention, those referring into the programme appreciated receiving feedback from those delivering the HL programme. This included telephone communication and letters which were sent to the referrers after each review appointment (end of 6-week programme and at 3, 6, 12-month follow-up appointments) detailing the participants progress. Good communication was respected. In addition, stakeholders valued being invited to attend project steering group meetings. This, alongside good communication, led to health professionals feeling more confident about referring families into the programme. This concurs with findings from a qualitative evaluation of a family WMP, where school nurses felt that feedback in relation to the programme would improve their knowledge and then in turn improve parental engagement (Johnson et al., 2018).

#### 4.6.3 Strengths and limitations

This research is limited by the small sample of adolescents recruited. Described further in section 5.9.1, due to a restructure within the PH department at Wolverhampton City Council, the one remaining HL worker sought employment elsewhere just as I was about to submit my ethics application. A large part of this study design was relying on the trust and rapport that this worker had with families as they were going to speak to families on my behalf to explain the research further, after receiving a postal invitation. Due to ethical and data protection restrictions, I was unable to contact participants directly myself to try and build this rapport in the HL workers absence. This meant that after postal invitations had been sent out, I was only able to wait for replies. To ensure adequate recruitment, someone was needed to talk to these adolescents and their families to explain the research further, not solely relying on a leaflet.

There are some clear similarities between what adolescents and stakeholders say about WMPs for this age group. Listening to these views and pairing that alongside what we already know leads to an effective intervention, may improve engagement. Issues with recruitment of adolescents into the study are discussed more fully in Chapter 5.

This study involved a small purposive sample of participants linked to a specific WMP in the West Midlands. This means the scope of their experience and knowledge may not include the full scope of what might be feasible nationwide. Stakeholders involved in this research were all female, reflective of the gender balance amongst health professionals

in general. An analysis of the representation of women across hospital and community health services reported that 77% of all NHS staff are female, with even greater numbers representing nursing (89%) (NHS Digital, 2018c).

As the researcher was previously involved in delivering a WMP for adolescents, the researcher's personal views may have influenced the themes that developed in this study. To reduce this risk, data were analysed thematically, taking an inductive approach and a second author (OO) audited themes. Further discussion of the researcher's previous experience can be seen in Chapter 1 section 1.2 and in Chapter 5, section 5.9.

#### 4.6.4 Future research recommendations

Qualitative data from Chapter 4 ('Advertising' theme, section 4.5.3.5.2) highlighted the need to undertake more research that attempts to identify which recruitment strategies work best for adolescents with obesity. There are limited studies investigating ways to successfully recruit adolescents into WMPs at present.

Communication between those delivering the HL programme and referrers was viewed positively by stakeholders in this study. Investigating this relationship further could serve to improve recruitment as those referring into the programme were more likely to do so when they had a greater understanding of the programme, due to this good communication. Adolescents may then in turn be more likely to attend if a trusted and influential professional was informing them about the programme. Understanding this relationship in greater detail amongst other WMPs would be beneficial.

Participants from the study presented in Chapter 4 noted that rewards and incentives worked well as a method for improving attendance (see 'goals' theme, section 4.5.2.1.6). Much of the research in this area is based on financial incentives and mostly focus on adults (Barte & Wendel-Vos, 2017; Giles et al., 2015). Most incentives offered in the HL programme were low value rewards such as water bottles and balls. Research exploring the role of these type of incentives, particularly qualitative, is limited in children and adolescents (Redfern, 2016).

The home-based setting of HL was praised by stakeholders in this study. Some stakeholders felt that it was not a suitable environment to implement specific aspects of a WMP, such as PA. However, this may be because most stakeholders involved were not PA specialists. More research is needed to assess the worth of incorporating home-based sessions into WMPs for adolescents with obesity. In a systematic review of child and

adolescent WMPs delivered in the home setting, nine out of 15 studies were found to be superior to the control condition (Appelhans et al., 2016). However, only five of these studies included adolescents and none were conducted in the UK. In a Cochrane review of diet, physical activity and behavioural interventions for the treatment of adolescent obesity (Al-Khudairy et al., 2017), out of 44 included trials nine were delivered in a school setting and only eight in a community setting. Of those eight, only one involved a home element. This US based intervention, which aimed to assess the effect of noncaloric beverages on weight gain, only included three 20-minute home check-in appointments throughout the year long intervention (Ebbeling et al., 2012). A large UK based trial investigating whether and how home-based WMPs increase effectiveness may be beneficial.

#### 4.7 Conclusion

Exploration of adolescent and stakeholder views in the West Midlands has revealed some key intervention components that are both wanted by adolescents and felt necessary by stakeholders. Long-term support from trusted professionals, family and peers came to light as vital elements for a WMP. Adolescents and stakeholders spoke of prior worries about attending an intervention and the need for psychological and emotional support. Practical, hands on activities and the inclusion of some form of technology should be considered. Although quantitative reviews have sought to understand the effectiveness of WMPs for adolescents with overweight or obesity (AL-Khudairy et al., 2017), qualitative research could aid their development, encouraging greater engagement. The stakeholders and adolescents in this study shared insights that may improve future development and delivery of adolescent WMPs.

#### 4.8 Chapter summary

This study presents the views of stakeholders and adolescents involved in a WMP in the West Midlands. The findings from Chapter 2 are used to investigate adolescent and stakeholder views of an obesity intervention at local level in Wolverhampton. These findings, along with findings from Chapter 2 and 3 will now be brought together for a final discussion in Chapter 5.

A manuscript draft for stage 2 of this Chapter, involving stakeholders, can be seen in Appendix 23. This manuscript has been submitted to the journal *Perspectives in Public Health*.

## Chapter 5. Discussion

### 5.1 Chapter outline

This chapter offers a summary of the three research phases in this PhD. A synthesis of the key findings across this PhD are then discussed. The competing interests of engagement, enjoyment and effectiveness are discussed in section 5.4, which is then followed by recommendations and implications for future research, policy and practice. A reflexive account is offered, including a personal account of the difficulties surrounding knowledge mobilisation in PH.

### 5.2 Re-cap of study phases

The aim of this PhD was to gain a better understanding of how to support adolescents with overweight or obesity to achieve a healthy weight within a WMP. To achieve this, the following research questions were explored:

- What are the views of overweight or obese adolescents (12-17 years) attending lifestyle obesity treatment interventions?
- Which conditions and combinations of conditions of adolescent lifestyle obesity treatment interventions form the pathways to intervention effectiveness and pathways to ineffectiveness?
- What are the barriers and facilitators to achieving a healthy weight for overweight or obese adolescents taking part in a lifestyle treatment intervention in the West Midlands?
- What are overweight or obese adolescents' experiences of attending an obesity lifestyle treatment intervention in the West Midlands?
- What are the reasons for adolescents with obesity not engaging with obesity lifestyle treatment interventions in the West Midlands?
- What are stakeholder views of lifestyle obesity treatment interventions for adolescents in the West Midlands?
- What are stakeholders views of the policy and practical implications of findings from a qualitative systematic review and interviews with adolescents with overweight and obesity.

An attempt to answer these research questions was made through three research study phases:

Phase 1) A qualitative systematic review exploring the views of adolescents with overweight or obesity attending lifestyle treatment interventions

Phase 2) Re-analysis of a systematic review to identify pathways to effectiveness in WMPs for adolescents

Phase 3) The perspectives of adolescents and relevant stakeholders involved in a WMP in Wolverhampton

Findings from all three phases will now be synthesised in this chapter. In addition, this chapter will present:

- A discussion connecting engagement and effectiveness in WMPs
- Recommendations for future research
- Implications for policy
- Implications for practice
- Strengths and limitations of the PhD as a whole
- A reflexive account
- Conclusions and original contributions of the research

### 5.3 Synthesis of key findings from Chapters 2-4

This section will present the combined findings from all three phases of this PhD. This includes support from professionals, family and peers, intervention setting and delivery mode, tailored support, the tension between autonomy and dependence, psychological and emotional support, active engagement, easing prior worries, goal setting, technology, PA and long-term support.

#### 5.3.1 Support

Together, findings from Chapters 2, 3 and 4 highlight the importance of support from professionals throughout a WMP. The provision of instruction or contact from a professional has been associated with effectiveness in adult WMPs previously (Dombrowski et al., 2012; Hartmann-Boyce et al., 2014), discussed further in Chapter 3, section 3.5.2. One of the most prominent themes from the qualitative systematic review reported in Chapter 2 was this avenue of support, which gave adolescents the personal attention that was needed. Adolescents particularly appreciated being able to develop a deeper and more meaningful relationship with professionals. The benefit of this higher level of professional support was also demonstrated in Chapter 3 (Re-analysis of a systematic review to identify pathways to effectiveness in WMPs for adolescents). A high

level of support, which included regular appointments with professionals, was shown as a potential WMP component that leads to effectiveness. Having someone to talk to and developing this more meaningful relationship with professionals, highlighted in Chapter 2, may be more likely if receiving a high level of professional support, which would increase the pace at which trust was gained. Adolescents that spoke negatively about professionals in Chapter 2 spoke of the absence of a good relationship with a professional, which in some cases led to recommendations being ignored. This is another possible theory why a high level of professional support was present in all three pathways to effectiveness presented in Chapter 3. These findings are supported through a qualitative enquiry (Chapter 4) where both dietitians that were interviewed stated that a 1-2-1 programme in a clinic setting was not effective. This was mainly because of the infrequent appointments offered to participants, as well as a less relaxed environment. Adolescents with overweight and obesity, and stakeholders recognised the importance of trust in this critical relationship.

Additionally, the benefit of family and peer support was also put forward by findings in Chapter 2 and 4. Chapter 2 described the importance of family support for continued motivation, with this increasing if the whole family joined in with behaviour change efforts. These views were reiterated by both adolescents and stakeholders involved in Chapter 4 with stakeholders commenting on the importance of family support in the home environment to ensure longer, sustainable lifestyle change. Stakeholders in this study described the benefit of group programmes for adolescents creating new bonds and friendships. Chapter 2 also reported a sense of belonging and acceptance among peers. This peer support acted as a security blanket for adolescents, something that was noted in Chapter 4 as particularly important when accessing and taking part in PA. Social cognitive theory suggests that behaviours may come about and become reinforced through imitating and observing others (Bandura, 1986). This may explain why peer and family support appear to be appreciated in this PhD. The impact of peer support on eating and physical activity behaviours in children and adolescents has been highlighted previously (Salvy & Bowker, 2014). Additionally, social support, including from family and friends, has been identified as an effective behaviour change technique in promoting healthy behaviours in adults (Olander et al., 2013; Van Achterberg et al., 2010). The mechanisms behind these findings have been said to involve social facilitation (the tendency for individuals to perform differently when in the company of others), impression management (when individuals consciously or unconsciously try to influence

the perceptions of other people by regulating their self-presentation) and modelling (copying the behaviour of others) (Salvy & Bowker, 2014).

### 5.3.2 Intervention settings and delivery mode

Details of intervention setting, and delivery format arose from stakeholders and adolescents in both Chapters 2 and 4. Chapter 2 did not highlight a preference between group and 1:1 WMPs in this synthesis of views from 28 studies. Peer support was spoken about favourably, as was a deeper level of professional support, that often comes from 1:1 support. Stakeholders from the study reported in Chapter 4, as well as findings from Chapter 2, spoke of the value of home-based programmes but felt this option was not financially sustainable, with groups offering a more cost-effective alternative. In addition, group programmes created that peer element, which was reported in sections 4.5.2.2.3 and 4.5.3.1.3 as useful for attendance by both stakeholders and adolescents in Chapter 4. Stakeholders also felt that it was difficult to deliver PA in a 1:1 setting. Furthermore, stakeholders felt that for most adolescents a 1:1 clinic setting was not effective but may be useful for those with greater needs. This balanced view is supported by findings from a quantitative systematic review of lifestyle obesity treatment interventions in adolescents that found no subgroup differences for type of intervention, setting or mode of delivery (Al-Khudairy et al., 2017). Furthermore, in a systematic review of school-based interventions targeting PA and sedentary behaviour in older adolescents (15-19 years), intervention length and mode of delivery were not associated with effectiveness (Hynynen et al., 2015). This systematic review of 10 interventions, included those delivered by computer programmes (n=2), leaflets (n=1) and face-to-face groups (n=7). A systematic review investigating the effect of behavioural techniques and delivery mode on effectiveness of WMPs in adults found no evidence of greater benefit between WMPs delivered in person versus remotely (Hartmann-Boyce et al., 2014). The combined findings from chapters 2 and 4 contribute towards highlighting the issue of vast variation in WMPs. What was apparent from these two studies (Chapter 2 and 4) is that some individuals may suit a 1:1 approach, whilst others may blossom more in a group setting. This is in line with current NICE guidance on weight management for overweight or obese children and young people (NICE, 2013a). The importance of this tailored approach will now be discussed in 5.3.3.

### 5.3.3 Tailored support

The review in Chapter 2 revealed the importance of tailoring WMPs to the needs of adolescents with overweight or obesity in terms of culture and age. The qualitative data gathered in Chapter 4 supports this finding with stakeholders commenting on the need for resources and activities to be tailored. This concurs with guidance by NICE that interventions should be tailored to different age groups, stages of development and cultures (NICE, 2013a). Stakeholders reported in Chapter 4 suggested that WMPs for children and adolescents should be split by age, recognising this variation in development. However, the practical difficulties of this was noted, including staff and small group numbers. In contradiction to the above points, Chapter 3 posits that the presence of a tailored problem solving component of a WMP does not lead to effectiveness. Potential reasons for this finding are discussed further later in this Chapter, in section 5.3.6 (active engagement).

### 5.3.4 Tension between autonomy and dependence

Although stakeholders in a previous study (Staniford et al., 2011) suggested that interventions need to enhance autonomy to aid independence in maintaining behaviour changes, tensions between autonomy and dependence are reported throughout this PhD. Findings from Chapter 2, a qualitative systematic review of adolescent views of lifestyle obesity treatment interventions, highlight this tension. This review shows that adolescents do recognise their personal responsibility for their weight but there is still a want for structured advice from professionals. This preference for professional support was also recognised in Chapter 4, whereas the need for professional support if the WMP is going to be effective was highlighted in the QCA analysis, presented in Chapter 3. However, professional support, especially given the current PH budget, cannot last forever. There must be a point at which adolescents leave a WMP and continue with what they have learnt themselves, perhaps with support from family or peers. In order to find the best WMP recipe to enable successful autonomy, more long-term follow-up outcomes ( $\geq 12$  months) are needed (discussed further in section 5.5). Adding to this, stakeholder reports given in Chapter 4 suggest that adolescents are more likely to take responsibility for their weight if their parents are on board, again reinforcing the value of family support. Stakeholders in this study felt that responsibility should be shared between the adolescent, parents and school. Chapter 2 also highlighted that adolescents feel guilt and a sense of failure when they are not able to lose or maintain weight, which can lead to attrition. Perhaps, sharing responsibility in this way would reduce these feelings and in

turn, attrition. The QCA analysis conducted in Chapter 3 included responsibility in two models (model 3 section 3.4.3 and model 4 section 3.4.4) which considered this tension between autonomy and dependence. Included in this condensed condition of responsibility were the original conditions of active engagement, autonomy, reflection and diet monitoring by participant (see section 3.3.1). Although the findings from Chapter 2 and 4 suggest that adolescents either do, or should, take responsibility for their weight, the QCA analysis in Chapter 3 does not put diet monitoring by participant, one element of responsibility, forward as a strong indicator towards either effectiveness or ineffectiveness. Additionally, the QCA analysis suggests that when goals are set by the adolescents that they are ineffective. Responsibility will be discussed further section 5.5, recommendations for future research.

#### 5.3.5 Psychological and emotional support

Collectively, Chapters 2 and 4 found that WMPs would benefit from the inclusion of a psychological and emotional health element. Chapter 2, in the views synthesis found that adolescents were strongly motivated to lose weight to improve body image, social desirability and self-esteem. In addition to this, adolescents reported feelings of guilt and failure if weight loss or maintenance was not achieved. Qualitative findings from Chapter 4 concurs with this, with adolescents describing body dissatisfaction as a clear motivation to improve body image; this mostly stemmed from idolising celebrity figures. Stakeholders in this study also stressed the importance of educating adolescents on emotional well-being, confidence and self-esteem. Stakeholders stated that a mental health element must be prioritised in a WMP, given the fragility of the adolescent period, with changing emotions and pressures. Chapter 3 contributes to this section by demonstrating a lack of adolescent WMPs that contain a mental health element. Within model 1 (section 3.4.1) there was a clustering of interventions representing the configuration shown in set 1 (see table 3.5) with 11 interventions presenting. This combination of components included healthy eating education, PA in addition to mental health support. The clustering shown in set 1 was for a configuration with the presence of healthy eating education but absence of PA and mental health support. Although this combination does warrant discussion regarding PA (see section 5.3.10), it does offer some suggestion that not enough WMPs are including this much needed emotional support. The need to focus on self-esteem in WMPs for adolescents has been reported elsewhere in a systematic review (n=13) investigating the impact of WMPs on self-esteem in 1,157 adolescents (10-19 year olds) (Murray et al., 2017). Furthermore, a meta-analysis of

WMPs (n=8) for adolescents (10-19 years old), involving quality of life measures, reported that focusing on psychosocial well-being appears linked to improvements in quality of life in adolescents, including self-confidence, self-esteem and body image (Murray et al., 2019). Additionally, a systematic review of community-based WMPs for adolescents (n= 21) concluded that the inclusion of a psychological component, alongside information on healthy lifestyles, improves long-term effectiveness (Moore et al., 2017).

#### 5.3.6 Active engagement

Findings from Chapters 2, 3 and 4 demonstrate the need for adolescent WMPs to be delivered in an active and practical way, for healthy eating, behaviour change education and PA. The systematic review reported in Chapter 2 highlighted the importance of this active rather than passive delivery approach, which led to a greater sense of fun. Qualitative data gathered in Chapter 4, again supports this with both adolescents and stakeholders commenting on the benefit and enjoyment of cooking activities and using visual and interactive education tools as part of the HL programme (see section 4.3.2 for more details of the HL programme). Findings from the QCA analysis in Chapter 3 showed that the absence of a tailored problem solving element to a WMP led to effectiveness. Theorising, this may be due to adolescents not being able to translate what they have learnt into practice, highlighting the need for more practical support. This can be linked to 'prompt practice', a principle of operant conditioning (Skinner, 1974), where the individual rehearses and repeats the designed behaviour (Abraham & Mitchie, 2008). A systematic review (n = 17) identified prompt practice as an effective behaviour change component in obesity prevention and treatment interventions for children (Martin et al., 2013). The sense of fun described in Chapter 2 also helped towards easing adolescents' prior worries regarding attending a WMP. This will now be discussed further in section 5.3.7.

#### 5.3.7 Easing prior worries

Chapters 2 and 4 both explore the feelings of worry that adolescents report prior to taking part in a WMP. Chapter 2, in a qualitative systematic review, found that these prior worries were mostly related to fears of PA intensity. Typically, incorrect preconceptions were formed by the WMP not being portrayed as fun or through previous negative experiences with health professionals. Adolescents in this review also were worried about not having someone to attend with, highlighting the importance of peer and family support. These findings are supported by data from Chapter 4, with adolescents speaking

of their uncertainty and nervousness before starting the HL programme. Stakeholders in this study stated that these prior worries stemmed from lack of confidence, emphasising again the importance of psychological support (see section 5.3.5) as well as transparency of what the programme will offer.

#### 5.3.8 Goal setting

Together, Chapters 2, 3 and 4 go some way towards producing guidance for the use of goal setting within a WMP for adolescents. Chapter 2 reports on the need for goals to be tailored and SMART, with the individual at the core of the goal setting process, alongside support. This is supported by findings from Chapter 4 with stakeholders describing the benefit of this collaborative goal setting. They recognised the sense of pride that adolescents felt when achieving goals. One adolescent in this study only had a vague recollection of working towards goals, but clearly remembered the rewards that she gained. Data regarding the role of goal setting from Chapter 3 is less clear cut. The condition, goal setting by participants, was not completely mirrored in both pathways to effectiveness and ineffectiveness. This condition was present in all four pathways that led to least effective interventions, but also present in one pathway to most effective interventions. These results do suggest participant goal setting as a WMP component to avoid. Potential reasons for this result are discussed in more detail in section 3.5.2 but include a lack of detail surrounding whether these goals were set solely by the participant or in collaboration with professionals, and whether they were SMART. Nonetheless, most evidence suggests collaborative goal setting as a useful behaviour change technique for improving PA and healthy eating behaviours (Golley et al., 2011; Samdal et al., 2017) discussed in more detail in Chapter 3, section 3.5.2.

#### 5.3.9 Technology

This section brings together findings from Chapters 2, 3 and 4 regarding the use of technology within a WMP. Chapter 2, in a synthesis of adolescent's views of obesity lifestyle treatment interventions, included seven studies that jointly recommend the use of technology, e.g. email, text message support, online programmes, exergames, in the delivery of WMPs for adolescents. Adolescents reported the practical and motivational effect of these and found them easy to use and enjoyable. One adolescent involved in stage one (Chapter 4), stated text messages would have been welcomed. Stakeholders in this same study also felt that including some sort of technology to help with long-term follow up support would be beneficial for both adolescents and parents. The role of

technology in self-monitoring, a central behaviour change technique, specifically may help with longer-term support. Mobile health technologies, enabling self-monitoring, in child WMPs have shown promising results for promoting healthy eating and PA (Darling & Sato, 2017; Turner et al., 2015). Given the value of professional support detailed previously (section 5.3.1), technology would only be recommended alongside face-to-face support. Mobile health devices, including mobile phones and other wireless devices, have been suggested as a useful way to support WMPs by providing support and encouragement to participants (Turner et al., 2015). Additionally, another key behaviour change strategy, goal setting, can be used to schedule activities and set tasks using electronic or mobile devices (Mohr et al., 2014). A systematic review of technology supported WMPs concluded that they may produce clinically significant weight loss, irrespective of technology platform, in adults with overweight or obesity (Coons et al., 2012). This PhD recognised that whilst technology would be useful, it was not currently well utilised by professionals. For the QCA analysis in presented in Chapter 3, technology, as an intervention component, was removed from the analysis as the types of technology were so wide ranging that it may have made the results unclear.

#### 5.3.10 Physical activity

The review in Chapter 2 found that PA elements were spoken about by adolescents more so than healthy eating education as part of a WMP. Adolescents appeared to enjoy PA, particularly if they were offered a variety of activities that were achievable yet challenging. Qualitative findings from Chapter 4 support these findings, particularly from the stakeholders involved. Stakeholders reinforced that adolescents seem to enjoy PA, as long as the activity is tailored to the individual and is fun. Stakeholders highlighted that PA needed to be affordable but also highlighted the lack of services in Wolverhampton. This lack of services may go some way to explaining the results in Chapter 3 of this PhD, in the QCA analysis. As mentioned in section 5.3.5, PA was included in model 1 alongside mental health support and healthy eating education. PA as a component within a WMP was not present in the two most heavily represented configurations in this model (See sets 1 and 2 in Table 3.5). A suggestion from stakeholders, in Chapter 4, to combat this was linking more with schools to provide PA sessions for adolescents with overweight or obesity. Increasing PA provision within schools was also highlighted in Chapter 2 as a way of offering longer-term support to adolescents with obesity.

### 5.3.11 Long-term support

The need for longer-term support was explored in Chapter 2 of this thesis, with adolescents describing their worries about maintaining lifestyle changes and motivation post intervention. Adolescents felt that longer-term support was needed to ensure new lifestyle habits became ingrained. Linked to this, adolescents also spoke of the difficulties in transferring new knowledge into the home environment, an element essential for long-term maintenance of weight. Qualitative data reported in Chapter 4 confirms these findings with both adolescents reporting the difficulties of maintaining behaviour change after the HL programme had finished. Both wanted a longer programme. Stakeholders involved in this study agreed that the HL programme, consisting of 6 weekly sessions and follow-up appointments at 3, 6 and 12 months, was not enough. These follow-up appointments were not regular enough. Stakeholders involved in delivering weight management support to adolescents in a clinic setting also reported that they irregular appointments were not effective (section 4.5.3.3.4). The role of the school arose again in this study, as well as leisure centres and gyms as a way of integrating services to provide the necessary long-term support. Although long-term support did not feature in the QCA analysis presented in Chapter 3, the other findings presented above from Chapters 2 and 4, do suggest that longer-term support should be facilitated by professionals; a high level of professional support was shown to lead to effectiveness in Chapter 3. To help with long-term support and success, WMPs may benefit from offering more focus on relapse prevention. Relapse prevention can be described as helping individuals identify situations that are likely to result in re-adopting unhealthy behaviours or not maintaining new behaviours, as well as helping the individual to manage or avoid these situations (Abraham & Michie, 2008). Relapse prevention strategies have been linked to more successful outcomes in a systematic review (n=44) that aimed to identify the active ingredients in behavioural interventions for adults (mean age  $\geq 40$  years) with obesity (Dombrowski et al., 2012). However, a study which aimed to determine which behaviour change techniques were included in weight loss mobile apps (n=30), found that relapse prevention was missing from all apps (Pagoto et al., 2013).

### 5.4 Engagement vs effectiveness

As detailed in Chapter 1 (section 1.4.10.2), engagement in WMPs for children and adolescents is notoriously low (NICE 2013a; Dhaliwal et al., 2014; Skelton & Beech, 2011). Engagement is a term that incorporates initiations, dropout, attrition, retention and adherence (Nobles et al., 2018). Previous research that has investigated attrition from

WMPs has mainly focused on participant characteristics, such as age, sex and baseline weight (Dhaliwal et al., 2014). However, recommendations have suggested looking past demographic predictors of attrition. Nobles et al., (2016), although focusing on children with a mean age of 10 years, found programme characteristics to be stronger predictors of programme engagement than participant characteristics, such as group size and time of year when delivery takes place. Although previous research has involved qualitative methods to seek reasons for non-engagement from parents or child obesity treatment clinicians (Kitscha et al., 2009; Skelton et al., 2012), those that focus on the adolescent age group are limited. For example, Kitscha et al., (2009) sought the reasons for non-return to a WMP in Canada from parents/caregivers of children with a mean age of 8 years. In the qualitative systematic review presented in Chapter 2, only four of 28 studies attempted to involve views of participants that had withdrawn from a programme (Banks et al., 2014; Holt et al., 2005; Owen et al., 2009; Twiddy et al., 2012). Views included in these four studies, as well as others that have sought views of adolescents attending WMPs have been synthesised in Chapter 2, and together with findings from Chapter 4, a better picture of intervention characteristics that would facilitate engagement with adolescents is given.

However, does increased engagement, through implementing programmes with components that adolescents enjoy, also lead to effectiveness (in terms of BMI/weight)? In a systematic review of the literature regarding satisfaction with WMPs, no studies were identified that investigated the association between satisfaction and weight outcomes (Skelton et al., 2014) and to the researcher's knowledge this remains a gap in the literature. Chapter 2 presents the findings on what adolescents say they want from a WMP; however, this does not necessarily equate to effectiveness. What may be appealing and attractive to adolescents and their families, and which may promote engagement, may be ineffective. The QCA presented in Chapter 3 attempts to draw out this balance using quantitative studies by investigating components and combinations of components that lead to effectiveness and ineffectiveness in terms of BMI z score and weight (kg). These results are discussed previously in sections 4.5, 4.6, and within the synthesis of key findings from the three phases for this PhD, in section 5.3. In summary, this QCA analysis, which took components that arose through the views synthesis (Chapter 2), theorised that the presence of a high level of professional support and absence of tailored problem solving lead to effectiveness. However, other components that lead to effectiveness or ineffectiveness are still to be determined. Researching this balance further is also

important when considering sustainability and maintenance of a healthy weight. An intervention may be effective over a 12 week period, perhaps due to prescriptive advice, which may also be enjoyed (as identified in Chapter 2), but this would not lead to autonomy and may therefore not be effective at 12 month follow-up. A WMP that is not enjoyed initially, perhaps because the advice is less prescriptive, may be less effective over 12 weeks, but see better results at 12 month follow-up, due to greater autonomy being developed with more dependence from professionals in the initial phase of the WMP.

Although the QCA analysis presented in Chapter 3 goes some way in considering whether what adolescents say leads to effectiveness, and finds that some aspects of WMPs that they value do appear to promote effectiveness, while others may not, it is also important to consider the synthesised key findings from all phases of this research, presented in section 5.3, in light of more general findings in previous reviews of effectiveness. The QCA analysis presented in Chapter 3 included studies investigating the effectiveness of WMPs for adolescents from a systematic review by Al-Khudairy et al., (2017). This review highlighted that for interventions to be effective, they should be multi-disciplinary (diet, PA and behavioural), a view supported by other previous systematic reviews of WMPs for children and adolescents (Ho et al., 2012; Kelly et al., 2008). Al-Khudairy et al., (2017) also found that longer interventions, as well as longer-follow-up duration resulted in greater effects on BMI and weight maintenance. Furthermore, this review highlighted that there were no subgroup differences in effect between interventions with or without parent involvement nor how the intervention was delivered (group or 1:1). Comparing these results more broadly with findings from Chapter 2 and 4 in this thesis, it appears that what leads to effectiveness is what is also viewed as important by adolescents and stakeholders in terms of wanting to attend a multi-disciplinary intervention for a longer period. Although this quantitative review shows indifference in terms of effect on BMI for parent involvement, adolescents and stakeholders involved in this PhD, clearly favour the inclusion of the whole family. These findings are supported by a previous systematic review, which showed that WMPs including nutrition, PA and behaviour elements, the majority of which had parental involvement, appear to be effective (Kelly et al., 2008). Moreover, a systematic review of the effect of PA interventions on BMI in adolescents highlighted the favourable effect of PA on BMI (Ruotsalainen et al., 2015). Findings from Chapters 2 and 4 point towards adolescents enjoying PA as part of a WMP. Finally, as with

the quantitative review by Al-Khudairy et al., (2017), this PhD did not note any preference regarding mode of delivery, although a peer element was seen as positive.

In summary of this section, it appears that some intervention characteristics and components that lead to effectiveness, based on systematic reviews of quantitative evidence, are also those that adolescents want from an intervention. Engagement is essential, with increased participation leading to increased weight loss (Miller & Brennan, 2015). This further justifies the need for qualitative evidence to be taken as a starting point when planning and delivering WMPs. With so much time and effort put in to these interventions, not just by the professionals involved, but also by participants, this would fall short of providing the best benefits to population health if engagement was poor. However, if engagement was good but the WMP ineffective, this would also be detrimental in terms of population health, and effort. Nonetheless, focussing solely on effectiveness may put a proportion of the eligible population off attending. The goal for future WMPs is to find the balance between something that appeals to adolescents and their families, promoting engagement, whilst also being effective. This section leads on to future recommendations for research.

## 5.5 Recommendations for future research

Whilst this PhD has answered several research questions, several gaps in the research have also been identified through the process. These include:

More research is needed to investigate this linked area of engagement and effectiveness. Currently most research in this area of engagement, only investigates the role of satisfaction and attrition. The association between satisfaction and weight outcomes needs to be explored further. Finding the balance between engagement and effectiveness is key to success. Following on from the QCA analysis presented in Chapter 3, and the perspectives of stakeholders reported in Chapter 4, a QCA analysis using a synthesis of stakeholder views, may offer a different perspective in relation to pathways to effectiveness and ineffectiveness.

The need to research what form of technology adolescents would prefer as part of a WMP has been identified. At present technology has been identified as a component in WMPs that adolescents enjoy using. This is unsurprising as children and young people have been brought up in an age of digital technology, and their familiarity with different devices has been established from an early age (OECD, 2018). Reports suggest that only 0.3% of 15 year olds from countries in The Organisation for Economic Co-operation and

Development (OECD) (an organisation comprising 36 countries dedicated to economic development) have never accessed the internet, with most spending an average of 29 hours on the internet, per week (OECD, 2018). Furthermore, 90% of adolescents and young people (16-24 years), regardless of sociodemographic status, own a smartphone (Ofcom, 2015). However, types of technology varied in interventions included in both Chapters 2 and 3. Gaining a greater understanding of which types of technology and how best to apply them would be useful when designing WMPs in the future. An issue with this is the rapid development in digital health interventions and health apps is outpacing research capacity (Hollis et al., 2017). The importance of ensuring the use of evidence-based approaches to technology is vital. Those using the internet for more than 6 hours a day has been linked to lower life satisfaction and well-being (OECD, 2018). Additionally, associations have been found between social media use and depression (McCrae et al., 2017), anxiety symptoms (Vannucci et al., 2017) and poorer sleep (Woods & Scott, 2016). Other risks include security related issues that have the potential to compromise confidentiality (Dubad et al., 2018). In addition, more research into the practical application and provision of these technology elements by staff involved in WMP would be beneficial as stakeholders involved in the study presented in Chapter 4 were aware of its use but admitted it was underutilised.

Concentrating on intervention dose (duration, number and length of sessions), a Cochrane review of interventions for overweight or obese adolescents completed subgroup analyses on dose, in terms of length of programme and length of follow-up (Al-Khudairy et al., 2017). Although subgroup analyses suggested that interventions greater than 6 months produced a more favourable effect on BMI, the majority of included studies reported outcomes at six to nine months, with few trials reporting outcomes at 24 months. In addition, no analysis of duration of individual sessions was considered. Only one study included in the views synthesis (Chapter 2) reported the length of individual sessions. It is likely that the greater the intervention dose, the better the outcome in the short-term. However, the higher the dose, the less likely the participant will be able to maintain what they have learnt and act independently in the long-term. Intervention dose, including length of individual sessions, should be clearly stated in future studies and more research investigating the relationship between dose and long-term outcomes is needed.

The qualitative research conducted in phase 3 of this PhD (Chapter 4), did not manage to recruit the planned number of adolescents from the HL WMP in Wolverhampton.

Therefore, there remains a gap in the evidence regarding the following research questions:

- What are the barriers and facilitators to achieving a healthy weight for overweight or obese adolescents taking part in a lifestyle treatment intervention in the West Midlands?
- What are overweight or obese adolescents' experiences of attending an obesity lifestyle treatment intervention in the West Midlands?

Benefit would be gained by exploring these views further with more adolescents in future research. Additionally, the evidence around engagement in WMPs targeting adolescents remains limited as the following research questions was not met:

- What are the reasons for adolescents with obesity not engaging with obesity lifestyle treatment interventions in the West Midlands?

Chapters 2, 3 and 4 highlighted either a want for, or a lack of, interventions containing a mental health element. A large scale RCT is needed to assess the effectiveness of WMPs that incorporate emotional and psychological support alongside PA, diet and behavioural components. This should be compared to a standard multi-disciplinary WMP containing PA, diet and behavioural components.

Prior worries before attending a WMP were identified by adolescents and stakeholders in Chapters 2 and 4 in this PhD. Future research would benefit from assessing the value of an induction or orientation session preceding a WMP. This may assist in improving engagement by putting adolescents at ease and managing their expectations. A study involving 342 children and adolescents (mean age 13 years), enrolled in a multi-disciplinary cognitive behavioural WMP in the USA, indicated that adolescents stayed significantly longer in the programme when they attended an orientation session first (Germann et al., 2006b). However, more up to date research is needed in this area.

The quantitative review used in Chapter 3 for the QCA analysis included 44 trials of behavioural, diet and PA interventions for adolescents with obesity (Al-Khudairy et al., 2017). Only eight of these trials reported participant views alongside weight and BMI outcomes. When evaluating and reporting interventions in the future, the views of

participants attending these interventions should be explored and presented. Alongside this, the interventions included in the systematic review of qualitative studies reported in Chapter 2, vary greatly in terms of their setting. If more interventions reporting effectiveness included qualitative views there may be more evidence that results in a clearer perception of which setting is preferred by adolescents. This may in turn contribute towards tackling engagement.

More detailed descriptions of WMP content is needed so standardised guidelines of intervention reporting should be used to aid future analyses. This would have gone some way to aiding the QCA analysis presented in Chapter 3 of this PhD and in future analysis of complex interventions.

Furthermore, the condition 'goal setting by participant' was present in all pathways that led to ineffectiveness in results from Chapter 3. This result is opposed by findings from Chapters 2 and 4, as well as previous research (Pearson, 2012) that describe goal setting as beneficial. However, Chapters 2 and 4 do suggest that goal setting is beneficial when set collaboratively between participants and professionals. The results from the QCA analysis may be because of poor reporting of interventions, where the detail of whether goals were set collaboratively or individually was not clear.

More research is needed to see whether adolescents taking more responsibility actually leads to more effective weight outcomes. A clearer definition of what constitutes responsibility is needed. Furthermore, standardised reporting guidelines are needed to ensure intervention components can be evaluated more easily in the future.

## 5.6 Implications for policy

Although NICE guidance recommends designing and developing WMPs that have taken into account the views of young people (NICE, 2013a), this should extend to stakeholders involved in the care of adolescents with obesity, and those likely to refer into WMPs.

To gain views of adolescents who have attended WMPs to inform future development, policy guidance must recommend that WMPs build in a qualitative enquiry as part of the evaluation of the programme. Within the checklist as part of the current Standard Evaluation Framework for weight management interventions (Public Health England, 2018c), gathering participant satisfaction is an 'essential' recommendation. Although these criteria are presented as a minimum recommendation, this should go further in recommending qualitative methods to gather more in-depth understanding of participant

views. Additionally, gaining reasons for dropping out of a WMP is only a 'desirable' criterion and should be made 'essential'. Although the most effective methods of gaining feedback is still not clear, this PhD suggests this should be completed by professionals involved in the delivery of a WMP, with whom adolescents have rapport and trust.

Policy guidance for those implementing WMPs should include the need for separate sessions for adolescents and younger children, to ensure a tailored design. Additionally, recommendations should be made to include an induction session for adolescents prior to taking part in a WMP, to help manage expectations and ease prior worries. Recommendations should also emphasise the importance of emotional and psychological support as part of a WMP for adolescents, with focus on improving self-esteem and confidence.

### 5.7 Implications for practice

This research has identified many aspects that are critical for practitioners and commissioners to consider when planning and delivering WMPs for adolescents. These will now be outlined:

WMPs should be tailored to the adolescent age group and adolescent appropriate resources and activities should be used. In addition, WMPs should be tailored to the individual. This should include offering 1:1 sessions, in addition to group sessions, if this is a more suitable option for some individuals.

Those working with adolescents directly on a WMP should work collaboratively with adolescents, and ideally with their family, to set behaviour change goals.

WMPs should include an induction or taster session prior to an intervention taking place to ease adolescents prior worries. Furthermore, in addition to ensuring interventions components are delivered in a fun and active way, this should extend to how the WMP is advertised. Ensuring adolescents understand the fun nature of the intervention from the outset may aid recruitment.

WMPs should include an element that focuses on emotionally and psychologically supporting adolescents in the areas of confidence, self-esteem and body image. Those delivering these elements should undertake specific training. Rapport and trust between professionals and adolescents is vital in a WMP; this should be considered if outsourcing to another organisation for this support.

Those commissioning, running and evaluating WMPs should use the Standard Evaluation Framework, or other evaluation guidance, for weight management interventions (Public Health England, 2018c) and ensure a study manual, with all intervention components, is clearly reported. This is to ensure access to this information is available for evaluation. Qualitative research with public health practitioners (n = 32) in England highlighted that evaluation documents, such as the Standard Evaluation Framework, are underused either because practitioners are unaware of them or they lack time to explore them fully (Denford et al., 2018).

WMPs should include delivery of PA. This element of a multi-disciplinary programme is evidently enjoyed by adolescents, and the effectiveness of PA as part of a WMP for adolescents is supported by systematic reviews (Al-Khudairy et al., 2017; Ho et al., 2012; Kelly et al., 2008; Ruotsalainen et al., 2015). This could be offered by linking with other organisations such as leisure centres, gyms or schools. Alternatively, by ensuring staff delivering the programme are trained and confident in delivering PA themselves. In addition, practitioners should not be afraid of trying more innovative approaches to multi-disciplinary WMPs for adolescents.

## 5.8 Strengths and Limitations

Specific strengths and limitations of each study phase are considered individually in Chapters 2, 3 and 4. This section will therefore consider the limitations of this PhD overall.

The difficulties with recruiting adolescents for focus groups, interviews and even postal questionnaires was a limitation of this PhD. In addition, because of the large changes within the PH department at WCC (see section 5.9.1) no HL workers were able to aid recruitment through word of mouth and therefore, adolescents involved in this study were those who had responded to postal invitations. Because of this, both adolescents who volunteered to take part had completed the HL programme in 2016; their memories of the programme may have been limited. Additionally, no adolescents that were referred into the HL programme but did not start the programme, nor those who that dropped out of HL were recruited in this PhD. These limitations influence the PhD as a whole as findings from Chapter 2, a qualitative systematic review of adolescent's views of obesity treatment interventions, could not fully be explored at a national or local level.

## 5.9 Reflexive account

The purpose of this section of the thesis is to discuss my personal experiences of conducting this research. In addition, I will discuss lessons learned.

Firstly, I thoroughly enjoyed engaging with all the participants, both stakeholders and adolescents, involved in Chapter 4. As I had previously been involved with the HL programme from the initiation of the programme until February 2016, I was familiar with most stakeholders who were interviewed. This ran the risk of compromising neutrality. Neutrality is a term that infers the qualitative inquiry is separate from the researcher's prior experience and perspectives (Given, 2008). However, I remained reflexive throughout the research process, completing regular memos. In addition, I feel that this rapport that I had established previously with stakeholders aided recruitment and I was able to gain more honest and open accounts from those involved in the interviews. I was not involved in working with the adolescents involved in this phase of the research so remained neutral with this element. This rapport that I had with stakeholders would have been critical in recruiting adolescents, however with no HL delivery staff remaining (see section 5.9.1 for details), recruitment was limited.

In addition, being so involved in a research project for three years, ran the risk of subjectivity. To account for this, several steps were taken to ensure quality in every phase of this research. This included two reviewers being involved in the qualitative systematic review (Chapter 2) during the initial screen of titles and abstracts, full text screen, data extraction and quality assessment. Thematic synthesis was audited and discussed regularly with a second researcher. In Chapter 3, conditions needed for the QCA analysis were coded independently by two reviewers and the analysis was audited and discussed regularly with two other researchers. Results from the qualitative enquiry presented in Chapter 4, involved an inductive approach and were audited regularly by a second researcher.

Throughout this research I have continually learned and have overcome many challenges. From the outset of my PhD journey, during the qualitative systematic review (Chapter 2), I learnt the unpredictable and challenging nature of research. I did not initially imagine finding such a large number of citations (24,395) that were then screened for inclusion by considering title and abstracts. This taught me the importance of having to take a flexible and adaptable approach to research as this number of citations had an overall effect on my timeline. The impact this had on my timescale meant that, following phase 1 (Chapter

2), I had to adapt and go straight into my primary research (Chapter 4). The initial aim was for the QCA analysis (Chapter 3), alongside the findings from Chapter 2, to inform the qualitative inquiry with adolescents and stakeholders presented in Chapter 4 (See Figure 1.3). As Chapter 2 was so vast, I made the decision to only use results from this qualitative systematic review and carry out the QCA at a later date. More challenges arose when conducting the primary research with stakeholders and adolescents (Chapter 4), again highlighting the unpredictable nature of elements that are beyond the control of the researcher. In addition to the setting being changed from Coventry City Council (CCC) to WCC (discussed further in section 5.9.1), challenges were experienced regarding ethical approval and recruitment. The challenges with recruiting adolescents are discussed further in sections 5.8 and 5.9.1. Due to my previous relationships and rapport with stakeholders involved in the HL programme, I had envisaged that this stage of the research would go more smoothly. However, issues did arise. After an initial conversation with the Health Research Authority (HRA), clarity was sought as to whether the qualitative enquiry with certain stakeholders, e.g. school nurses, would need to be reviewed by the NHS Research Ethics Committee (REC). Their response was that NHS REC review would not be needed as the school nurses were being approached because of their involvement in a local authority programme rather than NHS activity. When I initially went about recruiting stakeholder the lead for school nursing in Wolverhampton wanted clarity on the need for NHS ethics from the Research and Development team at the Royal Wolverhampton Health Trust. After an eight-week delay seeking approval to go ahead with recruitment of school nurses, who were identified as a key referral route in Phase 3 (Chapter 4), there was now only a 4-week window to recruit and interview before school nurses stopped working over the summer school holiday period. School nurses informed me that this was one of their busiest times of year, which inevitably had an impact on recruitment. One school nurse sent text responses back in response to the interview guide I had sent out with the recruitment email. They felt they did not have time to complete a face-to-face or telephone interview. I also never anticipated the complete restructure of the PH department at WCC and its effects on this research which is discussed further below in section 5.9.1. Throughout these processes it was important to stay focussed and remain resilient, a skill that I have developed in this research process.

If completing this research again I would recognise the need to be even more flexible than I feel I have already been in terms of switching between study phases. I recognised within myself that I prefer placing my full attention on one study before moving onto another.

Although I believe this has benefits in ensuring full effort goes into each study, if repeated I would have tried to move onto different study components alongside ones in progress, although there were restrictions to this (see section 5.9.1). Although members of staff involved in the HL programme at WCC were informed at the earliest stage possible and helped to inform development of phase 3 (Chapter 4), on reflection, I would also have made enquiries with departments, such as the school nursing team, at an earlier stage. Furthermore, although my timescale was initially altered due to the vastness of Chapter 2, I may have attempted Phase 2 (Chapter 3), the QCA analysis, at an earlier stage, alongside my primary research (Chapter 4). Having not undertaken this method previously, let alone any mixed methods approaches, as well as being unfamiliar with the software used (Kirk), I wanted to ensure this phase was given my full attention. Having gained confidence throughout this PhD, I would feel more able to complete different research studies alongside each other.

Writing up individual studies was completed throughout the 3 years of this PhD, which is something that I would do again in the future. Having my writing reviewed and critiqued by supervisors developed my feelings on how I deal with constructive criticism, which I will take forward not only in how I respond personally, but how I will offer constructive criticism and feedback to others in the future. Through this expert advice and knowledge imparted from my supervisors, I feel my ability to communicate written research has improved enormously. This has also improved through attending conferences and presenting both posters and oral presentations. Furthermore, my knowledge and practical experience of qualitative and mixed methods methodologies and techniques, as well as obesity treatment interventions for adolescents, has grown immensely.

#### 5.9.1 Broader learning of health system

This section discusses the learning I have gained about the role of research in the broader health system. This needs to be considered to make research meaningful to those in practice. WMPs in general, but other areas of healthcare also, could be improved if research and service provision were more tightly aligned. Currently the link between research and action are not well connected. The ways of sharing knowledge gained through research is often classed as knowledge mobilisation (Davies et al., 2015). In more recent years initiatives to improve the use of evidence gained through research, in health care practice and policy, have been created. One such initiative is the CLAHRC. This five-year initiative is funded by the NIHR with local health and social services providing

matched funds with the aim of improving service delivery for patient benefit. The CLAHRC West Midlands has provided the funding for this PhD, partners of which include Birmingham and Coventry City Councils, Warwickshire County Council, NHS Trusts in Birmingham and Sandwell, in addition to the Universities of Birmingham and Warwick.

Throughout this PhD, I learnt first-hand the difficulties of linking research with practice, mostly due to the rapidly changing infrastructure of PH. As a partner of the CLAHRC West Midlands, and one local to the University of Warwick, CCC was initially involved in this PhD. Jointly, these two organisations recognised a gap in the evidence and sought to understand how to reduce obesity in adolescence. The first challenge was that by the time I started this PhD, the individual involved in putting this idea forward, who would have been my key contact at CCC, had found other employment elsewhere. Attempts were then made to create new contacts at CCC, however by this time, the priority was no longer on adolescent obesity, but on early years obesity prevention. Initial meetings, conversations and scoping exercises were carried out. Community project leads, the lead for school nursing and the One Body One Life programme manager were all approached. However, it was clear after discussion, no services existed for adolescents with obesity nor was there an adolescent population who had experiences of WMPs in Coventry. With my research interest very much based on WMPs for adolescents, the focus turned to Wolverhampton. Although WCC was not a direct partner in the CLAHRC WM, it was felt that focusing on an established WMP in Wolverhampton that prioritised adolescent with obesity, would be most productive. In turn this research would provide recommendations for practice that could be applied across the whole West Midlands, including Coventry. Additionally, having worked on the HL WMP in Wolverhampton, I was already aware of their enthusiasm for my research focusing on their programme. Having these already established contacts at WCC allowed for an easy transition, with meetings taking place to inform the design and implementation of the phase three research study (Chapter 4). After the initial delay of collaborating with WCC, discussions and initial meetings with the programme manager of HL and one of the key workers delivering the programme took place mid-2017. At this point HL was in its fourth year of delivery with promising suggestion of the programme being extended for a further year in 2018. With analysis for Phase 1 (Chapter 2) taking longer than expected, along with seeking approval for a DBS check, use of an online focus group software through the IT security team at the University of Warwick, as well as gaining approval from the Information Governance team at WCC and receiving feedback from PPI members, the application to BSREC was submitted in

December 2017. During this time, again reflecting the constant changes in PH, a large restructure was announced for the PH department in Wolverhampton. Details, including timing of implementing this restructure, were vague but the uncertainty of this, led to the one remaining HL worker seeking employment elsewhere at the end of 2017. I was notified of this at the end of November 2017, just as I was about to submit my ethics application. The PH consultant overseeing the HL programme also left WCC. I was then informed soon afterwards, that the HL programme manager would be leaving the department in March 2018. With both the HL programme manager, as well as the last remaining worker involved with delivering directly to adolescents, alongside staff in the department unsure of their future job prospects, it was clear that the HL programme would not be continued. The main frustration and difficulty with this was the loss of the key worker in the HL programme, who I knew would have facilitated recruitment by word of mouth when working with families. The trust and rapport that had been established would have been beneficial. My focus then had to turn towards ensuring recruitment packs were sent out whilst the programme manager was still in post. Ethics approval was granted at the end of February 2018. With one month remaining, all efforts went into getting the recruitment packs sent out. This itself was not without challenges. As the ethics approval did not allow me access to participant details, I was reliant on WCC informing me of how many participants could be invited to take part. When chasing these figures, I was informed by the HL programme manager that, because of so many staff leaving including administrative support, they had to check that it was still ok to go forward with this research. This was later approved by a new PH consultant, and figures regarding participants on the HL programme were sent across. I made the recruitment packs and hand delivered them to WCC to be posted out as per the ethics approval (Appendix 1). Throughout this time period my first supervisor was on maternity leave and my third supervisor had moved organisations. Having only 1/3 of a supervision team during this challenging time, required me to take responsibility and make decisions independently.

This section goes some way to giving an example of the difficulties experienced throughout this PhD and the main reason for low recruitment of adolescents. The complications of trying to transfer knowledge about WMPs into practice, with the fast-changing pace of health care practice, is also recognised. This also highlights the importance of a clear strategy from the outset. If the decision was made sooner, to

collaborate with WCC, this research may have taken place more smoothly. This is an experience that has developed my resilience and adaptability in research.

### 5.10 Social-ecological framework of health behaviour

The findings from this PhD provide examples that support the use of a socio-ecological framework of health behaviour (described in Chapter 1, section 1.6.4) in recognising comprehensive action to support adolescents with obesity. Particularly, that individual knowledge alone is insufficient for behaviour change. Attention should be paid to multiple levels of a socio-ecological framework of health behaviour, including individual (e.g. knowledge and attitudes), interpersonal (e.g. family and peers), organisational (e.g. schools, WMPs), community (e.g. PA access in local areas) and societal (e.g. national policy).

Applying the findings from chapter 2 and chapter 4 to a social ecological framework may aid development of WMPs and of other interventions for childhood obesity in the future. These findings have been mapped onto the SEF as can be seen in table 2.6 (Chapter 2) and tables 4.1 and 4.3 (chapter 4). Individuals and organisations can use this to consider the factors, which are within their domain of influence. For example, organisations designing WMPs may consider factors within the organisational section of this framework. Family members, friends or professionals involved with the delivery of the programme may find it useful to refer to the individual and interpersonal sections to discover elements that may support an adolescent. At the other end of the socio-ecological framework, policy makers may be interested in focusing on community and societal factors that may influence behaviour change when considering the environment that must be created for WMPs to be successful

### 5.11 Conclusion and original contribution of the research

This PhD has made several original contributions to the evidence base in the treatment of adolescents with obesity. The systematic review completed in Chapter 2 is the first to focus solely on the views of adolescents attending WMPs. This systematic review identified 28 studies that have contributed to the understanding of adolescent views of WMPs.

This PhD also uses QCA to understand WMP components and combinations of components that lead to intervention effectiveness or ineffectiveness. Although other studies have used QCA analysis to investigate WMPs, these have been with adults and

young children (Burchett et al., 2018; Melendez-Torres et al., 2018). This is the first attempt of using this novel method on the topic of adolescent obesity treatment interventions and adds to understanding of complex interventions.

The use of qualitative methodology in Chapter 4 explored the views and experiences of stakeholders involved in a WMP targeting adolescents with obesity. Not only does this add to the limited evidence base regarding stakeholder views of obesity treatment interventions, this is the first to focus solely on adolescents in the UK. In addition, no qualitative studies have been identified in the UK that focus on a home-based WMP for adolescents, as was conducted in the HL programme.

Together, these research phases also contribute to the existing evidence base for WMPs targeting adolescents in the following ways:

- WMPs for adolescents should consider implementing an induction or taster session prior to programme initiation. Advertising of WMPs should highlight the fun nature of the programme.
- Policy should include guidance which states that the views of young people, as well as stakeholders involved in the care of adolescents with obesity, should be considered when designing and developing WMPs for adolescents.
- WMPs should include an element that focuses on emotional and psychological support for adolescents in the areas of confidence, self-esteem and body image.
- Support from professionals, family and peers are all highly valued by adolescents. Support by professionals should be tailored to the adolescent age group and individual, with fun and active methods of increasing knowledge used.
- Some form of technology should be used to aid support during an intervention and the maintenance phase to provide longer-term support.

It is time to find solutions rather than continuing to document the issue of overweight and obesity in adolescence. Whilst approaches are needed for obesity prevention, including improving the food and activity environments (see sections 1.4.7.3 and 1.4.7.5) the need for improved treatment options to help those adolescents who are already overweight or obese is great. Qualitative findings should continue to be used to inform future research and programme design. By pairing these views with what we already know regarding effectiveness, engagement and obesity levels may be improved.

Although many recommendations have come out of this PhD, three practical key findings that should be considered when designing a WMP for adolescents in the future include:

- The inclusion of a PA element
- Emotional and psychological support
- Fun, interactive, regular support from professionals

## References

Abraham, C. & Michie, S. (2008) A taxonomy of behavior change techniques used in interventions. *Health Psychology, 27* (3): 379.

Akers, J. D., Cornett, R. A., Savla, J. S., et al. (2012) Daily self-monitoring of body weight, step count, fruit/vegetable intake, and water consumption: a feasible and effective long-term weight loss maintenance approach. *Journal of the Academy of Nutrition and Dietetics, 112* (5): 685-692.

Al-Khudairy, L., Loveman, E., Colquitt., et al. (2017) Diet, PA and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years. *Cochrane Database of Systematic Reviews, (6)*.

Alm, M., Soroudi, N., Wylie-Rosett, J., et al. (2008) A qualitative assessment of barriers and facilitators to achieving behavior goals among obese inner-city adolescents in a weight management program. *Diabetes Educator, 34* (2): 277-284.

Alper, B. S., Fedorowicz, Z. & Zuuren, E. J. (2015) Limitations in conduct and reporting of cochrane reviews rarely inhibit the determination of the validity of evidence for clinical decision-making. *Journal of Evidence-Based Medicine, 8* (3): 154-160.

Appelhans, B. M., Moss, O. A. & Cerwinski, L. A. (2016) Systematic review of paediatric weight management interventions delivered in the home setting. *Obesity Reviews, 17* (10): 977-988.

Ashwell, M., Gunn, P. & Gibson, S. (2012) Waist-to-height ratio is a better screening tool than waist circumference and BMI for adult cardiometabolic risk factors: systematic review and meta-analysis. *Obesity Reviews, 13* (3): 275-286

Ashwell, M. & Gibson, S. (2014) A proposal for a primary screening tool: 'Keep your waist circumference to less than half your height'. *BMC Medicine, 12* (1): 1.

Ashwell, M. & Gibson, S. (2016) Waist-to-height ratio as an indicator of 'early health risk': simpler and more predictive than using a 'matrix' based on BMI and waist circumference. *BMJ Open, 6* (3): e010159.

Atieno, O. P. (2009) An analysis of the strengths and limitation of qualitative and quantitative research paradigms. *Problems of Education in the 21st Century, 13* (1): 13-38.

Attia, M. & Edge, J., (2017) Being a reflexive researcher: a developmental approach to research methodology. *Open Review of Educational Research*, 4 (1): 33-45.

Aune, D., Norat, T., Leitzmann, M., et al. (2015) Physical activity and the risk of type 2 diabetes: a systematic review and dose–response meta-analysis. *European Journal of Epidemiology*, 30 (7): 529-543.

Australian Bureau of Statistics. (2018) *National Health Survey. First results. Australia 2017-18*. [online] Available from: <http://www.abs.gov.au/ausstats> (Accessed 03 January 2019).

Babey, S. H., Hastert, T. A., Yu, H., et al. (2008) Physical activity among adolescents: when do parks matter? *American Journal of Preventive Medicine*, 34 (4): 345-348.

Bacopoulou, F., Efthymiou, V., Landis, G., et al. (2015) Waist circumference, waist-to-hip ratio and waist-to-height ratio reference percentiles for abdominal obesity among Greek adolescents. *BMC Pediatrics*, 15 (1): 1.

Bandura, A. (1986) *Social Foundations of Thought and Action: A social cognitive theory*. Prentice Hall.

Banks, J., Cramer, H., Sharp, D. J., et al. (2014) Identifying families' reasons for engaging or not engaging with childhood obesity services: A qualitative study. *Journal of Child Health Care*, 18 (2): 101-110.

Barnett-Page, E. & Thomas, J. (2009) Methods for the synthesis of qualitative research: a critical review. *BMC Medical Research Methodology*, 9 (1): 59.

Barte, J. C. & Wendel-Vos, G. W. (2017) A systematic review of financial incentives for physical activity: the effects on physical activity and related outcomes. *Behavioral Medicine*, 43 (2): 79-90.

Beets, M. W., Cardinal, B. J. & Alderman, B. L. (2010) Parental social support and the physical activity–related behaviors of youth: a review. *Health Education & Behavior*, 37 (5): 621-644.

Berkey, C. S., Rockett, H. R. & Colditz, G. A. (2008) Weight gain in older adolescent females: the internet, sleep, coffee, and alcohol. *The Journal of Pediatrics*, 153 (5): 635-639.

Bhaskaran, K., Douglas, I., Forbes, H., et al. (2014) Body-mass index and risk of 22 specific cancers: a population-based cohort study of 5.24 million UK adults. *The Lancet*, 384 (9945): 755-765.

- Birch, L. L., Fisher, J. O. & Davison, K. K. (2003) Learning to overeat: maternal use of restrictive feeding practices promotes girls' eating in the absence of hunger. *The American Journal of Clinical Nutrition*, 78 (2): 215-220.
- Bleich, S. N., Vercammen, K. A., Zatz, L. Y., et al (2018) Interventions to prevent global childhood overweight and obesity: a systematic review. *The Lancet Diabetes & Endocrinology*, 6 (4): 332-346.
- Bloom, S. (2007) Hormonal regulation of appetite. *Obesity Reviews*, 8: 63-65.
- Bonell, C., Farah, J., Harden, A., et al. (2013) Systematic review of the effects of schools and school environment interventions on health: evidence mapping and synthesis. *Public Health Research*, 1 (1).
- Boodai, S., McColl, J. & Reilly, J. (2014) National Adolescent Treatment Trial for Obesity in Kuwait (NATTO): project design and results of a randomised controlled trial of a good practice approach to treatment of adolescent obesity in Kuwait. *Trials*, 15 (1): 234.
- Booth, A. (2006) Clear and present questions: formulating questions for evidence based practice. *Library Hi Tech*, 24 (3): 355-368.
- Braithwaite, I., Stewart, A. W., Hancox, R. J., et al. (2014) Fast-food consumption and body mass index in children and adolescents: an international cross-sectional study. *BMJ Open*, 4 (12): e005813.
- Braun, V. & Clarke, V. Using thematic analysis in psychology. (2006) *Qualitative Research in Psychology*, 3 (2): 77-101.
- Brennan, L., Wilks, R., Walkley, J., et al. (2012) Treatment acceptability and psychosocial outcomes of a randomised controlled trial of a cognitive behavioural lifestyle intervention for overweight and obese adolescents. *Behaviour Change*, 29 (1): 36-62.
- Brown, T. J., Hardeman, W., Bauld, L., et al. (2018) A systematic review of behaviour change techniques within interventions to prevent return to smoking postpartum. *Addictive Behaviors*, 92: 236-243.
- Brownell, K., Kelman, J. & Stunkard, A. Treatment of obese children with and without their mothers: changes in weight and blood pressure. (1983) *Pediatrics*, 71 (4): 515-23.
- Brunton, G., O'Mara-Eves, A. & Thomas, J. (2014) The 'active ingredients' for successful community engagement with disadvantaged expectant and new mothers: a qualitative comparative analysis. *Journal of Advanced Nursing*, 70 (12): 2847-2860.

- Bryman, A. (2012) *Social research methods*. 4th ed. Oxford University Press.
- Bryman, A. (2016) *Social research methods*. 5th ed. Oxford University Press.
- Burchett, H. E., Sutcliffe, K., Melendez-Torres, G. J., et al. (2018) Lifestyle weight management programmes for children: A systematic review using Qualitative Comparative Analysis to identify critical pathways to effectiveness. *Preventive Medicine, 106*: 1-12.
- Burke, L. E., Wang, J. & Sevick, M. A. (2011) Self-monitoring in weight loss: a systematic review of the literature. *Journal of the American Dietetic Association, 111* (1): 92-102.
- Butler, A., Hall, H. & Copnell, B. (2016) A guide to writing a qualitative systematic review protocol to enhance evidence-based practice in nursing and health care. *Worldviews on Evidence-Based Nursing, 13* (3): 241-249.
- Campbell-Voytal, K. D., Hartlieb, K. B., Cunningham, P. B., et al. (2018) African American Adolescent-Caregiver Relationships in a Weight Loss Trial. *The Journal of Child and Family Studies, 27* (3): 835-42.
- Candy, B., King, M., Jones, L., et al. (2013) Using qualitative evidence on patients' views to help understand variation in effectiveness of complex interventions: a qualitative comparative analysis. *Trials, 14* (1): 1.
- Cappuccio, F. P., Taggart, F. M., Kandala, N., et al. (2008) Meta-analysis of short sleep duration and obesity in children and adults. *Sleep, 31* (5): 619-626.
- Carcary, M. (2009) The Research Audit Trial – Enhancing Trustworthiness in Qualitative Inquiry. *The Electronic Journal of Business Research Methods, 7* (1): 11 – 24.
- Colley, D., Cines, B., Current, N., et al. (2015) Assessing Body Fatness in Obese Adolescents: Alternative Methods to Dual-Energy X-Ray Absorptiometry. *The Digest, 50* (3): 1.
- Colquitt, J. L., Loveman, E., O'Malley, C., et al. (2016) Diet, physical activity, and behavioural interventions for the treatment of overweight or obesity in preschool children up to the age of 6 years. *Cochrane Database of Systematic Reviews, (3)*.
- Coons, M. J., DeMott, A., Buscemi, J., et al. (2012) Technology interventions to curb obesity: a systematic review of the current literature. *Current Cardiovascular Risk Reports, 6* (2): 120-134.

- Cooper, B. & Glaesser, J. (2012) Qualitative work and the testing and development of theory: Lessons from a study combining cross-case and within-case analysis via Ragin's QCA. *Forum: Qualitative Research*, 13 (2): 4.
- Craigie, A. M., Lake, A. A., Kelly, S. A., et al (2011). Tracking of obesity-related behaviours from childhood to adulthood: a systematic review. *Maturitas*, 70 (3): 266-284.
- Crawford, D., Cleland, V., Timperio, A., et al. (2010) The longitudinal influence of home and neighbourhood environments on children's body mass index and physical activity over 5 years: the CLAN study. *International Journal of Obesity*, 34 (7): 1177-1187
- Curtis, P. (2008) The experiences of young people with obesity in secondary school: some implications for the healthy school agenda. *Health & Social Care in the Community*, 16 (4): 410-4118
- Daley, A. J., Copeland, R. J., Wright, N. P., et al. (2005) Protocol for: Sheffield Obesity Trial (SHOT): A randomised controlled trial of exercise therapy and mental health outcomes in obese adolescents [ISRCNT83888112]. *BMC Public Health*, 5 (1): 113.
- Daley, A. J., Copeland, R. J., Wright, N.P., et al. (2008) 'I can actually exercise if i want to; it isn't as hard as i thought': a qualitative study of the experiences and views of obese adolescents participating in an exercise therapy intervention. *Journal of Health Psychology*, 13 (6): 810-819.
- Daniels, S. R. (2009) The use of BMI in the clinical setting. *Pediatrics*, 124 (Supplement 1): S35-S41.
- Darling, K. E. & Sato, A. F. (2017) Systematic review and meta-analysis examining the effectiveness of mobile health technologies in using self-monitoring for pediatric weight management. *Childhood Obesity*, 13 (5): 347-355.
- Davies, H. T., Powell, A. E. & Nutley, S. M. (2015) Mobilising knowledge to improve UK health care: learning from other countries and other sectors—a multimethod mapping study. *Health Services and Delivery Research*, 3 (27).
- Davies, I. G., Blackham, T., Jaworowska, A., et al. (2016) Saturated and trans-fatty acids in UK takeaway food. *International Journal of Food Sciences and Nutrition*, 67 (3): 217-224.
- Demerath, E., Guo, S., Chumlea, W., et al. (2002) Comparison of percent body fat estimates using air displacement plethysmography and hydrodensitometry in adults and children. *International Journal of Obesity*, 26 (3): 389

Denford, S., Lakshman, R., Callaghan, M., et al. (2018) Improving public health evaluation: a qualitative investigation of practitioners' needs. *BMC Public Health*, 18 (1): 190.

Department for Education. (2016) *Standards for school food in England*. [online] Available from:

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/551813/School\\_food\\_in\\_England.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/551813/School_food_in_England.pdf) (Accessed 28 January 2019).

Department of Health. (1992) *The health of the nation: a strategy for health in England*. London: HMSO.

Department of Health. (2003) *On the state of public health: Annual Report of the Chief Medical Officer 2002*. Department of Health Publications.

Dhaliwal, J., Nosworthy, N. M., Holt, N. L., et al (2014) Attrition and the management of pediatric obesity: an integrative review. *Childhood Obesity*, 10 (6): 461–473.

Dickens, E. & Ogden, J. (2014) The role of parental control and modelling in predicting a child's diet and relationship with food after they leave home. A prospective study. *Appetite*, 76: 23-29.

Dimbleby, H. & Vincent, J. (2013) *The School Food Plan*. [online] Available from: [www.schoolfoodplan.com](http://www.schoolfoodplan.com) (Accessed 13 July 2016). Department for Education.

Dinsdale, H., Ridler, C. & Ells, L. J. (2011) *A simple guide to classifying body mass index in children*. Oxford: National Obesity Observatory.

Dobbins, M., DeCorby, K., Robeson, P., et al. (2009) School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6-18. *The Cochrane Library*.

Dombrowski, S. U., Sniehotta, F. F., Avenell, A., et al. (2012) Identifying active ingredients in complex behavioural interventions for obese adults with obesity-related co-morbidities or additional risk factors for co-morbidities: a systematic review. *Health Psychology Review*, 6 (1): 7-32.

Dubad, M., Winsper, C., Meyer, C., et al. (2018) A systematic review of the psychometric properties, usability and clinical impacts of mobile mood-monitoring applications in young people. *Psychological Medicine*, 48 (2): 208-228.

Dunford, E., Webster, J., Barzi, F., et al. (2010) Nutrient content of products served by leading Australian fast food chains. *Appetite*, 55 (3): 484-489.

- Dunton, G. F., Kaplan, J., Wolch, J., et al. (2009) Physical environmental correlates of childhood obesity: a systematic review. *Obesity reviews*, 10 (4): 393-402.
- Ebbeling, C. B., Feldman, H. A., Chomitz, V. R., et al. (2012) A randomized trial of sugar-sweetened beverages and adolescent body weight. *New England Journal of Medicine*, 367 (15): 1407-1416.
- Eime, R. M., Young, J. A., Harvey, J. T., et al. (2013) A systematic review of the psychological and social benefits of participation in sport for children and adolescents: informing development of a conceptual model of health through sport. *International Journal of Behavioral Nutrition and physical activity*, 10 (1): 1.
- Elgar, F., Roberts, C., Moore, L., et al (2005) Sedentary behaviour, physical activity and weight problems in adolescents in Wales. *Public Health*, 119 (6): 518-524.
- Ells, L. J., Roberts, K., McGowan, V. J., et al. (2015) *Sugar reduction: The evidence for Action. Annex 3: A mixed method review of behavior changes resulting from marketing strategies targeted at high sugar food and non-alcoholic drink*. Public Health England.
- Ells, L. J., Rees, K., Brown, T., et al. (2018) Interventions for treating children and adolescents with overweight and obesity: an overview of Cochrane reviews. *International Journal of Obesity*, 42: 1823-1833.
- El-Sayed, A., 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): e516-e534.
- El-Sayed, A. M., Scarborough, P. & Galea, S. (2012) Socioeconomic inequalities in childhood obesity in the United Kingdom: a systematic review of the literature. *Obesity Facts*, 5 (5): 671-692.
- Engström, A., Abildsnes, E. & Mildestvedt, T. (2016) “It’s not like a fat camp”—A focus group study of adolescents’ experiences on group-based obesity treatment. *International Journal of Qualitative Studies on Health and Well-being*, 11 (1): 32744.
- Erkelenz, N., Kobel, S., Kettner, S., et al. (2014) Parental activity as influence on childrens BMI percentiles and physical activity. *Journal of sports science & medicine*, 13 (3): 645.
- Estrade, M., Dick, S., Crawford, F., et al. (2014) A qualitative study of independent fast food vendors near secondary schools in disadvantaged Scottish neighbourhoods. *BMC Public Health*, 14 (1): 1-8.

Evans, C. E. & Cade, J. E. (2017) A cross-sectional assessment of food-and nutrient-based standards applied to British schoolchildren's packed lunches. *Public Health Nutrition*, 20 (3): 565-570.

Evans, E. H., Sainsbury, K., Kwasnicka, D., et al. (2018) Support needs of patients with obesity in primary care: a practice-list survey. *BMC Family Practice*, 19 (1): 6.

Farooqi, I. S., Keogh, J. M., Yeo, G. S., et al. (2003) Clinical spectrum of obesity and mutations in the melanocortin 4 receptor gene. *New England Journal of Medicine*, 348 (12): 1085-1095.

Farooqi, I. S. & O'Rahilly, S. (2007) Genetic factors in human obesity. *Obesity Reviews*, 8: 37-40.

Farsani, S.F., Van Der Aa, M. P., Van Der Vorst, M.M.J., et al. (2013) Global trends in the incidence and prevalence of type 2 diabetes in children and adolescents: a systematic review and evaluation of methodological approaches. *Diabetologia*, 56 (7): 1471-1488.

Fatima, Y., Doi, S. A. R. & Mamun, A. (2015) Longitudinal impact of sleep on overweight and obesity in children and adolescents: a systematic review and bias-adjusted meta-analysis. *Obesity Reviews*, 16 (2): 137-149.

Fenner, A. A., Straker, L. M., Davis, M. C., et al. (2013) Theoretical underpinnings of a need-supportive intervention to address sustained healthy lifestyle changes in overweight and obese adolescents. *Psychology of Sport and Exercise*, 14 (6): 819-829.

Foley, M. (2018) *FocusGroupIt* [online] Available at: <https://www.focusgroupit.com/> Last accessed: 20 February 2019.

Ford, A.I., Bergh, C., Södersten, P., et al. (2010a) Treatment of childhood obesity by retraining eating behaviour: randomised controlled trial. *BMJ*, 340: b5388.

Ford, A. L., Hunt, L. P., Cooper, A., et al. (2010b) What reduction in BMI SDS is required in obese adolescents to improve body composition and cardiometabolic health? *Archives of Disease in Childhood*, 95 (4): 256-261.

Fosbøl, M. Ø. & Zerahn, B. (2015) Contemporary methods of body composition measurement. *Clinical Physiology and Functional Imaging*, 35 (2): 81-97.

Fox, M. K., Dodd, A. H., Wilson, A., et al. (2009) Association between school food environment and practices and body mass index of US public school children. *Journal of the American Dietetic Association*, 109 (2): S108-S117.

- Fraser, L. K., Edwards, K. L., Cade, J., et al. (2010) The geography of fast food outlets: a review. *International Journal of Environmental Research and Public Health*, 7 (5): 2290-2308.
- Fraser, L., Edwards, K., Cade, J., et al. (2011) Fast food, other food choices and body mass index in teenagers in the United Kingdom (ALSPAC): a structural equation modelling approach. *International Journal of Obesity*, 35 (10): 1325-1330.
- Frederick, C. B., Snellman, K. & Putnam, R. D., 2014. Increasing socioeconomic disparities in adolescent obesity. *Proceedings of the National Academy of Sciences*, 111 (4): 1338-1342.
- Freedman, D. S., Mei, Z., Srinivasan, S. R., et al. (2007a) Cardiovascular Risk Factors and Excess Adiposity Among Overweight Children and Adolescents: The Bogalusa Heart Study. *The Journal of Pediatrics*, 150 (1): 12-17.
- Freedman, D. S., Kahn, H. S., Mei, Z., et al. (2007b) Relation of body mass index and waist-to-height ratio to cardiovascular disease risk factors in children and adolescents: the Bogalusa Heart Study. *The American Journal of Clinical Nutrition*, 86 (1): 33-40.
- Gardner, B., Smith, L., Lorencatto, F., et al. (2016) How to reduce sitting time? A review of behaviour change strategies used in sedentary behaviour reduction interventions among adults. *Health Psychology Review*, 10 (1): 89-112.
- Garip, G. & Yardley, L. (2011) A synthesis of qualitative research on overweight and obese people's views and experiences of weight management. *Clinical Obesity*, 1 (2-3): 110-126.
- Gatineau, M. & Dent, M. (2011) *Obesity and Mental Health*. Oxford: National Obesity Observatory.
- Gatineau, M. & Mathrani, S. (2011) *Obesity and Ethnicity*. Oxford: National Obesity Observatory.
- Germann, J. N., Kirschenbaum, D. S. & Rich, B. H. (2006a) Child and parental self-monitoring as determinants of success in the treatment of morbid obesity in low-income minority children. *Journal of Pediatric Psychology*, 32 (1): 111-121.
- Germann, J. N., Kirschenbaum, D. S. and Rich, B. H. (2006b) Use of an orientation session may help decrease attrition in a pediatric weight management program for low-income minority adolescents. *Journal of Clinical Psychology in Medical Settings*, 13 (2): 169-179.

- Giles, E. L., Robalino, S., Sniehotta, F. F., et al. (2015). Acceptability of financial incentives for encouraging uptake of healthy behaviours: A critical review using systematic methods. *Preventive Medicine, 73*: 145-158.
- Ginde, S. R., Geliebter, A., Rubiano, F., et al. (2005) Air displacement plethysmography: validation in overweight and obese subjects. *Obesity Research, 13* (7): 1232-1237.
- Given, L. M. ed. (2008) *The Sage encyclopedia of qualitative research methods*. Sage Publications.
- Glaser, B. G., Strauss, A. L. & Strutzel, E. (1968) The discovery of grounded theory; strategies for qualitative research. *Nursing Research, 17* (4): 364.
- Glaser, B., & Strauss, A. L. (2017) *Discovery of grounded theory: Strategies for qualitative research*. Routledge.
- Golley, R. K., Hendrie, G. A., Slater, A., et al. (2011) Interventions that involve parents to improve children's weight-related nutrition intake and activity patterns—what nutrition and activity targets and behaviour change techniques are associated with intervention effectiveness?. *Obesity Reviews, 12* (2): 114-130.
- Golubic, R., Ekelund, U., Wijndaele, K., et al. (2013) Rate of weight gain predicts change in physical activity levels: a longitudinal analysis of the EPIC-Norfolk cohort. *International Journal of Obesity, 37* (3): 404-409.
- Government Office for Science. (2007) *Tackling Obesities: Future Choices - Project Report*. 2<sup>nd</sup> ed. Government Office for Science.
- Gradisar, M., Wolfson, A. R., Harvey, A. G., et al. (2013) The sleep and technology use of Americans: findings from the National Sleep Foundation's 2011 Sleep in America poll. *Journal of Clinical Sleep Medicine, 9* (12): 1291-1299.
- Green, J. & Thorogood, N. (2014) *Qualitative Methods for Health Research*. 3rd ed. SAGE.
- Grossoehme, D, H. (2014) Research methodology overview of qualitative research. *Journal of Health Care Chaplain. 20* (3): 109-122.
- Guh, D. P., Zhang, W., Bansback, N., et al. (2009) The incidence of co-morbidities related to obesity and overweight: a systematic review and meta-analysis. *BMC Public Health, 9* (1): 1.
- Gundersen, C., Mahatmya, D., Garasky, S., et al. (2011) Linking psychosocial stressors and childhood obesity. *Obesity Reviews, 12* (5): e54-e63.

Guo, S. S. & Chumlea, W. C. (1999) Tracking of body mass index in children in relation to overweight in adulthood. *The American Journal of Clinical Nutrition*, 70 (1): 145s-148s.

Haines, L., Wan, K. C., Lynn, R., et al. (2007) Rising Incidence of Type 2 Diabetes in Children in the U.K. *Diabetes Care*, 30 (5): 1097-1101.

Haines, J., Rifas-Shiman, S. L., Horton, N. J., et al. (2016) Family functioning and quality of parent-adolescent relationship: cross-sectional associations with adolescent weight-related behaviors and weight status. *International Journal of Behavioral Nutrition and Physical Activity*, 13 (1): 68.

Hale, L. & Guan, S. (2015) Screen time and sleep among school-aged children and adolescents: A systematic literature review. *Sleep Medicine Reviews*, 21: 50-58.

Hammar, S. L., Woolley, J. & Campbell, V. (1971) Treating adolescent obesity. Long-range evaluation of previous therapy. *Clinical Pediatrics*, 10 (1): 46-52.

Hannes, K. (2011) *Critical Appraisal of Qualitative Research*. Cochrane Qualitative Research Methods Group.

Hansen, M., Janssen, I., Schiff, A., et al. (2005) The impact of school daily schedule on adolescent sleep. *Pediatrics*, 115 (6): 1555-1561.

Harriger, J. A. & Thompson, J. K. (2012) Psychological consequences of obesity: weight bias and body image in overweight and obese youth. *International Review of Psychiatry*, 24 (3): 247-253.

Hartmann-Boyce, J., Johns, D. J., Jebb, S. A., et al. (2014) Effect of behavioural techniques and delivery mode on effectiveness of weight management: systematic review, meta-analysis and meta-regression. *Obesity Reviews*, 15 (7): 598-609.

Haug, E., Torsheim, T., Sallis, J. F., et al. (2008) The characteristics of the outdoor school environment associated with physical activity. *Health Education Research*, 25 (2): 248-256..

He, M., Tucker, P., Gilliland, J., et al. (2012) The influence of local food environments on adolescents' food purchasing behaviors. *International Journal of Environmental Research and Public Health*, 9 (4): 1458-1471.

Heerman, W. J., Jaka, M. M., Berge, J. M., et al. (2017) The dose of behavioral interventions to prevent and treat childhood obesity: a systematic review and meta-regression. *International Journal of Behavioral Nutrition and Physical Activity*, 14 (1): 157.

Hemetek, U., Ernert, A., Wiegand, S., et al. (2015) Which factors affect weight maintenance? a qualitative study with adolescents and their parents who have completed a ten-months intervention. *Gesundheitswesen*, 77 (11): 888-894.

Hennessy, E., Hughes, S. O., Goldberg, J. P., et al. (2010) Parent-child interactions and objectively measured child PA: a cross-sectional study. *International Journal of Behavioral Nutrition and Physical Activity*, 7 (1): 1.

Hester, J. R., McKenna, J. & Gately, P. J. (2009) Obese young people's accounts of intervention impact. *Patient Education and Counseling*, 79 (3): 306-314.

HM Government. (2008) *Healthy Weight, Healthy Lives: A Cross-Government Strategy for England*. HM Government.

HM Government (2010) *Healthy Weight, Healthy Lives: Two Years on*. HM Government.

HM Government. (2011) *Healthy Lives, Healthy People: A Call to Action on Obesity in England*. HM Government.

HM Government. (2016) *Childhood Obesity. A Plan for Action*. HM Government

HM Government (2018). *Childhood Obesity: A Plan for Action. Chapter 2*. HM Government

Ho, M., Garnett, S.P., Baur, L., et al. (2012) Effectiveness of lifestyle interventions in child obesity: systematic review with meta-analysis. *Pediatrics*, 130 (6): e1647-e1671.

Hoffmann, T. C., Oxman, A. D., Ioannidis, J. P., et al. (2017) Enhancing the usability of systematic reviews by improving the consideration and description of interventions. *BMJ*, 358: j2998.

Hofsteenge, G. H., Weijs, P. J., Delemarre-van de Waal, H. A., et al. (2013) Effect of the Go4it multidisciplinary group treatment for obese adolescents on health related quality of life: a randomised controlled trial. *BMC Public Health*, 13 (1): 939.

Hollis, C., Falconer, C. J., Martin, J. L., et al. (2017) Annual Research Review: Digital health interventions for children and young people with mental health problems—a systematic and meta-review. *Journal of Child Psychology and Psychiatry*, 58 (4): 474-503.

Holt, N. L., Bewick, B. M. & Gately, P. J. (2005) Children's perceptions of attending a residential weight-loss camp in the UK. *Child: Care, Health & Development*, 31 (2): 223-231.

Howie, E. K., McManus, A., Smith, K. L., et al. (2016) Practical lessons learned from adolescent and parent experiences immediately and 12 months following a family-based healthy lifestyle intervention. *Childhood Obesity*, 12 (5): 401-409.

Hsieh, S. & Yoshinaga, H. (1995) Abdominal fat distribution and coronary heart disease risk factors in men-waist/height ratio as a simple and useful predictor. *International Journal of Obesity and Related Metabolic Disorders: Journal of the International Association for the Study of Obesity*, 19 (8): 585-589.

Hynynen, S. T., Van Stralen, M. M., Sniehotta, F. F. et al. (2016) A systematic review of school-based interventions targeting physical activity and sedentary behaviour among older adolescents. *International Review of Sport and Exercise Psychology*, 9 (1): 22-44.

Jackson, S. E., Beeken, R. J. & Wardle, J. (2015) Obesity, perceived weight discrimination, and psychological well-being in older adults in England. *Obesity*, 23 (5): 1105-1111.

Jago, R., Davison, K. K., Brockman, R., et al. (2011a) Parenting styles, parenting practices, and PA in 10-to 11-year olds. *Preventive medicine*, 52 (1): 44-47.

Jago, R., Davis, L., McNeill, J., et al. (2011b) Adolescent girls' and parents' views on recruiting and retaining girls into an after-school dance intervention: Implications for extra-curricular PA provision. *International Journal of Behavioral Nutrition and Physical Activity*, 8 (1): 91.

Jago, R., Stamatakis, E., Gama, A., et al. (2012) Parent and child screen-viewing time and home media Environment. *American Journal of Preventive Medicine*, 43 (2): 150-158.

James, W., Bailes, J., Davies, H., et al. (1978) Elevated metabolic rates in obesity. *The Lancet*, 311 (8074): 1122-1125.

Janssen, I. & LeBlanc, A. G. (2010) Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International Journal of Behavioral Nutrition and Physical Activity*, 7 (1), 40.

Jensen, M. D., Ryan, D. H., Apovian, C. V., et al. (2014) AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults: a Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and The Obesity Society. *Journal of the American College of Cardiology*, 63: 2985-3023.

Jerrett, M., McConnell, R., Chang, C. R., et al. (2010) Automobile traffic around the home and attained body mass index: a longitudinal cohort study of children aged 10–18 years. *Preventive Medicine*, 50: S50-S58.

Jiang, J., Xia, X., Greiner, T., et al. (2005) A two year family based behaviour treatment for obese children. *Archives of Disease in Childhood*, 90 (12): 1235-1238.

Jogova, M., Song, J. E. S., Campbell, A. C., et al. (2013) Process evaluation of the Living Green, Healthy and Thrifty (LiGHT) web-based child obesity management program: combining health promotion with ecology and economy. *Canadian Journal of Diabetes*, 37 (2): 72-81.

Johnson, R. E., Oyebode, O., Walker, S., et al. (2018) The difficult conversation: a qualitative evaluation of the 'Eat Well Move More' family weight management service. *BMC Research Notes*, 11 (1): 325

Jones, H., Melendez-Torres, G. J., Al-Khudairy, L. (2016) *What are the views of overweight and obese adolescents (12-17yrs) attending lifestyle treatment interventions: a qualitative systematic review.* [online] Available from: [http://www.crd.york.ac.uk/PROSPERO/display\\_record.php?ID=CRD42016039588](http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42016039588) (Accessed 28 January 2019).

Jones, H. M., Al-Khudairy, L., Melendez-Torres, G. J., et al. (2018) Viewpoints of adolescents with overweight and obesity attending lifestyle obesity treatment interventions: a qualitative systematic review. *Obesity Reviews*, 20 (1).

Kakinami, L., Barnett, T. A., Séguin, L., et al. (2015) Parenting style and obesity risk in children. *Preventive Medicine*, 75: 18-22.

Kelly, S. A. & Melnyk, B. M. (2008) Systematic review of multicomponent interventions with overweight middle adolescents: implications for clinical practice and research. *Worldviews on Evidence-Based Nursing*, 5 (3): 113-135.

Keynote (2015) *Fast-Food & Home-Delivery Outlets.* [online] Available from: <https://www.keynote.co.uk/market-report/food/fast-food-home-delivery-outlets> (Accessed 13 July 2016).

Kitscha, C. E., Brunet, K., Farmer, A., et al. (2009) Reasons for non-return to a pediatric weight management program. *Canadian Journal of Dietetic Practice and Research*, 70 (2): 89-94.

Klesges, L. M., Williams, N. A., Davis, K. S., et al. (2012) External validity reporting in behavioral treatment of childhood obesity: a systematic review. *American Journal of Preventive Medicine*, 42 (2): 185-192.

Kopelman, P. G., Caterson, I. D. & Dietz, W. H. (2010) *Clinical obesity in adults and children*. 3<sup>rd</sup> ed. Wiley-Blackwell.

Korstjens, I. & Moser, A. (2018) Series: Practical guidance to qualitative research. Part 4: Trustworthiness and publishing. *European Journal of General Practice*, 24 (1): 120-124.

Kriemler, S., Puder, J., Zahner, L., et al. (2010) Estimation of percentage body fat in 6-to 13-year-old children by skinfold thickness, body mass index and waist circumference. *British Journal of Nutrition*, 104 (10): 1565-1572.

Lachal, J., Orri, M., Speranza, M., et al. (2013) Qualitative studies among obese children and adolescents: a systematic review of the literature. *Obesity Reviews*, 14 (5): 351-368.

Lam, E., Partridge, S. R. & Allman-Farinelli, M. (2016) Strategies for successful recruitment of young adults to healthy lifestyle programmes for the prevention of weight gain: a systematic review. *Obesity Reviews*, 17 (2): 178-200.

Lee, C. M. Y., Huxley, R. R., Wildman, R. P., et al. (2008) Indices of abdominal obesity are better discriminators of cardiovascular risk factors than BMI: a meta-analysis. *Journal of Clinical Epidemiology*, 61 (7): 646-653.

Lenhart, C. M., Wiemken, A., Hanlon, A., et al. (2017) Perceived neighborhood safety related to physical activity but not recreational screen-based sedentary behavior in adolescents. *BMC Public Health*, 17 (1): 722.

Leung, L. (2015) Validity, reliability, and generalizability in qualitative research. *Journal of Family Medicine and Primary Care*. 4: (3): 324-327.

Lewin, S., Glenton, C., Munthe-Kaas, H., et al. (2015) Using qualitative evidence in decision making for health and social interventions: an approach to assess confidence in findings from qualitative evidence syntheses (GRADE-CERQual). *PLoS Medicine*, 12 (10): e1001895.

Li, J. & Siegrist, J. (2012) Physical activity and risk of cardiovascular disease—a meta-analysis of prospective cohort studies. *International Journal of Environmental Research and Public Health*, 9 (2): 391-407.

Li, X., Zhou, X. & Hesketh, T. (2016) Experiences and perspectives of children attending a weight loss camp in China: a qualitative study. *Child: Care, Health and Development*, 42 (5): 644-651.

Lijadi, A. A. & Van Schalkwyk, G. J. (2015) Online Facebook focus group research of hard-to-reach participants. *International Journal of Qualitative Methods*, 14 (5): 1609406915621383.

Lindson-Hawley, N., Thompson, T. P. & Begh, R. (2015) Motivational interviewing for smoking cessation. *Cochrane Database of Systematic Reviews*, (3).

Lo, K., Wong, M., Khalechelvam, P., et al. (2016) Waist-to-height ratio, body mass index and waist circumference for screening paediatric cardio-metabolic risk factors: a meta-analysis. *Obesity Reviews*, 17 (12): 1258-1275.

Loth, K.A., MacLehose, R.F., Fulkerson, J.A., et al. (2013) Food-related parenting practices and adolescent weight status: a population-based study. *Pediatrics*, 131 (5): e1443-e1450.

Lovasi, G. S., Hutson, M. A., Guerra, M., et al. (2009) Built environments and obesity in disadvantaged populations. *Epidemiologic Reviews*, 31 (1): 7-20.

Loveman, E., Al-Khudairy, L., Johnson, R. E., et al. (2015) Parent-only interventions for childhood overweight or obesity in children aged 5 to 11 years. *Cochrane Database of Systematic Reviews*, (12).

Lubans, D. R., Morgan, P. J., Aguiar, E. J., et al. (2011) Randomized controlled trial of the Physical Activity Leaders (PALs) program for adolescent boys from disadvantaged secondary schools. *Preventive Medicine*, 52 (3-4): 239-246.

Luna-Pech, J. A., Torres-Mendoza, B. M., Luna-Pech, J. A., et al. (2014) Normocaloric diet improves asthma-related quality of life in obese pubertal adolescents. *International Archives of Allergy & Immunology*, 163 (4): 252-258.

Luppino, F. S., de Wit, L. M., Bouvy, P. F., et al. (2010) Overweight, obesity, and depression a systematic review and meta-analysis of longitudinal studies. *Archives of General Psychiatry*, 67 (3): 220-229.

Luttikhuis, H. O., Baur, L., Jansen, H., et al. (2009) Interventions for treating obesity in children. *Cochrane Database of Systematic Reviews*.

Magkos, F., Fraterrigo, G., Yoshino, J., et al. (2016) Effects of moderate and subsequent progressive weight loss on metabolic function and adipose tissue biology in humans with obesity. *Cell Metabolism*, 23 (4): 591-601.

Marmot, M., Atinmo, T., Byers, T., et al. (2007) *Food, nutrition, physical activity, and the prevention of cancer: a global perspective*. World Cancer Research Fund/American Institute for Cancer Research.

Martin, S. B., Rhea, D. J., Greenleaf, C. A., et al. (2011) Weight control beliefs, body shape attitudes, and physical activity among adolescents. *Journal of School Health*, 81 (5): 244-250.

Martin, J., Chater, A. & Lorencatto, F. (2013). Effective behaviour change techniques in the prevention and management of childhood obesity. *International Journal of Obesity*, 37 (10): 1287.

McCrae, N., Gettings, S. & Pursell, E. (2017) Social media and depressive symptoms in childhood and adolescence: A systematic review. *Adolescent Research Review*, 2 (4): 315-330.

McLeroy, K. R., Bibeau, D., Steckler, A., et al. (1988) An ecological perspective on health promotion programs. *Health Education Quarterly*, 15 (4): 351-377.

Melendez-Torres, G. J., Sutcliffe, K., Burchett, H. E., et al. (2018) Weight Management Programmes: re-analysis of a systematic review to identify pathways to effectiveness. *Health expectations*.

Melnyk, B. M., Small, L., Morrison-Beedy, D., et al. (2007) The COPE Healthy Lifestyles TEEN program: feasibility, preliminary efficacy, & lessons learned from an after school group intervention with overweight adolescents. *Journal of Pediatric Health Care*, 21 (5): 315-322.

Menschik, D., Ahmed, S., Alexander, M. H., et al. (2008) Adolescent physical activities as predictors of young adult weight. *Archives of Pediatrics & Adolescent Medicine*, 162 (1): 29-33.

- Mérelle, S., Kleiboer, A., Miriam, M., (2017) Which health-related problems are associated with problematic video-gaming or social media use in adolescents?. *Clinical Neuropsychiatry: Journal of Treatments Evaluation*, 14 (1): 11-19.
- Michie, S., Abraham, C., Whittington, C., et al. (2009) Effective techniques in healthy eating and physical activity interventions: a meta-regression. *Health Psychology*, 28 (6): 690.
- Micklesfield, L. K., Goedecke, J. H., Punyanitya, M., et al. (2012) Dual-energy x-ray performs as well as clinical computed tomography for the measurement of visceral fat. *Obesity*, 20 (5): 1109-1114.
- Miller, B. M. & Brennan, L. (2015) Measuring and reporting attrition from obesity treatment programs: a call to action! *Obesity Research & Clinical Practice*, 9 (3): 187-202.
- Mohr, D. C., Schueller, S. M., Montague, E., et al. (2014) The behavioral intervention technology model: an integrated conceptual and technological framework for eHealth and mHealth interventions. *Journal of Medical Internet Rresearch*, 16 (6).
- Moore, C. J., Bell, L. K., Miller, J., et al., (2018) A systematic review of community-based interventions for the treatment of adolescents with overweight and obesity. *Obesity Reviews*, 19 (5): 698-715.
- Morinder, G., Marcus, C., Mattsson, E., et al. (2011) Adolescents' perceptions of obesity treatment -- an interview study. *Disability & Rehabilitation*, 33 (12): 999-1009.
- Morland, K., Roux, A. V. D. & Wing, S. (2006) Supermarkets, other food stores, and obesity: the atherosclerosis risk in communities study. *American Journal of Preventive Medicine*, 30 (4): 333-339.
- Morrissey, T. W., Jackowitz, A. & Vinopal, K. (2014) Local food prices and their associations with children's weight and food security. *Pediatrics*, peds-2013.
- Morrissey, J. L., Janz, K. F., Letuchy, E. M., et al. (2015) The effect of family and friend support on physical activity through adolescence: a longitudinal study. *International Journal of Behavioral Nutrition and Physical Activity*, 12 (1): 103.
- Morselli, L. L., Guyon, A. & Spiegel, K. (2012) Sleep and metabolic function. *Pflügers Archiv-European Journal of Physiology*, 463 (1): 139-160.

Munn, Z., Porritt, K., Lockwood, C., et al. (2014) Establishing confidence in the output of qualitative research synthesis: the ConQual approach. *BMC Medical Research Methodology*, 14 (1): 1-7.

Murawski, M. E., Milsom, V. A., Ross, K. M., et al. (2009) Problem solving, treatment adherence, and weight-loss outcome among women participating in lifestyle treatment for obesity. *Eating Behaviors*, 10 (3): 146-151.

Murray, M., Dordevic, A. L. & Bonham, M. P. (2017) Systematic review and meta-analysis: the impact of multicomponent weight management interventions on self-esteem in overweight and obese adolescents. *Journal of Pediatric Psychology*, 42 (4): 379-394.

Murray, M., Pearson, J. L., Dordevic, A. L., et al. (2019) The impact of multicomponent weight management interventions on quality of life in adolescents affected by overweight or obesity: a meta-analysis of randomized controlled trials. *Obesity Reviews*, 20 (2): 278-289.

Narang, I. & Mathew, J. L. (2012) Childhood obesity and obstructive sleep apnea. *Journal of Nutrition and Metabolism*, 2012.

National Sleep Foundation. (2016) *Sleep drive and your body clock*. [online] Available from: <https://sleepfoundation.org/sleep-topics/sleep-drive-and-your-body-clock> (Accessed 29 January 2019).

National Center for Health Statistics. (2017). *Sugar-sweetened Beverage Consumption Among U.S. Youth, 2011–2014*. [online] Available from: <https://www.cdc.gov/nchs/products/databriefs/db271.htm> (Accessed 28 January 2019).

National Center for Health Statistics. (2018) *Prevalence of overweight, obesity, and severe obesity among children and adolescents aged 2–19 years: United States, 1963–1965 Through 2015–2016*. Available from: [https://www.cdc.gov/nchs/data/hestat/obesity\\_child\\_15\\_16/obesity\\_child\\_15\\_16.htm](https://www.cdc.gov/nchs/data/hestat/obesity_child_15_16/obesity_child_15_16.htm) (Accessed 28 January 2019).

Ng, M., Fleming, T., Robinson, M., et al. (2014) Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*, 384 (9945): 766-781.

Nguyen, B., Shrewsbury, V., O'Connor, J., et al. (2012a) Twelve-month outcomes of the loozit randomized controlled trial: a community-based healthy lifestyle program for

overweight and obese adolescents. *Archives of Pediatrics & Adolescent Medicine*, 166 (2): 170-7.

Nguyen, B., McGregor, K. A., O'Connor, J., et al. (2012b) Recruitment challenges and recommendations for adolescent obesity trials. *Journal of Paediatrics and Child Health*, 48 (1): 38-43.

Nguyen, B., Lau, C., Steinbeck, K. S., et al. (2014) A process evaluation of an adolescent weight management intervention: findings and recommendations. *Health Promotion International*, 30 (2): 201-212.

NHS. (2016) Obesity. [online] Available from: <https://www.nhs.uk/conditions/obesity/> (Accessed 19 February 2019).

NHS Choices. (2015) *How much sleep do kids need?* [online] Available from: <http://www.nhs.uk/Livewell/Childrenssleep/Pages/howmuchsleep.aspx> (Accessed 28 January 2019).

NHS Digital. (2018a) *National Child Measurement Programme, England - 2017/18 School Year*. [online] Available from: <https://digital.nhs.uk/services/national-child-measurement-programme/> (Accessed 28 January 2019).

NHS Digital. (2018b) *Health Survey for England, 2017*. [online] Available from: <https://files.digital.nhs.uk/5B/B1297D/HSE%20report%20summary.pdf> (accessed 29 January 2019).

NHS Digital. (2018c) *Analysis of the representation of women across the hospital and community health services workforce*. [online] Available from: <https://digital.nhs.uk/data-and-information/find-data-and-publications/supplementary-information/2018-supplementary-information-files/analysis-of-the-representation-of-women-across-the-hospital-and-community-health-services-workforce> Accessed 20 January 2019.

NICE. (2013a) *Weight management: lifestyle services for overweight or obese children and young people*. [online] Available from: <https://www.nice.org.uk/guidance/ph47> Accessed 28 January 2019.

NICE. (2013b) *Costing report - Managing overweight and obesity among children and young people: lifestyle weight management services*. NICE

NICE. (2014a) *Obesity: identification, assessment and management*. [online] Available from: <https://www.nice.org.uk/guidance/cg189> (Accessed 28 January 2019).

- NICE. (2014b) *Weight management: lifestyle services for overweight or obese adults*. [online] Available from: [www.nice.org.uk/guidance/ph53](http://www.nice.org.uk/guidance/ph53) (Accessed 02/01/2019).
- NICE. (2015) *Preventing excess weight gain*. [online] Available from: [www/nice.org.uk/guidance/NG7](http://www.nice.org.uk/guidance/NG7) (Accessed 28 January 2019).
- NICE. (2019) *Nice pathway: Obesity management in children and young people*. [online] Available from: <https://pathways.nice.org.uk/pathways/obesity/obesity-management-in-children-and-young-people> (Accessed 28 January 2019).
- NICE Public Health Collaborating Centre – Physical activity. (2006) *Physical activity and the environment. Review one: Transport*. NICE.
- Noble, H. & Smith, J. (2015) Issues of validity and reliability in qualitative research. *Evidence Based Nursing*. 18 (2): 34-35.
- Nobles, J., Griffiths, C., Pringle, A., et al. (2016) Design programmes to maximise participant engagement: a predictive study of programme and participant characteristics associated with engagement in paediatric weight management. *International Journal of Behavioral Nutrition and Physical Activity*, 13 (1): 76.
- Nobles, J. D., Perez, A., Skelton, J. A., et al. (2018) The engagement pathway: A conceptual framework of engagement-related terms in weight management. *Obesity Research & Clinical Practice*, 12 (2): 133-138.
- Noblit, G. W. & Hare, R. D. (1988) *Meta-ethnography: Synthesizing qualitative studies*. Sage.
- Noreen, E. E. & Lemon, P. W. (2006) Reliability of air displacement plethysmography in a large, heterogeneous sample. *Medicine and Science in Sports and Exercise*, 38 (8): 1505.
- Norman, G., Huang, J., Davila, E. P., et al. (2016) Outcomes of a 1-year randomized controlled trial to evaluate a behavioral ‘stepped-down’ weight loss intervention for adolescent patients with obesity. *Pediatric Obesity*, 11 (1): 18-25.
- Noyes, J. & Lewin, S. (2011) Chapter 6: supplemental guidance on selecting a method of qualitative evidence synthesis, and integrating qualitative evidence with Cochrane intervention reviews. In: Noyes, J., Booth, A., Hannes, K., et al., (editors), *Supplementary guidance for inclusion of qualitative research in Cochrane systematic reviews of interventions*. Cochrane Collaboration Qualitative Methods Group.

- Noyes, J., Hendry, M., Booth, A., et al. (2016) Current use was established and Cochrane guidance on selection of social theories for systematic reviews of complex interventions was developed. *Journal of Clinical Epidemiology*, 75: 78-92.
- Nye, E., Melendez-Torres, G. J. & Bonell, C. (2016) Origins, methods and advances in qualitative meta-synthesis. *Review of Education*, 4 (1): 57-79.
- Office for National Statistics. (2018) *Ethnicity facts and figures*. [online] Available from: <https://www.ethnicity-facts-figures.service.gov.uk/british-population/demographics/age-groups/latest> (Accessed 11 February 2019).
- OECD. (2018) *Children & Young People's Mental Health in the Digital Age*. [online] Available from: <http://www.oecd.org/els/health-systems/Children-and-Young-People-Mental-Health-in-the-Digital-Age.pdf> (Accessed 19 February 2019).
- Ofcom. (2015) *The Communications Market Report*. [online] Available from: [https://www.ofcom.org.uk/\\_\\_data/assets/pdf\\_file/0022/20668/cmr\\_uk\\_2015.pdf](https://www.ofcom.org.uk/__data/assets/pdf_file/0022/20668/cmr_uk_2015.pdf) (Accessed 19 February 2019).
- Olander, E. K., Fletcher, H., Williams, S., et al. (2013) What are the most effective techniques in changing obese individuals' physical activity self-efficacy and behaviour: a systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, 10 (1): 29.
- Olds, T., Blunden, S., Petkov, J., et al. (2010) The relationships between sex, age, geography and time in bed in adolescents: a meta-analysis of data from 23 countries. *Sleep Medicine Reviews*, 14 (6): 371-378.
- Ohri-Vachaspati, P., DeLia, D., DeWeese, R. S., et al. (2015) The relative contribution of layers of the Social Ecological Model to childhood obesity. *Public Health Nutrition*, 18 (11): 2055-2066.
- O'Reilly, M. & Kiyimba, N. (2015) *Advanced Qualitative Research*. 1st ed. SAGE.
- Ouzzani, M., Hammady, H., Fedorowicz, Z., et al. (2016) Rayyan—a web and mobile app for systematic reviews. *Systematic Reviews*, 5 (1): 210.
- Owen, S. E., Sharp, D. J., Shield, J. P., et al. (2009) Childrens' and parents' views and experiences of attending a childhood obesity clinic: A qualitative study. *Primary Health Care Research and Development*, 10 (3): 236-244.

Oyebode, O. & Mindell, J. (2013) Use of data from the Health Survey for England in obesity policy making and monitoring. *Obesity Reviews*, 14 (6): 463-476.

Pagoto, S., Schneider, K., Jojic, M., et al. (2013) Evidence-based strategies in weight-loss mobile apps. *American Journal of Preventive Medicine*, 45 (5): 576-582.

Pakpour A, Gellert P, Dombrowski S, et al., (2015) Motivational interviewing with parents for obesity: an RCT. *Pediatrics*, 135 (3): e644-652.

Park, S., Sappenfield, W. M., Huang, Y., et al. (2010) The impact of the availability of school vending machines on eating behavior during lunch: the Youth PA and Nutrition Survey. *Journal of the American Dietetic Association*, 110 (10): 1532-1536.

Patsopoulou, A., Tsimtsiou, Z., Katsioulis, A., et al. (2017) Evaluating the efficacy of the feeding exercise randomized trial in overweight and obese adolescents. *Childhood Obesity*, 13 (2): 128-137.

Patton, G. C., Coffey, C., Carlin, J. B., et al. (2011) Overweight and obesity between adolescence and young adulthood: a 10-year prospective cohort study. *Journal of Adolescent Health*, 48 (3): 275-280.

Pbert, L., Druker, S., Gapinski, M., et al. (2013) A school nurse-delivered intervention for overweight and obese adolescents. *Journal of School Health*, 83 (3): 182-93.

Pearce, M. S., Salotti, J. A., Little, M. P., et al. (2012) Radiation exposure from CT scans in childhood and subsequent risk of leukaemia and brain tumours: a retrospective cohort study. *The Lancet*, 380 (9840): 499-505.

Pearson, E. S. (2012) Goal setting as a health behavior change strategy in overweight and obese adults: a systematic literature review examining intervention components. *Patient Education and Counseling*, 87 (1): 32-42.

Peeters, C., Marchand, H., Tulloch, H., et al. (2012) Perceived facilitators, barriers, and changes in a randomized exercise trial for obese youth: A qualitative inquiry. *Journal of Physical Activity and Health*, 9 (5): 650-660.

Petticrew, M. (2011). When are complex interventions 'complex'? When are simple interventions 'simple'? *European Journal of Public Health*. 21 (4): 397–398.

Peirson, L., Fitzpatrick-Lewis, D., Morrison, K., et al. (2015) Treatment of overweight and obesity in children and youth: a systematic review and meta-analysis. *CMAJ Open*, 3 (1): E35.

Pieters, D., De Valck, E., Vandekerckhove, M., et al. (2014) Effects of pre-sleep media use on sleep/wake patterns and daytime functioning among adolescents: the moderating role of parental control. *Behavioral Sleep Medicine*, 12 (6): 427-443.

Pont, S. J., Puhl, R., Cook, S. R., et al. (2017) Stigma experienced by children and adolescents with obesity. *Pediatrics*, 140 (6): e20173034.

Pope, C. & Mays, N. (2000) *Qualitative Research in Health Care*. BMJ Books.

Pope, C. & Mays, N. (2006) *Qualitative research in health care*. 3<sup>rd</sup> ed. Blackwell Publishing Ltd.

Popkin, B. M. & Slining, M. M. (2013) New dynamics in global obesity facing low- and middle-income countries. *Obesity Reviews*, 14: 11-20.

Prentice, A. (2007) Are defects in energy expenditure involved in the causation of obesity? *Obesity Reviews*, 8: 89-91.

Prentice, A. M., Black, A., Coward, W., et al. (1986) High levels of energy expenditure in obese women. *British Medical Journal (Clinical Research Ed.)*, 292 (6526): 983-987.

Prentice-Dunn, H. & Prentice-Dunn, S. (2012) Physical activity, sedentary behavior, and childhood obesity: A review of cross-sectional studies. *Psychology, Health & Medicine*, 17 (3): 255-273.

Prochaska, J.O. & Velicer, W.F. (1997). The transtheoretical model of health behavior change. *American Journal of Health Promotion*, 12 (1): 38-48.

Public Health England. (2014) *Child obesity and socioeconomic status data factsheet*. [online] Available from: [https://webarchive.nationalarchives.gov.uk/20160805123235/http://www.noo.org.uk/securefiles/160805\\_1340//ChildSocioeconomic\\_Aug2014\\_v2.pdf](https://webarchive.nationalarchives.gov.uk/20160805123235/http://www.noo.org.uk/securefiles/160805_1340//ChildSocioeconomic_Aug2014_v2.pdf) (Accessed 28 January 2019).

Public Health England. (2017) *Causes of obesity*. [online] Available from: [https://webarchive.nationalarchives.gov.uk/20170110170031/https://www.noo.org.uk/NOO\\_about\\_obesity/causes](https://webarchive.nationalarchives.gov.uk/20170110170031/https://www.noo.org.uk/NOO_about_obesity/causes) (Accessed 30 January 2019).

Public Health England. (2018a) *National Diet and Nutrition Survey. Results from Years 7 and 8 (combined) of the Rolling Programme (2014/2015 to 2015/2016)*. [online] Available from:

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/699241/NDNS\\_results\\_years\\_7\\_and\\_8.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/699241/NDNS_results_years_7_and_8.pdf) (Accessed 29 January 2019).

Public Health England. (2018b) *Wolverhampton: Local Authority Health Profile 2018*. [online] Available from: <https://fingertips.phe.org.uk/profile/health-profiles> (Accessed 20/01/2019).

Public Health England. (2018c) *Standard Evaluation Framework for Weight Management Interventions*. [online] Available from: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/685545/SEF\\_weight\\_management\\_interventions.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685545/SEF_weight_management_interventions.pdf) (Accessed 15 February 2019).

Rashidian, A., Shakibazadeh, E., Karimi-Shahanjarini, A., et al. (2013) Barriers and facilitators to the implementation of doctor-nurse substitution strategies in primary care: qualitative evidence synthesis (Protocol). *The Cochrane Library*.

Redfern, J. (2016) Summary of the evidence for the role of incentives in health-related behavior change: implications for addressing childhood obesity. *Annals of Public Health and Research*, 3 (3): 1042.

Reece, L. J., Bissell, P. & Copeland, R. J. (2016) 'I just don't want to get bullied anymore, then I can lead a normal life'; Insights into life as an obese adolescent and their views on obesity treatment. *Health Expectations*, 19 (4): 897-907.

Rees, R. W., Caird, J., Dickson, K., et al. (2014) 'It's on your conscience all the time': a systematic review of qualitative studies examining views on obesity among young people aged 12–18 years in the UK. *BMJ Open*, 4 (4): e004404.

Reichert, C. & Rubinson, C., (2014). *Kirq, version 2.1. 12* [Computer program]. Houston, TX: University of Houston-Downtown.

Richardson, C. E., Gradisar, M., Short, M. A., et al. (2017) Can exercise regulate the circadian system of adolescents? Novel implications for the treatment of delayed sleep-wake phase disorder. *Sleep Medicine Reviews*, 34: 122-129.

Riiser, K., Ommundsen, Y., Helseth, S., et al. (2013) Development and usability testing of an internet intervention to increase physical activity in overweight adolescents. *Journal of Medical Internet Research: Research Protocols*, 2 (1): e7.

- Riveros-McKay, F., Mistry, V., Bounds, R., et al. (2019) Genetic architecture of human thinness compared to severe obesity. *PLoS Genetics*, 15 (1): e1007603.
- Rosenheck, R. (2008) Fast food consumption and increased caloric intake: a systematic review of a trajectory towards weight gain and obesity risk. *Obesity Reviews*, 9 (6): 535-547.
- Royal College of Physicians. (2016) *Childhood obesity strategy: a missed opportunity*. [online] Available from: <https://www.rcplondon.ac.uk/news/childhood-obesity-strategy-missed-opportunity> (Accessed 19 February 2019).
- Rubinson, C. (2016) *A very brief guide to conducting QCA with Kirq*. [online] Available from: <http://grundrisse.org/qca/docs/kirqtut.html> (Accessed 29 January 2019).
- Rudolf, M., Christie, D., McElhone, S., et al. (2006) WATCH IT: a community based programme for obese children and adolescents. *Archives of Disease in Childhood*, 91 (9): 736-739.
- Ruotsalainen, H., Kyngäs, H., Tammelin, T., et al. (2015) Systematic review of physical activity and exercise interventions on body mass indices, subsequent physical activity and psychological symptoms in overweight and obese adolescents. *Journal of Advanced Nursing*, 71 (11): 2461-2477.
- Russell-Mayhew, S., McVey, G., Bardick, A., et al. (2012) Mental health, wellness, and childhood overweight/obesity. *Journal of Obesity*, 2012.
- Salvy, S. J., De La Haye, K., Bowker, J. C., et al. (2012) Influence of peers and friends on children's and adolescents' eating and activity behaviors. *Physiology & Behavior*, 106 (3): 369-378.
- Salvy, S. J. & Bowker, J. C. (2014) Peers and obesity during childhood and adolescence: a review of the empirical research on peers, eating, and physical activity. *Journal of Obesity & Weight Loss Therapy*, 4 (1).
- Samara, A., Ventura, E., Alfadda, A., et al. (2012) Use of MRI and CT for fat imaging in children and youth: what have we learned about obesity, fat distribution and metabolic disease risk? *Obesity Reviews*, 13 (8): 723-732.
- Samdal, G. B., Eide, G. E., Barth, T., et al. (2017) Effective behaviour change techniques for physical activity and healthy eating in overweight and obese adults; systematic review and

meta-regression analyses. *International Journal of Behavioral Nutrition and Physical Activity*, 14 (1): 42.

Savoie, M., Shaw, M., Dziura, J., et al. (2007) Effects of a weight management program on body composition and metabolic parameters in overweight children: a randomized controlled trial. *JAMA*, 297 (24): 2697-2704.

Savva, S. C., Lamnisos, D., Kafatos, A. G., et al. (2013) Predicting cardiometabolic risk: waist-to-height ratio or BMI. A meta-analysis. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, 6: 403-419.

Schneider, H. J., Friedrich, N., Klotsche, J., et al. (2010) The predictive value of different measures of obesity for incident cardiovascular events and mortality. *The Journal of Clinical Endocrinology & Metabolism*, 95 (4): 1777-1785.

Schranz, N., Tomkinson, G., Parletta, N., et al. (2014) Can resistance training change the strength, body composition and self-concept of overweight and obese adolescent males? A randomised controlled trial. *British Journal of Sports Medicine*, 48 (20):1482-1428.

Scientific Advisory Committee on Nutrition. (2015) *Carbohydrates and Health*. London: TSO.

Seers, K. & Toye, F. (2012) What is quality in qualitative health research? *Evidence-Based Nursing*, 15 (1).

Seers, K. (2015) Qualitative systematic reviews: their importance for our understanding of research relevant to pain. *British Journal of Pain*, 9 (1): 36-40.

Selvendran, S. S., Penney, N. C., Aggarwal, N., et al. (2018) Treatment of Obesity in Young People—a Systematic Review and Meta-analysis. *Obesity Surgery*, 28 (8): 2537-2549.

Semper, H. M., Povey, R. & Clark-Carter, D. (2016) A systematic review of the effectiveness of smartphone applications that encourage dietary self-regulatory strategies for weight loss in overweight and obese adults. *Obesity Reviews*, 17 (9): 895-906.

Shepherd, J., Kavanagh, J., Picot, J., et al. (2010) The effectiveness and cost-effectiveness of behavioural interventions for the prevention of sexually transmitted infections in young people aged 13-19: a systematic review and economic evaluation. *Health Technology Assessment*, 14 (7): 1-230.

- Simmonds, M., Llewellyn, A., Owen, C. G., et al. (2016) Predicting adult obesity from childhood obesity: a systematic review and meta-analysis. *Obesity Reviews*, 17 (2): 95-107.
- Skelton, J. & Beech, B. (2011) Attrition in paediatric weight management: a review of the literature and new directions. *Obesity Reviews*, 12 (5): e273–e281.
- Skelton, J. A., Irby, M. B., Beech, B. M., et al. (2012) Attrition and family participation in obesity treatment programs: clinicians' perceptions. *Academic Pediatrics*, 12 (5): 420-428.
- Skelton, J. A., Irby, M. B. & Geiger, A. M. (2014) A systematic review of satisfaction and pediatric obesity treatment: new avenues for addressing attrition. *Journal for Healthcare Quality*, 36 (4): 5-22.
- Skelton, J. A., Martin, S. & Irby, M. B. (2016) Satisfaction and attrition in paediatric weight management. *Clinical Obesity*, 6 (2): 143-153.
- Skinner, B. F. (1974). *About Behaviorism*. New York, Knopf.
- Slater, A. & Tiggemann, M. (2011) Gender differences in adolescent sport participation, teasing, self-objectification and body image concerns. *Journal of Adolescence*, 34 (3): 455-463.
- Small, C. J. & Bloom, S. R. (2004) Gut hormones and the control of appetite. *Trends in Endocrinology & Metabolism*, 15 (6): 259-263.
- Smith, D., Cummins, S., Clark, C. & Stansfeld, S. (2013) Does the local food environment around schools affect diet? Longitudinal associations in adolescents attending secondary schools in East London. *BMC Public Health*, 13 (1): 1.
- Smith, K. L., Kerr, D. A., Fenner, A. A. & Straker, L. M. (2014a) Adolescents just do not know what they want: a qualitative study to describe obese adolescents' experiences of text messaging to support behavior change maintenance post intervention. *Journal of Medical Internet Research*, 16 (4).
- Smith, K. L., Straker, L. M., McManus, A, et al. (2014b) Barriers and enablers for participation in healthy lifestyle programs by adolescents who are overweight: A qualitative study of the opinions of adolescents, their parents and community stakeholders. *BMC Pediatrics*, 14 (1): 53.

Spahn, J. M., Reeves, R. S., Keim, K. S., et al. (2010) State of the evidence regarding behavior change theories and strategies in nutrition counseling to facilitate health and food behavior change. *Journal of the American Dietetic Association*, 110 (6): 879-891.

Spruijt-Metz, D., Nguyen-Rodriguez, S. T. & Davis, J. N. (2010) Behavior, energy balance, and cancer: an overview. In: *Cancer and energy balance, epidemiology and overview*. Springer: 233-266.

Staiano, A. E., Abraham, A. A. & Calvert, S. L. (2012) Motivating effects of cooperative exergame play for overweight and obese adolescents. *Journal of Diabetes Science & Technology*, 6 (4): 812-819.

Staniford, L. J., Breckon, J. D., Copeland, R.J., et al. (2011) Key stakeholders' perspectives towards childhood obesity treatment: A qualitative study. *Journal of Child Health Care*, 15 (3): 230-44.

Stunkard, A. J., Foch, T. T. & Hrubec, Z. (1986) A twin study of human obesity. *JAMA*, 256 (1): 51-54.

Stokols, D. (1996) Translating social ecological theory into guidelines for community health promotion. *American Journal of Health Promotion*, 10 (4): 282-298.

Sturm, R. & Datar, A. (2005) Body mass index in elementary school children, metropolitan area food prices and food outlet density. *Public Health*, 119 (12): 1059-1068.

Sutcliffe, K., Richardson, M., Rees, R., et al. (2016) *What are the critical features of successful Tier 2 weight management programmes for adults? A systematic review to identify the programme characteristics, and combinations of characteristics, that are associated with successful weight loss*. London: EPPI-Centre, Social Science Research Unit, UCL Institute of Education, University College London.

Sutcliffe, K., Melendez-Torres, G. J., Burchett, H. E., et al. (2018) The importance of service-users' perspectives: A systematic review of qualitative evidence reveals overlooked critical features of weight management programmes. *Health Expectations*, 21: 563-573.

Sweeting, H. N. (2007) Measurement and definitions of obesity in childhood and adolescence: A field guide for the uninitiated. *Nutrition Journal*, 6 (1): 1-8.

Sørensen, T., Price, R. A., Stunkard, A. J., et al. (1989) Genetics of obesity in adult adoptees and their biological siblings. *BMJ*, 298 (6666): 87-90.

Tates, K., Zwaanswijk, M., Otten, R., et al. (2009) Online focus groups as a tool to collect data in hard-to-include populations: examples from paediatric oncology. *BMC Medical Research Methodology*, 9 (1): 15.

Tedstone, A., Targett, V. & Allen, R. (2015) *Sugar Reduction. The Evidence for Action*. Public Health England.

The Guardian (2016) *Childhood Obesity: UKs 'inexcusable' strategy is wasted opportunity, say experts*. [online] Available from: [www.theguardian.com/society/2016/aug/18/childhood-obesity-strategy-wasted-opportunity-campaigners](http://www.theguardian.com/society/2016/aug/18/childhood-obesity-strategy-wasted-opportunity-campaigners) (Accessed 29 January 2019).

Thomas, J. & Harden, A. (2008) Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Medical Research Methodology*, 8 (1): 1-10.

Thomas, J., O'Mara-Eves, A. & Brunton, G. (2014a) Using qualitative comparative analysis (QCA) in systematic reviews of complex interventions: a worked example. *Systematic Reviews*, 3 (1): 1.

Thomas, J. G., Bond, D. S., Phelan, S., et al. (2014b) Weight-loss maintenance for 10 years in the National Weight Control Registry. *American Journal of Preventive Medicine*, 46 (1): 17-23.

Townsend, N., Wickramasinghe, K., Williams, J., et al. (2015) *Physical Activity Statistics 2015*. London: British Heart Foundation.

Turner, T., Spruijt-Metz, D., Wen, C. F., et al. (2015) Prevention and treatment of pediatric obesity using mobile and wireless technologies: a systematic review. *Pediatric Obesity*, 10 (6): 403-409.

Twiddy, M., Wilson, I., Bryant, M., et al. (2012) Lessons learned from a family-focused weight management intervention for obese and overweight children. *Public Health Nutrition*, 15 (7): 1310-1317.

Ul-Haq, Z., Mackay, D. F., Fenwick, E., et al. (2013) Meta-analysis of the association between body mass index and health-related quality of life among adults, assessed by the SF-36. *Obesity*, 21 (3): E322-E327.

Van Achterberg, T., Huisman-de Waal, G. G., Ketelaar, N. A., et al. (2010) How to promote healthy behaviours in patients? An overview of evidence for behaviour change techniques. *Health Promotion International*, 26 (2): 148-162.

- Van Der Horst, K., Oenema, A., Ferreira, I., et al. (2007) A systematic review of environmental correlates of obesity-related dietary behaviors in youth. *Health Education Research*, 22 (2): 203-226.
- Van Egmond-Frohlich, A., Brauer, W., Goldschmidt, H., et al. (2006) Effects of a programme for structured outpatient follow-up care after inpatient rehabilitation of obese children and adolescents - a multicentre, randomized study. *Rehabilitation*, 45 (1): 40-51.
- Vanderwall, C., Eickhoff, J., Clark, R.R., et al. (2018) BMI z-score in obese children is a poor predictor of adiposity changes over time. *BMC Pediatrics*, 18 (1): 187.
- Van Jaarsveld, C. H. M. & Gulliford, M. C. (2015) Childhood obesity trends from primary care electronic health records in England between 1994 and 2013: population-based cohort study. *Archives of Disease in Childhood*, 100 (3).
- Vannucci, A., Flannery, K. M. & Ohannessian, C. M. (2017) Social media use and anxiety in emerging adults. *Journal of Affective Disorders*, 207: 163-166.
- Veitch, J., Carver, A., Abbott, G., et al. (2015) How active are people in metropolitan parks? An observational study of park visitation in Australia. *BMC Public Health*, 15 (1): 1.
- Veitch, J., Salmon, J., Parker, K., et al. (2016) Adolescents' ratings of features of parks that encourage park visitation and physical activity. *International Journal of Behavioral Nutrition and Physical Activity*, 13 (1): 1.
- Viner, R. M., Kinra, S., Nicholls, D., et al. (2018) Burden of child and adolescent obesity on health services in England. *Archives of disease in childhood*, 103 (3): 247-254.
- Visuthranukul, C., Sirimongkol, P., Prachansuwan, A., et al. (2015) Low-glycemic index diet may improve insulin sensitivity in obese children. *Pediatric Research*, 78 (5): 567-573.
- Vos, R., Wit, J., Pijl, H., et al. (2011) The effect of family-based multidisciplinary cognitive behavioral treatment in children with obesity: study protocol for a randomized controlled trial. *Trials*, 12 (1): 110.
- Wan, C. S., Ward, L. C., Halim, J., et al. (2014) Bioelectrical impedance analysis to estimate body composition, and change in adiposity, in overweight and obese adolescents: comparison with dual-energy x-ray absorptiometry. *BMC Pediatrics*, 14 (1): 1.

- Wang, Y. & Lim, H. (2012) The global childhood obesity epidemic and the association between socio-economic status and childhood obesity. *International Review of Psychiatry*, 24 (3): 176-188.
- Wang, Y., Cai, L., Wu, Y., et al. (2015) What childhood obesity prevention programmes work? A systematic review and meta-analysis. *Obesity Reviews*, 16 (7): 547-565.
- Waterlander, W. E., de Boer, M. R., Schuit, A. J., et al. (2013) Price discounts significantly enhance fruit and vegetable purchases when combined with nutrition education: a randomized controlled supermarket trial. *The American Journal of Clinical Nutrition*, 97 (4): 886-895.
- Waters, E., de Silva-Sanigorski, A., Burford, B. J., et al. (2011) Interventions for preventing obesity in children. *Cochrane Database of Systematic Reviews*.
- Watson, L. A., Baker, M. C. & Chadwick, P. M. (2016) Kids just wanna have fun: Children's experiences of a WMP. *British Journal of Health Psychology*, 21 (2): 407-420.
- Watts, A. W., Lovato, C. Y., Barr, S. I., et al. (2015) A qualitative study exploring how school and community environments shape the food choices of adolescents with overweight/obesity. *Appetite*, 95: 360-367.
- Wells, J. C., Williams, J. E., Chomtho, S., et al. (2012) Body-composition reference data for simple and reference techniques and a 4-component model: a new UK reference child. *The American Journal of Clinical Nutrition*, 96 (6): 1316-1326.
- Wengle, J, Hamilton, J., Manlhiot, C., et al. (2011) The 'Golden Keys' to health—a healthy lifestyle intervention with randomized individual mentorship for overweight and obesity in adolescents. *Paediatrics & Child Health*, 16 (8): 473-478.
- Wohlfahrt-Veje, C., Tinggaard, J., Winther, K., et al. (2014) Body fat throughout childhood in 2647 healthy Danish children: agreement of BMI, waist circumference, skinfolds with dual X-ray absorptiometry. *European Journal of Clinical Nutrition*, 68 (6): 664-670.
- Wolfson, A. R. & Carskadon, M. A. (1998) Sleep schedules and daytime functioning in adolescents. *Child Development*, 69 (4): 875-887.
- Woods, H. C. & Scott, H. (2016) # Sleepyteens: Social media use in adolescence is associated with poor sleep quality, anxiety, depression and low self-esteem. *Journal of Adolescence*, 51: 41-49.

Woolford, S. J., Clark, S. J., Strecher, V. J., et al. (2010) Tailored mobile phone text messages as an adjunct to obesity treatment for adolescents. *Journal of Telemedicine and Telecare*, 16 (8): 458-461.

Woolford, S. J., Khan, S., Barr, K. L. C., et al. (2012a) A picture may be worth a thousand texts: Obese adolescents' perspectives on a modified photovoice activity to aid weight loss. *Childhood Obesity*, 8 (3): 230-236.

Woolford, S. J., Sallinen, B. J., Schaffer, S., et al. (2012b) Eat, play, love: Adolescent and parent perceptions of the components of a multidisciplinary weight management program. *Clinical Pediatrics*, 51 (7): 678-684.

World Health Organization. (2016a) *Obesity and Overweight*. [online] Available from: <http://www.who.int/mediacentre/factsheets/fs311/en/> (Accessed 29 January 2019).

World Health Organization. (2016b) *Adolescent development*. [online] Available from: [http://www.who.int/maternal\\_child\\_adolescent/topics/adolescence/dev/en/](http://www.who.int/maternal_child_adolescent/topics/adolescence/dev/en/) (Accessed 29 January 2019)

World Health Organization. (2018) *Noncommunicable diseases*. [online] Available from: <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases> (Accessed 10 February 2019)

Wu, Y., Zhang, D. & Kang, S. (2013) Physical activity and risk of breast cancer: a meta-analysis of prospective studies. *Breast Cancer Research and Treatment*, 137 (3): 869-882.

Zahra, J., Ford, T. & Jodrell, D. (2014) Cross-sectional survey of daily junk food consumption, irregular eating, mental and physical health and parenting style of British secondary school children. *Child: Care, Health and Development*, 40 (4): 481-491.

Appendix 1 Phase three: Research ethics approval from BSREC



WARWICK  
THE UNIVERSITY OF WARWICK

PRIVATE  
Miss Helen Jones  
WMS  
University of Warwick  
Coventry  
CV4 7AL

1 June 2018

Dear Miss Jones

**Study Title and BSREC Reference:** *Understanding how best to support overweight and obese adolescents to achieve a healthy weight: an exploration of adolescent and stakeholder views in Wolverhampton* REGO-2018-2149 AM01

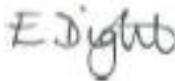
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Thank you for submitting the revisions to a substantial amendment application for the above-named project to the University of Warwick's Biomedical and Scientific Research Ethics Sub-Committee.

I am pleased to confirm that the changes that you wish to make to this study have been approved.

Please keep a copy of the signed version of this letter with your study documentation.

Yours sincerely

pp. 

Dr David Ellard  
Chair  
Biomedical and Scientific  
Research Ethics Sub-Committee

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## Appendix 2 Phase one: Viewpoints of adolescents with overweight and obesity attending lifestyle obesity treatment interventions: a qualitative systematic review

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**Key words:** Obese, adolescent, qualitative systematic review, thematic synthesis, intervention, CERQual.

**Running title:** Adolescent views of obesity interventions

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**Potential conflicts of interest:** The authors have no conflicts of interest to declare.

## ABSTRACT

**Background:** Current UK guidance recommends that adolescents with obesity attend a family-based multi-component obesity intervention. However, these programmes suffer from low recruitment and high rates of attrition. Understanding the views of adolescents is necessary for developing future interventions. The aim of this systematic review was to synthesise and explore the views of adolescents who have attended an obesity intervention.

**Methods:** Published literature was identified by searching six databases. Studies of adolescents (12-17 years) who attended an obesity intervention were examined. Only studies that collected and analysed data qualitatively were included. Full-texts were analysed using thematic synthesis.

**Results:** Twenty-eight studies were included. Thirty-five analytical themes were developed that were broadly divided into seven domains. Key themes included ensuring adolescents receive a 'tailored intervention' that involves 'active engagement'. Support from professionals, family and peers was valued highly. Adolescents expressed 'prior fears of attending interventions' and wanted 'longer-term support'. 'Enjoyment of sport and physical activity' was evident and adolescents were strongly motivated by improving body image and social desirability.

**Discussion:** Considering the views of adolescents attending obesity interventions may help to inform policy makers in the development of future interventions. This may lead to an improvement in recruitment and attrition rates.

## INTRODUCTION

Obesity is widely observed as a significant public health issue. A third of children in England are affected by overweight or obesity (1). Worldwide, the prevalence of children (2-19 years) with overweight or obesity has increased by 47.1% between 1980 and 2013 (2). The World Health Organization classifies adolescence as the stage in growth and development occurring between the ages of 10 to 19 (3). Adolescence is a stage where progression of obesity is likely (4). Observational studies highlight the rising prevalence of type 2 diabetes in adolescents with obesity and cardiovascular risk factors such as hypertension and hyperlipidaemia (5, 6). In addition to cardiovascular risk factors, sleep apnoea is thought to occur in 60% of children affected by obesity globally (7). Obesity during adolescence is also associated with psychosocial consequences such as low self-esteem, self-worth and

bullying (8-10). This is especially concerning as a recent systematic review showed 80% of adolescents with obesity remain affected by obesity into adulthood where both these physical and psychosocial factors persist (11, 12). The current recommendations in England and Wales are for adolescents with obesity to attend a family-based multi-component weight management service (13). Multi-component refers to programmes that focus on a combination of healthy eating, physical activity and behaviour change. Cochrane reviews have shown that lifestyle programmes can be effective in reducing adiposity (14-16). However, due to the quantitative nature of these reviews, we do not know why these programmes are effective or why they only successfully recruit between 0.5 and 1.5% of the eligible population (17). For those children that do attend obesity interventions attrition ranges from 8-83% (18, 19). This is of concern, as increased participation is associated with more successful outcomes (20). By learning from adolescents that have attended these interventions, improvements can be made that may help reduce attrition and improve recruitment rates, and therefore weight management. Qualitative research can give a more in-depth understanding of participant perception (21) and has a central role to play in evidence-based health care. A qualitative approach can help to address questions that cannot be answered quantitatively, such as identifying obstacles to change and what is important for the participant (22). A synthesis of qualitative research focusing on the experiences of adults attending weight management interventions has been completed (23), however, systematic reviews that help us decide how to treat obesity in adolescents is limited. While adolescent experiences, along with child, parent and professional views of child and adolescent obesity have been synthesised (24, 25), this is the first to solely examine adolescent views of weight management interventions. This review aims to examine the viewpoints of adolescents with obesity who have attended a weight management intervention in studies that present qualitative data.

## **METHODS**

The protocol for this qualitative systematic review has been registered with PROSPERO (CRD42016039588) (26).

### **Search strategy**

Published literature was identified primarily by searching MEDLINE, Embase, PsycINFO, ASSIA, CINAHL and Web of Science. The date of the final search was July 2018. Relevant systematic reviews, key journals and reference lists of included studies were manually screened. A specialist librarian was consulted to refine the search. Search terms for the

primary database search included concepts for obesity, views, adolescents, diet, activity and behaviour. A pilot search was carried out to identify any adjustments. Search terms were adapted to different databases accordingly. There was no limit on language or year of study (Table S1).

### **Inclusion criteria**

(i) Studies must have used qualitative methods for data collection and analyses (these may have been presented alongside quantitative outcomes), (ii) included adolescents with overweight and obesity participating in lifestyle interventions with the primary aim of treating obesity, (iii) mean age of 12-17 years at time of the study commencing (to align with the age range used in the Cochrane childhood obesity treatment review series), (iv) Single or multi-component lifestyle interventions, in any setting, any method of delivery, e.g. group, (v) full text articles only.

### **Exclusion criteria**

(i) Children under 12 years or adults over 18 years, (ii) adolescents who were a healthy weight (>2<sup>nd</sup> to <85<sup>th</sup> percentile), pregnant or breastfeeding, (iii). Interventions aiming to treat adolescents with a medical cause for obesity (E.g. Prader Willi syndrome), (iv) conference abstracts. Three exclusion criteria were not originally set out in the protocol but added later: (v) adolescents with an eating disorder, (vi) adolescents with severe long-term mental health conditions, e.g. schizophrenia, (vii) studies where participants had not experienced an actual programme as it was felt that views of what adolescents think they want from an intervention may be different if they have actually attended an intervention. Exclusion criteria (vi) and (vii) were set because these groups may require more specialist intervention.

### **Study selection, data extraction and quality assessment**

Screening of titles and abstracts was carried out by two reviewers (HMJ, LA-K, GJMT, OO) independently following a pre-defined screening form. For formal inclusion/exclusion, full texts were retrieved for potentially relevant papers then evaluated by two independent reviewers (HMJ, LA-K, GJMT, OO) following a pre-defined form. Disagreements were resolved by a third reviewer. Data extraction was carried out by two independent reviewers (HMJ, LA-K, OO) following a pre-defined form. Disagreements were resolved through discussion. Criteria developed by the Evidence for Policy and Practice Information and Coordinating Centre (EPPI-Centre) for reviews of school-based interventions was

used for quality assessment (Table S2) (27, 28). This tool was chosen as it assessed the extent to which the study privileged adolescent experiences. This tool also assessed the strength of sampling, data collection and analysis, whether the findings were supported by data, as well as breadth and depth of findings. Studies were rated as low, medium or high in terms of trustworthiness and reliability of findings. Studies were also rated low, medium or high in terms of usefulness for this review. Two reviewers assessed quality independently (HMJ, LA-K, OO). Any disagreements were resolved through discussion.

### **Assessment of confidence in the review findings**

The Confidence in the Evidence from Reviews of Qualitative research (CERQual) approach was utilised to summarise the confidence in the findings across studies (29). CERQual assesses confidence in the evidence, based on four key components: methodological limitations of included studies, relevance of the included studies to the review question, coherence of the review finding, and adequacy of the data contributing to a review finding. After assessing each of the four components, overall confidence of findings, in this case analytical themes, was judged as high, moderate, low or very low by one reviewer (HMJ) and audited by a second reviewer (GJMT).

### **Synthesis**

Data were analysed using thematic synthesis as described by Thomas and Harden (30). NVivo version 11 was used. Thematic synthesis took the form of three stages: line-by-line coding, development of descriptive themes and development of analytical themes. Qualitative memos were written by one reviewer (HMJ) throughout the synthesis to record thoughts, reflect on the process and articulate interesting observations. Thematic synthesis was completed by one reviewer (HMJ) and all results were audited by another (GJMT).

## **RESULTS**

### **Study characteristics**

24,395 records were screened (title and abstract), with 297 full texts evaluated for formal inclusion/exclusion. Twenty-eight studies (29 records) were then included in the qualitative synthesis (See figure 1). The included studies represent views of 735 adolescent, 662 of which were identifiable by gender (41.0% male, 58.9% female). Nine studies were from the UK, eight from the USA, four from Australia, four from Europe, two from Canada and one from China. Twenty-four of the studies were multi-component

interventions (8, 31-53). Three studies were single-component physical activity interventions (54-56) and one was a single-component dietary intervention (57). Seven studies had a technology element to the intervention (e.g. web-based, text or email support, photos, exergame) (49-53, 55, 56). Features of interventions, including direct provision of physical activity or a peer element are shown in Table 1.

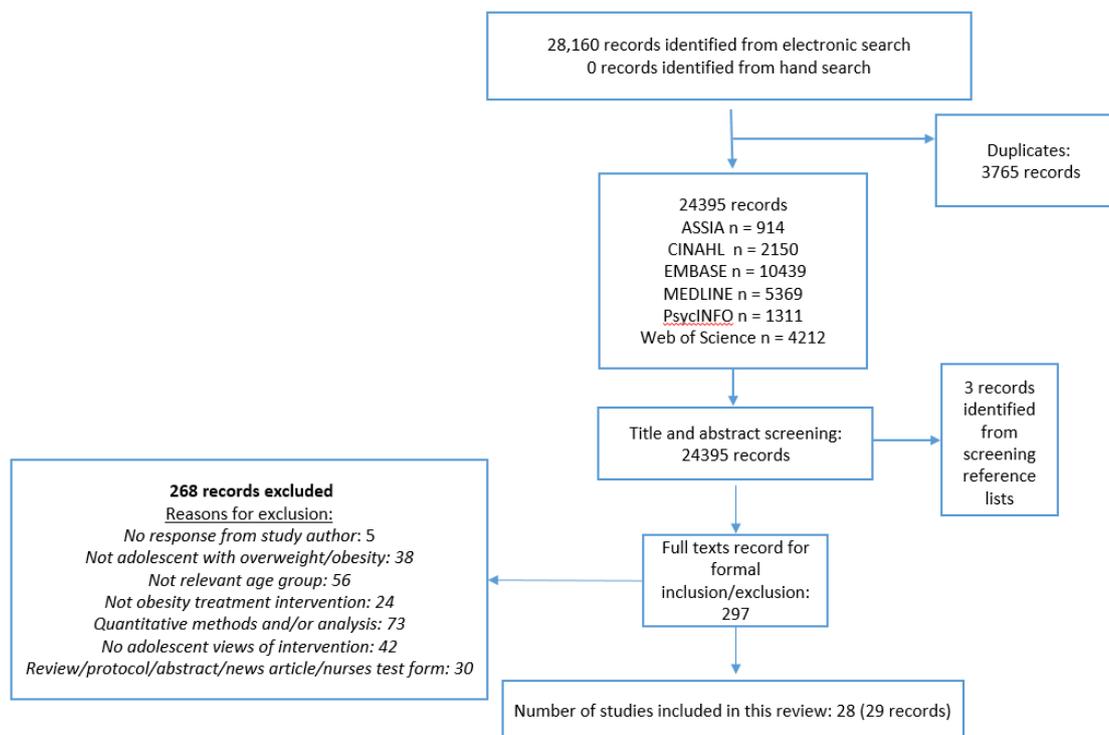


Figure 1 COREQ flow diagram of search results

### Quality assessment and assessment of confidence

In terms of trustworthiness and reliability, 11 studies were of high quality, 13 demonstrated medium quality and four demonstrated low quality. In terms of usefulness for this review, 12 studies were rated high, eight medium and eight low (Table S2). Sensitivity analysis was performed individually for study contribution (how many included studies contributed to each of the seven domains (see below)) and study quality. Sensitivity analysis results were then combined to report the order of domains from most to least sensitive, in terms of quality and contribution. For CerQual, 19 of the analytical themes were assessed to be of high certainty. Fourteen findings were assessed to be of moderate certainty and two of the findings were assessed to be of low certainty (Table S3).

Table 1. Characteristics of included studies

Author (Date)	Aims	Features	Country	Population	Data collection methods	Data analysis methods
<b>Alm (2008)</b> (43)	To examine the reasons for managing weight, to investigate the barriers and facilitators to achieving behaviour goals, and assess how a behaviour coach affects the goal-setting process of inner-city adolescents with obesity in a weight management program	MC	USA	Adolescents with overweight/obesity (n=18) Male: 6, female: 12. Mean age: 14.9 years	Semi-structured telephone interviews	Constant comparative method
<b>Banks (2014)</b> (42)	To examine families' reasons for engaging with, or disengaging from, a child weight management clinic	MC, G	UK	Adolescents with overweight (n = 17) 11-16 years old Completers' and withdrawers	Semi-structured interviews	Analysed thematically.
<b>Campbell-Voytal (2018)</b> (47)	1) To describe the perspectives of African American adolescents and caregivers on participating in an evidence-based weight loss trial; 2) Explore experiential differences of adolescents-caregiver dyads who achieved adolescent weight loss compared to those who did not	MC	USA	Adolescents with Obesity (n=136) Male: 42, Female: 94. Mean age: 13	Semi-structured interviews	Content and thematic analysis
<b>Daley (2008)</b> (54)	To explore the experiences of participants who were randomised to an exercise therapy intervention	S, PA	UK	Adolescents with overweight (n=25) Male: 9, Female: 16. Mean age: 13 years	Semi-structured interviews	Thematic approach
<b>Engström (2016)</b> (46)	To explore adolescents' and young adults' motivation for attending group-based obesity treatment and social and environmental	MC, PA, G	Norway	Adolescents with obesity (n=14) Male: 7, Female: 7 Age: 13-17 years	Focus group interviews	Systematic text condensation (method for

	factors that can facilitate or hinder lifestyle change.					thematic cross-case analysis)
<b>Hammar (1971)</b> (57)	Which method of treatment for obesity (dietary, counselling or group) resulted in the best weight loss over time. Also, to evaluate clinic experience	S, G	USA	Young people with overweight/obesity (n= 65) Male:17, female: 48. Mean age 14.8 years)	Questionnaires. Additional face-to-face meeting or telephone inquiry with a clinic nurse if necessary	Frequency counts and statements
<b>Hemetek (2015)</b> (41)	To optimise therapy measures in the treatment of children and adolescents with obesity	MC, PA, G	Germany	Adolescents with overweight (n=7) Male: 4, Female: 3 Mean age: 14.6 years	Interviews	Qualitative context analysis
<b>Hester (2009)</b> (33)	To uncover qualitative accounts of intervention impact from young people with obesity after attending a residential weight-loss camp	MC, PA, G	UK	Adolescents with overweight (n=5) Male: 3, Female: 2. 14-16 years old.	Semi-structured interviews	Inductive analysis.
<b>Holt (2005)</b> (38)	Examined children's perceptions of attending a residential paediatric weight-loss camp	MC, PA, G	UK	Adolescents with overweight (n= 15) Male: 9, Female: 6 Mean age: 13.65 years	Semi-structured interviews	Micro-analysis and constant comparative method.
<b>Howie (2016)</b> (45)	To identify practical strategies for practitioners implementing interventions in community settings by exploring experiences of adolescents with overweight or obesity	MC, PA, G	Australia	Adolescents with overweight/obesity (n=37) Age: 12-16 years	Qualitative interviews and focus groups	Thematic analysis
<b>Jogova (2013)</b> (49)	A process evaluation of the Living Green, Healthy and Thrifty (LiGHT) program: a novel virtual child obesity management program	MC	Canada	Adolescents with overweight/obesity (n = 28)	Semi-structured interviews, focus group and survey	Thematic analysis for post intervention groups

				Male: 14, female: 14 Mean age: 14.3 years	with open-ended questions	
<b>Li (2016)</b> (48)	To investigate the operations of a weight loss camp for children in China and to explore the experiences and perceptions of children in relation to these camps	MC, PA, G	China	Adolescents with overweight/obesity (n=119) (2 participants were a 'normal' weight) Male: 9, Female:10 Mean age: 12.4 years	Ethnographic techniques (field observation) and semi-structured interviews	Thematic analysis
<b>Melnyk (2007)</b> (39)	a) Determine feasibility of implementing the interventions b) obtain feedback c) examine the preliminary efficacy of the programme on the adolescents' weight	MC, PA, G	USA	Adolescents with overweight/obesity (n=23) Male: 19, female: 4 Mean age 15.9 years	Questionnaire (including open-ended)	Not stated
<b>Morinder (2011)</b> (36)	To describe adolescents' perceptions of obesity treatment.	MC, PA, G	Sweden	Adolescents with obesity (n = 18) Male: 6, female: 12. Mean age: 15 years	Semi-structured interviews	Phenomonographic approach
<b>Nguyen (2014)</b> (50)	1) Report findings from the process evaluation of the Loozit programme including adolescent perception of the programme 2) provide recommendations for future trials	MC, PA, G	Australia	Adolescents with overweight/obesity (n=14) Mean age: 14.1 years	Evaluation forms and telephone interviews	Qualitative items identified and coded

<b>Owen (2009)</b> (44)	To explore childrens' and parents' views and experiences of attending a hospital-based childhood obesity clinic	MC	UK	Children with obesity (n = 11) Male: 5, female: 6. Age: 5-18 years	Interviews	Thematic analysis
<b>Peeters (2012)</b> (27)	To investigate adolescents' experiences during their participation in the HEARTY RCT	MC, PA, G	Canada	Adolescents with overweight/obesity (n= 44) Male: 23, female: 21 Mean age: 16.7 years	Semi-structured telephone interview	Content analysis
<b>Reece (2015)</b> (8)	To explore the adolescent experience of living with obesity and their engagement with obesity treatments	MC, PA, G	UK	Adolescents with overweight/obesity (n = 12) Male: 4, female: 8. 11-16-year olds	Interviews and focus groups	Framework method
<b>Riiser (2013)</b> (55)	To describe the process of development and evaluation of usability of a web-based program for increasing physical activity in adolescents who are overweight	S,	Norway	Adolescents with overweight/obesity (n = 15) 12-16-year olds	Observation, questionnaire and focus group	Content analysis
<b>Rudolf (2006)</b> (32)	To ascertain if the programme was successfully implemented, impact on children and their families and the outcome on the health of the young people involved	MC, PA, G	UK	Adolescents with overweight/obesity (n=20) Male: 14, female: 6 Mean age: 12.2 years	Semi-structures interviews & focus groups	framework analysis
<b>Smith (2014a)</b> (47)	To explore the opinions of adolescents who are overweight and their parents regarding the use of text messages support during the	MC, PA, G	Australia	Adolescents with overweight/obesity (n = 12)	Focus groups	Thematic analysis

	maintenance period following an intervention			Male: 1, female: 11 Mean age 14.3 years		
<b>Smith (2014b)</b> (53)	To identify key individual, family and community enablers/barriers to the implementation of a multi-disciplinary family-centred intervention for adolescents who are overweight	MC, PA, G	Australia	Adolescents with overweight/obesity (n = 44) Male: 21, female: 23 12-16 years old	Focus groups and interviews	Thematic analysis
<b>Staiano (2012)</b> (56)	To investigate effects of cooperative versus competitive exergame play during an intervention with youth with overweight or obesity	S, PA, G	USA	Adolescents with overweight/obesity (n = 31) Male: 16, female: 15. Mean age: 16.2 years Also asked drop outs reasons for withdrawing	Individual interviews	Thematic analysis
<b>Twiddy (2011)</b> (35)	The aim of the present qualitative study was to explore the views of the key stakeholders involved in child weight management programme	MC, PA, G	UK	Children with overweight/obesity (n= 23) Male: 13, female: 10 9-18-year olds (15 were 12- 18 years old) Range of completers and drop outs	Semi-structured interviews & focus groups	Template analysis

<b>Watson (2016)</b> (34)	To explore children's accounts of their experiences of MEND	MC, PA, G	UK	Adolescents with overweight/obesity (n = 14) Male: 8, female: 6. Mean age: 12.6 years	Semi structured interviews	Interpretative Phenomenological Analysis (IPA)
<b>Woolford (2010)</b> (45)	Test the feasibility and acceptability of a computerised system to send tailored messages to the mobile phones of adolescents with obesity enrolled in a weight management programme	MC, PA, G	USA	Adolescents with obesity (n = 20) Male: 13, female: 17 Mean age: 14 years	Survey and semi-structures interview	Unclear
<b>Woolford (2012a)</b> (52)	Explore the Photovoice method to improve engagement and retention among adolescents with obesity enrolled in an intensive weight management program	MC, PA, G	USA	Adolescents with obesity (n = 23) Male: 5, female: 18 Mean age: 14 years	Photovoice and semi-structured interviews	Thematic analysis
<b>Woolford (2012b)</b> (40)	To explore participants' perceptions of the MPOWER program	MC, PA, G	USA	Adolescents with overweight/obesity (n = 25) Male: 4, female: 21 12-18-year olds	Semi-structured phone interviews	Thematic analysis

\*G = Group programme with peer element. PA = Direct provision of physical activity. MC = Multi-component programme. S = Single component intervention.

## **Adolescent views**

Analysis resulted in 184 descriptive codes, which led onto the development of 35 analytical themes. Analytical themes have been broadly divided into seven domains: intervention content, support, barriers to attending a weight management programme and being healthy, physical activity vs diet, motivations, maintenance and technology. A network diagram of all domains and analytical themes is shown in Figure S5. Representative quotes for each theme can be seen in Table S4.

## **Summary of the findings**

This review identified key themes which included ensuring adolescents receive a ‘tailored intervention’ that involves ‘active engagement’. Additionally, support from professionals, family and peers was valued highly. Adolescents expressed ‘prior fears of attending interventions’ and wanted ‘longer-term support’. ‘Enjoyment of sport and physical activity’ was evident and adolescents were strongly motivated to lose weight to improve body image and social desirability. Adolescents enjoy using technology as part of an intervention.

The most salient themes within each domain are presented below. Section 2.1 examines findings on intervention content, section 2.2 explores the importance of supportive relationships whilst section 2.3 highlights the barriers adolescents face not only with attending weight management interventions, but being healthy. Section 2.4 explores the importance of incorporating both physical activity and diet education into an intervention and section 2.5 identifies the motivations behind adolescents attending interventions. The difficulty of maintaining weight loss after an intervention has finished is detailed in section 2.6 and adolescents use of technology is examined in section 2.7.

## **Intervention content**

Themes that relate to intervention content will now be discussed:

### *Tailored intervention*

One factor that appears to be very important when planning and delivering an adolescent weight management programme is tailoring it to the individual, including different ethnicities, cultures, and to the specific age group (8, 36, 38, 40, 42, 49, 51-53, 56). In a study that described adolescent’s experiences of text message support through the maintenance period of an intervention (53), no consensus was found that suggested

adolescents preferred a specific time to receive text messages, or how often, highlighting the need for individual tailoring. Adolescents reported that they wanted to attend an intervention that was created with their age group in mind. Often interventions were designed for wider age ranges (E.g. 8-16 years). There was a strong feeling of lack of services aimed at adolescents (8, 42). One study involved home visits for adolescents and their families taking part in an intervention (40). This opportunity for tailored advice in the home environment received positive feedback.

### *Active engagement*

Enjoyment and fun are of large importance to adolescents when attending an obesity intervention (34, 40, 45). This sense of fun appears to be driven by hands on activities. Active engagement and fun has been highlighted in depth by Watson et al., (34) regarding exercise and classroom-based learning of healthy eating. The importance of ensuring active engagement rather than passive is an important theme to recognise in intervention content. Fun seemed an important aspect to reduce anxiety among participants attending an intervention. This sense of fun created an environment where it did not seem that learning was taking place; sessions were effortless and flowed.

### **Support**

Data from this synthesis highlights the importance of social support in adolescents being successful with their weight loss attempts, from professionals, family and peers:

#### *Professional support valued*

This prominent domain of support is weighted in favour of professional support, with 15 included studies supporting this theme. Professional support appears to be valued more so than support coming from peers and family (8, 31-33, 35, 36, 38, 40, 43, 44, 48, 50, 54, 55, 57). The friendly and fun nature of this supportive relationship was particularly welcomed by adolescents who appreciated professionals encouraging attitude towards them (38, 43). Adolescents appeared to value being given personal attention by professionals. The feeling of finally being given the support they have needed and having someone to talk to (36). This appreciation appears to be emphasised when that professional is experienced and specialises in childhood obesity (36). Adolescents felt comforted by this; it gave them a sense that they were not the only one who was overweight. A non-forceful approach from professionals was appreciated and adolescents

valued gentle encouragement (35, 38). Additionally, adolescents valued receiving support that focused on more than just weight loss, such as self-esteem and well-being (36, 57). Negative comments about professional support were to do with the absence of a more personal relationship, leading to feelings of neglect and frustration, which in turn can lead to the adolescent defying all recommendations. There was a general desire from adolescents to work more closely with regular professionals, whether this be an individual professional or a team, to develop this deeper and more meaningful relationship (36).

#### *Importance of family support*

Another avenue of support that appears to be valued highly by adolescents was their own family (8, 31, 33, 34, 36, 37, 39, 40, 43, 45-49, 51). Family support gave adolescents continued motivation and encouragement to continue with their weight loss attempts (31). Adolescents particularly found family supportive when they joined in with behaviour change efforts and valued the effect this had on bringing the family closer together (39, 43). Themes from this synthesis clearly show that family support can assist in providing a positive framework for behaviour change and providing important encouragement to make healthier choices. This encouragement appears to be coming more from the mother within families, highlighting this important family figure. Although adolescents benefited from positive family support, sometimes lack of knowledge from a parent around weight management, healthy eating and behaviour change caused a barrier to weight loss for the adolescent (33, 43). This lack of family support appeared more common in those adolescents reporting no success. The absence of understanding and knowledge from family members can lead to frustration, despair and can create a sense of self-blaming.

#### *Peer support valued*

Adolescents also valued support from their peers (8, 31, 33, 34, 36-40, 43, 46, 48, 49, 51, 53, 56, 57). Adolescents described being around their peers as a security blanket, allowing them to feel comfortable and confident (34). This peer support gave adolescents with obesity a sense of belonging by allowing them to talk to adolescents in a similar position to them, sharing their struggles and issues. This feeling of acceptance is something they may not have experienced outside of the intervention (38, 40). Adolescents commented on their initial motivations for taking part that related to peer support and socialising. Adolescents took part to make friends outside of school and improve their social skills (36 and 44). Peer support was often mentioned in relation to exercise, with adolescents enjoying exercising with other adolescents (31) and engaging in competitive activities (31,

34).

### **Barriers to attending a weight management programme and being healthy**

This synthesis identified many barriers to engagement with weight management programmes and successful outcomes:

#### *Prior fears of attending interventions*

Adolescents from seven of the included studies reported prior fears of attending an intervention (32, 33, 37, 38, 40, 46, 54). Many of these worries related to the intensity of weight loss activities, type of food on offer or incorrect preconceptions. These preconceptions stem from the interventions not being portrayed as fun, something that has been described earlier in the theme 'active engagement' as an important element. Also, some adolescents had prior worries about being bullied, group dynamics and not being accepted (38). Additional worries related to previous negative experiences with health professionals and not having someone to attend with, reiterating the importance of family and/or peer support (32, 37).

#### *Obesity treatment bringing about feelings of failure, guilt and shame*

Adolescents commented on being fearful of being told off by a health professional for not losing weight and feeling like a failure (36, 43). These feelings would lead to adolescents not continuing with the intervention, which led to feelings of guilt and shame. Attending obesity interventions also appeared to bring out a greater focus on weight, which in turn could lead to lower self-esteem (36, 42). These negative feelings can also be seen after an intervention when there is a struggle with weight loss maintenance (33). Longer-term support that considers the mental health of adolescents is needed when planning interventions.

### **Physical activity vs. Diet**

Physical activity was well received and several themes developed in this section. Although physical activity was spoken about more often than the diet element of interventions, adolescents did speak positively about their experiences of learning to eat healthily:

#### *Enjoyment from learning to eat healthily*

Adolescents from three multi-component interventions (33, 39, 45) highlighted the benefits of understanding the nutritional content of different foods and drinks as well as giving them a better awareness of what foods should be eaten in moderation. Additionally, adolescents appeared to prefer healthy eating related activities that were more practical and hands-on (40). These visual activities seemed to engage adolescents more than tasks that involved lots of writing. The element of having more practical and interactive activities is discussed in more detail previously within the theme 'active engagement'.

#### *Enjoyment of sports and physical activity*

Most adolescents commented on their enjoyment of taking part in exercise (31, 33, 38, 40, 41, 43, 44-46, 50, 51, 54). Again, fun was an important element. Many adolescents enjoyed being able to use a gym facility (31), whilst others commented on their enjoyment of sports and other activities such as cycling and basketball (51). Adolescents commented on how physical activity made them feel, both physically and mentally, which created that sense of accomplishment.

#### **Motivations**

It is important to try to understand what motivates adolescents to take part in obesity interventions to improve attrition and recruitment rates:

#### *Weight loss as primary motivation*

Understanding adolescent's primary motivations for taking part in an intervention is vital to improve engagement. Adolescents from nine out of the 24 included studies commented on weight loss being their primary goal for taking part in an intervention (31, 33, 35, 36, 38, 43, 50, 54, 57). Although not the primary reason for motivating weight loss, some adolescents were driven to lose weight to prevent health sequelae (36, 43). In some cases, being aware of preventing health sequelae was due to having family members with a health condition (43).

#### *Being a healthy weight as 'normal' and socially desirable*

Many adolescents viewed being a healthy weight as 'normal' and held this as the key to being accepted socially (8, 31, 33, 35, 38, 41, 43, 54). Normality, from the point of view of an adolescent in these studies suggested having a boyfriend and the ability to socialise and play with friends (8, 41, 43). As well as seeing weight loss as the key to social desirability, some adolescents felt that losing weight would reduce the bullying they

received, which would lead to a normal and happy life (8, 38).

#### *Adolescents recognising personal responsibility and personal motivation for weight loss*

Adolescents highlighted a strong personal drive that motivated their weight loss (8, 31, 35, 36, 41, 43, 44, 51); this was often initiated through experiencing a 'light bulb' moment (36). Sometimes this came from reminders of past negative experiences or not wanting to be overweight like other family members (51). This personal drive appeared also in part due to adolescents realising their own responsibility in losing weight and following a healthy lifestyle. This is contradictory to another finding within this review where adolescents appreciated a prescriptive and regulated diet and exercise routine set by a professional (41,57) (See Table S4 & Figure S5). Nonetheless, more data supported the use of concise and practical messages throughout interventions (36, 53, 54). Adolescents liked gaining evidence-based knowledge, bringing the responsibility back to the individual. Adolescents spoke of a desire to lose weight to feel proud, which motivated their weight loss and personal drive (44).

#### **Maintenance**

Adolescents often spoke about their struggles with continuing and maintaining weight loss efforts after an intervention had finished:

#### *Transferring skills learnt into a home environment and routine*

Many adolescents commented on their struggles with adjusting to and transferring newly learnt skills and knowledge into everyday life (8, 33, 36, 38-41, 43, 48). With many interventions taking place in a clinical or artificial setting and with professional support being more regular, the transition from an intense intervention back to a normal routine can be difficult. Adolescents also commented on the challenge of changing their eating habits for the longer term, the need for these eating habits to be engrained into normal everyday life. A sense that weight loss or weight loss maintenance was something that you must continually work at and the frustration surrounding this. Other adolescents found the transition from intervention into real life easier and felt that they had learnt and remembered valuable skills and knowledge that could be carried out in a home environment (33).

#### *Longer-term support*

Several studies included in this synthesis noted comments from adolescents suggesting that they would have benefited from more sessions as part of an intervention and post

intervention (8, 31, 33, 36, 39-41, 43, 45, 48, 50, 54). Feedback from five interventions that lasted six to eight weeks all suggested that these programmes were too short (8, 39, 41, 50, 54). Another study that provided support after a multi-component intervention (41) found that those participants that had been successful in losing weight through the initial programme found the additional post-intervention sessions positive. However, those that were unsuccessful felt the follow-on sessions lacked physical activity opportunities and did not motivate participants. Adolescents did express their concerns and worries about maintaining their weight loss after an intervention (33). This may be due to their recognition of the challenge of losing weight as well as their recognition of individual responsibility (8, 33). Adolescents commented on their struggles with lacking motivation after an intervention had finished and relapsing back into old habits due to the amount of focus required post-intervention (33, 41). Some adolescents commented on the support they received from professionals and family members post-intervention, both positively and negatively (31, 33). For some, continued support from professionals was helpful (33), whilst for others, over time, in terms of taking part in physical activity, was less important (31). Adolescents felt that physical activity was lacking in the school environment (43). Improving physical activity opportunities within schools will help to provide longer-term support for adolescents with overweight and obesity. The importance of family support in the maintenance period is also important, but this appeared to decrease over time (31).

### **Technology**

Seven studies contained data that related to the use of technology in an intervention (49-53, 55, 56). Technology in this instance, included telephone and electronic communication, web and online programmes, exergames and photography. Three themes emerged within this domain:

#### *Adolescents enjoy using technology and do so with ease*

Most studies using technology suggested that adolescents enjoyed their use (49-52, 55, 56). Through observations and semi-structured telephone interviews, most adolescents gave the impression of using certain technologies, such as exergames, internet and taking photographs, with ease.

## **DISCUSSION**

### **Situating within the wider literature**

Adolescents described a clear desire for professional and peer support. These avenues of support were also identified in a systematic review of qualitative evidence that investigated components valued by adult weight management service users (58). Having support from family members was also important to adolescents and has been highlighted as important to younger children as well in a review of lifestyle weight management programmes (59). There is some discrepancy in what adolescents say they want from an intervention. Although support from professional, family and peers was discussed frequently, adolescents also placed great emphasis on their personal responsibility for achieving a healthy weight; identified previously in a qualitative systematic review on adolescent's general experiences of obesity (25). However, adolescents in this review have also stated preferences for receiving concise and prescriptive advice, which draws away from that personal responsibility. Additionally, the inflexible nature of a prescriptive diet and exercise plan will make the transition period into the home after an intervention has finished more difficult, a finding that this review has highlighted. Finding the correct balance between personal responsibility and prescription is key. This concurs with the findings from a review of overweight adult's views who also noted this tension between dependence on the programme and autonomy (23). Active engagement was valued highly by adolescents in this review, when learning about both healthy eating and physical activity. Similar views have been shown in younger children, who prefer practical and interactive experiences, rather than receiving didactic information (59). Understanding adolescent motivations towards weight loss and attending interventions is important for initial engagement and improving attrition. Most adolescents included in this review were primarily motivated by weight loss rather than health improvements. This review recognised that a heavy focus on weight loss could lead to lower self-esteem, perhaps due to this emphasis on personal responsibility. Adolescents described feelings of failure and guilt when their desired weight loss was not achieved; when designing interventions, it is important to find a balance between weight loss, health and psychosocial outcomes. The impact of weight management on adolescent's mental health long-term is important. Approaches that offer more than health education to adolescents and their families, is important. Motivations for weight loss stemmed mostly from a social point of view. Adolescents felt that being a healthy weight was more desirable socially, and would lead to increased confidence, more friends and less bullying. This is supported by another review which examined adolescent's views of obesity (25) that emphasised social consequences related

to body size. There was wide variation in dose among interventions included in this review. This wide variation has been highlighted in a review that aimed to understand the link between dose and outcome (60). Only one study in this review (39) explored the length of individual sessions highlighting a need for improved reporting and exploration of intervention dose.

### **Strengths and limitations**

This is the first qualitative systematic review, of which the researchers are aware, that synthesises views of adolescents attending obesity interventions. There is growing recognition of the value of qualitative research, the synthesis of which can be used to inform policy and practice. This review included studies from eight developed countries (Table 1). Nine studies were UK based, giving a strong basis of generalisability to the UK at a time when there is an urgent need for targeted, evidence-based interventions for older children. As with all reviews, some relevant literature may have been missed. However, a sensitive and broad search of bibliographic databases was completed, supplemented by hand searching reference lists, relevant systematic reviews and key journals. This synthesis is further enhanced by having two reviewers involved at the initial screen, full-text screen, data extraction and quality assessment stages. There were no limits on language reducing potential reviewing bias. Authors of potentially relevant studies were also contacted for clarity on inclusion criteria. Thematic synthesis was conducted by the first reviewer; all findings were discussed with a second reviewer. A limitation is that conference abstracts were not included, however these usually have limited data. Additionally, only four of the 28 included studies attempted to involve participants that had withdrawn from an intervention (35, 38, 42, 44). Therefore, this review may be over represented with the views of adolescents that had positive experiences of obesity interventions. Even when attempts were made to recruit withdrawers, those with negative experiences of an obesity intervention would have been less likely to engage.

### **Implications for research**

More research is needed to investigate the views of adolescents that have not engaged with, or withdrawn from, obesity interventions. Additionally, primary studies need to be clearer when reporting on intervention dose, to enable more research into the most appropriate dose of obesity intervention for adolescents.

## **Implications for practice**

Ensuring that an initial assessment opportunity is given to adolescents may reduce their prior fears of attending by managing expectations. Although widely recognised that a multi-component intervention is the most evidence-based approach (13, 14) for child obesity interventions, this review highlighted the importance of exercise. Allowing adolescents an opportunity to try new and varied activities in a non-forceful manner may help to improve uptake and attrition rates. Obesity interventions should involve the whole family in certain elements, whilst allowing adolescents to create bonds with peers, offering an alternative avenue of support. Professionals should be on hand to provide valuable tailored advice, both health and mental well-being, in a structured and non-judgmental way that also allows autonomy to develop post intervention. Interventions may benefit from focusing on psychosocial elements of weight loss to improve maintenance and attrition rates. Offering longer-term support is essential; incorporating an element of technology into interventions may aid this.

## **CONCLUSION**

This review gives a strong argument for ensuring adolescents views are listened to when planning obesity interventions. Incorporating the views of adolescents from many individual studies resulted in a comprehensive overview of potentially pertinent factors. Findings may inform local and national policy makers in the development of future interventions for adolescents with obesity. Developing interventions with adolescent views in mind may improve recruitment and attrition rates.

### **Authors contributions:**

HMJ designed the protocol, designed and ran the searches; HMJ, LA-K, OO and GJMT performed the initial screening and screening of full-text articles; HMJ, LA-K, OO extracted data and performed quality assessment; HMJ synthesised extracted data and performed CERQual, both were audited by GJMT. HMJ wrote the first draft of the manuscript; LA-K, OO and GJMT reviewed the manuscript.

### **Supporting information:**

Supporting Information: Table S1 – Example of search on MEDLINE

Supporting Information: Table S2 – Quality assessment of included studies using criteria developed by the EPPI-Centre

Supporting Information: Table S3 – CERQual Evidence Profile

Supporting Information: Table S4 – Representative quotes

Supporting Information: Figure S5 - Network diagram showing domains and analytical themes

## REFERENCES

1. Van Jaarsveld CHM, Gulliford MC. Childhood obesity trends from primary care electronic health records in England between 1994 and 2013: population-based cohort study. *Arch Dis Child* 2015.
2. Ng M, Fleming T, Robinson M, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2014;**384**(9945):766-81.
3. World Health Organization. Adolescent development 2016 [12/10/2016]. Available from: [http://www.who.int/maternal\\_child\\_adolescent/topics/adolescence/dev/en/](http://www.who.int/maternal_child_adolescent/topics/adolescence/dev/en/).
4. Patton GC, Coffey C, Carlin JB, et al. Overweight and Obesity Between Adolescence and Young Adulthood: A 10-year Prospective Cohort Study. *J Adolesc Health*. 2011;**48**(3):275-80.
5. Freedman DS, Mei Z, Srinivasan SR, Berenson GS, Dietz WH. Cardiovascular Risk Factors and Excess Adiposity Among Overweight Children and Adolescents: The Bogalusa Heart Study. *J Pediatr*. 2007;**150**(1):12-7.e2.
6. Haines L, Wan KC, Lynn R, Barrett TG, Shield JPH. Rising Incidence of Type 2 Diabetes in Children in the U.K. *Diabetes Care*. 2007;**30**(5):1097-101.
7. Narang I, Mathew JL. Childhood obesity and obstructive sleep apnea. *J Nutr Metab*. 2012;**2012**.
8. Reece LJ, Bissell P, Copeland RJ. 'I just don't want to get bullied anymore, then I can lead a normal life'; Insights into life as an obese adolescent and their views on obesity treatment. *Health Expectations*. 2016;**19**(4):897-907.
9. Curtis P. The experiences of young people with obesity in secondary school: some implications for the healthy school agenda. *Health Soc Care Community*. 2008;**16**.
10. Martin SB, Rhea DJ, Greenleaf CA, Judd DE, Chambliss HO. Weight control beliefs, body shape attitudes, and physical activity among adolescents. *J Sch Health*. 2011;**81**(5):244-50.
11. Fenner AA, Straker LM, Davis MC, Hagger MS. Theoretical underpinnings of a need-supportive intervention to address sustained healthy lifestyle changes in overweight and obese adolescents. *J Sport Exerc Psychol*. 2013;**14**(6):819-29.
12. Simmonds M, Llewellyn A, Owen CG, Woolacott N. Predicting adult obesity from childhood obesity: a systematic review and meta-analysis. *Obes Rev*. 2016;**17**(2):95-107.
13. NICE. Weight management: lifestyle services for overweight or obese children and young people. 2013 PH47.
14. Al-Khudairy L, Loveman E, Colquitt JL, et al. Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years. *Cochrane Database Syst Rev*. 2017(6).
15. Waters E, de Silva-Sanigorski A, Hall BJ, et al. Interventions for preventing obesity in children. *Cochrane Database Syst Rev*. 2011;**12**(00).
16. Luttikhuis HO, Baur L, Jansen H, et al. Interventions for Treating Obesity in Children (Cochrane Review). *Cochrane Database Syst Rev*. 2009.

17. NICE. Costing report. Managing overweight and obesity among children and young people: lifestyle weight management services. 2013 [13/10/2016]. Available from: <https://www.nice.org.uk/guidance/ph47/resources/costing-report-69149341>.
18. Dhaliwal J, Nosworthy NM, Holt NL, et al. Attrition and the management of pediatric obesity: an integrative review. *Child Obes*. 2014;**10**(6):461-73.
19. Skelton J, Beech B. Attrition in paediatric weight management: a review of the literature and new directions. *Obes Rev*. 2011;**12**(5):e273-e81.
20. Miller BM, Brennan L. Measuring and reporting attrition from obesity treatment programs: A call to action! *Obes Res Clin Pract*. 2015;**9**(3):187-202.
21. Butler A, Hall H, Copnell B. A Guide to Writing a Qualitative Systematic Review Protocol to Enhance Evidence-Based Practice in Nursing and Health Care. *Worldviews Evid Based Nurs*. 2016.
22. Munn Z, Porritt K, Lockwood C, Aromataris E, Pearson A. Establishing confidence in the output of qualitative research synthesis: the ConQual approach. *BMC Med Res Methodol*. 2014;**14**(1):1-7.
23. Garip G, Yardley L. A synthesis of qualitative research on overweight and obese people's views and experiences of weight management. *Clin Obes*. 2011;**1**(2-3):110-26.
24. Lachal J, Orri M, Speranza M, et al. Qualitative studies among obese children and adolescents: a systematic review of the literature. *Obes Rev*. 2013;**14**(5):351-68.
25. Rees RW, Caird J, Dickson K, Vigurs C, Thomas J. 'It's on your conscience all the time': a systematic review of qualitative studies examining views on obesity among young people aged 12–18 years in the UK. *BMJ Open*. 2014;**4**(4).
26. Jones H, Melendez-Torres GJ, Al-Khudairy L, Oyebode L. What are the views of overweight and obese adolescents (12-17yrs) attending lifestyle treatment interventions: a qualitative systematic review: PROSPERO 2016:CRD42016039588; 2016 [16/10/2016]. Available from: [http://www.crd.york.ac.uk/PROSPERO\\_REBRANDING/display\\_record.asp?ID=CRD42016039588](http://www.crd.york.ac.uk/PROSPERO_REBRANDING/display_record.asp?ID=CRD42016039588).
27. Bonell C, Farah J, Harden A, et al. Systematic review of the effects of schools and school environment interventions on health: evidence mapping and synthesis. *Public Health Research*. 2013;**1**(1).
28. Shepherd J, Kavanagh J, Picot J, et al. The effectiveness and cost-effectiveness of behavioural interventions for the prevention of sexually transmitted infections in young people aged 13-19: a systematic review and economic evaluation. *Health Technol Assess*. 2010;**14**(7):1-230.
29. Lewin S, Booth A, Glenton C, et al. Applying GRADE-CERQual to qualitative evidence synthesis findings: introduction to the series. *Implementation Science*. 2018;**13**(1):2.
30. Thomas J, Harden A. Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Med Res Meth*. 2008;**8**.
31. Peeters C, Marchand H, Tulloch H, et al. Perceived facilitators, barriers, and changes in a randomized exercise trial for obese youth: A qualitative inquiry. *J Phys Act Health*. 2012;**9**(5):650-60.
32. Rudolf M, Christie D, McElhone S, et al. WATCH IT: a community based programme for obese children and adolescents. *Arch Dis Child* 2006;**91**(9):736-9 4p.
33. Hester JR, McKenna J, Gately PJ. Obese young people's accounts of intervention impact. *Patient Educ Couns*. 2009;**79**(3):306-14 9p.
34. Watson LA, Baker MC, Chadwick PM. Kids just wanna have fun: Children's experiences of a weight management programme. *Br J Health Psychol* 2016;**21**(2):407-20.

35. Twiddy M, Wilson I, Bryant M, Rudolf M. Lessons learned from a family-focused weight management intervention for obese and overweight children. *Public Health Nutr* 2012;**15**(7):1310-7.
36. Morinder G, Marcus C, Mattsson E, Biguet G, Larsson UE. Adolescents' perceptions of obesity treatment -- an interview study. *Disabil Rehabil*. 2011;**33**(12):999-1009 11p.
37. Smith KL, Straker LM, McManus A, Fenner AA. Barriers and enablers for participation in healthy lifestyle programs by adolescents who are overweight: A qualitative study of the opinions of adolescents, their parents and community stakeholders. *BMC Pediatr*. 2014b;**14** (53).
38. Holt NL, Bewick BM, Gately PJ. Children's perceptions of attending a residential weight-loss camp in the UK. *Child Care Health Dev*. 2005;**31**(2):223-31 9p.
39. Melnyk BM, Small L, Morrison-Beedy D, et al. The COPE Healthy Lifestyles TEEN Program: Feasibility, Preliminary Efficacy, & Lessons Learned from an After School Group Intervention with Overweight Adolescents. *J Pediatr Health Care* 2007;**21**(5):315-22.
40. Woolford SJ, Sallinen BJ, Schaffer S, Clark SJ. Eat, play, love: Adolescent and parent perceptions of the components of a multidisciplinary weight management program. *Clin Pediatr* 2012b;**51**(7):678-84.
41. Hemetek U, Ernert A, Wiegand S, Bau AM. Which Factors Affect Weight Maintenance? A Qualitative Study with Adolescents and their Parents who have Completed a Ten-months Intervention. *Gesundheitswesen*. 2015;**77**(11):888-94.
42. Banks J, Cramer H, Sharp DJ, Shield JP, Turner KM. Identifying families' reasons for engaging or not engaging with childhood obesity services: A qualitative study. *J Child Health Care*. 2014;**18**(2):101-10.
43. Alm M, Soroudi N, Wylie-Rosett J, et al. A qualitative assessment of barriers and facilitators to achieving behavior goals among obese inner-city adolescents in a weight management program. *Diabetes Educ*. 2008;**34**(2):277-84 8p.
44. Owen SE, Sharp DJ, Shield JP, Turner KM. Childrens' and parents' views and experiences of attending a childhood obesity clinic: A qualitative study. *Prim Health Care Res Dev*. 2009;**10**(3):236-44.
45. Howie EK, McManus A, Smith KL, Fenner AA, Straker LM. Practical Lessons Learned from Adolescent and Parent Experiences Immediately and 12 Months following a Family-Based Healthy Lifestyle Intervention. *Child*. 2016;**12**(5):401-9.
46. Engstrom A, Abildsnes E, Mildestvedt T. "It's not like a fat camp" - A focus group study of adolescents' experiences on group-based obesity treatment. *International Journal of Qualitative Studies on Health and Well-Being*. 2016;**11**:12.
47. Campbell-Voytal KD, Hartlieb KB, Cunningham PB, et al. African American Adolescent-Caregiver Relationships in a Weight Loss Trial. *J Child Fam Stud*. 2018;**27**(3):835-42.
48. Li X, Zhou X, Hesketh T. Experiences and perspectives of children attending a weight loss camp in China: A qualitative study. *Child: Care, Health and Development*. 2016;**42**(5):644-51.
49. Jogova M, Song JES, Campbell AC, Warbuton D, Warshawski T, Chanoine JP. Process evaluation of the Living Green, Healthy and Thrifty (LiGHT) web-based child obesity management program: combining health promotion with ecology and economy. *Can J Diabetes*. 2013;**37**(2):72-81.
50. Nguyen B, Lau C, Steinbeck KS, Shrewsbury VA, Hill AJ, O'Connor J. A process evaluation of an adolescent weight management intervention: findings and recommendations. *Health Promot Int* 2014;**30**(2):201-12.

51. Woolford SJ, Khan S, Barr KLC, Clark SJ, Strecher VJ, Resnicow K. A picture may be worth a thousand texts: Obese adolescents' perspectives on a modified photovoice activity to aid weight loss. *Child Obes* 2012a;**8**(3):230-6.
52. Woolford SJ, Clark SJ, Strecher VJ, Resnicow K. Tailored mobile phone text messages as an adjunct to obesity treatment for adolescents. *J Telemed Telecare* 2010;**16**(8):458-61.
53. Smith KL, Kerr DA, Fenner AA, Straker LM. Adolescents Just Do Not Know What They Want: A Qualitative Study to Describe Obese Adolescents' Experiences of Text Messaging to Support Behavior Change Maintenance Post Intervention. *J Med Internet Res*. 2014a;**16**(4).
54. Daley AJ, Copeland RJ, Wright NP, Wales JKH. 'I Can Actually Exercise If I Want To; It Isn't As Hard As I Thought': A Qualitative Study of the Experiences and Views of Obese Adolescents Participating in an Exercise Therapy Intervention. *J Health Psychol*. 2008;**13**(6):810-9.
55. Riiser K, Ommundsen Y, Helseth S, Lodal K, Sundar T. Development and Usability Testing of an Internet Intervention to Increase Physical Activity in Overweight Adolescents. *J Med Internet Res*. 2013;**15**(1).
56. Staiano AE, Abraham AA, Calvert SL. Motivating effects of cooperative exergame play for overweight and obese adolescents. *J Diabetes Sci Technol*. 2012;**6**(4):812-9.
57. Hammar SL, Woolley J, Campbell V. Treating adolescent obesity. Long-range evaluation of previous therapy. *Clin Pediatr* 1971;**10**(1):46-52.
58. Sutcliffe K, Melendez-Torres GJ, Burchett Helen ED, Richardson M, Rees R, Thomas J. The importance of service-users' perspectives: A systematic review of qualitative evidence reveals overlooked critical features of weight management programmes. *Health Expectations*. 2018;**21**(3):563-73.
59. Burchett HED, Sutcliffe K, Melendez-Torres GJ, Rees R, Thomas J. Lifestyle weight management programmes for children: A systematic review using Qualitative Comparative Analysis to identify critical pathways to effectiveness. *Preventive Medicine*. 2018;**106**:1-12.
60. Heerman WJ, JaKa MM, Berge JM, et al. The dose of behavioral interventions to prevent and treat childhood obesity: a systematic review and meta-regression. *Int J Behav Nutr Phys Act*. 2017;**14**(1):157.

## Appendix 3 Phase one: EMBASE search terms

### EMBASE

1. *exp obesity/ or obes\* .mp.*
2. *overweight.mp.*
3. *body weight.mp. or exp body weight/*
4. *exp body mass/*
5. *1 or 2 or 3 or 4*
6. *patient satisfaction.mp. or exp patient satisfaction/*
7. *exp attitude to health/ or attitude.mp. or exp attitude/*
8. *patient preference.mp. or exp patient preference/*
9. *preference.mp.*
10. *views.mp.*
11. *exp experience/ or experience.mp.*
12. *opinion.mp.*
13. *exp qualitative research/ or qualitative research.mp.*
14. *6 or 7 or 8 or 9 or 10 or 11 or 12 or 13*
15. *exp diet/ or diet.mp.*
16. *nutrition.mp. or exp nutrition/*
17. *physical activity.mp. or exp exercise/ or exp physical activity/*
18. *"physical activity"/*
19. *motor activity.mp. or exp motor activity/*
20. *health behavior?.mp. or exp health behavior/*
21. *behavior?r change.mp. or exp behavior change/*
22. *health promotion.mp. or exp health promotion/*
23. *exp behavior/ or behavior?.mp.*
24. *behavior?r therapy.mp. or exp behavior therapy/*
25. *counselling.mp. or exp counselling/*
26. *nutritional support.mp. or exp nutritional support/*
27. *social support.mp. or exp social support/*
28. *15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27*
29. *young adult.mp. or exp young adult/*
30. *youth.mp. or exp juvenile/*
31. *exp adolescence/ or young person.mp. or young adult/*
32. *29 or 30 or 31*
33. *5 and 14 and 28 and 32*
34. *limit 33 to human*

## Appendix 4 Phase one: ASSIA search terms

2 **Name:** ASSIA Final [Edit name](#)

**Searched for:** ((SU.EXACT("Body Mass Index") OR SU.EXACT("Body weight") OR SU.EXACT("Obesity")) OR (obes\* OR overweight OR "body mass index" OR BMI OR " body weight")) AND ((SU.EXACT("Attitudes") OR SU.EXACT("Qualitative research") OR SU.EXACT("Experiences") OR SU.EXACT("Patient satisfaction") OR SU.EXACT("Opinions") OR SU.EXACT("Satisfaction") OR SU.EXACT("Preferences")) OR (satisfaction OR attitude\* OR experience\* OR preference\* OR view OR view\* OR opinion\* OR "qualitative research")) AND ((SU.EXACT("Behaviour") OR SU.EXACT("Exercise") OR SU.EXACT("Health promotion") OR SU.EXACT("Behavioural changes") OR SU.EXACT("Counselling") OR SU.EXACT("Social support") OR SU.EXACT("Nutrition") OR SU.EXACT("Nutritional therapy") OR SU.EXACT("Behaviour therapy") OR SU.EXACT("Diet") OR SU.EXACT("Motor activity") OR SU.EXACT("Physical activity") OR SU.EXACT("Health behaviour")) OR (diet OR nutrition OR "physical activity" OR "motor activity" OR exercise OR "health behavio\*r" OR "behavio\*r change" OR "health promotion" OR behavio\*r OR "behavio\*r therapy" OR counsel\*ing OR "nutritional support" OR "social support")) AND ((SU.EXACT("Adolescents") OR SU.EXACT("Young people") OR SU.EXACT("Young adults")) OR (Adolescen\* OR "young adult\*" OR teen\* OR youth\* OR "young person\*"))

**Databases:** Applied Social Sciences Index and Abstracts (ASSIA)

*These databases are searched for part of your query.*

**Notes:** [Add notes](#)

**Saved:** 04 August 2016

[Modify Search](#) [Delete](#) [Create alert](#) [Create RSS feed](#) [Get link](#)

## Appendix 5 Phase one: psycINFO search terms

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**Name:** psycINFO  Edit name

**Searched for:** (((SU.EXACT.EXPLODE("Body Weight") OR SU.EXACT.EXPLODE("Obesity") OR SU.EXACT.EXPLODE("Body Mass Index")) OR SU.EXACT.EXPLODE("Overweight") OR (obes\* OR overweight OR BMI OR "body weight" OR "body mass index")) AND ((SU.EXACT.EXPLODE("Health Attitudes") OR SU.EXACT.EXPLODE("Satisfaction") OR SU.EXACT.EXPLODE("Preferences") OR SU.EXACT.EXPLODE("Attitudes") OR SU.EXACT.EXPLODE("Qualitative Research")) OR (satisfaction OR attitude\* OR experience\* OR preference\* OR view OR view\* OR opinion\* OR "qualitative research"))) AND ((SU.EXACT.EXPLODE("Behavior Therapy") OR SU.EXACT.EXPLODE("Health Behavior") OR SU.EXACT.EXPLODE("Counseling") OR SU.EXACT.EXPLODE("Behavior Change") OR SU.EXACT.EXPLODE("Diets") OR SU.EXACT.EXPLODE("Behavior") OR SU.EXACT.EXPLODE("Physical Activity") OR SU.EXACT.EXPLODE("Social Support") OR SU.EXACT.EXPLODE("Health Promotion") OR SU.EXACT.EXPLODE("Nutrition") OR SU.EXACT.EXPLODE("Exercise")) OR (diet OR nutrition OR "physical activity" OR "motor activity" OR exercise OR "health behavior\*" OR "behavior\* change" OR "health promotion" OR behavior\* OR "behavior\* therapy" OR counsel\*ing OR "nutritional support" OR "social support"))) AND age.exact("Adolescence (13-17 Yrs)" OR "School Age (6-12 Yrs)") AND (stype("Scholarly Journals") AND po("Human"))

**Databases:** PsycINFO

**Notes:**  Add notes

**Saved:** 03 August 2016

 [Modify Search](#)  [Delete](#) [Create alert](#) [Create RSS feed](#)  [Get link](#)

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## Appendix 6 Phase one: Web of Science search terms

#36	#35 AND #29 AND #15 AND #5 DocType=All document types; Language=All languages;
#35	#34 OR #33 OR #32 OR #31 OR #30 DocType=All document types; Language=All languages;
#34	ts=(young person) DocType=All document types; Language=All languages;
#33	ts=(youth) DocType=All document types; Language=All languages;
#32	ts=(teen*) DocType=All document types; Language=All languages;
#31	ts=(young adult) DocType=All document types; Language=All languages;
#30	ts=(adolesc*) DocType=All document types; Language=All languages;
#29	#28 OR #27 OR #26 OR #25 OR #24 OR #23 OR #22 OR #21 OR #20 OR #19 OR #18 OR #17 OR #16 DocType=All document types; Language=All languages;
#28	ts=(social support) DocType=All document types; Language=All languages;
#27	ts=(nutritional support) DocType=All document types; Language=All languages;
#26	ts=(counseling) DocType=All document types; Language=All languages;
#25	ts=(behavior therapy) DocType=All document types; Language=All languages;
#24	ts=(behavior) DocType=All document types; Language=All languages;
#23	ts=(health promotion) DocType=All document types; Language=All languages;
#22	ts=(behavior change) DocType=All document types; Language=All languages;
#21	ts=(health behavior) DocType=All document types; Language=All languages;
#20	ts=(exercise) DocType=All document types; Language=All languages;
#19	ts=(motor activity) DocType=All document types; Language=All languages;
#18	ts=(physical activity) DocType=All document types; Language=All languages;
#17	ts=(nutrition) DocType=All document types; Language=All languages;
#16	ts=(diet) DocType=All document types; Language=All languages;
#15	#14 OR #13 OR #12 OR #11 OR #10 OR #9 OR #8 OR #7 OR #6 DocType=All document types; Language=All languages;
#14	ts=(qualitative research) DocType=All document types; Language=All languages;
#13	ts=(opinion) DocType=All document types; Language=All languages;
#12	ts=(experience) DocType=All document types; Language=All languages;
#11	ts=(views) DocType=All document types; Language=All languages;
#10	ts=(preference) DocType=All document types; Language=All languages;
#9	ts=(patient preference) DocType=All document types; Language=All languages;
#8	ts=(attitude to health) DocType=All document types; Language=All languages;
#7	ts=(attitude) DocType=All document types; Language=All languages;
#6	ts=(patient satisfaction) DocType=All document types; Language=All languages;
#5	#4 OR #3 OR #2 OR #1 DocType=All document types; Language=All languages;
#4	ts=(body mass index) DocType=All document types; Language=All languages;
#3	ts=(body weight) DocType=All document types; Language=All languages;
#2	ts=(overweight) DocType=All document types; Language=All languages;
#1	ts=(obesity) DocType=All document types; Language=All languages;

## Appendix 7 Phase one: CINAHL search terms

Search ID#	Search terms
S36	S5 AND S15 AND S29 AND S35
S35	S30 OR S31 OR S32 OR S33 OR S34
S34	"young person"
S33	"youth"
S32	"teen*"
S31	(MH "Young Adult") OR "young adult"
S30	(MH "Adolescence+") OR "adolesc*"
S29	S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28
S28	(MH "Support, Psychosocial+") OR "social support"
S27	(MH "Nutritional Support+") OR "nutritional support"
S26	(MH "Counseling+") OR "counsel#ing"
S25	(MH "Behavior Therapy+") OR "behavio#r therapy"
S24	(MH "Behavior+") OR "behavio#r"
S23	(MH "Health Promotion+") OR "health promotion"
S22	(MH "Behavioral Changes") OR "behavio#r change"
S21	(MH "Health Behavior+") OR "health behavio#r"
S20	(MH "Exercise+") OR "exercise"
S19	(MH "Motor Activity+") OR "motor activity"
S18	(MH "Physical Activity") OR "physical activity"
S17	(MH "Nutrition+") OR "nutrition"
S16	(MH "Diet+") OR "diet"
S15	S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14
S14	(MH "Qualitative Studies+") OR "qualitative research"
S13	"opinion"
S12	"experience"
S11	"views"
S10	"patient preference"
S9	"preference"
S8	(MH "Attitude to Health+") OR "attitude to health"
S7	(MH "Attitude+") OR "attitude"
S6	(MH "Patient Satisfaction") OR "patient satisfaction"
S5	S1 OR S2 OR S3 OR S4
S4	(MH "Body Mass Index") OR "body mass index"
S3	(MH "Body Weight+") OR "body weight"
S2	"overweight"
S1	(MH "Obesity+") OR "obes*"

## Appendix 8 Phase one: Checklist for screening title/abstracts and full texts

### Inclusions:

#### 1) Study design:

- Any

#### 2) Participants:

- Are the participants overweight (>85<sup>th</sup> centile) or obese (> 95<sup>th</sup> centile)?
- Are the participants aged 12-17 years at the time of the study commencing (if a wider age range then the mean age needs to be 12-17 years)?

#### 3) Intervention:

- Single or multicomponent lifestyle interventions aimed at treating overweight and obese – dietary, physical activity and or behavioural element. Any setting and delivery mode.
- Qualitative data collection methods.

#### 4) Outcomes:

- Qualitative data analysis methods
- Does the study include adolescent views on attending an obesity lifestyle treatment intervention?

### Exclusions:

- Conference abstracts
- Adolescents with eating disorders
- Pregnant or breastfeeding adolescents
- Adolescents with a medical cause for obesity, e.g. Prader Willi syndrome
- Adolescents with severe long-term mental health conditions, e.g. schizophrenia

### Note:

There are no language restrictions so potentially relevant non-English language references should be included.

## Appendix 9 Phase one: Guidance for completing quality assessment

### 1. What steps were taken to increase rigour in the sampling?

- Consider whether the sampling strategy was appropriate to the questions posed in the study (e.g. was the strategy well-reasoned and justified?)
- Consider whether attempts were made to obtain a diverse sample of the population in question (think about who might have been excluded who may have had a different perspective to offer)
- Consider whether characteristics of the sample critical to the understanding of the study context and findings were presented (i.e. do we know who the participants were in terms of, for example, basic socio-demographics, characteristics relevant to the context of the study)

### 2. Were steps taken to increase rigour in the data collected?

- Consider whether data collection was comprehensive, flexible and/or sensitive enough to provide a complete and/or vivid and rich description of people's perspectives and experiences (e.g. did the researchers spend sufficient time at the site/with participants? did they keep 'following up'? was more than one method of data collection used?).
- Consider whether steps were taken to ensure that all participants were able and willing to contribute (e.g. processes for consent, language barriers, power relations between adults and children/young people)

### 3. Were steps taken to increase rigour in the analysis of the data?

- Consider whether data analysis methods were systematic (e.g. was a method described/can a method be discerned?)
- Consider whether diversity in perspective was explored
- Consider whether the analysis was balanced in the extent to which it was guided by preconceptions or by the data
- Consider whether the analysis sought to rule out alternative explanations for findings (this could be carried out by, for example, searching for negative cases/exceptions, feeding back preliminary results to participants, asking a colleague to review the data, or reflexivity)

### 4. Were the findings of the study grounded in/supported by the data?

- Consider whether enough data are presented to show how the authors arrived at their findings
- Consider whether the data presented fit the interpretation/support claims about patterns in data
- Consider whether the data presented illuminate/illustrate the findings
- Consider whether quotes are numbered or otherwise identified, and the reader can see that they do not just come from one or two people

### 5. Please rate the findings of the study in terms of their breadth and depth (it may be helpful to consider 'breadth' as the extent of description and 'depth' as the extent to which data have been transformed/analysed).

- Consider whether a range of issues are covered
- Consider whether the perspectives of participants are fully explored in terms of breadth (contrast of two or more perspectives) and depth (insight into a single perspective)
- Consider whether richness and complexity have been portrayed (e.g. variation explained, meanings illuminated)
- Consider whether there has been theoretical/conceptual development

**6. To what extent does the study privilege the perspectives and experiences of children and/or young people?**

- Consider the following questions and make an overall judgement:
  - there was a balance between open-ended and fixed-response options
  - whether children/young people were involved in designing the research
  - there was a balance between the use of an a priori coding framework and induction in the analysis
  - the position of the researchers (did they consider it important to listen to the perspectives of children?)
  - steps were taken to assure confidentiality and put children/young people at their ease

**7. Overall, what weight would you assign to this study in terms of the reliability/trustworthiness of its findings?**

- Think (mainly) about the answers you have given to the first four questions above

**8. What weight would you assign to this study in terms of the usefulness of its findings for this review?**

- think (mainly) about the answers you have given above and consider
  - the match between the study aims and findings and the aims and purpose of the synthesis
  - its conceptual depth/explanatory power

Appendix 10 Phase two: Data table with all interventions and all 37 conditions

Intervention	Age tailored	Tailored support	Goal setting by participant	Weight loss goal set by provider	Weight loss goal set by participant	Diet goal set by provider	Diet goal set by participant	Practical & prescriptive support
Boodai	0	0	1	0	0	1	1	1
Pakpour (5)	1	1	1	0	0	1	1	1
Pbert	1	1	1	0	0	1	1	1
Van Egmond-Frohlich	0	1	1	0	0	1	0	1
Daley	1	1	1	0	0	0	1	1
Nguyen	1	1	1	0	0	0	0	1
Norman	1	1	1	1	0	0	0	1
Wengle	1	1	1	0	0	1	1	1
Visuthranukul	0	1	1	0	0	1	0	1
Hofsteenge	1	0	1	0	0	0	0	1
Brownell (2)	1	0	0	0	0	0	0	1
Ford	0	1	1	0	0	1	1	1
Jiang	1	1	1	0	0	1	1	1
Luna Pech	1	1	0	0	0	1	0	1
Pakpour (4)	1	1	1	0	0	1	1	1
Vos	0	1	1	1	0	1	1	1
Brownell (1)	1	0	0	0	0	0	0	1
Patsopoulou (3)	1	1	0	0	0	0	0	1
Patsopoulou (4)	1	1	0	0	0	0	0	1
Savoye	1	1	1	0	0	0	0	1
Schranz	1	0	0	0	0	0	0	1
Brennan	1	1	1	0	0	0	1	1

<b>Intervention</b>	<b>Active engagement</b>	<b>Anthropometrics</b>	<b>Consistent &amp; regular support</b>	<b>Professional support</b>	<b>High level of professional support</b>	<b>Family support</b>	<b>Peer support</b>	<b>Extinguishing prior fears</b>
<b>Boodai</b>	0	0	0	1	0	1	1	0
<b>Pakpour (5)</b>	0	0	1	1	1	1	1	0
<b>Pbert</b>	0	1	1	1	0	0	0	0
<b>Van Egmond-Frohlich</b>	0	1	1	1	1	1	0	0
<b>Daley</b>	1	1	1	1	1	0	0	0
<b>Nguyen</b>	1	1	1	1	1	1	1	0
<b>Norman</b>	1	1	1	1	1	1	0	1
<b>Wengle</b>	0	1	1	1	1	1	1	0
<b>Visuthranukul</b>	1	1	1	1	0	1	1	0
<b>Hofsteenge</b>	1	1	1	1	1	1	1	0
<b>Brownell (2)</b>	0	1	1	1	1	1	1	1
<b>Ford</b>	0	1	1	1	1	1	0	0
<b>Jiang</b>	0	1	0	1	1	1	0	0
<b>LunaPech</b>	0	1	1	1	1	0	0	0
<b>Pakpour (4)</b>	0	0	1	1	1	0	1	0
<b>Vos</b>	1	1	1	1	1	1	1	1
<b>Brownell (1)</b>	0	1	1	1	1	1	1	1
<b>Patsopoulou (3)</b>	1	1	1	1	1	0	1	0
<b>Patsopoulou (4)</b>	1	1	1	1	1	1	1	0
<b>Savoye</b>	1	1	1	1	1	1	1	0
<b>Schranz</b>	1	1	1	1	1	0	1	1
<b>Brennan</b>	0	1	1	1	1	1	1	0

<b>Intervention</b>	<b><i>Achievable yet challenging PA</i></b>	<b><i>Direct provision of PA</i></b>	<b><i>Gym</i></b>	<b><i>PA goals</i></b>	<b><i>Transfer knowledge into home environment</i></b>	<b><i>Longer-term support</i></b>	<b><i>Follow-up support</i></b>	<b><i>Weight loss aim</i></b>
<b>Boodai</b>	0	0	0	1	0	0	0	1
<b>Pakpour (5)</b>	0	0	0	1	0	0	1	1
<b>Pbert</b>	0	0	0	1	1	0	0	1
<b>Van Egmond-Frohlich</b>	0	0	0	1	1	1	1	1
<b>Daley</b>	1	1	1	1	1	1	0	0
<b>Nguyen</b>	1	1	0	0	0	1	1	1
<b>Norman</b>	0	0	0	1	1	1	1	1
<b>Wengle</b>	1	1	0	1	0	1	0	1
<b>Visuthranukul</b>	0	0	0	0	1	1	0	1
<b>Hofsteenge</b>	0	0	0	1	0	1	1	1
<b>Brownell (2)</b>	0	0	0	1	1	1	1	1
<b>Ford</b>	0	0	0	1	0	1	1	1
<b>Jiang</b>	1	0	0	1	1	1	1	1
<b>LunaPech</b>	0	0	0	0	0	1	0	1
<b>Pakpour (4)</b>	0	0	0	1	0	0	1	1
<b>Vos</b>	0	0	0	1	1	1	1	1
<b>Brownell (1)</b>	0	0	0	1	0	1	1	1
<b>Patsopoulou (3)</b>	1	1	0	0	0	1	0	1
<b>Patsopoulou (4)</b>	1	1	0	0	1	1	0	1
<b>Savoye</b>	1	1	0	1	0	1	1	1
<b>Schranz</b>	1	1	1	0	0	1	1	0
<b>Brennan</b>	0	0	0	1	1	1	0	1

<b>Intervention</b>	<b><i>Gender separate PA</i></b>	<b><i>Mental health support</i></b>	<b><i>Problem solving</i></b>	<b><i>Tailored problem solving</i></b>	<b><i>Punishment</i></b>	<b><i>Low cost activity</i></b>	<b><i>Healthy eating education</i></b>	<b><i>Variety of physical activity</i></b>
<b>Boodai</b>	0	0	1	1	0	0	1	0
<b>Pakpour (5)</b>	0	0	1	1	0	0	1	0
<b>Pbert</b>	0	1	1	1	0	1	1	0
<b>Van Egmond-Frohlich</b>	0	0	1	1	0	0	1	0
<b>Daley</b>	1	1	1	1	0	1	1	1
<b>Nguyen</b>	0	1	0	0	0	1	1	1
<b>Norman</b>	0	0	1	1	1	1	1	0
<b>Wengle</b>	0	0	1	1	0	1	1	1
<b>Visuthranukul</b>	0	0	0	0	0	0	1	0
<b>Hofsteenge</b>	0	1	1	1	0	0	1	0
<b>Brownell (2)</b>	0	0	1	0	1	0	1	0
<b>Ford</b>	0	0	0	0	0	0	1	0
<b>Jiang</b>	0	0	1	1	1	0	1	1
<b>LunaPech</b>	0	0	0	0	0	0	1	0
<b>Pakpour (4)</b>	0	0	1	1	0	0	1	0
<b>Vos</b>	0	1	1	1	0	0	1	0
<b>Brownell (1)</b>	0	0	1	0	1	0	1	0
<b>Patsopoulou (3)</b>	0	0	0	0	0	1	0	1
<b>Patsopoulou (4)</b>	0	0	1	0	0	1	1	1
<b>Savoye</b>	0	1	1	0	0	1	1	1
<b>Schranz</b>	1	0	0	0	0	1	0	1
<b>Brennan</b>	0	1	1	1	0	0	1	0

<b>Intervention</b>	<i>Technology</i>	<i>Diet monitoring by participant</i>	<i>Opportunities to reflect</i>	<i>Autonomy</i>	<i>Assessing readiness to change</i>
<b>Boodai</b>	0	1	1	1	0
<b>Pakpour (5)</b>	0	1	1	1	0
<b>Pbert</b>	0	1	1	1	0
<b>Van Egmond Frohlich</b>	0	0	1	1	0
<b>Daley</b>	0	1	1	1	0
<b>Nguyen</b>	1	0	0	0	0
<b>Norman</b>	1	1	1	1	1
<b>Wengle</b>	1	1	1	1	0
<b>Visuthranukul</b>	0	1	0	0	0
<b>Hofsteenge</b>	0	1	1	1	1
<b>Brownell (2)</b>	0	1	1	1	0
<b>Ford</b>	1	0	1	1	0
<b>Jiang</b>	0	1	1	1	0
<b>LunaPech</b>	0	1	1	0	0
<b>Pakpour (4)</b>	0	1	1	1	0
<b>Vos</b>	1	1	1	1	1
<b>Brownell (1)</b>	0	1	1	1	0
<b>Patsopoulou (3)</b>	0	0	0	1	0
<b>Patsopoulou (4)</b>	0	0	0	1	0
<b>Savoye</b>	0	0	0	1	1
<b>Schranz</b>	0	0	0	0	0
<b>Brennan</b>	1	1	1	1	1

Appendix 11 Phase two: Contradictory configurations from Table 3.9

Set	GS	HPROS	TPSV	DM	Most EF consistency (coverage)	Least EF consistency (coverage)	Con (YES/NO)	Total # of cases
1	True	True	True	True	0.44	0.56	YES	9 (4 most effective, 5 least effective)
2	True	True	False	False	0.67	0.33	YES	3 (2 most effective, 1 least effective)
3	False	True	False	True	0.67	0.33	YES	3 (2 most effective, 1 least effective)

GS = Goal setting by participant, HPROS = High level of professional support, TPSV = Tailored problem solving, DM = Diet monitoring by participant, EF = effectiveness, Con = contradictory

Effective and ineffective interventions for each contradictory configuration

Set	Effective interventions	Ineffective interventions	Total effective	Total ineffective
1	Jiang et al., 2005 Pakpour et al., 2015 (4) Vos et al., 2011 Brennan et al., 2013	Daley et al., 2005 Hofsteenge et al., 2013 Norman et al., 2016 Pakpour et al., 2015 (5) Wengle et al., 2011	4	5
2	Ford et al., 2010 Savoie et al., 2007	Nguyen et al., 2012	2	1
3	Brownell et al., 1983 (1) Luna-Pech et al., 2014	Brownell et al., 1983 (2)	2	1

Based only on BMI z score, the truth table would look as follows:

Set	Effective interventions	Ineffective interventions	Total effective	Total ineffective
1	Jiang et al., 2005 Pakpour et al., 2015 (4) Vos et al., 2011	Daley et al., 2005 Norman et al., 2016 Pakpour et al., 2015 (5) Wengle et al., 2011	3	4
2	Ford et al., 2010	Nguyen et al., 2012	1	1
3	Luna-Pech et al., 2014	-	1	0

Based only on interventions with a group delivery format

Set	Effective interventions	Ineffective interventions	Total effective	Total ineffective
1	Vos et al., 2011 Brennan et al., 2013	Hofsteenge et al., 2013 Wengle et al., 2011	2	2
2	Savoye et al., 2007	Nguyen et al., 2012	1	1
3	Brownell et al., 1983 (1)	Brownell et al., 1983 (2)	1	1

Based only on interventions with 1:1 delivery format

Set	Effective interventions	Ineffective interventions	Total effective	Total ineffective
1	Jiang et al., 2005 Pakpour et al., 2015 (4)	Daley et al., 2005 Norman et al., 2016 Pakpour et al., 2015 (5)	2	3
2	Ford et al., 2010	-	1	0
3	Luna-Pech et al., 2014	-	1	0

## Appendix 12 Phase three: PIS for adolescents

### Understanding how best to support adolescents to achieve a healthy weight.

We would like to ask you to take part in a research study. Before you decide if you would like to join in, you should know what the study is about. Feel free to talk to your parents/carers before you decide. Your opinion is important. If you have any questions, you or your parents/carers can call or email us. We will talk everything through with you.

**Why have I been asked to take part?** We would like to talk to people your age who have taken part in the Hearty Lives programme. Others in the same age group as you (12-17 years) who have taken part in Hearty Lives have also been asked to take part. We think it is very important to make sure the voices of young people are heard so we can improve the design of programmes like Hearty Lives, in the future.



**What will happen if I take part?** You are being invited to take part in an online focus group. A focus group is when a group of people get together to share their thoughts about a topic. For an online focus group, you can share your thoughts on your mobile phone or computer without anyone knowing who you are. The researcher will ask some questions on the online focus group. These questions



will ask you about your experience of the Hearty Lives programme. You can respond to the researcher as well as other people in the group who have also been involved in the Hearty Lives programme. There will be no more than 8 children your age in the group. If you and your parent decide you want to take part, you will be sent details of when and how to join the online focus group. When the focus group is over we will look at what everyone has said and write a report. If you would prefer to tell us your views over the telephone on an individual basis, rather than in an online focus group, that is fine too. Telephone interviews will be audio recorded.

**Do I have to take part?** No. The choice is up to you and your parents/carers. It's also fine to change your mind. You can stop the research at any time, for any reason.

**Will my personal information be kept private?** Yes, all information about you will be kept very safe and private. Your name will not be used in the report so no one will know what you have said. No one will know that you have taken part other than those that you wish to tell yourself. If you say anything that makes us think that you or anyone else may be at risk of harm, then we may have to speak to someone outside of the research team.

As a token of appreciation for sparing your time, you will be given a £5 high street voucher.

If you have any questions, you or your parents can email or call Helen Jones at the University of Warwick: [h.jones@warwick.ac.uk](mailto:h.jones@warwick.ac.uk) / 07717572280

**What if there is a problem?** This study is covered by the University of Warwick's insurance and indemnity cover. 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:

Head of Research Governance, Research & Impact Services, University House, University of Warwick, Coventry, CV4 8UW

Tel: 024 76 522746

Email: [researchgovernance@warwick.ac.uk](mailto:researchgovernance@warwick.ac.uk)

## Appendix 13 Phase three: PIS for parents

### Understanding how best to support adolescents to achieve a healthy weight.



We would like to invite your child to take part in a research study. Before you decide if you are happy for your child to take part, it is important to know why the research is being done and what would be involved. Please read the following information carefully. Talk to others about the study if you wish. If anything is not clear or you would like more information please contact the researcher by phone or email.

#### Important things you should know

**What is the study about?** Many children aged 12-17 years struggle with their weight. We know that attending a healthy lifestyle programme tailored to their age group can help. We would like to know what adolescents in Wolverhampton think about the Hearty Lives programme so we can improve the design of programmes like Hearty Lives, in the future. We think it is very important to make sure the voices of young people attending Hearty Lives are heard.

**Why has my child been asked to take part?** We are interested in the views of children aged 12- 17 years old that have been referred to the Hearty Lives programme in Wolverhampton. We are interested in the views of those that took part in the programme as well as those that were referred but decided not to take part.

**What will my child have to do if they take part?** Your child is being invited to take part in an online focus group or a phone interview. A focus group is when a group of people get together to share their thoughts about a topic. The researcher will post some questions about your child's experience of the Hearty Lives programme. Your child can respond to the researcher as well as other people in the group who have also been involved in the Hearty Lives programme. There will be no more than 8 children in the group to ensure that everyone's voice is heard. Your child will be sent details of the focus group, including when and



how to join. They will be sent a link to the focus group website and given a unique username. Only invited participant will have access to the focus group website. Your child can respond to the questions at any time over a period of 1 week. Another option would be a telephone interview instead of an online focus group. A phone interview is a conversation between two people (researcher and your child) where your child will be asked questions about their experience of the Hearty Lives programme. This would involve speaking to your child over the phone for a maximum of 1 hour. Telephone interviews will be audio recorded.

If your child does not want to take part in a focus group or phone interview, but would still like to tell us their views, they can complete the questionnaire (green piece of paper) and return using the stamped addressed envelope.

**What will I have to do?** If you are happy for your child to take part and for the researcher to have access to your Hearty Lives records, please fill-in and return the enclosed consent form. Please ask your child to also complete their consent form. We have included a stamped addressed envelope for you to use. Alternatively, you can scan and email a signed copy of the consent forms to the researcher.

**Does my child have to take part?** No. It is entirely up to you and your child to decide. If you or your child changes their mind you can stop the research at any time before or during the study. You can also ask to withdraw your child after taking part in the study. In this case, we will do our best to remove your child's quotes from any written reports, however this may not always be possible if already published. You will not have to give a reason for withdrawing and this will not affect you or your circumstances in any way.

**What are the possible benefits of taking part in this study?** Your child may enjoy being able to give their views on the Hearty Lives programme, alongside children who have gone through the same experience. At the end of the research, we hope to use the findings to support other adolescents in Wolverhampton to achieve a healthy weight. By taking part, their input could help other children in the future.

**What are the possible disadvantages of taking part in this study?** Your child will need to spare some of their own time. The research team will ensure that your child does not need to take time out of their school day. Focus groups/phone interviews will take place at weekends, evenings or in school holidays.

Some of the topics that come up in discussion may be personally sensitive to your child. If your child becomes upset, they can leave the focus group/phone interview at any time and will be followed up by one of the researchers for support if needed.

**Will my child be safe?** Yes. Your child will take part in the online focus group/phone interview in a place that they feel comfortable e.g. at home. Children will be assigned an anonymous username when logging into the focus group so no other participants will know who they are. The focus group will be managed by the researcher. The focus group will have ground rules, which will be shown to you and your child before taking part in the focus group. If someone breaks the ground rules, they will be given a warning and then removed from the group. The researchers have experience in working with children and an up-to-date enhanced Disclosure and Barring Service check (This is a criminal records check that prevents unsuitable people from working with children).

**Will my child's information be kept private?** Yes. Any information about your child will be kept very safe and private. Any personal information will be kept in a password protected electronic folder on University managed computers or will be locked in a filing cabinet at the University of Warwick. Information will be kept for 10 years and then will be disposed of safely. We won't tell anyone that your child is taking part in the focus group, but you and your child are free to talk to anyone you wish to about it. In the event of a sensitive disclosure, e.g. if your child says something that makes us think that they or anyone else may be at risk of harm, then we may have to speak to someone outside of the research team.

**What will happen to the results of the study?** Reports of the research will be written. This will include quotes from your child and other children involved in this research. Your child's name, and any identifiable characteristics, will not be used in any reports so quotes will be anonymous. If you would like to receive a copy of the report then please let the researcher know. This project will form part of the lead researcher's PhD and will be published as a chapter of her thesis. It will also be written up as a manuscript for publication in a peer-reviewed academic journal. The findings will be communicated to Wolverhampton City Council.

**Expenses:** As a token of appreciation for sparing their time, your child will be given a £5 high street voucher.

Thank you for taking the time to read this information. For more information about the study please contact:



Helen Jones (PhD Researcher)  
[H.jones@warwick.ac.uk](mailto:H.jones@warwick.ac.uk)  
07717572280

Helens research is supervised by Dr Al-Khudairy (lena.al-khudairy@warwick.ac.uk)

#### 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): (BSREC number and date of approval)

#### What if there is a problem?

This study is covered by the University of Warwick's insurance and indemnity cover. Any complaint about the way you or your child 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:

Head of Research Governance

Research & Impact Services

University House

University of Warwick

Coventry, CV4 8UW

Tel: 024 76 522746

Email:

[researchgovernance@warwick.ac.uk](mailto:researchgovernance@warwick.ac.uk)

#### Who is funding the study?

This research is funded through the National Institute of Health Research (NIHR).



**NHS**  
National Institute for  
Health Research



## Appendix 15 Phase three: Parent consent form

**Understanding how best to support adolescents to achieve a healthy weight.**



**Parent consent form**

**Please tick**

I confirm that I have read and understand the information sheet dated 30<sup>th</sup> April 2018 for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

1. I understand that my child's participation is voluntary and that he/she is free to withdraw at any time without giving any reason, with no negative consequences. I understand that my child may decline even if I have given consent.

2. I understand that the information that my child and I give will remain confidential and anonymous.

3. I understand that phone interviews will be audio recorded and any comments given by my child in the focus group/phone interview will be saved securely.

4. I understand that the researcher will have access to personal records obtained by the Hearty Lives team.

5. I agree for my child to take part in the above study.

Childs name	
Childs age	
Your name	
Telephone number	
Email	
Date	
Signature	

Name of researcher	Date	Signature

ID	
----	--

## Appendix 16 Phase three: Semi-structured questionnaire for those either not starting the HL programme or those dropping out



This questionnaire is for those that have decided **NOT** to take part in an online focus group. We would like to give you another opportunity to tell us your thoughts. We would be very grateful if you could respond to the questions below and send this back to the research team at the University of Warwick using the stamped-addressed envelope enclosed. Alternatively, you can scan and email this questionnaire back using the contact details on the Participant Information Sheet, or complete the questionnaire online before the *[insert date 6 weeks after letter has been sent: SURVEY URL HERE]*

Reports of the research (focus groups and questionnaires) will be written. This may include quotes from the children involved. Names, and any identifiable characteristics, will not be used in any reports so quotes will be anonymous.

**This questionnaire is to be filled out by the person aged 12-17 years in the household that was invited to join the Hearty Lives programme, NOT by the parent/carer.** Please be as honest as possible. All responses will be kept very safe and private as detailed in the Participant Information Sheet.

	Answers (please use the back of the questionnaire if you require more space)
What is your name?	
Address (for voucher):	
How old were you when you were invited to take part in the programme?	
Gender (male/female/other/prefer not to say)?	
<i>If you did not start the Hearty Lives programme, please go straight to Q6.</i> <b>Q3.</b> How many Hearty Lives sessions took place in your home (1-6)?	
<b>Q4.</b> Programmes like Hearty Lives are not for everyone. Please tell us, as honestly as possible, why you did not continue with the programme?	
<b>Q5.</b> Is there anything that could have been done differently to make you stay on the programme?	
<b>Q6.</b> <i>Do not answer this Q if you have answered Q's 3-5.</i> If you decided not to start the Hearty Lives programme, please tell us why?	

***Please turn over...***

By returning a completed questionnaire you are giving your consent for the questionnaire information that you have supplied to be used in this study and formal signed consent will not

be collected. As a token of appreciation for sparing your time, a £5 high street voucher will be posted (please input address above).

Thank you for taking the time to complete this questionnaire. Your responses may help other adolescents in the future who are trying to achieve a healthy weight.

Best wishes,

Helen Jones

**Any other comments:**



## Appendix 17 Phase three: Focus group guide

### Focus group guide

This semi-structured focus group guide has been developed with findings from a qualitative systematic review (Phase one).

- How did you hear about Hearty Lives?
- What did you think about the Hearty Lives programme?
- What made you want to take part? What made you want to lose weight?
- Did you feel that the Hearty Lives programme was suited/tailored to your age group? How?
- How did you feel about the programme taking place in your home? Was it helpful? What are your thoughts on a group programme? Would you have preferred a group setting? How did you feel about your family being involved? What about a 1-2- session and optional group PA sessions?
- Did you work on goals with your Hearty Lives worker e.g. more fruit and veg? Did you find setting goals with your Hearty Lives worker useful? Did you achieve them? What helped you achieve them? If not, why do you think you didn't achieve them?
- How did you feel about being weighed and measured regularly? Why?
- Did you ever feel like you would get told off for not losing weight?
- How did your weight change on the programme? Have you maintained? How has this been?
- There were six weekly sessions then follow up appointments at 3, 6 and 12 months. Do you think these were regular enough? Would you have liked more or less sessions? Was each session long enough? How long?
- Could you rearrange a session if you couldn't attend one? What did you think of this flexible approach?
- What makes losing weight difficult? Was there anything that made attending the Hearty Lives sessions difficult?
- What did you learn on the hearty lives programme? E.g. knowing how much fruit and veg you are meant to eat and how much physical activity you are meant to do. Why?
- Did you enjoy learning about a healthy diet? Why? What? What did you think of the more interactive activities? Sugar kits? Cooking? Snack tasting?
- Did you find it difficult to change what you ate? Tell me about that?
- Did you enjoy the programme? If yes, what did you enjoy most about the programme? If no, why?

- How did you feel before starting the Hearty Lives programme? Nervous, excited? Did you know what to expect?
- Whose support did you value through the programme? Friends, family, Hearty Lives worker? Why?
- How would you have felt if your Hearty lives worker helped you with things like confidence and self-esteem (making you feel good about yourself)?
- How did you feel about working with just one professional? Did this make you feel more comfortable? Would you have liked it if another professional delivered an exercise session for example?
- Did Hearty Lives recommend physical activity services that you could attend? Were there enough options? Were there any you really enjoyed? Did you dislike any of the physical activity you took part in? Was there enough variety?
- Did Hearty Lives provide you with new opportunities for taking part in physical activity? Did you try anything new? Would you have liked to take part in PA sessions with the Hearty lives worker?
- What do you think about exercise facilities and opportunities in Wolverhampton for your age group? Are they affordable? Did this affect you taking part in physical activity?
- How do you feel about the services in Wolverhampton for your age group - Do you find there are enough services for your age group to help you achieve a healthy weight locally?
- Do you like being challenged in a physical activity session?
- Have you ever gone to the gym? Did you like it? What would make you attend?
- Do you think you would have liked having support online as part of the programme? Logging goals online? Receiving motivational messages from your advisor online or by text?
- How do you feel about the cost of food? Is it something that concerns you? Why?
- Would you prefer girl/boy only sessions if in a group?
- Would Hearty Lives appeal to you now you are a little older? Would you want to attend?

**Extra:**

- What do you think would help to engage other adolescents in weight management programmes? DO you need to trust the professional?
- Do you remember who referred you into the programme? Was it a joint decision?

**For those that were referred into the Hearty Lives programme but decided to not start the programme, the schedule will include:**

- Can you remember who referred you to the Hearty Lives programme?
- Do you feel you were given enough information about the programme?
- Was this referral a joint decision?
- How did you feel after the referral was made?
- How did you feel after you or your parent decided not to take part?
- What made you decide not to take part in the programme?
- Would you have preferred for the programme not to take place in your home?
- Is there anything that would have made you attend?
- Would you have preferred a programme that was just for other boys/girls?
- Would you have rather a programme that was delivered online?
- If offered again, do you think you would like to take part in a programme like Hearty Lives?

## Appendix 18 Phase three: Ethical considerations included in ethics application to BSREC

### **Informed consent**

Informed consent will be sought from participants to enable them to weigh up decisions for their self-interest. All information will be given to participants for them to make these decisions. This is a clear agreement that the participant is willing to take part in the research. As adolescents are not legally allowed to consent, informed parental consent will also be required and obtained. A PPI representative from the CLAHRC West Midlands has reviewed the PIS and consent forms. Any issues with informed consent will be addressed by implementing the following:

- Participants will receive a PIS initially via post or email along with a copy of the consent form. Information will be repeated at commencement of the online focus group or telephone interview. Stakeholders will receive this explanation in person or over the phone, depending on where the interview is carried out.
- Written consent will be required to participate in focus groups or telephone interviews. Participants taking part in the focus groups or telephone interview will be required to post the completed consent forms back using the stamped-addressed envelope. Participants may also scan and send the consent form back by email if preferred. Parental consent will also be required as the participants are under 18 years of age.
- Stakeholders being interviewed will be asked to return a written consent form either by post or electronically.
- Participants understanding of the research and their rights will be checked at the beginning of the interviews and focus groups by asking a number of closed questions that require a yes or no response, e.g. Do you understand that you can leave this focus group at any time?

### **Participant confidentiality**

Any issues with participant confidentiality will be addressed by implementing the following:

- Participants (Stakeholders and adolescents) will be assigned ID numbers so no identifiable information will be published. Adolescent participants taking part in online focus groups will be asked to log on using these ID numbers so their

responses remain anonymous to other participants. This will also mean that participants will not be able to search for each other on social media sites.

- Names or identifiable characteristics will not be used in publicly available reports or publications.
- If names or identifiable characteristics are used by participants in discussion, these will be changed within the transcription to avoid identifying individuals.
- Participants will be informed of ground rules at the start of the focus group, including the importance of not sharing personal details.
- Any planned publications arising will be shared with participants quoted in order to seek their approval prior to publication.
- Audio recorded telephone interviews will take place in a private room to ensure confidentiality.

### **Data Security**

Any issues with data security will be addressed by implementing the following:

- Discussions will be archived from the site after completion of the focus group and exported into qualitative analysis software. Participants will be unable to log back into the group after this point. Only the researcher that created the focus group will be able to export and save the data.
- Participant data, audio recordings and transcripts will be stored electronically on University managed password protected computers at the University of Warwick. These will only be accessible by the researcher. Participant ID's will be stored in a separate electronic folder.
- Paper consent forms and any other paper files will be locked in a filing cabinet at the University of Warwick. The Primary investigator will be the only person to have access to these files.
- Participant data will be kept for 10 years once created according to the University of Warwick's guidelines (these will be passed to my supervisor upon completion of the PhD).

### **Right of withdrawal**

Any issues around right of withdrawal will be addressed by implementing the following:

- Participants will be informed about their right to withdraw from the study at any time in the PIS and again before the interviews and focus groups commence.

- Participants will be made aware that they can stop the interview or leave the online focus group if they wish to withdraw from the study at any time.
- If participants decide to withdraw their data post interview and focus group, every effort will be made to remove their data, however this may not always be possible if publication has already taken place. This will be explained in the PIS (appendix 2).
- Participants will not have to give their reasons for withdrawal as detailed in PIS.
- If choosing to withdraw from the study, any data collected before withdrawal will be deleted and quotes will be removed from any written reports.

### **Process for dealing with sensitive disclosures**

Processes for dealing with sensitive disclosures are described:

- Participants will be given the contact details for relevant local and national services if something sensitive is disclosed.
- Disclosures may need to be communicated outside of the research team if any participants state anything that may place themselves or anyone else at harm.

### **Avoidance of emotional harm**

Emotional harm will be avoided by considering the following:

- Extensive questioning may cause the participants emotional stress and obesity can be a sensitive topic. The researcher will be sensitive to the style and impact of questioning.
- Two researchers will be moderating the online focus groups. One researcher will be responsible for facilitating the focus group, whilst the second will be moderating content regularly, being more concerned with looking out for signs of emotional harm amongst participants. They will follow up with participants if concern is raised, for example, if a particularly emotive response is sent.
- Ground rules will be set at the start of the focus group. Participants will be informed at the start of the focus group that all views and experiences are very valued and important to this research.
- Focus groups will be managed by the lead researcher. The researcher will intervene in the discussion if needed.

- Disagreements will be handled carefully but If individuals become disruptive or if they do not follow the ground rules, they will initially be given a warning. If ignored and the unwanted behaviour continues, individuals will be removed from the online focus group. Any unsuitable messages posted in the online focus group will be removed immediately.
- Both researchers will be moderating the focus group regularly and monitor for any signs of participant distress. As a further safeguard, following any disruptive behaviour, the researchers will follow up with other members of the focus group individually, outside of the main focus group, to check that they are happy to continue. If necessary, the young person/s will be signposted to immediate support services, such as Childline.
- As the focus groups are asynchronous, there are likely to be slower interactions between participants. This will make it more likely that any disruptive comments will be removed before others are able to view, reducing potential harm to other participants.
- Homogenous focus groups will be undertaken so participants that have had a similar experience are grouped together. E.g. drop outs and completers

### **Researcher safety**

Researcher safety should not be compromised as focus groups will be undertaken online. As the Hearty Lives programme takes place in family's homes, using online focus groups removes the need for entering unknown homes alone, therefore reducing risk significantly. Telephone interviews, which also offer enhanced researcher safety, have been chosen as an alternative method in case of low recruitment. Stakeholder interviews will be completed either over the phone or in a Wolverhampton City Council managed building, to ensure the researchers safety and reduce risk.

### **Child protection**

The researchers will have a disclosure and barring service (DBS) check (approved). Participants will be informed of this in the PIS (APPENDIX 2). Any disclosures of child abuse, neglect, self-harm or illegal activity will be raised with the Hearty Lives coordinator at Wolverhampton City Council.

### **Benefits and risks:**

#### **Benefits**

- As focus group participants are residing in the city of Wolverhampton, they may benefit directly or indirectly from this research as results may inform the development of future obesity treatment interventions in the local area.
- Interview and focus group participants may feel they are helping others by taking part. Findings may help adolescents in the future.
- Adolescents are given an opportunity to feedback and give their views on the intervention.
- Stakeholders are given an opportunity to reflect on their professional experiences of adolescent obesity.
- Participants taking part in focus groups may enjoy listening to the views of others that have taken part in the intervention.
- As focus groups are taking place online and there is the opportunity of completing interviews over the telephone, participants will not incur any additional financial costs.
- Participants will be asked if they wish to receive a lay summary of the published paper.

#### **Risks**

- Taking part will mean that participants are required to give up some of their time. Another reason for opting for asynchronous focus groups is to ensure that focus groups do not interfere with learning. Participants can comment flexibly at a time that suits them. If possible, focus groups will take place in a school holiday period. Telephone interviews will be offered after school, on weekends or in school holidays at a time that suits them. Adolescents taking part in focus groups, telephone interviews or completing a questionnaire will be given a £5 high street voucher as a token of appreciation for giving up their time.
- Stakeholder interviews will take be undertaken at a time and place that suits the participant, minimising any inconvenience.
- No physical risks are associated with this study. Avoidance of emotional harm is outlined above.

## Appendix 19 Phase three: Semi-structured questionnaire for all participants (amended version)

This questionnaire is for those that have decided **NOT** to take part in an online focus group or phone interview. We would like to give you another opportunity to tell us your thoughts. We would be very grateful if you could respond to the questions below and send this back to the research team at the University of Warwick using the stamped-addressed envelope enclosed. Alternatively, you can scan and email this questionnaire back using the contact details on the Participant Information Sheet, or complete the questionnaire online before the **31<sup>st</sup> August 2018**: <https://warwick.onlinesurveys.ac.uk/hearty-lives-2>

Reports of the research (focus groups/telephone interviews and questionnaires) will be written. This may include quotes from the children involved. Names, and any identifiable characteristics, will not be used in any reports so quotes will be anonymous.

**This questionnaire is to be filled out by the person aged 12-17 years in the household that was invited to join the Hearty Lives programme, NOT by the parent/carer.** Please be as honest as possible. All responses will be kept very safe and private as detailed in the Participant Information Sheet.

	Answers
What is your name?	
Address (for voucher):	
How old were you when you were invited to take part in the programme?	
Gender (male/female/other/prefer not to say)?	
<b><i>If you did not start the Hearty Lives programme, please go straight to Q15</i></b>	
Q1. How did you feel before taking part in Hearty Lives? (e.g. excited, nervous, worries, happy)	
Q2. What did you enjoy about the Hearty Lives programme? Are there any activities that you liked?	
Q3. What did you not enjoy about the Hearty Lives programme?	

Q4. How would you make the Hearty Lives programme better?	
Q5. Do you think Hearty Lives was suited to your age group (please explain)?	
Q6. What did you think of Hearty Lives taking place in your home?	
Q7. What did you think about opportunities for physical activity on the Hearty Lives programme?	
Q8. Whose support did you value throughout the programme <b>and</b> why? E.g. Hearty lives worker, friends, family, school nurse?)	
Q9. What did you think about the length of the Hearty Lives programme? (E.g. too long or too short?)	
Q10. How did you find being weighed and measured throughout the programme?	
Q11. How would you have felt about receiving more support throughout and after the programme online or by phone? (e.g. motivational text messages)	

<b>If you started but did not complete the hearty lives programme then please answer questions 12-14 as well.</b>	
<b>Q12. How many Hearty Lives sessions took place in your home (1-6)?</b>	
<b>Q13. Programmes like Hearty Lives are not for everyone. Please tell us, as honestly as possible, why you did not continue with the programme?</b>	
<b>Q14. Is there anything that could have been done differently to make you stay on the programme?</b>	
<b>This question is just for those who did not start the Hearty Lives programme:</b>  <b>If you decided not to start the Hearty Lives programme, please tell us why?</b>	

By returning a completed questionnaire you are giving your consent for the questionnaire information that you have supplied to be used in this study and formal signed consent will not be collected. As a token of appreciation for sparing your time, a £5 high street voucher will be posted **(please input address above)**.

Thank you for taking the time to complete this questionnaire. Your responses may help other adolescents in the future who are trying to achieve a healthy weight.

Best wishes,

Helen Jones

<b>Any other comments:</b>
----------------------------

## Appendix 20 Phase three: Stakeholder consent form

### Understanding how best to support adolescents to achieve a healthy weight.



#### Participant consent form

**Please tick**

1. I confirm that I have read and understand the information sheet dated 20<sup>th</sup> February 2018 for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. This will not affect my circumstances in any way.
3. I understand that the information I give will remain confidential and that I will be given anonymity in any research reports.
4. I understand that this interview will be audio recorded and all recordings will be stored securely.
5. I agree to take part in the above study.

\_\_\_\_\_  
Name of participant                      Date                      Signature

\_\_\_\_\_  
Name of researcher                      Date                      Signature

ID	
----	--

## Appendix 21 Phase three: Stakeholder PIS

### Understanding how best to support adolescents to achieve a healthy weight.



We would like to invite you to take part in a research study. Before you decide if you are happy to take part, it is important to know why the research is being done and what would be involved. Please take the time to read the following information carefully. Talk to others about the study if you wish. If anything is not clear or you would like more information please contact the researcher by phone or email. Please take time to decide whether you wish to take part.

#### Important things you should know

**What is the study about?** Many children aged 12-17 years in Wolverhampton are overweight or obese. We



know that attending a family-based multi-component lifestyle weight management programme can help to reduce the number of overweight and obese adolescents. However, these programmes suffer from low recruitment and high drop-out rates. We would like to know what adolescents and stakeholders in Wolverhampton think about weight management programmes so we can improve the design of these programmes in the future. We think it is very important to make sure the voices of young people attending weight management programmes, as well as those working with overweight adolescents, are heard.

**Why have I been asked to take part?** We are interested in the views of community stakeholders who have worked with overweight adolescents, those that are involved in the planning of adolescent weight management programmes and those who have referred families into the Wolverhampton Hearty Lives programme.

**What will I have to do if I take part?** You are being invited to take part in an individual interview. The interview will last no longer than 1 hour and can take place at a time and



place convenient for you. The interview can be undertaken over the phone if needed. Interviews will be audio recorded. Before interviewing you, we would have spoken to adolescents who have attended Hearty Lives. We are interested in hearing what you think of adolescent weight management programmes and what the adolescents attending Hearty Lives have said.

**What will I have to do?** If you are happy to take part, please fill-in and return the enclosed consent form. We have included a stamped addressed envelope for you to use. Alternatively, you can scan and email a copy back to the researcher. The researcher will then contact you to arrange the interview.

**Do I have to take part?** No. It is entirely up to you to decide. If you change your mind you can stop the research at any time before or during the interview. You can also ask to withdraw up to 3 months after taking part in the study. In this case, we will do our best to remove your quotes from any written reports. You will not have to give a reason for withdrawing and this will not affect you or your circumstances in any way.

**What are the possible benefits of taking part in this study?** At the end of the research, we hope to use the findings to improve the management of adolescent obesity locally. By taking part your input could have policy and practical implications when working with overweight and obese adolescents.

**What are the possible disadvantages of taking part in this study?** You will need to spare one hour of your own time. The research team will ensure that interviews take place at a time and place convenient to you.

**Will my information be kept private?** Yes. Any information you give will be kept very safe and private. Any personal information will be kept in a password protected electronic folder on University managed computers or will be locked in a filing cabinet at the University of Warwick. Information will be kept for 10 years and then will be disposed of safely. We won't tell anyone that you are taking part in an interview, but you are free to talk to anyone you wish to about it.

**What will happen to the results of the study?** Reports of the research will be written. This will include quotes from your interview. Your name, and any identifiable characteristics, will not be used in any reports so quotes will be anonymous. If you would like to receive a copy of the report then please let the researcher know. This project will form part of the lead researcher's PhD and will be published as a chapter of her thesis. It will also be written up as a manuscript for publication in a peer-reviewed academic journal. The findings will be communicated to Wolverhampton City Council. Findings will also be more widely disseminated (eg: to other Local Authorities and wider stakeholders across the West Midlands).

**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): REGO-2018-2149 AM01

Thank you for taking the time to read this information. For more information about the study please contact:



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### What if there is a problem?

This study is covered by the University of Warwick's insurance and indemnity cover. Any complaint about the way you or your child 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:

Head of Research Governance

Research & Impact Services

University House

University of Warwick

Coventry, CV4 8UW

Tel: 024 76 522746

Email:

[researchgovernance@warwick.ac.uk](mailto:researchgovernance@warwick.ac.uk)

### Who is funding the study?

This research is funded through the National Institute of Health Research (NIHR).



## Appendix 22 Phase three: Interview guide

*Prompt questions are in italics.*

*Different sections are colour coded*

### **Start recording:**

Hello. Thank you for taking part in this interview and for giving your time.

- \* The interview will take about 60 minutes.
- \* You can stop this interview at any time.
- \* I will record the interview.
- \* Your feedback will be used to develop programmes like Hearty Lives in the future, however your responses will be anonymous. It will not be possible to identify individuals from this interview.
- \* Are you happy to take part in the interview?

**Questions for all interviewees related to Wolverhampton services e.g. Hearty Lives: I am going to ask you some questions about weight management services for adolescents, specifically those targeting overweight or obese adolescents between 12 -17 years of age. Some questions relate specifically to the Hearty Lives weight management programme in Wolverhampton.**

1. How did you first hear about Hearty Lives?
2. What was your involvement with the Hearty Lives programme?
3. What are your general impressions or thoughts of the Hearty Lives programme?
4. What feedback did you receive from adolescents who took part in Hearty Lives/what feedback did you hear about the Hearty Lives programme if you didn't receive it directly from adolescents?
5. Is there anything that you think programmes like Hearty Lives could do differently/better?
6. Are you aware of any adolescent weight management services in surrounding areas?
  - *If yes, what are your thoughts of these services?*
7. What do you think about the current state of adolescent weight management services in Wolverhampton?

8. More research is needed to gain data from withdrawers, those that drop out from weight management programmes? How do you think this could be implemented?
9. Another issue is engaging overweight adolescents in the first place. What do you think stops overweight adolescents engaging in weight management services?
10. What are your thoughts regarding using online/technology support when working with overweight adolescents?  
Text message/telephone/online forum/email support?

Questions for all interviewees related to systematic review:

**As part of this research project, I have completed a systematic review that includes studies, which gathered the views of adolescents who have attended weight management interventions. All these adolescent views, which have come from 24 different weight management interventions across the world, have been combined. The next set of questions relate to findings from this systematic review:**

1. The results of the SR highlighted importance of a weight management programme being tailored to a specific age group. Adolescents did not like attending weight management programmes when there were other children outside their age range (e.g. a programme for 8-16-year olds). What are your thoughts on this?
  - *How easy or difficult would this be to implement in practice?*
  - *Is there a need for them to be tailored to the adolescent age group?*
2. This SR showed that as well as adolescents wanting a programme that was tailored to their age group, tailored individual advice was important. Adolescents also valued having peer and group support. What are your thoughts on this?
3. The results of the SR highlighted the importance of physical activity and how much overweight and obese adolescents enjoyed taking part in physical activity within weight management programmes. What are your thoughts on this?
  - *Hearty Lives although, multi-component was more focused on behaviour change and diet. What are the practicalities of incorporating more physical activity into a weight management intervention?*
  - *Would this information from the systematic review make physical activity more of a priority when developing future programmes?*

- *SR also highlighted cost was a big factor for adolescents engaging with physical activity. low cost or free gym access for example was a big draw to adolescents– what are your thoughts on this?*
4. A systematic review highlighted that many adolescents take part in weight management programmes because their family or professionals (e.g. school nurses, GP) have made them aware about the availability of a weight management intervention. What can be done to improve adolescents' awareness of weight management interventions?
  5. The SR also showed that adolescents appreciated professionals that specialised in child weight management. This made adolescents feel like they were not the only ones with a weight issue and increased trust between adolescents and professionals. What are your thoughts regarding this?
    - *Is it always possible to have staff specialising in weight management?*
  6. SR highlighted that some adolescents have prior fears of attending an intervention. Their expectations can be different to actual experience. For example, some felt that the physical activity element of a weight management programme would be very intense and military in style, perhaps from watching weight loss programmes on TV. What could be done to reduce this prior worry?
    - *As someone referring in to the HL programme, were you fully aware of the details of the programme and felt confident explaining this to the adolescent and their family?*
  7. SR highlighted the desire for professionals to give more than just weight support, but support around self-esteem and building confidence. They valued having someone they could talk to about issues in addition to weight. How practical is this to implement?
    - *Prompt for those working with adolescents: How would you feel delivering this type of support*
  8. Adolescents noted their primary motivation for attending weight loss interventions was weight loss rather than health. What do you think of this?
    - *The main driving force behind weight loss as the primary aim was mostly to do with adolescents wanting to improve their appearance. They felt this was the route to having more friends and reducing bullying. They felt that weight loss would lead to what they described as a more 'normal' life. What are your thoughts on this?*

9. Female adolescents have reported embarrassment of wearing sportswear and exercising in front of boys.

- For those working directly: What is your experience of this?
- For those working directly and those commissioning/managing: How practical could it be to have gender separate activity sessions?

Those referring in to Hearty Lives

**These next questions are for those professionals who have had direct experience of referring adolescents into the Hearty Lives programme or similar programmes (if no, go to pink section below):**

1. How did you find the process of referring adolescents into the Hearty lives programme?

- *How easy was this process? Any barriers to referring families into the programme?*
- *Please describe your experience of engaging with adolescents and their families?*

2. How comfortable were you with informing parents and adolescents about the hearty Lives programme?

- *Did you have enough information?*
- *Were posters, leaflets etc used?*

3. Could anything be done to improve the referral system?

- *Would you have benefited from more information?*

**These questions are for those that do not have direct experience of referring into the Hearty Lives or similar programmes:**

1. What are your thoughts on the referral system for Hearty Lives or weight management programmes in general?

- Could anything be improved?
- What worked well?

**To finish:**

- Do you have any other comments about adolescent weight management interventions or anything else you would like to add?

**Thank you for taking part in the study. Your contribution has been invaluable, and we will be back in contact with details of any publications or papers that come out of this research.**

## Appendix 23 Phase three: Stakeholders views of adolescent weight management programmes: a qualitative study

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**Key words:** Obese, adolescent, weight management programme, thematic analysis, stakeholder.

**Running title:** Stakeholder views of adolescent weight management.

**Word Count:** 2590

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## **ABSTRACT**

**Aims:** Child and adolescent obesity is a significant public health concern. Family-based multi-component weight management programmes are recommended. Understanding stakeholders' views of these programmes may lead to more effective programmes targeting adolescents with obesity in the future. The aim of this study is to gather stakeholder's views on adolescent weight management programmes.

**Methods:** 11 stakeholders were recruited by purposive sampling. Semi-structured interviews were audio recorded, transcribed and analysed using thematic analysis.

**Results:** Stakeholders recognised the importance of support from experienced professionals, as well as family and peers. There was agreement amongst stakeholders that longer-term support was needed for adolescents with obesity; suggestions included integrating follow-up support with schools and leisure services. The need for the educational side of a programme to be practical and hands on was recognised. Emotional and psychological support must be prioritised. Having a variety of delivery modes, such as group and 1-2-1, particularly in the home environment, were recommended. Stakeholders agreed that weight management programmes for adolescents need to be more proactive at incorporating technology.

**Conclusions:** This study identified key themes, which should be considered when developing weight management programmes for adolescents with overweight or obesity. By taking on board the views of those that work closely with this group, attrition and dropout rates for weight management programmes may be improved.

## **INTRODUCTION**

Obesity is well documented as a significant issue to public health. 28% of children between the age of 2-15 years in England are overweight or obese [1]. Not only are adolescents with obesity at greater risk of cardiovascular risk factors [2, 3], but psychosocial effects such as low self-esteem are evident [4]. Adolescents with obesity are likely to continue into adulthood with obesity [5]. Family-based multi-component weight management programmes (WMPs) are recommended for adolescents with obesity in England and Wales [6-9]. However, these programmes suffer from poor uptake and high attrition rates [10-12]. Alongside adolescent views on WMPs, listening to those that work closely with adolescents with obesity on WMPs can give insight that might improve their future planning and delivery, in turn improving attrition and recruitment. This study aimed to gather stakeholder views in the UK on the policy and practical implications of findings from a qualitative systematic review looking into the views of overweight and obese adolescents attending lifestyle obesity treatment interventions [13]. Additionally, stakeholders' own views on WMPs for adolescents were sought, with specific reference to Hearty Lives (HL), a home-based WMP for families run by Wolverhampton City Council and part-funded by the British Heart Foundation.

## **METHODS**

Semi-structured interviews (May – August 2018) were used to collect data from stakeholders, chosen to allow a more in-depth understanding of stakeholder views. A purposive sampling approach was used to recruit HL service providers, commissioners and those referring adolescents into the programme. Participants were approached via email and provided with information about the research prior to undertaking the interviews. Participants were offered telephone or face-to-face interviews. All interviews were completed by one trained female researcher, undertaking a PhD, who had significant experience in WMPs and previous experience with qualitative methods (HMJ). Due to this prior experience, the researcher was known to some stakeholders involved in this research. Written consent was gained either electronically or in person during the face-to-face interview. The interview guide was informed by a qualitative systematic review looking at the views of overweight and obese adolescents attending obesity treatment interventions [13]. The interview guide was checked with two authors (GJMT, LA-K), piloted prior to data collection and sent to stakeholders before the interviews commenced. Interviews were continued until data saturation was reached.

## Analysis

Audio-recorded interviews were transcribed verbatim and exported into NVivo 11 software. Data was approached using inductive thematic analysis. Thematic analysis is a process of identifying, analysing and recording patterns in data in addition to interpretation [14]. Themes were identified in an inductive way, without a pre-existing framework, reducing researcher preconceptions, by one author (HMJ). Memos were written alongside data collection to aid reflection, enable changes to the interview guide and allow new concepts to be explored. Analysis was audited by another author (OO) to improve reliability. Research ethics approval was obtained (REGO-2018-2149 AM01) from the University of Warwick's Biomedical and Scientific Research Ethics Sub-Committee.

## RESULTS

11 stakeholders were recruited to this study. 11 stakeholders were recruited to this study. Stakeholders were all female and included HL WMP workers (n = 2), School nurses (n = 3), dieticians (n = 2), HL manager (n = 1), Public Health Consultant (n = 1), PE and School Sport Partner Manager (n = 1), Health advisor (n = 1). A further 10 school nurses were contacted but did not take part. Two had retired or left the trust, eight did not respond. Interviews were on average 52 minutes (36 -74 mins). Three interviews were completed face-to-face, the remainder over the telephone (n = 7). One stakeholder emailed text responses to the interview guide. Analysis led to the development of three main categories that relate to what stakeholders consider important for future WMP design and delivery. Themes are highlighted in bold throughout the text. A network diagram of all categories and themes can be seen in Figure 1. Transcribed quotations can be seen in Table 1.

### Support

Stakeholders commented on **the importance of qualified and experienced weight management professionals** with a mix of skills including physical activity, nutrition and psychology. Stakeholders felt that experienced staff instilled confidence in adolescents and parents.

Stakeholders felt that adolescents engaged better with 'cool' and relatable professionals, especially youth workers. Non-judgemental **characteristics** were important with adolescents and when speaking to parents/carers about their child's weight. Stakeholders recognised that adolescents' value being treated like an adult. Building rapport and trust with adolescents increased engagement in WMPs.

The consensus among stakeholders was that adolescents valued the **peer support** that came with attending a group programme. This made adolescents feel like they were not the only ones struggling with their weight, leading to new bonds and friendships.

Stakeholders

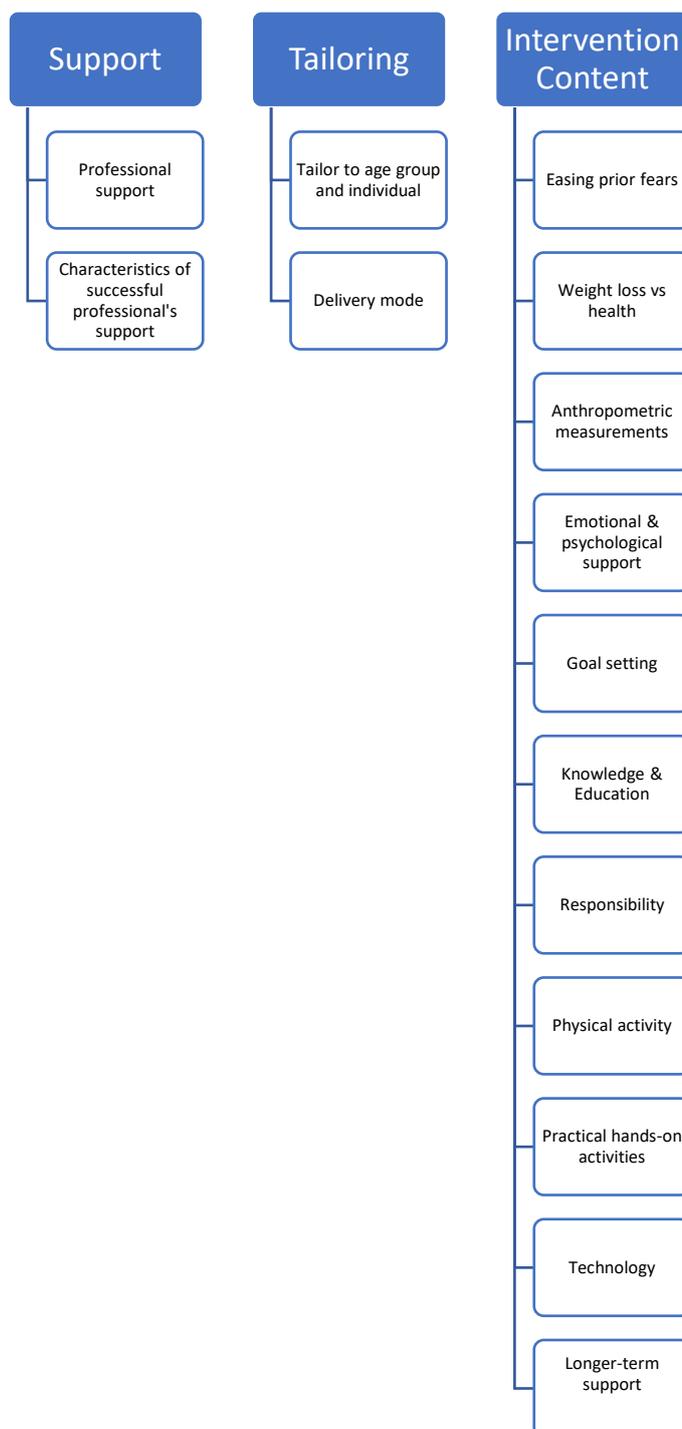


Figure 1 Network diagram

commented on how self-conscious adolescents with obesity feel in school Physical Education classes; exercising with others of a similar size made adolescents feel more comfortable.

The importance of **family support** was highlighted by all stakeholders. It was felt that without family support, behavioural changes would be limited and that educating the whole family facilitated longer sustainable lifestyle changes. Stakeholders spoke about the difficulty of engaging with some parents and found adolescents took more responsibility and were more motivated if their parents/carers were engaged. Some stakeholders felt the defensive nature of some parents was a barrier. If the parent was defensive, the adolescent was less receptive to making changes.

### **Tailoring**

Stakeholders highlighted the importance of staff having the skills to be flexible and **individually tailor** sessions, depending on the adolescent's mood on the day, as well as tailoring to the family's needs. Adolescents need different support and resources compared with younger children. Stakeholders felt incentives were important, but that they must be **appropriate to the adolescent age group**. The consensus was that this was harder than finding appropriate incentives for younger children. Adolescents also have different needs to adults, for example, they are generally concerned with short-term outcomes and not with the risk of poor health in the long-term.

Variety in terms of **delivery mode** of WMPs was spoken about in depth by all stakeholders. Many praised the home setting of the HL programme because of its ability to tailor to each family, and to reach families who might not otherwise engage. However, although the benefits of 1-2-1 programmes were recognised, particularly in a home setting, several stakeholders felt that this option was not sustainable or time-efficient in the current Public Health financial situation. Groups on the other hand offered a more cost-effective approach and were a good way to increase adolescents' self-esteem. Both dieticians interviewed felt 1-2-1 programmes in clinic settings were not effective, mainly because of infrequent appointments, and formal atmosphere. Nonetheless, most stakeholders felt that the best option was to offer both group and 1-2-1 **options accommodating the differing needs of adolescents and families wanting support**.

### **Intervention content**

Stakeholders recognised that adolescents felt embarrassed and lacked confidence prior to attending WMPs. Suggestions to **ease these prior fears** included a taster session. This was mainly linked to the physical activity element of a WMP, whether this be taking part or viewing the session. Stakeholders suggested a promotional video for potential participants to watch, on a website or social media, which could include interviews with previous participants. In addition, stakeholders emphasised the importance of an induction session for adolescents prior to a programme starting.

Stakeholders spoke about the importance of **focusing on health within a WMP**, even if weight loss was the adolescent's motivation for initiating attendance.

Stakeholders felt that most adolescents, either didn't mind, or liked having **anthropometric measurements** taken. Some were interested in logging changes in their Body Mass Index (BMI). Adolescents seemed to like modern technology that could calculate their BMI. Stakeholders noted the importance of making sure measurements were taken in an informal, sensitive and discreet manner, with no pressure placed on the individual.

One of the most well supported themes within this analysis was the importance of ensuring all WMPs for adolescents include support around **emotional wellbeing, confidence and self-esteem**. Stakeholders commented on how fragile adolescents were in terms of their self-esteem and confidence. With adolescence being a period of life with changing emotions and potential pressures, stakeholders suggested mental health support must be prioritised. Stakeholders felt that staff involved in WMPs and those who knew the adolescent well, should support their emotional well-being, rather than referring them on to external organisations. However, stakeholders were not comfortable speaking to adolescents about mental health without specific training. Stakeholders spoke about how body conscious adolescents were. They felt appearance was more important to adolescents, particularly girls, than their health.

Stakeholders spoke about the benefit of **goal setting** with adolescents. Stakeholders felt that adolescents were generally receptive to this and there was a sense of pride when a goal was achieved. It was important that these goals were SMART (Specific, Measurable, Achievable, Realistic and Time-bound) and although the priority should be on letting the adolescent decide the goal, stakeholders suggested this should be done with support from their parent/carer. An important factor in effective goal setting was that goals were

reviewed regularly by a professional and progress monitored. Stakeholders acknowledged that small changes might be all that is manageable for some families.

Stakeholders spoke of the importance of nutrition and physical activity **education to improve knowledge**. This was not only essential for adolescents, but also their parents. Stakeholders felt it was important for adolescents to understand the reasoning behind promoted health messages. This may help adolescents to take more responsibility for their health and weight. Stakeholders felt that parents should also receive education on parenting skills. Cooking skills for both parents and adolescents was deemed important as well as opportunities to try new foods, again highlighting the importance of family involvement.

The consensus amongst stakeholders was that adolescents need to take **responsibility** for their health and weight, but this should be shared responsibility with parents. Some stakeholders felt that adolescents do not realise it is their responsibility so incorporating this learning into an intervention could be promising.

Stakeholders' general impression was that adolescents with obesity enjoy taking part in **physical activity** when completed as part of a WMP. This was felt to be a significant aspect of any WMP, kick starting engagement with physical activity. Stakeholders spoke of the importance of physical activity being fun. Helping adolescents to recognise that options for physical activity can include more than just sessions in the gym. Activity must be tailored to the individual and not begin too strenuously. It should be affordable, free or subsidised. Accessibility was also noted as an important factor to encourage attendance. Stakeholders spoke about how adolescents feel in terms of poor confidence and body image, which leads to embarrassment when taking part in physical activity, particularly swimming. One criticism of the HL programme was that it did not directly provide physical activity as part of the programme. Gender specific sessions were felt to be a good option if resources were available and several stakeholders commented on the competitive nature of some adolescents. A healthy level of competition, whether this was with family or friends, was motivating, reiterating the need for peer and family support.

Stakeholders spoke of the importance of using **practical, hands-on activities** when educating adolescents as part of a WMP. Visual and interactive activities, which were more creative than typical didactic teaching was favoured. Stakeholders were very positive about including interactive cooking activities within a WMP.

All stakeholders spoke about incorporating **technology** into a WMP. Email, text, WhatsApp or other apps were suggested as useful tools to support and motivate both parents/carers and adolescents throughout a WMP and for longer-term support. Apps were suggested as a good way to gain feedback on a programme, as adolescents would feel more comfortable completing a form online, rather than on paper, highlighting their ability to use online or digital technology with ease.

Stakeholders agreed that online support really should be part of a WMP, not alone, but paired with face-to-face support. Stakeholders commented on the use of social media platforms as a way of supporting and promoting WMPs. Websites were also recommended but stakeholders commented on the need for commitment from staff to keep these up-to-date and continue promoting them. It seems stakeholders felt the idea of using technology, in principle, was something they should do, but were not currently doing well. The negative impact of social media in terms of poor body image was noted.

Most professionals commented on the need for **longer-term support** for adolescents taking part in WMPs. HL, was a 6-week programme with 12 months follow-up support at 3 monthly intervals; however the initial programme and follow-up period was felt to be too short to ensure new habits were solidified. Stakeholders commented on integrating long-term support into other services. Examples included free gym or leisure centre passes for completers, or linking more with schools, including after school activity clubs.

**Table 1. Representative quotes**

<b>Themes</b>	<b>Representative quote</b>
<b>Professional Support</b>	<i>'And I do believe that we need some, to have a good skill mix and, and multi skilled individuals.'</i> (S4)
<b>Characteristics of successful professional's support</b>	<i>'Yeah, I think there's so much judgement around being overweight in the health professional world, you know? 'Cause not all dieticians are non-judgemental about overweight children. And when you get a parent who is so defensive and being so full of barriers my judgement of that parent is horrendous. So I think it is a very skilled area to work in because you have got to be non-judgemental at all times, even when you're told ridiculous things.'</i> (S8)
<b>Peer Support</b>	<i>'People realise that they're not the only ones who are struggling. And you can build friendship groups and create almost a, a cooperative around healthy lifestyle factors.'</i> (S4)
<b>Family Support</b>	<i>'If the parent is open and willing to change, then the, then the teenager is. If the parent is defensive and, "You haven't, your diet hasn't worked for me," or, "The GP</i>

	<i>doesn't help," or, "We're all overweight." Then the child, the teenager is very unreceptive.' (S8)</i>
<b>Tailored to age group and individual</b>	<i>But, yeah. It's, it's very hard and you do have to take a lot more time and consider the individual as well. 'Cause they are young adults at the end of the day. So it's not, it's not as simple as just going and, and picking something up last minute for the store cupboard and going and thinking, "Oh, that'll be a good incentive." You've got to try and think about the person that you're working with (S2) 'I don't think they particularly think about long term what it's gonna do to their health. I think that it's pretty much in the, it's in the here and now isn't it ...how they feel at that time?' (S9)</i>
<b>Relationship between weight management programme and other organisations and professionals</b>	<i>'Yes, I think we felt very comfortable because we were, we went to the meetings, one of us went to the meetings, so we understood what the program was about. If we hadn't been to those meetings, we may not, we wouldn't have understood what the program was about, so we couldn't be so passionate about it 'cause we'd be making it up rather than knowing that it was home visits and, yeah, yeah, yeah. So, I think for any referral process you need to know a lot about the program to be able to basically sell it, isn't it? Yeah, yeah. But we felt very comfortable because we'd got enough information.' (S8)</i>
<b>School involvement</b>	<i>'... I think schools as well. Although the, the schools are supposed to have quite healthy, healthy dinners that are, the government have standards that they've set, which they should ideally follow. But I find a lot of them say that they follow it, and then when I'm actually, 'cause I do a lot of works with schools from the Diabetes point of view, when, when they actually go into schools it's nothing like what they say that have but... and it's, it's perfectly possible. Like, I had one child that used to have pizza with two brownies for lunch every day...So I think schools as well, have a, a lot of room for improvement.' (S10)</i>
<b>Public Health budget cuts and priorities</b>	<i>'I don't think there even, I don't think there is a current state, because there isn't anything being delivered as far as I'm aware. So it, it, it is pretty bad, really, when you think of all of the children that were, that we worked with during the Hearty Lives programme, it's clear that there is a huge demand for a service that, that supports young people that are struggling with their weight. But there clearly isn't anything available for them now.' (S2)</i>
<b>Delivery mode</b>	<i>'I think, I think a mixture, because I think you would, you will get some, some young people that, especially if they've got, like, they're really self-conscious, they wouldn't want to be in a group situation. But then I think you've got others that would thrive in a group situation, because, you know, they know it's not just them that's, that's, that's, you know, maybe got a weight issue, or ...I think it's a little bit of, you know, when you're with other</i>

	<i>people you can, you know, you can spur each other on, can't you? Give each other encouragement and ...I, I, I think a mixture.'</i> (S9)
<b>Easing prior fears</b>	<i>'You, you could have a promotional site for the program where there might be clips on there of, video clips of what participants have done before and what people have said, participants have said. So, you know, I think people always do want information. Where would they go for information? I would imagine a website.'</i> (S1)
<b>Weight loss vs Health.</b>	<i>'I think it doesn't really matter what the primary motivation is, once you've got them there you can sell the message of how losing weight does help to improve their, their, their health. I think adolescents, as well as some adults, are concerned about their appearance, so if their appearance is driving them into your (coughs) excuse me, into their, into your arena, once you've got them there, it's selling the health message.'</i> (S4)
<b>Anthropometric measurements</b>	<i>'And, they would get very happy and excited to know that their BMI had gone down'</i> (S2)
<b>Emotional and psychological support</b>	<i>'I think that just shows that their self-esteem is so fragile that that needs to be the number one priority in the program is to build, build the self-esteem of the teenager.'</i> (S8)
<b>Goal setting</b>	<i>'think it works really well if there's continued involvement with them. I think when I'm doing it, and then I'm seeing them three months later it's not ...it's not so ... actually, again, it depends on how involved and positive the other family members are. So if someone, if some of them come back and they've done brilliantly, and it's fab, and it's great and it's really positive. But some of them say, they do it for a week and then they lose motivation, so I think they need that continued involvement with somebody who's going to help motivate them.'</i> (S10)
<b>Knowledge and education</b>	<i>'And I think it's poor knowledge of nutrition as well, even though there's a lot out there, and I kind of, 'cause I worked, in nutrition I always think it's obvious what's healthy and what's not healthy, but I think often there was like, no comprehension of what healthy, like (?), is, even though there's quite a lot of information out there. And there's, there's a lot of confusion because you see different things in the media, and, and different family members have different ideas over what's, like, healthy eating and what's not.'</i> (S10)
<b>Responsibility</b>	<i>'Well, definitely at, at school, and in terms of what they eat between meals and things, I think they have sole control over it. Over, over the meals themselves the parents are the ones that buy the food. Yeah. So, so I think they, they, it's going to be shared responsibility between the ... it can't be all one, or all the other.'</i> (S10)
<b>Physical activity</b>	<i>'It's about being free, it's about easy access, it's about being able to get there.'</i> (S5)

<b>Practical hands on activities</b>	<i>'So we've taken fruit to try and we've, we've found quite a lot of games that you can play. We've, we use the Eat Well plate and the plastic food and you have to sort that. So it's things that they, they have to do and that ... or they'll make themselves up a healthy plate of food. It's got to be relevant and practical.'</i> (S6)
<b>Technology</b>	<i>'They love apps, anything like that, social media, you'll, you'll get them, you'll grab them.'</i> (S5)
<b>Longer term support</b>	<i>'The groups need to go on for a long time for far more than a year to, to sustain real change I would think.'</i> (S8)
<b>Adolescent insight needed</b>	<i>'But I think if you, if you're trying to design services ... I mean, the other way of posing the question isn't, "Why don't you want what we've got on offer?" but to actually go out to your target audience and say, "What is it you want?" 'Cause I don't know how much time we spend getting the insight from the people that we think should want it. We're, sort of, doing it the wrong way round in a way.'</i> (S1)
<b>Advertising</b>	<i>'You get the adolescent back to give some feedback. And then the others will think, "Well, that persons gone through it, that was good, look at how they are, perhaps I can do that.'</i> (S5)

## DISCUSSION

This study identified key themes, which should be considered in the future when developing WMPs for adolescents with overweight or obesity. Stakeholders recognised the importance of support from experienced professionals, family and peers, when developing and delivering a tailored WMP for adolescents. This corresponds with findings from other qualitative studies of stakeholder's perspectives towards child obesity treatment [15]. There was agreement amongst stakeholders that longer-term support was needed for adolescents with obesity, but also recognition of the restraints on resources to enable this. Stakeholders felt that face-to-face support was still necessary, but suggestions included integrating follow-up support into schools and leisure services. This transition has also been suggested by stakeholders in Australia [16].

Additionally, the importance of easing prior worries about a programme is important to engage adolescents in the first place. Once engaged, stakeholders recognised the need for the educational side of a programme to be practical and hands-on. This active engagement has been recognised elsewhere in a qualitative study of children's views of the MEND programme [17]. Additionally, the need to offer adolescents emotional and psychological support within a WMP, in addition to nutrition and physical activity

education was noted. This concurs with a recent systematic review investigating the views of adolescents attending obesity treatment interventions [13].

There was consensus amongst stakeholders that community-based WMPs worked best, as opposed to clinical settings. Having a variety of delivery modes, such as group and 1-2-1, particularly in the home environment, were recommended. Not only was the home setting of HL praised in this study, other home-based WMPs have received positive feedback from adolescents [18]. The existing evidence suggests that there is no difference between individual or group-based programmes in terms of their effectiveness [7], however, a combination approach may warrant further investigation.

Stakeholders agreed that WMPs for adolescents need to be more proactive at incorporating an element of technology. This is encouraging, as text-messaging and web-based programmes have been positively reported previously [19-21].

### **Strengths and limitations**

This study involved a small purposive sample of participants linked to a specific WMP in the West Midlands. This means the scope of their experience and knowledge may not include the full scope of what might be feasible nationwide. As the researcher was previously involved in delivering a WMP for adolescents, the researcher's personal views may have influenced the themes that developed in this study. To reduce this risk, data were analysed thematically, taking an inductive approach and a second author (OO) audited themes.

### **CONCLUSION**

This study presents the views of stakeholders on WMPs for adolescents. Although quantitative reviews have sought to understand the effectiveness of these [7] qualitative research could aid their development, encouraging greater recruitment and retention. The stakeholders in this study shared insights that may improve future development and delivery of adolescent WMPs.

## **References**

1. NHS Digital. *Health Survey for England 2016*. Available from: <https://digital.nhs.uk/data-and-information/publications/statistical/health-survey-for-england/health-survey-for-england-2016>.
2. Freedman DS, Mei Z, Srinivasan SR, et al. Cardiovascular Risk Factors and Excess Adiposity Among Overweight Children and Adolescents: The Bogalusa Heart Study. *J Pediatr*. 2007;**150**(1):12-7.e2.
3. Haines L, Wan KC, Lynn R, et al. Rising Incidence of Type 2 Diabetes in Children in the U.K. *Diabetes Care*. 2007;**30**(5):1097-101.
4. Reece LJ, Bissell P, Copeland RJ. 'I just don't want to get bullied anymore, then I can lead a normal life'; Insights into life as an obese adolescent and their views on obesity treatment. *Health Expect*. 2016;**19**(4):897-907.
5. Patton GC, Coffey C, Carlin JB, et al. Overweight and Obesity Between Adolescence and Young Adulthood: A 10-year Prospective Cohort Study. *J Adolesc Health*. 2011;**48**(3):275-80.
6. NICE. *Weight management: lifestyle services for overweight or obese children and young people*. 2013. Report No. PH47.
7. Al-Khudairy L, Loveman E, Colquitt JL, et al. Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years. *Cochrane Database Syst Rev*. 2017(6).
8. Waters E, de Silva-Sanigorski A, Hall BJ, et al. Interventions for preventing obesity in children. *Cochrane Database Syst Rev*. 2011;**12**(00).
9. Luttikhuis HO, Baur L, Jansen H, et al. Interventions for Treating Obesity in Children. *Cochrane Database Syst Rev*. 2009.
10. NICE. *Costing report. Managing overweight and obesity among children and young people: lifestyle weight management services*. 2013 [Available from: <https://www.nice.org.uk/guidance/ph47/resources/costing-report-69149341>].
11. Dhaliwal J, Nosworthy NM, Holt NL, et al. Attrition and the management of pediatric obesity: an integrative review. *Child Obes*. 2014;**10**(6):461-73.
12. Skelton J, Beech B. Attrition in paediatric weight management: a review of the literature and new directions. *Obes Rev*. 2011;**12**(5):e273-e81.
13. Jones HM, Al-Khudairy L, Melendez-Torres GJ, Oyebo O. Viewpoints of adolescents with overweight and obesity attending lifestyle obesity treatment interventions: a qualitative systematic review. *Obes Rev*. 2018.

14. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol.* 2006;3(2):77-101.
15. Staniford LJ, Breckon JD, Copeland RJ, et al. Key stakeholders' perspectives towards childhood obesity treatment: A qualitative study. *Journal of Child Health Care.* 2011;15(3):230-44.
16. Smith KL, Straker LM, McManus A, et al. Barriers and enablers for participation in healthy lifestyle programs by adolescents who are overweight: a qualitative study of the opinions of adolescents, their parents and community stakeholders. *BMC Pediatr.* 2014;14(1):53.
17. Watson LA, Baker MC, Chadwick PM. Kids just wanna have fun: Children's experiences of a weight management programme. *Br J Health Psychol.* 2015;21(2):407-20.
18. Woolford SJ, Sallinen BJ, Schaffer S, et al. Eat, play, love: adolescent and parent perceptions of the components of a multidisciplinary weight management program. *Clin Pediatr.* 2012;51.
19. Jogova M, Song JE-S, Campbell AC, et al. Process Evaluation of the Living Green, Healthy and Thrifty (LiGHT) Web-Based Child Obesity Management Program: Combining Health Promotion with Ecology and Economy. *Can J Diabetes.* 2013;37(2):72-81.
20. Woolford SJ, Khan S, Barr KLC, et al. A Picture May Be Worth a Thousand Texts: Obese Adolescents' Perspectives on a Modified Photovoice Activity To Aid Weight Loss. *Child Obes.* 2012;8(3):230-6.
21. Woolford SJ, Clark SJ, Strecher VJ, et al. Tailored mobile phone text messages as an adjunct to obesity treatment for adolescents. *J Telemed Telecare.* 2010;16(8):458-61.