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**Prevalence and Determinants of Oral Diseases  
and Oral Health Care Needs in Slums: A  
comparative study with non-slum urban  
settings in Nigeria**

**by**

**Mary Ebelechukwu OSUH**

A thesis submitted in partial fulfillment of the  
requirements for the award of the degree of  
Doctor of Philosophy (Ph.D.) in Health Sciences

University of Warwick, Warwick Medical School

October 2022

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## **Acknowledgment**

This research journey has been immense for me and I would like to express my sincere gratitude to several individuals and organizations that supported me through the study. First, I wish to express my sincere gratitude to the National Institute of Health Research (NIHR) Global Health Research Unit on Improving Health in slums. This study was conducted with financial assistance from the UK Government under the UK Aid for the support of global health research. Without this funding, it would not be possible for me to embark, least of all complete this Ph.D. work. I remain grateful for the scholarship opportunity. I also wish to express my profound gratitude to the entire crew of Improving Health in slums Collaborative, ably led by Prof Richard J. Lilford. I have been well nurtured in research through the wealth of experiences willingly shared by members of the collaborative. I feel privileged to be a part of the research family, working towards improving the health of people living in slums. I thank the University of Warwick for my admission into their graduate school program. I am indebted to the University of Ibadan for providing me with the institutional platform for the scholarship. I would like to express my sincere appreciation to my supervisors Professor Richard J Lilford, for his enthusiasm, patience, insightful comments, helpful information, practical advice, and unceasing ideas that have helped me tremendously through the research and the writing of this thesis. I feel very privileged to learn from his wealth of knowledge and experience. Professor Gbemi Oke, my oral health expert, has skillfully and patiently managed me. Her immense knowledge, profound experience, and professional expertise in oral health research which she generously shared with me contributed in no small measure to the success of this research from its foundation. Professor Eme Owoaje for always being so positive, and supportive. Her wise counsels and constant prodding kept me on my toes. Dr. Bronwyn Harris, for generously sharing her reflective research experience and professional expertise with me. Her motherly style and warmth whenever her attention is required make her even more fascinating to work with. I am grateful to Dr. Yen- Fu Chen who patiently but firmly managed me, he knew when to push me through challenges or new learning and when to assist me which he does painstakingly. He fostered my learning and understanding of systematic reviews and quantitative methods patiently, despite my inadequacies at times. I am grateful for his generosity of spirit, time, and attention. Overall, I could not have imagined any better supervisors for my study. The team spirit and oneness of purpose through which they operated greatly helped my successful delivery of this work. Other key personnel that have contributed in no small measure to the success of this project have been AJ Asaolu, Dr. Godwin Yeboah, Taiwo Abiona, Laura Quinn, Dr. Tunde Adedokun

(US), and Dr. Olalekan Taiwo who have all assisted technically. I am grateful to Simon Smith, the project manager, for the selflessness and warmth displayed in his roles to ensure that I am comfortable in the UK. His favorite quote is *“always happy to help out, Mary!”*. I thank Prof Akinyinka Omigbodun for his constant support and encouragement. His assurances even through tough times were rather strengthening. I thank Dr. Motunrayo Ayobola, and Dr. Olufunke Fayehun, as well as all the members of my research team for their support, encouragement and prayers. Special appreciations goes to my colleague Dr Samuel Tunde Tobi-Alao who provided needed technical assistance throughout the conduct of the study. I also appreciate members of the Department of Periodontology and Community Dentistry, my very own department in the University of Ibadan, whose tremendous support and encouragement saw me through. They had my back each time I needed to be away from the department in pursuit of this programme. I thank the members of staff of the National Population Commission (NPopC) in Nigeria, the community heads, heads of landlords’ association, and all residents of the slum and the non-slum sites that participated in the survey for their support and cooperation.

To my husband, partner, and best friend, Jackson, for being my number one support through the period and always. I know that the many times I had to be away, and my mental and emotional attention was absent from the family, such times were particularly tough, but you held the domestic fort and parenting of our children happily and responsibly, as always. You are simply the best and I am so proud of you. I am grateful to our children Ahachukwu, Okwuchukwu, and Ozichukwu, their love, understanding, and support, as always, added strong pillars to my strength. To my parents, Lawrence and Cecilia Chirah, mother-in-law Jane Osuh and all my immediate and extended family members: brothers, brothers-in-law, sisters-in-law nephews, nieces, cousins, uncles, and aunts who are too numerous to mention by names for their love, support, and prayers.

To my dear friends, Dr. Clara Akinyamoju, Dr. Olaide Gbadebo, members of Vine Branch Ministries, Arulogun, Ibadan, my local church as well as members of the Full Gospel Business Men’s Fellowship International (FGBMFI), Ibadan SW-1 district. I thank you all for the love, support, prayers, and spiritual backing. God bless you all.

Lastly, I would like to thank the Almighty God for the opportunity and grace to undertake the research successfully. For letting me overcome all challenges and difficulties through the journey. I have experienced your guidance each day and will keep on trusting you for subsequent steps in the future.

## **Declaration**

I, Mary Ebelechukwu Osuh declare that this thesis is submitted to the University of Warwick in support of my application for the degree of Doctor of Philosophy in Health sciences. It has been composed by myself and has not been submitted for a degree at another university nor in any previous application for any degree.

The work presented (including data generated and data analysis) was carried out by me, the author. Where information or guidance has been derived from other sources, I confirm that this has been indicated using reference.

## Papers

### Published papers

1. Osuh, M. E., Oke, G. A., Lilford, R. J., Owoaje, E., Harris, B., Taiwo, O. J., Yeboah, G., Abiona, T., Watson, SI., Hemming, K., Quinn, L., & Chen, Y-F. (2022). Prevalence and determinants of oral health conditions and treatment needs among slum and non-slum urban residents: Evidence from Nigeria. *PLOS Global Public Health*, 2(4), e0000297. Also available at <https://doi.org/10.1371/journal.pgph.0000297>

Acceptance date: 7 March 2022

Publication date: 22 April 2022

### Accepted paper

2. Title of manuscript: Tooth adornment among siblings living in an urban slum in Nigeria: Health implications for a vulnerable population

Manuscript ID: CCR3-2022-05-1107.R1

Journal: Clinical Case Report Journal (ScholarOne Manuscripts)

Acceptance date: 21 October 2022

### Manuscripts being developed:

3. Oral health in an urban slum, Nigeria: residents' perception, practices, and care-seeking experience
4. Prevalence of oral diseases and health care behaviour among residents of slums and non-slum urban settings of Low and Middle-Income Countries (LMICs)- A systematic review.
5. Oral disease burden and health care needs in slums: evidence from a mixed methods research, Nigeria.

## Conference presentations

*Conference:* International Association for Dental Research (IADR) Nigerian Division. 19th Annual General Scientific Meeting, Kano, Nigeria. 28 - 29th September 2022

Oral presentation title:

- a. Mary Osuh, Gbemisola Oke, Eme Owoaje, Bronwyn Harris, Richard Lilford, Yen-Fu Chen. Oral disease burden and health care needs in slums: evidence from a mixed methods research, Nigeria
- b. Mary E. Osuh, Gbemisola A. Oke, Eme Owoaje, Richard J. Lilford, Yen-Fu Chen, Bronwyn Harris. Oral health in an urban slum, Nigeria: residents' perceptions, practices and care-seeking experiences

*Conference:* WMS POSTGRADUATE RESEARCH SYMPOSIUM 2021. University of Warwick 26<sup>th</sup> May 2021

Oral presentation title:

- a. Mary E. Osuh, Gbemisola A. Oke, Eme Owoaje, Yen-Fu Chen, Bronwyn Harris, Richard J. Lilford. Oral health in an urban slum, Nigeria: Disease prevalence and residents' perceptions, practices, and care-seeking experiences

*Conference:* WMS POSTGRADUATE RESEARCH SYMPOSIUM 2020. University of Warwick 30<sup>th</sup> September 2020

Poster title presented:

- a. Mary E. Osuh, Gbemisola A. Oke, Eme Owoaje, Yen-Fu Chen, Bronwyn Harris, Richard J. Lilford. Prevalence of oral diseases among slum and non-slum residents in Ibadan, Nigeria

*Conference:* National Institute for Health Research (NIHR) Global Health Research Unit on Improving Health in Slums Scientific Advisory Group Conference and Meeting at Holiday Inn, Kenilworth on Tuesday 28 – Wednesday 29 January 2020

Poster title presented:

- a. Mary E. Osuh, Gbemisola A. Oke, Eme Owoaje, Yen-Fu Chen, Bronwyn Harris, Richard J. Lilford. Prevalence of oral diseases among slum and non-slum residents in Ibadan, Nigeria

*Conference:* i-Research 2019: Innovation for Development (I-4-D) Ibadan. College of Medicine, University of Ibadan. Ibadan. 10 - 12th September 2019

Poster title-

- a. Osuh ME, Oyaniran OH, Tunde-Alao TS, Oke GA, Chen YF, Lilford R. (2019). Incidental finding of aggressive periodontitis in a 45-year-old

## **Abstract**

**Background:** Little is known about the prevalence, determinants, and treatment needs of people who reside in the slums of Nigeria, and information on slum dwellers' experiences about oral health care is scarce. Such information is needed to plan appropriate interventions to improve the oral health and well-being of Nigeria's growing slum population, hence this study.

**Methods:** This thesis was mixed methods parallel convergent in design and was approached by conducting three research works: 1) a systematic review on oral health in slum and non-slum urban settings of the Low and Middle-Income Countries (LMICs); 2) a community oral health survey on the prevalence of oral health conditions, the determinants and treatment needs among slum residents in comparison with non-slum residents in Ibadan; 3) qualitative research exploring the perspectives of slum dwellers about their dental health experience.

**Results:** Combined findings suggest bleeding gum, periodontal pocket, and dental caries as prevalent oral diseases in the slum. Oral health outcomes were worse when compared to the non-slum counterpart and this is comparable to findings from the LMICs in terms of high prevalence. Verified normative needs confirmed the slum residents' felt treatment needs and identified 35% that required the "prompt and urgent" levels of treatment. Dental visits were generally low, mostly problem-driven, often as last resort, and worse in the slum. Wide practice of alternative dental care remedy options that generally preceded professional healthcare seeking abound. Oral health needs include improved access to more comprehensive dental treatments at reduced costs as well as increased oral health literacy.

**Conclusions:** The slum residents had high oral disease burden with worse outcomes relative to their non-slum counterparts. Potentially harmful oral self-care remedy options abound among them and these generally precede professional healthcare seeking. They could benefit from targeted oral health education and improved access to professional dental care.

**Word count:** 300

Thesis word count: 50,192

## **List of Abbreviations**

BPOC Basic Package of Oral Care

BSREC Biomedical and Scientific Research Ethics Committee

CAL Clinical Attachment Level

CPI Community Periodontal Index

CPITN Community Periodontal Index of Treatment Needs

DMFT Decayed Missing Filled and Teeth

IADR International Association for Dental Research

LGA Local Government Area

LMIC Low- and Middle-Income Countries

MDG Millennium Development Goals

MMAT Mixed Methods Assessment Tool

NPopC National Population Commission

PRISMA Preferred Reporting Items for Systematic Reviews and Meta-Analyses

SDG Sustainable Development Goals

WP Work package

OHRQoL Oral-Health-Related-Quality-of-Life



## Chapter 1: Introduction to the thesis

### 1.1. Overview of chapter

This chapter is an introduction to the thesis. It features the context, problem statement, the justification, aim and objectives, relevance and scope as well as the structure of the thesis.

### 1.2. Context

Slums are generally described as densely populated residential areas comprising mostly crowded, decrepit housing units in a situation of depreciated or incomplete infrastructure and occupied mostly by impoverished individuals (Ezeh *et al.*, 2016; Saglio-Yatzimirsky, 2021). Slum settlements are reported to be the fastest-growing social cluster of communities and are estimated to provide homes for about 1 billion of the current world population (Ezeh *et al.*, 2016; Saglio-Yatzimirsky, 2021). Slums feature in many cities globally, especially in low and middle-income countries (LMICs). In Nigeria, almost half of the entire population is believed to be living in slums (Aduwo *et al.*, 2016)

A major concern about slums is the attendant effect on the overall health of the residents and these manifest in both chronic and acute diseases (Davidson *et al.*, 2006; Ezech *et al.*, 2016; Lilford *et al.*, 2017; O'Donnell, 2007; Peters *et al.*, 2008; Riley *et al.*, 2007; UN-Habitat, 2018). Oral diseases, like most other diseases, are heavily influenced by people's lifestyle and life circumstances (Davidson *et al.*, 2006; Petersen, 2003; Singla *et al.*, 2016; Watt, 2005). Research has established a link between the lifestyle of individuals, their environment, and their oral health (Gupta *et al.*, 2015; Salehi *et al.*, 2017). Oral diseases are chronic, often silent, and slowly progressive in nature. The diseases are often neglected and patients tend not to seek care early (Okunseri *et al.*, 2004; Varenne *et al.*, 2006). The fact that dental diseases constitute a neglected epidemic in many developing nations, worsens the situation. Consequently, common oral diseases such as dental caries and periodontal diseases (PD) continue to flourish among deprived population groups (Maupomé, 1998; Petersen *et al.*, 2005; Sheiham *et al.*, 2015). In studies conducted among children in Mexico and India, untreated dental caries are 2.5 times as prevalent among slum dwellers compared to children in other settings (Christensen *et al.*, 2003; Maupomé, 1998). Poor oral health negatively affects quality

of life, school performance, work productivity and increases family health spending (Al-Jundi, 2004; Guarnizo-Herreño & Wehby, 2012; Masood *et al.*, 2015).

Moreover, research evidence has linked periodontal disease to various non-communicable diseases such as hypertension, diabetes, osteoporosis; poor mental health, and adverse pregnancy outcomes (Arigbede *et al.*, 2012; Kim & Amar, 2006). As such, controlling these risk factors in oral diseases can majorly impact on general disease control at a lower cost, greater efficiency, and effectiveness than disease-specific approaches (Singla *et al.*, 2016; Watt, 2005). Oral health is, therefore, an integral component of the general health and well-being of every individual and has become one of the basic components of Primary Health Care (PHC). Unfortunately, the service component of oral health is absent at most PHC facilities in Nigeria. Oral diseases are largely preventable, but up to 90% of world populations have experienced oral/ dental diseases and some eventually die as a result (Akpata, 2004; Braimah *et al.*, 2016; Varenne, 2012).

Many studies, both in Nigeria and abroad, have focussed on oral health or its related diseases in hospitals, rural or general urban settings, but little information is available on oral health or disease issues in slum settings. To date, little is known about the spectrum, burden, determinants, and oral health treatment needs of people who reside in the slums of Nigeria. As Nigeria and the rest of the world are experiencing a surge in the growth of slum communities, the need to improve slum dwellers' health by way of effective control of oral diseases is imperative. It will not only improve the quality of life of affected persons but will aid in controlling the major chronic diseases of public health concern in a cost-effective manner. Therefore, to facilitate the development of appropriate programmes that will improve the oral health of slum residents in Nigeria, this study aims to assess and compare the prevalence and determinants of oral diseases and oral health care needs among adult residents of slums and non-slum settings in Nigeria.

### 1.3. Statement of problem

Oral diseases exist in all populations of the world varying only in prevalence and severity (Petersen *et al.*, 2005). The diseases are strongly age-related and vary in profile among population groups with different socioeconomic levels, behavioural characteristics, and environmental conditions so that it tends towards flourishing at the poverty level (Adeniyi *et al.*, 2012; Maupomé, 1998; Petersen *et al.*, 2005). There is a rise in the trend of dental diseases

especially among the socially marginalized and deprived communities including the slums mainly because of limited access to needed dental care (Adeniyi *et al.*, 2012; Petersen *et al.*, 2005) for socioeconomic, behavioural and environmental reasons. Children residing in the slum environments are particularly susceptible as they experience about 2.5 times more oral diseases when compared to children residing in other environments (Christensen *et al.*, 2003; Maupomé, 1998). Dental caries, an irreversible dental disease, causing decay on the tooth, is the commonest oral disease affecting up to 60-90% of school-aged children in populations that have been surveyed worldwide (Akpata, 2004; Braimah *et al.*, 2016; Guarnizo-Herreño & Wehby, 2012). Untreated dental diseases compromise a child's ability to eat well, sleep well, and function well at home and school. Consequently, it leads to missed school days, malnutrition, poor growth, and poor performances at school (Ahmed & Haboubi, 2010; Moynihan, 2005; Petersen, 2003; Petersen *et al.*, 2005). The un-aesthetic nature of untreated dental decay compromises the child's self-esteem and social development (Guarnizo-Herreño & Wehby, 2012). Periodontal disease features chronic destruction of tooth-supporting structures. It is the commonest dental disease in the adult population affecting almost entire populations (Akpata, 2004). The effect of dental diseases in adults manifests as the compromised quality of life, reduced productivity, and unanticipated family health spending (Al-Jundi, 2004; Masood *et al.*, 2015). The global economic burden of dental diseases was estimated at \$442 Billion in 2010, of which \$298 Billion was attributable to direct treatment costs and \$144 Billion to indirect costs in terms of productivity losses due to caries, periodontitis, and tooth loss (Listl *et al.*, 2015). In the United States of America, oral health-related illnesses were reported to be responsible for 6.1 million days of hospital admissions, 12.7 million days of restricted activities and 20.5 million workdays lost each year (National Institute of Dental & Craniofacial Research (US), 2000). Un-restored missing teeth could have a profound effect on an individual's self-confidence, speech, and choice of food thereby leading to weight loss (National Institute of Dental & Craniofacial Research (US), 2000; Petersen & Yamamoto, 2005).

Dental service utilization and access to care reflect gross inequalities. The inequality gap which widens with worsening socioeconomic status is mostly attributed to residential environments and remains a concern in most regions (Akpata, 2004; Baldani & Antunes, 2011; Christensen *et al.*, 2003; Mathur *et al.*, 2014; Mathur *et al.*, 2016; Peters *et al.*, 2008). Inequality in oral health care access among slum dwellers, when compared to those in better social and economic conditions (Christensen *et al.*, 2003; O'Donnell, 2007; Peters *et al.*, 2008), signals a rising trend in unmet oral health care needs, hence, the significance of this study.

#### 1.4. Rationale for study

Oral diseases are of public health importance and deserve priority for prevention and control because of the high prevalence and morbidity, risk of mortality, and feasibility of a cost-effective control (Walsh & Warren, 1980). As noted earlier, oral diseases share common risk factors with other chronic systemic diseases. Therefore, a collective control on all these diseases can be exerted by controlling the risk factors these diseases share at a cheaper cost, greater efficiency, and effectiveness than disease-specific control methods (Sheiham & Watt, 2000). Oral health is one of the basic components of Primary Health Care (PHC), yet the service component is absent at most PHC facilities in Nigeria. Since oral health is less researched compared to other PHC components, information on slum dwellers' oral health and concerns about their access to care is also scarce.

Despite the burden of oral diseases, few representative population-based oral health surveys have been conducted in Nigeria. Available epidemiological studies have been sporadic in nature and convenience-based, many of which involve retrospective reviews of hospital-based data (Akpata, 2004). Consequently, little is known about the spectrum, burden, determinants, and treatment needs of oral diseases of slum dwellers in Nigeria. This study aimed to address these deficiencies in data. Moreover, a focus of this study on the adult population group ensured the inclusion of at least two standard age groups (34-44 years and 65-74 years) for surveillance of oral health conditions (Petersen, 2013). Data from these age groups can provide information on the full effect oral disease, the level of severity, and the general effects of oral health care as well as estimates of the manifestation of oral disease from a life course perspective (Petersen, 2013). Such information is useful for planning appropriate interventions that can improve the oral health outcomes of Nigeria's growing slum population. In addition, this study involved a scientific synthesis of existing literature and data on oral health in slums which were hitherto, generally scarce. An understanding of how the inhabitants of a slum environment have fared relative to the inhabitants in the other urban sites would also facilitate the planning of appropriate intervention strategies.

Slum-dwellers are intimately, linked economically, socially, and culturally to the rest of the urban population (Dafe, 2009; Macharia, 1992; Saglio-Yatzimirsky, 2021; UN-HABITAT, 2004), since slums serve as transit points to many urban dwellers (Dafe, 2009; Macharia, 1992; Saglio-Yatzimirsky, 2021; UN-HABITAT, 2004). Therefore, identifying the problems of oral health in the slums not only aid in controlling diseases of public health importance within the slums but may also assist in controlling them across urban settings.

### 1.5. Primary goal

The primary goal for this research was to generate baseline data that can be useful for planning effective strategies that can improve the oral health and general well-being of people who reside in slums.

### 1.6. Thesis structure

The thesis has eleven chapters and is organized as follows:

Chapter 1 provides an overview of areas relevant to the wider context of the thesis, and provide a statement of the research problem, rationale, and primary goal.

Chapter 2 is a brief background to the study. This involves a narrative review of the literature to crystallize the research focus.

Chapter 3 describes the methodological approach to the project and the rationale. It outlines the objectives and the three main components of work involved (a systematic review, a quantitative survey and a qualitative study, described as individual work packages [WPs] in subsequent chapters). The ethical issues were also considered.

Chapter 4 outlines the design and method deployed for the systematic review. It is known in this thesis as Work Package-1 (WP-1).

Chapter 5 presents the results of the systematic review (WP-1).

Chapter 6 outlines in details, the design and method of the quantitative survey component of the project also known as Work Package-2 (WP-2).

Chapter 7 presents the results obtained from the analysis of data generated from the quantitative survey (WP-2).

Chapter 8 communicates the design deployed for the qualitative study component of the project, also known as Work Package-3, (WP-3).

Chapter 9 presents the results from analyzing the data generated from the qualitative study (WP-3) component.

Chapter 10 brings together findings from the quantitative and qualitative studies (WP-2 and WP-3) for integration and discussion while comparing the findings with other relevant studies systematically gathered from the LMICs literature in WP-1.

The conclusion, strengths and limitations of the thesis, as well as the implications and recommendations for future research and practice are considered in Chapter 11 of the thesis.

## Chapter 2: Background to the study

### 2.1. Overview of chapter

This chapter is a narrative of existing knowledge on the subject of study and covers the following topics: definitions, types, and growth of slums, history of slums in Nigeria, the importance of slums to the host communities, slum health, oral health burden, determinants of oral disease, consequences of unmet oral health needs, oral health and primary health care, and utilization of dental services. It also highlights current research gaps in the area of study.

### 2.2. Defining slum

The importance of identifying slum dwellers - people living in settings of deprivation, for research purposes and efficient management of resources and services, cannot be overemphasized (Ezeh *et al.*, 2016; Lilford *et al.*, 2019; Sheuya, 2008). Defining slums has been a matter of debate among researchers with numerous features proposed as the characteristics (Kohli *et al.*, 2012; Lilford *et al.*, 2019). Owing to their perceived complexity, slums have been viewed as the least well understood places on earth (Smith, 2013). For a better understanding of slums, the Affordable Housing Institute (AHI), Boston USA, proposed a dozen definitions. These include: Its description as different from the formal world's mental image; Overcrowded spaces or highly dense, low-rise, substandard, and unhealthy environments; Places that are dangerous to live in and work; Wealth-extraction machine; Places where physical reality and legal documentation are wildly at odds; Alternative-universe power structure that emerges inside a spontaneous and self-built community; A never silent hives of entrepreneurs; A self-organizing ecosystem; An adaptive response to economically rational' delivery of 'affordable housing; and lastly as a phase that every rapidly urbanizing city goes through (Smith, 2013).

The United Nations (UN-HABITAT, 2004) provides an operational definition of a slum household as a group of people living under one roof especially in urban areas and lacking access to at least one of the following:

1. Durable housing of a permanent nature that protects against extreme climate conditions.
2. Sufficient living space which means no more than three people sharing the same room.
3. Easy access to safe water in sufficient amounts at an affordable price.
4. Access to adequate sanitation in the form of a private or public toilet shared by a reasonable number of people.
5. Security of tenure that prevents forced evictions.

While some reports have viewed slums in terms of percentage of urban area by countries (United Nations, 2014) others have looked at slum's constitution in terms of the city's development (Akanle & Adejare, 2017; Simon *et al.*, 2013).

### 2.3. Development and growth of slums

In the last two centuries, the major cities and towns all over the world, particularly in developing countries, have experienced a remarkable influx of people in search of better livelihood (Ezeh *et al.*, 2016; Simon *et al.*, 2013). The very rapid process of urbanization experienced by these cities and towns result in the degradation of facilities in these urban centres (Pat-Mbano & Nwadiaro, 2012; Simon *et al.*, 2013). The urbanization process is accompanied by specific changes in the distribution and structure of the population as well as in the size, system, network, and character of affected settlements and these events are synonymous with the formation of slums (Simon *et al.*, 2013). Massive slums which started as rapid urbanization were first seen in Europe and North America after the Industrial Revolution of the late 18th century. Since then countries, particularly of the LMICs of the world, have experienced massive urbanization, characterized by a growing number of slums that are homes to more than half of the population in countries such as India, Kenya, as well as in cities such as Bangkok, and Abidjan (UN-HABITAT, 2004).



#### 2.4. Slum formation process

According to the United Nations (UN-HABITAT, 2004), slums can be broadly categorized into two types:

1. The declining areas, which comprised 'old' city centre slums (residential areas of cities that undergo deterioration as their original owners move out to newer, and more fashionable residential areas); and the 'new' slum estates (structures are relatively new and generally not in private ownership. For example, public housing estates and that built by industry to house industrial workers)
2. The progressing settlements, that comprise squatter settlements (people who occupy land or buildings without the explicit permission of the owner) and semi-legal subdivisions (settlements where the land has been subdivided, resold, rented or leased by its legal owner to people who build their houses upon the plots that they buy).

The concept of a slum is associated with deprived living conditions. Consequently, the operational definition of slum provided by the United Nations (UN-HABITAT, 2004) portrays varying degrees of deprivation and suggests a range from "less deprived" to "more deprived" settlements (Pugalis *et al.*, 2014). Such settlements may be differentiated in terms of spatial features based on the concept that each slum exhibits particular types of socio-spatial characteristics with some qualities that are capable of reinforcing its strengths, its weaknesses and determining the appropriate intervention for such area as shown in Table 2.1.(Pugalis *et al.*, 2014; UN-HABITAT, 2004).

Table 2.1: Major categories of slums' socio-spatial characteristics

<b>Categories</b>	<b>Type</b>	<b>Description</b>
<b>Origin and age</b>	Historic city-centre slums	Usually, a mixture of grand buildings and public spaces, mostly in semi-ruins, or taken over for private use
	Slum estates	Rundown inner-city housing (private and public)
	Consolidating informal settlements	Developments on informally subdivided land have gained recognition over time
	Recent slums	Newer and unconsolidated neighbourhoods, often characterized by poorer and less permanent developments
<b>Location and boundaries</b>	Central slums	Formed when original owners of houses in the inner city move to more prosperous locations. Residents benefit from closeness to employment opportunities
	Scattered slums	Islands of slums surrounded by formal housing and other officially sanctioned land use
	Peripheral slums	Settlements on the city fringe occupied either illegally or through a rent arrangement with the owner
<b>Size and scale</b>	Mega or large slum settlements:	Often equivalent to cities in size – sometimes home to the majority of a city's inhabitants
	Medium-sized slum settlements	Combining several neighbourhoods or districts
	Small slums	Single streets and neighbourhoods
<b>Legality and vulnerability</b>	Illegal	Contravening state regulations
	Informal	Occupied without any formal recognition
<b>Development state: Dynamic and diagnosis</b>	Intervention-led improved slums:	Settlements where some intervention has been made in certain aspects but whereby substantial issues remain
	Upgraded slums:	Settlements that have experienced sustained interventions that have resulted in a significant improvement to living conditions
	Communities/individuals lacking incentive for improvement	
	Slums with ongoing individual and community-led development	

Source: Adapted from UN-Habitat (2003)

## 2.5. Slums in Nigeria

Nigeria is widely known as the most populous country in Africa. Since the dawn of the 21st century, there has been an upsurge in the quest to live in major cities with associated unguided rapid urbanization processes. These processes have heralded the sprawling of many slums in

the major cities and the periphery of urban centres all over the country (Agbola & Agunbiade, 2009; Bakare, 2014; Fourchard, 2003; Pat-Mbano & Nwadiaro, 2012). According to Alkali (2005), Nigeria's experience of rapid urbanization in terms of scale, pervasiveness, and historical antecedents have been unique. In Nigeria, with well over 840 urban centres, and more than 10 cities each having a population of well over a million, it is estimated that more than 60 percent of the Nigerian population will live in urban centres by the year 2025 (Alkali, 2005; Taiwo & Gbolabo, 2020). Similar to the challenges of rapid urbanization the world over, Nigeria is confronted with sustainable development challenges which have greatly accelerated poverty so that well over 70 million live in poverty (Taiwo & Gbolabo, 2020). Examples of notable cities in Nigeria with numerous slum settlements are Lagos, Ibadan, Aba, Port-Harcourt, and Kano.

#### 2.6. Importance of slum on host countries

Slum communities play a significant role in their host country's economy. The majority of the host country's labour force resides in such communities. Various reasons such as affordability, proximity, and accessibility to better opportunities have been adduced. As such slums serve as rallying points for diverse ethnic, cultural, and racial groups as well as socioeconomic classes. It also serves as transit settlement points for many of the people moving forwards in the higher socioeconomic class. Many of the important forces which shape economic industries such as music, dance, sports, and politics originate from these settlements (UN-HABITAT, 2004). This is in addition to the main workforce of the host nation. Therefore, for the survival and corporate existence of the host nation, the health and well-being of such population groups should be on the front burner of the governments' agenda.

#### 2.7. Slum health

The importance of slum health to global health cannot be overemphasized. About one billion of the world's population currently reside in slums at an alarming growth rate. As such slum health will increasingly determine the indicators for both urban and national health (Ezeh *et al.*, 2016; Saglio-Yatzimirsky, 2021). With the current transition gradient, slums are no longer a halfway point on the route from rural poverty to the urban middle class. They are homes to a large majority of its residents (Lilford *et al.*, 2017; Mberu *et al.*, 2016; Sheuya, 2008). Slums have high density, and youthful populations that could potentially amplify the impact of public

health interventions. But people have a lower quality of life when compared to non-slum dwellers because of the recognizable distinguishing features of its environment: the presence of poor quality housing, generalized poverty, lack of public and private services, and poor integration into broader society and its opportunities (Mberu *et al.*, 2016; UN-HABITAT, 2004); thus it is not a fair gradient. Similarly, human development ratings among slum residents are reported to be far lower when compared to other urban residents because they have more health problems, lack access to social services, and employment, and most of them have very low income. The attendant inequity from these unfair gradients has implications for political stability and increased radicalization of the youth. (Ezeh *et al.*, 2016; Mberu *et al.*, 2016; Sheuya, 2008; UN-HABITAT, 2004). The public health impacts of health problems in slum areas are enormous. Children are particularly vulnerable in slum settings and studies have reported poorer health outcomes among children living in slums relative to those living in non-slum settings (Ezeh *et al.*, 2016; Lilford *et al.*, 2017; Mberu *et al.*, 2016; Riley *et al.*, 2007). Moreover, the natural and social barriers that support the management of outbreaks become more difficult to control once they are in the general urban space because of the slum environmental setting (Mberu *et al.*, 2016; Sheuya, 2008). With the advent of COVID-19 pandemic, the health situation in slums took a turn for the worse where residents access to healthcare services was reportedly lower compared to the pre-covid era as the costs of healthcare services were observed to increase while household income reduced (Ahmed *et al.*, 2020).

## 2.8. Oral health burden

Oral health is an integral component of general health and well-being (US Department of Health, 2016). The distribution and severity of oral diseases vary in different parts of the world and within the same country. Its pattern reflects distinct profiles across age groups, population living conditions, lifestyles, and environmental factors as well as intervention with oral health-promoting activities (Petersen, 2013; Singla *et al.*, 2016; Watt, 2005). Like many other aspects of health, oral health has been reported to be heavily influenced by a person's environment and lifestyle (Davidson *et al.*, 2006; Gupta *et al.*, 2015; Petersen, 2003; Salehi *et al.*, 2017; Singla *et al.*, 2016; Watt, 2005). The situation is expected to be worsened in slums which are characterized by marked deprivation, especially of social amenities. Studies on oral health or associated diseases in slum settings of LMICs are few and have come mostly from Asian countries with negligible few from East Africa (Airen *et al.*, 2014; Mathur *et al.*, 2014; Mehta *et*

*al.*, 2015). These studies unanimously reported a high oral disease burden among people residing in slums.

In Nigeria, oral diseases are generally neglected and affected persons tend not to seek care early (Okunseri *et al.*, 2004; Varenne *et al.*, 2006). Consequently, oral health care services within the formal sector are perpetually confronted by complications arising from late presentations of the few users, and in such cases, treatment options are adversely limited (Al-Jundi, 2004). Poor oral health negatively affects the quality of life, productivity and increases family health spending (Singla *et al.*, 2016). In children, poorer dental health is shown to be significantly associated with reduced school performance and psychosocial well-being (Watt, 2005).

Periodontal disease and dental caries are considered the most common oral diseases of global importance. Evidence points to shared risks between periodontal disease and some non-communicable diseases such as hypertension, diabetes, osteoporosis, cancers, poor mental health, cardiovascular and respiratory diseases as well as adverse pregnancy outcomes (Arigbede *et al.*, 2012; Kim & Amar, 2006). As such the case for intervention to control both types of diseases is strengthened (Sheiham & Watt, 2000). Common dental problems include dental caries, periodontal diseases, oral tumours, malocclusion (imperfect positioning of the teeth when the jaws are closed), dental fluorosis (white spots on teeth), dental trauma, oral cancer, halitosis (mouth odour), dental erosion (tooth wear), and edentulism (tooth loss) to mention a few.

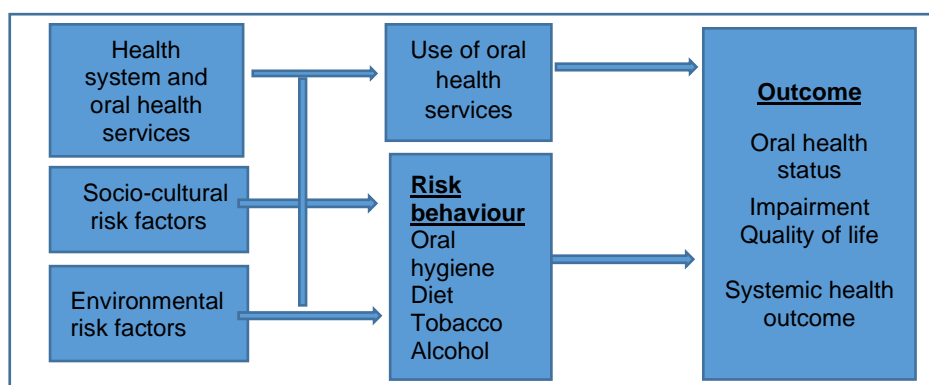
## 2.9. Consequences of unmet oral health care needs

Poorly managed or untreated dental health problems can have untold consequences on the sufferers. Some of the impacts on children include pain, abscess, swelling, irritability, disturbed sleeping habits, absenteeism from school, malnutrition leading to poor growth and cognitive development, which lead to poor school performances (Low *et al.*, 1999; Pine *et al.*, 2006; Sheiham, 2006). Cancrum Oris, an acute and ravaging gangrenous infection affecting the face with sepsis, and death may complicate severe cases. In some studies, conducted at the preschool level, children with untreated dental infection developed abscesses, weighed less, experienced reduced growth, and poorer quality of life when compared to controls. Once intervention was instituted there was rapid growth velocity, improvement in weight gain, and significant improvement in their quality of life as well as in their cognitive development (Pine *et*

*al.*, 2006; Sheiham, 2006). In adult populations, uncontrolled dental and periodontal diseases can lead to serious morbidity, mortality, reduced quality of life and considerable health care spending (Arigbede *et al.*, 2012; Kim & Amar, 2006; Shay, 2002; Vieira, 2014). Once bacteria from an infected tooth enters the pulp chamber, hematogenous seeding from the oral source becomes a dominant cause of diseases such as mediastinal abscesses, meningitis, vertebral osteomyelitis, hepatobiliary disease, and bacterial endocarditis (Navazesh & Mulligan, 1995), with bacterial endocarditis being the commonest complication (Shay, 2002; Wahl, 1994). Periodontal diseases impair glycemic control in people with diabetes and poorly controlled diabetes may exacerbate periodontal disease by increasing insulin tissue resistance in them (Negrato *et al.*, 2013; Zaidan *et al.*, 2018). Similarly, periodontopathic bacteria in the bloodstream have been linked to the development of atherosclerosis, coronary artery disease, and stroke (Navazesh & Mulligan, 1995; Shay, 2002; Stewart & West, 2016; Vieira, 2014).

## 2.10. Determinants of oral health

The WHO proposed an operational model (Fig. 1) for use by investigators or public health administrators when considering an appropriate intervention for oral health (Petersen, 2013). This model is expected to guide the gathering of data by focusing on socio-environmental determinants and modifiable risk factors of oral health such as diet/nutrition, tobacco use, and excessive alcohol consumption as these are considered risk factors in the development of dental diseases (Petersen, 2013).



*Petersen, WHO 2002*

Fig 2.1: Theoretical model showing the risk factor approach in the promotion of oral health as suggested by the WHO

### 2.10.1. Social determinants

Social factors have increasingly gained attention as determinants of oral health. This is because educational preventive approaches alone are known to be severely limited at improving health and reducing inequalities in health care access (Watt, 2002). According to Newton and Bower (2005), a conceptual framework used in mainstream epidemiology which suggests complex causal pathways between social structure and health through interlinking material, psychosocial and behavioural pathways may be applied to oral epidemiological research to explain the mechanisms that link features of social life to oral health (Newton & Bower, 2005). Admittedly, much is yet to be understood about the way social determinants of health operate to produce different oral health outcomes. The framework simplifies the complexity that characterizes socio-biological pathways. Hence, social factors such as employment status, educational status, and income level are identified as independent determinants of oral health (Assari, 2018b; Rebelo *et al.*, 2016). The US Surgeon General Report emphasizes the importance of social and environmental determinants of oral health and advocates the need to adopt a more holistic approach to oral health promotion activities (Oral health in America, 2000).

#### 2.10.1.1. Level of Education

Education is known to equip individuals with a sense of control over life circumstances which in turn influences health (Marya, 2011). In a study by Vano *et al.* (2015), individuals with a higher level of education were reported to show significantly better oral hygiene habits in contrast to those with a lower educational level who had significantly increased levels of oral diseases (Vano *et al.*, 2015). Since educational level independently influences oral conditions, it ought to be considered under risk assessment and in planning appropriate oral disease prevention measures (Crocombe *et al.*, 2018; Paulander *et al.*, 2003; Vano *et al.*, 2015).

#### 2.10.1.2. Employment status

Employment status is also known to be associated with health, be it unemployment, underemployment, or even overworked or stressful job situations (Marya, 2011). These factors singly or together have been associated with poorer oral health, worsening oral health-related behaviours, and also increased stress (Al-Sudani *et al.*, 2016; Marya, 2011). Individuals who

are in employment have better control over their work situation, hence have lower stress levels. Such people are better able to afford regular dental services with improved oral health-related outcomes, while unemployed people are considered a risk group for poor oral health behaviour resulting in poor oral health outcomes (Al-Sudani *et al.*, 2016; Marya, 2011).

#### 2.10.1.3. Income Level and income inequality

Undoubtedly, income is a factor capable of influencing the general health status of a person. Living conditions such as safe housing, security, and the ability to buy sufficient good food are known to be influenced by income level (Marya, 2011). Barriers such as insurance, cost of transportation, and time flexibility have been reported to hinder low income individuals from the possibility of having a dental visit (Assari, 2018b; National Institute of Dental & Craniofacial Research (US), 2000). In a study conducted in France, the prevalence of dental care needs was reported to be higher among adults with lower socioeconomic status (Trohel *et al.*, 2016). Similarly, income inequalities in terms of unequal gain of equal resources are identified key contributors to oral health disparities (Assari, 2018a; Assari, 2018b). In the US, a study report confirms an association between income inequality and oral health, such that adults who resided in areas of lower-income inequality reported better oral health and oral health-related quality of life than their counterparts in areas of higher income inequalities (Moeller *et al.*, 2017).

#### 2.10.2. Cultural beliefs and value system

Cultural beliefs, value systems, and norms vary among individuals and populations. A study conducted in Morocco has shown that negative social and cultural factors play a significant role in the lack of uptake of health-promoting programmes (Msefer *et al.*, 2004). Some of these beliefs may lead to the entrenchment of deleterious oral health habits among the people. Examples include the belief in some ill-defined worms as aetiology of dental problems, the practice of eating areca nut, use of battery water, local herbs and concoction and cow's dung on the teeth leading to complications which further worsen oral health outcomes (Basavaraj, 2014; Oke *et al.*, 2011).



### 2.10.3. Biological Factors

Inheritance and events surrounding conception, pregnancy, birth and general living conditions such as stress have been shown to affect general and oral health outcomes (Gomaa *et al.*, 2016). Negative events such as stress, some drugs, alcohol, infections especially around the period of conception and birth, have often resulted in the birth of children with special health care needs who have been identified as particularly vulnerable to dental health challenges (Dharmani, 2018; Feldkamp *et al.*, 2017; Hoang *et al.*, 2016; Pinto *et al.*, 2018; Yenen & Ataçağ, 2019). In the same vein, individuals with highly virulent *Streptococcus mutans* strain, a potent biological factor, are known to be at the risk of a higher caries burden (Argimon *et al.*, 2014). Children with more *Streptococcus mutans* genotypes therefore manifest higher levels of carious infection (Momeni *et al.*, 2016).

### 2.10.4. Gender

The prevalence of many oral diseases displays gender differences in their distribution patterns. While in some studies, males and females were shown to have a similar risk of developing dental diseases, others have shown a variation in the risk patterns between the gender (Gleissner, 2014; Mamai-Homata *et al.*, 2016; Sanadi *et al.*, 2017). As it obtains for health in general, oral health between males and females, especially at specific stages in life is expected to differ. The interplay of different hormones plays a major role in the vast changes observed in the oral health of both genders (Branch-Elliman, 2012). For example, the important role of estrogen deficiency in the epidemiology of oral cancer among post-menopausal women has been demonstrated (Suba, 2007). Gender as an expression of behavior and lifestyle choices has also been suggested as a source of oral health disparity (Etetafia & Azodo, 2019). In a study conducted on healthcare-seeking behavior among residents of a slum setting, similarities in the formal and informal healthcare-seeking behavior were reported for both genders (Das *et al.*, 2018). In contrast, differences were reported for oral diseases where men were reported to have more periodontal disease, dental trauma and oral cancer, while women develop more dental caries (Lipsky *et al.*, 2021). A proper understanding of the oral health differences and behaviour in gender and their changes with age is important and should be put into consideration when studying the slums of LMICs. Such information will be a useful tool in the hands of dental care professionals as it will impact gender and age-specific oral health care delivery, hence delivering a more holistic oral health (Branch-Elliman, 2012).

#### 2.10.5. Habits and Lifestyle

Various lifestyle habits and practices such as healthy eating, exercise, smoking, alcohol use, dental hygiene, and stress management are all related either directly or indirectly to the health of the mouth. In like manner, sedentary lifestyle and poor eating and drinking habits have been shown to be closely associated with being overweight and poor oral conditions (Brown *et al.*, 2009). A study has shown that an increase in sugar intake in the form of drinks can contribute greatly to the obesity epidemic (Capewell, 2014) with attendant dental caries development (Marya, 2011). In a review, smoking was shown to increase the severity of periodontal disease and that smokers are more likely to have periodontal destruction than nonsmokers (Sherwin *et al.*, 2013). A study conducted on the lifestyle of people who reside in slums reported unacceptable lifestyles and habits and advocated the improvement of these for a corporate national development (Basher *et al.*, 2012).

#### 2.11. Primary Health Care (PHC) in Nigeria and Oral health

Since the declaration of the Alma Ata in 1978, (World Health Organization, 1978) and renewed by the recent declaration of Astana (World Health Organization, 2019), the importance of PHC towards universal health coverage has continued to be emphasized and many countries have continued to adopt the PHC system. Though oral health was not one of the components of PHC from inception, it was later included together with mental health. Nigeria adopted the PHC system in 1985, but to date, is still struggling to get the program fully functional. Presently, the service component of oral health, especially the preventive oral health care aspect is conspicuously absent at most PHC facilities in Nigeria (Brimoh *et al.*, 2014.). The association between poor oral health and pain, discomfort, speech affectation, inability to eat nor sleep well, and lack of self-esteem and confidence, is now considered important and integral to the determination of general health and well-being of every individual. Therefore, integrating oral health care into the existing PHC systems remains a viable and sustainable way to improve access to oral health care especially in the LMICs (Brimoh *et al.*, 2014.; Fatusi *et al.*, 2018).

#### 2.12. Oral health services and access

Currently, oral health services are delivered in all health care levels (primary, secondary and tertiary) in Nigeria. The primary level of oral care is concerned with the prevention of dental

diseases and management of dental emergencies, but the services are available at only a few primary health care centres (PHCCs) nationwide (Adeniyi *et al.*, 2012; Gaines *et al.*, 2020; Oke, 2007). The secondary level of oral care deals with general treatment of oral disorders. The services are available at private dental clinics, general hospitals, institutions run by faith-based organisations, federal medical centres and armed forces hospitals. The tertiary level of oral care is concerned with specialised oral health services including treatment of oral diseases and patient rehabilitation and these are provided teaching hospitals (Adeniyi *et al.*, 2012; Gaines *et al.*, 2020). Other oral health care service providers include traditional oral care providers who are available in most regions; as well as few non-governmental organisations, all providing oral health services to the people (Adeniyi *et al.*, 2012; Akpata, 2004; Oke *et al.*, 2011). Of all the oral health care service delivery levels, the primary level of oral care is considered as the sure means to ensure easy access to oral health service to people in all locations, because of its widespread location in the country (Adeniyi *et al.*, 2012; Gaines *et al.*, 2020; Northridge *et al.*, 2020), but the delivery on its service mandate has been plagued with persistent challenges (manpower and other resources). Consequently, most oral health services are directed towards the provision of curative and rehabilitative care from the secondary and tertiary levels of care (Adeniyi *et al.*, 2012). These levels of care are offered mainly in the big cities, where such facilities are located and largely through an out-of-pocket payment system (Akpata, 2004). To date the inclusion of oral health into existing PHCs has continued to suffer setbacks in terms of facilities and capacity building (Adeniyi *et al.*, 2012; Oke, 2007). A number of autonomous initiatives targeted at charting a direction for Primary Oral Health Care were set up in various dental schools in Nigeria, to ameliorate the situation, but these are too few to meet the oral health need of the Nigerian populace as they lack adequate staffing and are largely funded from out of pocket (Adeniyi *et al.*, 2012; Oke, 2007). The Nigeria's National Health Insurance Scheme (NHIS) has a mandate, through various prepayment systems, to design and implement a social health insurance scheme that can facilitate easier access to affordable and available quality health care services as well as achieve a universal health coverage (UHC) (Gaines *et al.*, 2020). But it is challenged by: poor financing of the health system by governments, an absence of prepayment schemes, and a growing population of poorly paid people who reside majorly in slums (Adeniyi *et al.*, 2012; Gaines *et al.*, 2020). Thus, the NHIS billing system on oral health is considered only at the level of secondary care (Adeniyi & Onajole, 2010; Adeniyi *et al.*, 2012).

### 2.13. Utilization of Dental Health Care Services

Dental diseases are often neglected and patients tend not to seek care early (Okunseri *et al.*, 2004; Varenne *et al.*, 2006). The few existing reports from developing countries show a low utilization pattern of oral health care services among the general population and that such visits are oriented towards the relief of symptoms or pain rather than preventive care (Olusile *et al.*, 2014; Varenne *et al.*, 2006). The use of both herbal medicine and modern medicine as forms of self-medication for dental health care is a common practice among dental patients (Adetokunbo *et al.*, 2019; Anyanechi & Saheeb, 2014). However, utilization of dental health care facilities is predicated upon effective health care coverage which makes accessing health care easy (Evans *et al.*, 2013; Gulliford *et al.*, 2002). To define access to health care in general, four dimensions are indicated: availability, accessibility, affordability, and acceptability (Evans *et al.*, 2013). All of these dimensions must be considered in the definition of the concept of effective healthcare coverage in any population, more so in slum settings. Only then, can access to health care, which is a prelude to the utilization of such care facilities among slum dwellers, be evaluated.

### 2.14. Summary of narrative review

Nigeria is experiencing rapid urbanization process resulting in a growing number of slums that are estimated to be home to about 60% of the population by 2025. Slum environments have established links with the general health and wellness of the inhabitants and oral health is an integral component of general health and well-being. Oral diseases, though largely preventable, are endemic in all populations of the world, affecting close to ninety percent of populations under survey. The consequence of untreated dental diseases can negatively affect the quality of life, family health spending, work productivity in adults and performance in children. Research has established a linked between oral diseases and major non communicable diseases such as hypertension and diabetes through their common risk factors. As such, a control of these risk factors confers more efficient control on the linked diseases. Studies on oral health in relation to the slum environment in Nigeria and Africa are scanty. Available studies on oral health and its associated diseases have focused majorly on general urban, rural, and hospital settings in all regions. Documented determinants of oral diseases include social- educational level, employment status, level of income; cultural beliefs; biological factors; gender; and lifestyle habits, access to clean water and utilization of dental services.

However, the interplay of these factors in the prevalence of oral diseases in slum environment as well as the oral health needs of slum dwellers are largely unknown. Such information is required for research purposes and efficient management of resources and services in a resource poor economy like Nigeria, hence the need for this study.

#### 2.15. Research gaps

While reviewing the background to the subject of study, some research gaps were identified and these informed the study's direction. The research gaps were as follows:

1. Population oral health studies in Africa and Nigeria, in particular, are few. Available studies in Nigeria are sporadic in nature and convenience-based and targeted mainly at rural, general urban, and institutionalized populations including hospital settings. The few available studies are hardly representative of the pattern in slum settings.
2. Whereas it has become well established that slum dwellers have a lower quality of life in terms of overall health and well-being when compared to non-slum dwellers, this relationship is largely unexplored in terms of dental health.
3. Studies have produced estimates of dental disease burden for different population sub-groups in settings relatively easy to access, but estimates of oral diseases in representative slum populations and that deployed WHO criteria (Petersen, 2013) and methods are scarce.
4. Studies comparing differences in oral health outcomes among slum dwellers and non-slum residents in Nigeria are almost not existent.
5. While the debate has continued about the best oral health intervention strategies for the management of oral health-related issues in slums in the countries where the studies have been conducted, far too little attention was paid to the slum dwellers' perspective about their oral health care and care-seeking experience. Such information is crucial to the sustainability of any intervention strategy.

## Chapter 3: Overall research design

### 3.1. Overview of chapter

This chapter provides the background to the methodology of the research in this thesis: choice and rationale for the mixed methods approach as well as the rationale for each component of the mixed methods design, data collection methods, analysis, point of integration, as well as ethics approval for the project, are elaborated.

### 3.2. Mixed methods research

The Mixed methods research design was considered the most suitable to address the research questions described in section 3.6. Mixed methods research involves the use of data generated from both quantitative and qualitative research methods (Creswell & Clark, 2017), such that researchers can draw on the strengths of each of the methods. Mixed methods research is also considered a method or methodology in study design. As Creswell and Clark stated:

*“As a methodology, mixed methods research involves philosophical assumptions that guide the direction of the collection and analysis of data and the mixture of qualitative and quantitative approaches in many phases in the research process. As a method, it focuses on collecting, analysis and mixing both quantitative and qualitative data in a single study or series of studies”*

One key strength of mixed methods research is that it provides both breadth and depth of evidence for specific questions of research interest. As such while the quantitative methods provide statistical evidence to draw generalisable descriptions and causal inferences, qualitative methods provide some foundational or additional contextual, process, and experiential evidence. The mixed methods research is however not a simple dichotomy between quantitative and qualitative research approaches. Rather, it is applied research that operates in a social context that is dynamic and changing and can have the best of both worlds. It acknowledges both the pragmatic limitations of the context and the reality of needing to provide information that is generalized, meaningful, and useful (Callingham & Hay, 2018).

### 3.3. Significance of the Mixed methods design for the thesis

Tackling population health challenges such as the oral health challenges of a given population is both a dynamic process and is multi-faceted. It requires a comprehensive and synergistic approach to intervention planning (Benzian *et al.*, 2021; Classen *et al.*, 2007). For the planned intervention to be effective and sustainable, the approach must be based on the values that the affected population attaches to the health event as well as their normative health statistics, which can be asserted through community, organizational and policy strategies (Benzian *et al.*, 2021; Classen *et al.*, 2007). Integrated findings from quantitative and qualitative results illustrating the socio-ecological factors and their interrelatedness may provide a basis for rational decision-making and policy direction. Currently, there exists no data presented as composite of oral health burden and health care needs (quantitative) along with the views of household representatives residing in the slum (qualitative), thus informing my use of mixed methods design in this research. Healthcare providers, researchers, and policymakers need information presented in this concise manner to make health decisions especially in the presence of scarce resources. The findings will provide structure for the development of a multi-system intervention plan that will be viable and sustainable.

### 3.4. Appropriateness of a mixed methods design for this research: The theoretical perspectives

In the philosophy of science and social sciences, realism has been a key approach in design for decades. The concept of realism describes the idea in which there is a real-world in which we interact, and to which our concepts and theories refer. As such it may be helpful to view research designs as real entities as well as actual conceptualizations and practices employed in a specific study and not simply as models for research (Maxwell & Mittapalli, 2010).

Quantitative approaches are often associated with positivist (realist) beliefs that the world can be understood through a subject-object relationship where the understanding focuses on the object (entity) and its causal relationships with the environment, using objective measurements, facts, and figures. A qualitative approach, on the other hand, is often underpinned by a relativist's position, that believes that the world is to be understood through interacting subjects that share ideas, opinions, values, and emotions regarding the objects they encounter leading to a common understanding (De Roo & Hillier, 2016).

To achieve a more holistic understanding of the physical and social dimension of the oral health of those that reside in slums, especially for a better understanding of their problems and for

planning, the limitations of the critical realists' perspective only, necessitates the inclusion of the relativists' perspective (De Roo & Hillier, 2016). Moreover, one type of research design alone (qualitative or quantitative) is not enough to address the research question raised in this thesis, thus giving credence to a design involving both quantitative and qualitative data, together. Therefore, information on the range of oral diseases, their prevalence and determinants as well the residents' perspective of their oral health needs will be helpful to effectively respond to the research question. Using the mixed methods approach (Cresswell & Plano Clark, 2011), the quantitative data was integrated with the qualitative data; thus supporting the building of a socio-ecological model as a framework for intervention planning for the slum dwellers (Classen *et al.*, 2007).

#### 3.4.1. Pragmatism

The theoretical perspective for this thesis is based on pragmatism. Pragmatism is based on the proposition that researchers should use the philosophical and/or methodological approach that works best for the particular research problem being investigated (Kaushik & Walsh, 2019; Tashakkori *et al.*, 1998).

#### 3.5. Overall aim of the thesis

The overall aim is to assess and compare the prevalence and determinants of oral diseases and oral health care needs among adult residents of slum and non-slum settings in Nigeria

#### 3.6. Research questions

Research questions guiding the conduct of the study were:

1. What information exists on oral disease prevalence, determinants, perception, practices, and utilization of dental services among residents of slums and residents of non-slum urban settings of LMICs?
2. What is the spectrum of oral diseases and their distribution among people who reside in the slum and non-slum urban settings in Nigeria?
3. What factors are associated with the development of oral diseases among residents of slum and non-slum urban settings of Nigeria?



4. Is there a difference in the prevalence of diseases, determinants, healthcare-seeking behaviour, and utilization pattern of available oral health services between residents of slum and non-slum urban settings in Nigeria?
5. What are the slum dwellers' perspectives about their own oral health care, and care-seeking experience?

### 3.7. Objectives of the thesis

The research questions were addressed through achieving the following four objectives for this thesis:

1. To summarize evidence from existing literature on oral disease burden, the determinants, healthcare-seeking behaviour, and utilization pattern of available oral health services in slums and non-slum urban settings of LMICs.
2. To determine the prevalence of oral diseases, treatment needs and oral health behaviour among adult residents of the slum and non-slum urban study sites in Nigeria.
3. To examine the associated factors for oral diseases among the adult residents of the slum and the non-slum urban study sites.
4. To investigate the slum dwellers' views about their oral health needs, the barriers to care, and recommendations for intervention strategies.

### 3.8. Hypothesis

The null hypothesis for the comparison between slum dwellers and non-slum dwellers was that there is no difference in the burden of oral disease. The hypothesised mechanism was that different factors might pull in opposite directions with slum dwellers taking less cariogenic diet than non-slum city inhabitants while the non-slum residents exhibited better dental hygiene and had better access to dental health care. (Aikins & Braimoh, 2015; Gautam et al., 2012a; Gautam et al., 2012b; Locker, 2000; Patel et al., 2017; Sanders et al., 2006)

### 3.9. Data collection methods

Questionnaire survey, oral examination and focus group discussions (FGDs) were the primary data collection methods deployed. The methods adopted for each objective are:

Objective 1- addressed by a systematic review

Objective 2 & 3 – addressed by quantitative questionnaire + oral examination

Objective 4- addressed by FGDs

### 3.10. Components of Thesis

Three main components of work, organized as work packages (WPs) were contemplated and planned for the thesis, each with research designs, objectives, and methods. These three components of work undertaken for the thesis are described in detail in subsequent chapters.

Work Package 1: Objective 1- This involves the systematic review component of the thesis. A preliminary narrative review had revealed very few studies conducted on oral health in slum settings, globally. The need to systematically assess existing literature to summarise the latest evidence regarding oral diseases in the slums and non-slum urban settings of LMICs was therefore necessitated.

Work Package 2: Objectives 2 and 3- The quantitative components of the thesis. This involved a descriptive cross-sectional survey with an analytical comparison between slum and non-slum urban sites.

Work Package 3: Objective 4- The qualitative component of the thesis and involved focus group discussions (FGD).

### 3.11. Rationale/ justification for the different research objectives and designs

The following are justifications for the different components of the thesis: the justification for each research objective as well as justification for the respective research design.

3.11.1. Justification for research objective 1 and research design - Systematic review  
*Justification for research objective 1:* Community oral health surveys in slums are scarce. This may be due to the technical difficulties and substantial resources required for conducting oral health surveys that would be representative of population groups in slums and other non-slum

urban settings, hence the vast majority of published oral health surveys in Nigeria have been sporadic and based on convenience samples (Akpata, 2004). However, with the aid of a systematic review, it is possible to gain insight into the oral health issues affecting slums and other urban settings from these existing surveys conducted in Nigeria as well as other LMICs. Moreover, a comprehensive summary of evidence relevant to oral health in slum settings is scarce. Therefore, a contemporary, evidence-based review of existing information on oral disease burden, its determinants, care-seeking behavior, and utilization of existing services among people who reside in the slum and other urban settings of Nigeria and LMICs is necessary. Health care providers and policymakers require such systematic reviews to efficiently integrate existing information for rational decision-making (Mulrow, 1994).

*Justification for the research design (systematic review):* A systematic review is a secondary research method that uses systematic and explicit methods to identify, select, critically appraise and summarize all existing primary research evidence relevant to a specific research topic/ question and to extract and analyze data from the studies included in the review (Khan *et al.*, 2001; Murad *et al.*, 2014). Findings from the systematic review designed for this thesis may be more reliable and comprehensive than the traditional literature reviews as it followed a protocol using pre-specified, standardized and reproducible methods that limit any potential source of bias in its process as well as used critical appraisal tools to assess the quality of evidence for each study included (Glasziou *et al.*, 2001; Tacconelli, 2010).

Systematic review involves the application of established standards to collate all that is known on a given topic and identify the basis of that knowledge as well as provide a comprehensive report using explicit processes so that rationale, assumptions, and methods are open to scrutiny by external parties in such a way that the steps can be replicated/updated (Klassen *et al.*, 1998; Møller & Myles, 2016). Through systematic reviews, health care providers, researchers, and policymakers can efficiently integrate existing information and provide data for rational decision-making from large unmanageable amounts of information. Furthermore, it aids decision-making as to whether scientific findings can be generalized across populations, settings, and treatment variations, or whether findings vary significantly by particular subsets (Møller & Myles, 2016; Mulrow, 1994).

A well-designed systematic review tops the traditional hierarchy of evidence and aids in identifying the best available research evidence to identify knowledge gaps, and suggest future research focus on it (Glasziou *et al.*, 2001; Tacconelli, 2010).

### 3.11.2. Justification for research objectives 2 and 3 and research design - Quantitative survey

*Justification for research objective 3:* In tackling the particular oral health care challenges arising in the urban slums, a knowledge of the current burden of oral diseases, determinants, treatment needs, utilization pattern of existing services, and the healthcare-seeking behaviour of the study participants will be required. Such information will inform the planning of an appropriate oral health intervention strategy that will meet the oral health care needs of the slum dwellers.

*Justification for research objective 3:* A comparison of research findings between slum and the non-slum urban sites would provide empirical evidence to test the study hypothesis (described in Section 3.8), and subsequently determine the different strategies required to improve oral health in slum versus non-slum urban settings. The Null hypothesis of no difference in the oral health status between the residents of slum and non-slum urban sites was set.

*The justification for the research design (quantitative survey):* The choice of a cross-sectional, quantitative survey design was made because part of the thesis was set out to describe the overall picture of the oral health situation of slum and non-slum settings. To date, no known scientific study has assessed the information using a population-based approach in these settings. Information derived from the survey would provide baseline data for future studies.

Quantitative researches are used to measure variables, test hypotheses, investigate causal relationships and even predict future results. The data generated are usually in numerical format, and require the use of statistical and mathematical methods for analysis. Findings from a representative survey sample may be generalized to the target population to explain a specific phenomenon of interest (Creswell, 2014; Robson & McCartan, 2016). Quantitative research designs are broadly classified into two categories: descriptive and experimental (Baker, 2017). A cross-sectional survey is a form of descriptive study that is carried out at a single time-point or over a short period. As such the measurement of the outcomes and the exposures in the study participants are conducted at the same time (Levin, 2006; Setia, 2016). It is usually deployed for the estimation of the prevalence of an outcome of interest for a given population especially when public health planning is the main focus (Levin, 2006). These qualities of the cross-sectional study design justified the quantitative survey part of this thesis.

### 3.11.3. Justification for research objective 4 and research design - Qualitative - Focus Group Discussion

*The justification for objective 4:* A thorough understanding of the slum dwellers' perspectives in terms of oral health challenges, their practices, and experiences in accessing care can assist in the development of appropriate and focused interventions to the oral health needs of the slum community. To date, no known scientific studies have examined this, hence the objective.

*Justification of research design:* Focus Group Discussion (FGD) was chosen because it gathers people to discuss a specific topic. In FGDs, in-depth information is collected. Participants leverage on information provided by others to recall experiences that will be useful to the topic of discussion. Knowledge, is said to be understood through subjective means and is local and contextualized (Bishop & Holmes, 2013; Mouraz & Leite, 2013). A group interaction is therefore helpful in examining how people think and why they think in the way they do, based on their knowledge and experiences while providing the researcher with rich experiential data (Kitzinger, 1994; Kitzinger, 1995).

Focus Groups Discussions are discussions designed to elicit group interaction and “obtain perceptions on a specified area of interest in a permissive, nonthreatening environment” (Krueger & Casey, 2000). In FGDs, the researcher is expected to keep the discussions focused without participating in them nor leading them. The researcher’s aim is to get participants talking about the phenomenon of interest while observing interactions among the participants (DeCarlo, 2018). For many decades, FGDs have been used in health care research for the evaluation of clients’ satisfaction with particular services (Parsons & Greenwood, 2000) and for promoting public health-related issues (Kitzinger, 1995; Morgan, 1996). Focus Group Discussions have also been deployed to find appropriate terminologies (item generation) and generate hypotheses (item refinement) through the use of discussion guides or application of unstructured agenda (Nassar-McMillan & Borders, 2002). In FGDs, open-ended questions are used as a means of gathering information (Kitzinger, 1995; Krueger, 2014). There is no set group size or number, however, a minimum of two or three groups with group sizes of between 6 - 8 participants was suggested (Kitzinger, 1995; Krueger, 2014), and in some cases up to 13 participants (Bloor, 2001) is recommended. The very nature of focus groups may mean that there may be a particular propensity for participants to reveal information about which they would otherwise remain silent. Such decisions were made based on context, logistics or inevitable practical constraints (Bloor, 2001; Kitzinger, 1995).

FGDs are designed to reveal '*dimensions of understanding that often remain untapped by more conventional data collection techniques*' (Kitzinger, 1995). Consequently, there are no definite rules for the use of focus groups, and the characteristics make their use a flexible method that can be adapted to suit the needs of researchers (Nassar-McMillan & Borders, 2002). The Focus Group Discussion method was therefore most suitable in achieving the fourth objective of this research.

### 3.12. Mixed methods design

I utilized a convergent design deploying the parallel databases variant, the relative priority of which is the quantitative data. The convergent design describes a concurrent (at the same time) data collection where data are merged after initial separate analysis (Moseholm & Fetters, 2017). Then the two databases were mixed by merging the results during interpretation and discussion.

### 3.13. Purpose of mixed methods design

Complementary: The choice of mixed methods design was to corroborate findings from the two different study methods (quantitative and qualitative). As such the two datasets give a fuller and clearer understanding or answer than one data set following standard practice (Andrew & Halcomb, 2009).

### 3.14. Data integration

In integration, the strengths of each data set are combined to answer research questions. In this instance, the qualitative data gathered aided in the validity assessment of the quantitative findings.

### 3.15. Point of Integration:

The point of integration was at the point of interpretation, reporting, and write-up. Integration of quantitative and qualitative data at the interpretation and reporting level usually occurs through three approaches: (1) integrating through narrative; (2) integrating through data transformation;

and (3) integrating through joint displays (Fetters *et al.*, 2013). The integration approach in which the quantitative and the qualitative data are brought together through a visual means (joint display) to draw out new insights beyond the information gained from the separate quantitative and qualitative results was used in the research and this formed the choice of approach for this thesis (Fetters *et al.*, 2013).

The main findings (prevalence, determinants, care practices) related to the residents of the slum were integrated and compared within and between the qualitative and the quantitative data. The interpretation allowed me to identify the most important oral health need (normative and felt need), its determinants, and risk behaviours among the residents of the slum setting, resulting in a framework that will facilitate the planning of a targeted intervention.

### 3.16. Analysis approach

The parallel/ merged mixed-methods analysis method was used. It involves separate analysis of the data sets from quantitative and qualitative studies independently. Then, the interpretation, discussion, and conclusions were made in a way that incorporates findings from separate analysis of the two data sets during triangulation (Moseholm & Fetters, 2017). The analysis occurred in the following stages:

1. Within each dataset independently
2. Comparison of the two datasets
3. Meta-inferences that incorporate the comparisons

The use of the meta-matrix (Fig 3.1) during triangulation facilitated the data analysis process so that patterns are recognized across data sets. The results were projected out into a common area where data are melded and discussed. A few unexpected relationships that were found between the two datasets strengthened my understanding the results and assisted in identifying questions for further research (Wendler, 2001).

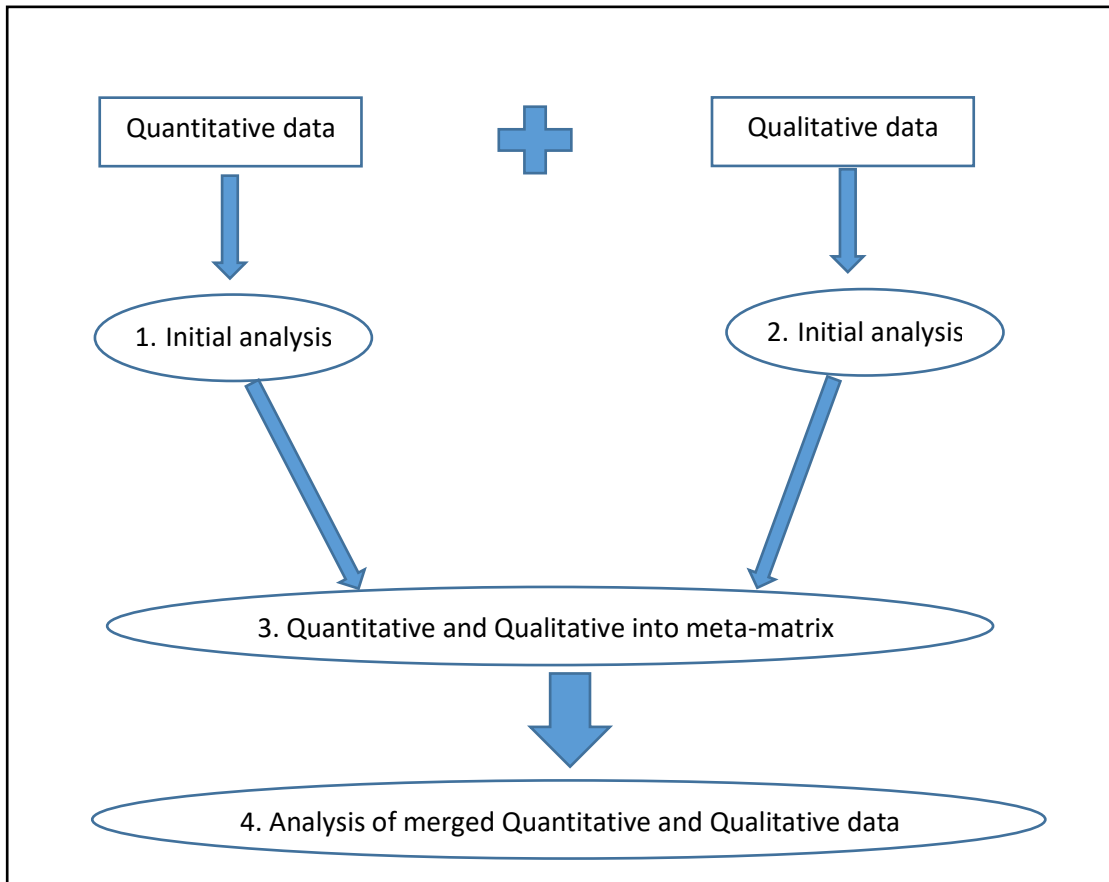


Figure 3.1: Analysis scheme for the mixed methods design

### 3.17. Data display/ meta-matrix

Qualitative + Quantitative: Display is an intentional process by which a researcher brings the findings from qualitative and quantitative approaches together in a study (Fetters et al., 2013). The display method used for this study is side-by-side style [Table 3.1]. The quantitative and qualitative data were displayed together by key findings.

The findings matrix was used. It presents the key findings of the qualitative and quantitative analysis alongside one another. It is often used in conjunction with a convergent design and a merged analysis (Cresswell & Plano Clark, 2011)



### 3.18. Coherence of finding (“Fit” of Data Integration)

This is described as the fitness of the quantitative and qualitative findings in the process of integration and may lead to three possible outcomes: confirmation, expansion, and discordance (Fetters *et al.*, 2013). In this thesis, elements of confirmation and expansion were featured in the findings. Confirmation occurred when the findings from both data types confirmed the results of each other thereby providing similar conclusions for example common dental problems. Expansion occurred when the findings from the two sources of data diverged to expand insights of the phenomenon of interest by addressing different aspects of a single phenomenon or describing complementary aspects of a central phenomenon of interest (Fetters *et al.*, 2013) such as the participants’ oral health care practices

Table 3.1. Side-by side joint display of findings

	<b>Quantitative Results</b>	<b>Qualitative Interview Findings</b>	<b>Mixed Methods Interpretation</b>
Objective or domain	Summary of results related to the theme	Descriptive summary codes, quotes,	Summary of inferences; confirmation, discordance, expansion

### 3.19. Ethical approval of the study

Ethical approval for the conduct of the study was granted from the Biomedical and Scientific Research Ethics Committee (BSREC) at the University of Warwick (reference number BSREC 37/18-19). As this research involved household residents within some communities in Ibadan, Oyo State of Nigeria, ethical approval was also sought and obtained from the Oyo State Research Ethics Review Committee (reference number AD 13/479/1247). Please see both ethical approval letters in Appendices 3.1 & 3.2. Ethics were considered in relation to the study design, quantitative and qualitative data collection processes, the personal information provided and data gathered, and how data were handled.

## **Chapter 4: Methods for the systematic review (Work Package 1)**

### 4.1. Chapter overview

This chapter outlines the methods used in conducting the systematic review. It comprises the aim, research design, rationale, literature search strategy, criteria for selecting studies for the review; data extraction, quality assessment, and data analysis.

### 4.2. Review aim

This review aimed at systematically assessing the literature on oral disease burden, perception and practices on oral health, and utilization pattern of available oral health services in slums and other urban settings of LMICs.

### 4.3. Research design

The protocol for the systematic review was registered with PROSPERO in February 2020 (available from:

[https://www.crd.york.ac.uk/PROSPERO//display\\_record.php?ID=CRD42020123613](https://www.crd.york.ac.uk/PROSPERO//display_record.php?ID=CRD42020123613)).

PROSPERO is an international database of registered systematic reviews in health and social care funded by the National Institute for Health Research, England, the Department of Health, Public Health Agency, Northern Ireland, and the National Institute for Social Care and Health Research, Welsh Government.

### 4.4. Review questions

- a. What is the prevalence of oral diseases (dental caries, periodontal disease, and oral cancer) among adult residents of slum and non-slum urban settings of LMICs?
- b. What factors are associated with oral diseases in adults residing in the slum and non-slum urban communities of LMICs?
- c. What are the perceptions of adult residents of slums and non-slum urban settings of LMICs about their oral health status?
- d. What are the oral health practices of adult residents of slums and non-slum urban settings of LMICs?

e. What are the oral health service utilization patterns of adult residents of slums and non-slum urban residents in LMICs?

4.5. PECO concepts

**Table 4.1: The PECO concepts**

PECO concepts	
<b>Population</b>	Adult residents
<b>Exposure</b>	Slum setting
<b>Comparator</b>	Non-slum urban setting
<b>Outcomes</b>	Oral disease prevalence, perceptions and practice related to oral health, oral healthcare-seeking behavior, utilization of available dental services

4.6. Inclusion and exclusion criteria

The following criteria were applied in study selection (Table 4.2)

Table 4.2: systematic review inclusion and exclusion criteria for study selection

S/N	Characteristics	Inclusion	Exclusion
1	Age	Adults (male and female) 18 years and above	Children population less than 18 years
2	Population	Residents of slum and non-slum urban settings, or nationally representative samples including them	Mentally challenged, disabled, and institutionalized population groups
3	Location/ setting	Slums and other urban settings in LMICs	High-income countries; studies in LMICs that focus on rural settings or other settings that are unlikely to cover areas with slums
4	Type of study	Any study design that provides empirical data on oral disease burden, its determinants, care-seeking behaviour, and utilisation of existing services in slums and other urban settings of LMICs. These include: Quantitative studies that were carried out in a representative urban population or national surveys covering such populations. Qualitative studies carried out in slums or other similar urban settings (e.g. poverty areas within cities)	Commentaries, opinions.
5	Type of publication	Full-text published research and grey literature such as official government reports	Abstract-only publications
6	Language	English language	Other languages without available English language translations
7	Date/Period of Study:	Publications from the year 2000 till 2020	Publications before the year 2000

#### 4.7. Databases searched

I searched the following electronic bibliographic databases: Embase (Ovid); PubMed; CRD DARE Database; ELDIS; Essential Health Links; HINARI; African Index Medicus (AIM); Bioline International. Table 4.3 provides a brief description of some of the less well-known, LMIC-focused databases. Details of web address/ link for each database used in my search and hits yielded are shown in Appendix 4.1

Table 4.3: LMIC-focused databases and their description

<b>Database</b>	<b>Description</b>
ELDIS	A database hosted by the Institute of Development Studies in the UK and covers high-quality research from smaller organizations/ institutions, especially those from developing countries, alongside that of the larger, northern-based, research organizations and used by a large global audience of development practitioners, decision-makers, and researchers.
Essential Health Links	Is a resource that provides more than 750 useful websites for health professionals, medical library communities, publishers, and NGOs in developing and emerging countries.
HINARI	The Hinari was set up by WHO together with other major publishers to enable LMICs to gain access to one of the world's largest collections of biomedical and health literature. Launched in 2002, it provides free or very low-cost online access to the major journals in biomedical and related social sciences to a growing number of local, not-for-profit institutions in developing countries.
Bioline International	An online platform for sharing works by peer-reviewed open access bioscience journals published in developing countries in Africa, Asia, and South America covering a range of metadata, abstracts, and individual articles in pdf and HTML. It was founded by Leslie Chan as an international collaboration between the University of Toronto Libraries as stewards, the Reference Center on Environmental Information in Brazil for technical infrastructure, and Bioline UK as a liaison.

##### 4.7.1. Search terms used

Key concepts related to the systematic review include oral health, slum and urban setting, and LMICs. The concepts were developed in line with the PECO framework (Table 4.1). indexed terms and keywords related to the concepts were combined using Boolean operators AND or OR.

The databases were searched to identify all relevant articles published from 2000 to 2020. The search strategies [Appendix 4.1] follow the structure of [oral health OR dental caries OR (other

oral health-related terms)] AND [LMIC related terms] AND [slum and urban-related terms] AND [outcome-related terms such as prevalence or incidence or determinants or behaviour or access or utilization].

#### 4.7.2. Other information sources searched/checked

Other methods utilized for identifying relevant research included using the search engine Google Scholar to search the internet and contacting some experts in the field of dental public health in Nigeria. I also searched for possible studies from local and international conferences e.g. International Association of Dental Research (IADR) and Dental Public Health conferences.

#### 4.8. Management of records

Records retrieved from the search process were uploaded into Mendeley software for reference management, where duplicates were removed. Retrieved articles were stored on DropBox, a web-based storage service that aided collaboration among the reviewers involved.

#### 4.9. Methods for study selection

Study selection was carried out independently by two reviewers first by inspecting titles and abstracts, and then by examining full-text papers for those considered potentially relevant.

In the review of studies, a total of three reviewers were involved: two main reviewers and a third reviewer who resolved disagreements. A colleague from the University of Ibadan and myself were the main reviewers. We independently assessed the records of titles and abstracts retrieved from databases to select potentially relevant studies. A final decision on the papers to be selected was made through inspection of the full-texts and/ or by a discussion with a third reviewer. Decisions and reasons for excluding articles were clearly recorded by the main reviewers.

#### 4.10. Data Extraction

Data extraction was carried out by the two reviewers, independently in duplication and was checked by the third reviewer. A standardized data extraction form was used to extract data. The following data were extracted from included studies for each of the review objectives as follows: Author and year of publication, country of study, the summary of methods deployed, characteristics of the participating population, the exposure, outcome, and summary findings.

#### 4.11. Quality Assessment:

Quality assessment was carried out by the two reviewers, independently. The Mixed Methods Assessment Tool (MMAT) (Hong *et al.*, 2018) was used to appraise the quality of empirical studies included in this research. This is because it permits the appraisal of methodological quality of studies of different designs. MMAT facilitates the critical appraisal process in systematic mixed studies reviews by providing methodological quality criteria for different designs (qualitative research, randomized controlled trials, non-randomized studies, quantitative descriptive studies, and mixed methods studies) within a single tool (Hong *et al.*, 2019). Since the design of this review involves the inclusion of qualitative, quantitative, and mixed methods studies, MMAT was considered the most suitable option (rather than the use of an individualized appraisal method for each study design). This tool can help identify issues related to the validity and reliability of the research being appraised, using acceptable standards (Pluye *et al.*, 2009; Souto *et al.*, 2015). It is also discriminatory in terms of separating poor-quality studies from good-quality studies (Hong *et al.*, 2019).

Criteria used to determine the quality of studies during the critical appraisal of each paper using the standardized MMAT checklist include:

- i. quantitative descriptive studies: appropriate sampling strategy, representativeness of the target group, appropriateness of measurements, appreciable low level of risk of non-response bias, and appropriateness of statistical analysis (Hong *et al.*, 2018).
- ii. qualitative studies: the appropriateness of qualitative approach to answer the research question, adequacy of the qualitative data collection methods in addressing the research question, adequate derivation of findings from the data, sufficient substantiation of interpretation of results by data, and coherence between qualitative data sources, collection, analysis, and interpretation (Hong *et al.*, 2018).

#### 4.12. Strategy for data presentation and synthesis

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram was utilized to layout the study selection process using the narrative approach (Page *et al.*, 2021). This included information such as the number of studies identified, reviewed, included, and excluded. The Synthesis Without Meta-analysis (SWiM) reporting guideline (Campbell *et al.*, 2020) was adopted for data synthesis. Data from included studies were tabulated and sorted by country, geographical location, setting, and according to issues relevant to this oral health systematic review: Prevalence of oral diseases, determinants/ risk factors of the diseases, self-perceived oral health status, oral health practices, and self-reported utilization of existing oral health care facilities.

Tables were used to facilitate the visualization of data but no meta-analysis was done. This is because studies were conducted in different locations and at different times. Given the heterogeneity between these studies, it would be inappropriate to pool all the proportions and rates together.

#### 4.13. Exploratory subgroup comparisons

To highlight the unique oral disease burden and healthcare needs of slum residents, particular attention was paid to collate data where subgroup comparisons were made between slum settings versus non-slum urban settings. Variations in findings between countries and geographical locations and variations in time trends were also noted. To avoid confounding by study-level characteristics, data for these comparisons were primarily obtained from subgroup analyses conducted within individual studies.

#### 4.14. Review reporting

Reporting of the review was done in accordance with the PRISMA statement (Page *et al.*, 2021) as well as the SWiM reporting guideline (Campbell *et al.*, 2020).

#### 4.15. Deviation from the registered review protocol

There were a few deviations from the original protocol registered in PROSPERO. The changes became necessary following observations during the study selection process. The changes involved inclusion and exclusion criteria for the “Participant/ Population” as well as “type of

study to be included”. Details of the previous statements in the original protocol and changes are as shown in Table 4.4.

Table 4.4: Deviation from the originally registered protocol

Section	Previous statement in the original protocol	Change introduced	New statement	Justification
Participant/Population (Exclusion criterion)	Mentally challenged, disabled, and institutionalized adult population groups as well as children population	Adjusted	Mentally challenged, disabled, and institutionalized adult population groups as well as children-only population	Many study populations cut across children and adult age groups, which still provide relevant information
	Children population less than 18 years	Adjusted	Children-only population less than 18 years	
Type of study (exclusion criteria)	Study publications in which data for the urban population are compared with the rural population as opposed to the slum population	Deleted	N/A	Searches yielded very few hits of studies focusing exclusively on slum populations
	Study publications from general urban settings in LMICs without specific reference to data from slum and non-slum population	Deleted	N/A	
Type of study (inclusion criteria)	N/A	New statement added	Quantitative studies carried out in a representative urban population or national surveys covering such (slum) populations.	Searches yielded few slum-specific studies and therefore it was considered useful to expand the coverage to quantitative studies that were likely to have included some slum population
	N/A	New statement added	Qualitative studies carried out in slums or other similar urban settings (e.g. poverty areas within cities)	Searches yield few slum-specific studies and therefore it was considered useful to expand the coverage to qualitative studies that were carried out in other urban settings similar to slums



## **Chapter 5: Results for systematic review (work package 1)**

### 5.1. Chapter overview

This chapter outlines the results from the systematic review. It includes a description of the literature search and selection of studies, a summary of the characteristics of the included studies, quality assessment / critical appraisal, and summary of study findings.

### 5.2. Results of literature search and study selection

The number of records identified and screened for eligibility and those studies included in the systematic review are shown in Figure 5.1.

A total of 3,531 records were identified from the search. Among them, 515 duplicates were removed, leaving 3,016 abstracts to be screened against the inclusion and exclusion criteria for relevance. A total of 2,977 records were excluded as they did not meet the inclusion criteria based on titles and abstracts. The remaining 39 full-text articles were then accessed for eligibility. Twenty-one articles were excluded due to the following reasons: commentary (one article); protocol publication (one article); conducted among institutionalized population groups (eight articles); did not include dental health (two articles); based on exclusively rural or village settings (seven articles); high-income country (one article); companion paper of a primary study (one article). In total, eighteen studies were included in the systematic review (Figure 5.1).

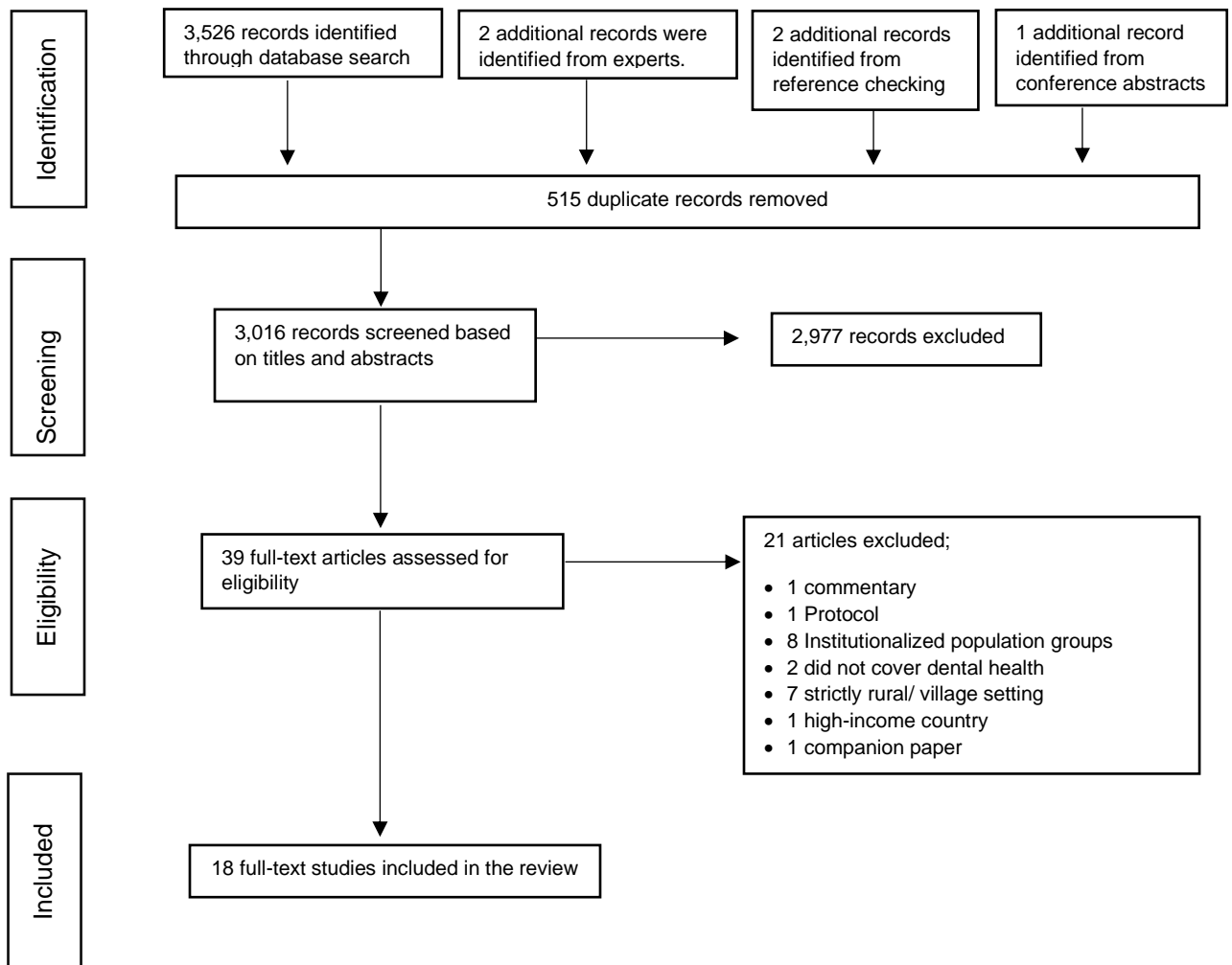


Figure 5.1: summary of studies retrieved and selected

### 5.3. Summary of characteristics of included studies

All of the 18 studies were primary / original studies, of which one was a qualitative study and the remaining were quantitative studies. Three focused on slums (one examined slum and urban non-slum and two examined purely slum settings), two examined general urban settings, eight included both rural and urban areas in their settings, three covered the national population or whole country, and one each examined the disadvantaged and high versus low socioeconomic regions respectively. The included primary studies are summarized in Table 5.1 according to their settings, authors, methods, participants, and main outcome measures.

**Table 5.1: Summary of characteristics of included studies in the review**

S/N	Setting(s) included / compared	Author & year of publication	Methods	Participants & sample size	Outcome Measures	Code*
1.	Urban / Urban slum	Patel et al 2017	Purposely selected residents of Municipal Corporation (AMC) area of Vejalpur ward, Ahmedabad.  Questionnaire and WHO oral health surveys (1997)	Indian population  People >10 years of age  N = 300	Dental caries, staining, abscess formation, mouth ulcers, bad breath, gingivitis, tooth sensitivity, malocclusion, tonsillitis, bleeding gums dental hygiene practices	a, b, d
2.	Urban slum	Hannan et al 2014	A cross-sectional survey was conducted in the 12 slum clusters of Tongi Municipality  A close-ended questionnaire was used as well as oral examination using standard indices	Bangladesh population  Participants of all age groups and sex  N = 3,904	Mean DMFT Decayed Missing Filled components of DMFT	a, b
3.	Urban slum	Airen et al. 2014	A cross-sectional survey adopting random sampling technique through the house-to-house visits and enrolment.  WHO oral health assessment 1997	Indore city, Central India  Age range 5 – 64-year-old. 5-14= (n=5), 15-34 (n= 86), 35-44 (n=38), 45-64 (n=14). N = 143	Dentition status (caries prevalence and DMFT) and treatment need	a, b
4.	Urban	Rezaei et al 2017	Cross-sectional survey of households to assess dental health-care utilization among household heads in Kermanshah city, western Iran using a self-administered questionnaire	Western Iran population  Household head, 18 years and above  N = 894	Utilization of dental services and their determinants	e
5.	Urban	Costa et al. 2012	Home-based, cross-sectional field study  WHO Oral health surveys: basic methods. (1997)	Brazilian population  Adults 35 to 44 years of age N = 1,150	Caries experience	a, b
6.	Urban / Rural	Hong-Ying et al 2002	An epidemiological survey using a Cross-sectional study design on the whole China population using WHO oral health basic methods (1987)	Chinese population  Whole population  N = 140,712	Caries experience Periodontal disease: gingival bleeding and calculus	a, b
7.	Urban / Rural	Tobin and Ajayi 2017	Pathfinder survey method stratified cluster sampling technique in 2 LGAs in Kwara State  WHO Oral health surveys: basic methods. (1997)	Nigerian population  WHO index ages 5–6, 12 and 35–44 years' age groups  N = 150	Dental plaque Calculus Gingivitis Enamel wear Dental caries Mean DMFT.	a, b
8.	Urban / Rural	Handa et al.	Descriptive cross-sectional study using multistage random sampling technique	Indian population  WHO's index ages and age groups of 5,	Dental health practices Mean DMFT and components	a, d

		2016	among the population of Gurgaon Block, Gurgaon District, Haryana, India. WHO Oral health surveys: basic methods. (1997)	12, 15, 35-44, and 65-74 years N = 810	Prevalence of dental caries, periodontal diseases malocclusions, dental fluorosis Dental treatment needs	
9.	Urban / Rural	Morgan et al.  2018	World Health Organization (WHO) Oral Health Surveys Pathfinder stratified cluster methodologies using WHO oral health basic methods: World Health Organization (2013)  first National Oral Health Survey of Rwanda	Rwandan population  Whole country 2-5, 6-11, 12-19, 20-39, and 40 and above years  N = 2,097	Prevalence of dental caries. Quality-of-life affection Access to dental health care	<b>a, b, e</b>
10.	Urban / Rural	Sun et al.  2018	Multistage stratified sampling of civilians in all the 31 provinces of China using Questionnaires as well as periodontal health examination was done using CPI probe	Chinese population  34 – 44 years of age  N = 4,410	Periodontal diseases Risk factors or associated factors	<b>a, b</b>
11.	Rural / Urban	Masalu et al.  2009	National pathfinder cross-sectional survey  WHO simplified oral health questionnaire for adults	Tanzania Adult respondents from the six geographic zones of mainland  N = 1,759	Oral health-related behaviour and practices	<b>d, e</b>
12.	Urban / Rural	Hessari et al.  2006	Stratified cluster random sampling following the WHO 1997 guidelines  Data collected as part of a national survey	All 35- to 44-year-old Iranians living in Iran.  N = 8,301	Dental caries DMFT Bleeding Calculus Shallow pocket Deep pocket	<b>a, b</b>
13.	Urban and rural	Varenne et al.  2004	Multistage cluster sampling of households  WHO basic oral health survey 1987	Final study Burkinabe population covered four age groups: 6 years (n = 424), 12 years (n = 505), 18 years (n = 492) and 35-44 years (n = 493)  N = 1,914	Dental caries prevalence to provide epidemiological data for planning and evaluation of oral health care programmes	<b>a</b>
14.	A nationally representative sample of adults	Olutola and Ayo-Yusuf  2012	A national representative sample using a multi-stage probability sampling strategy to select 107,987 persons from 28,129 households and obtained living environment characteristics of SASAS participants, including sources of water and energy from the data	South African adults (≥16 years)  Participants in the 2007 South African Social Attitude Survey (SASAS).  N=2,907	Self-rated oral health and associated socio-environmental factors	<b>c, e</b>
15.	Whole country	Msyamboza et al.  2016	Multi-stage sampling method was used on EAs, households, and participants in the whole country  New WHO Surveillance tool 2003.	Malawian population (85% rural)  Ages 12, 15, 35-44, and 65-74-year-olds.  N = 5,400	Prevalence of dental caries and missing teeth  Risk factors for dental disease.	<b>a, b, d</b>
16.	Whole country	Olusile et al	Multistage sampling using all 36 states of the federation	Nigeria	Perception about oral health status	<b>c, d, e</b>

		2014	The questionnaire was developed and refined by the authors with input from Dentists in other parts of the ;country.	Ages 18 to 81 N = 7,630	Oral health practices Dental service utilization	
17.	Urban disadvantaged / National population	Jaafar et al. 2014	Random sampling of living quarters (households) in the selected areas of Kuala Lumpur adopting WHO Oral health surveys: basic methods. (1997)	Malaysian population Adults 19 years & older household residents N = 586	Dental Caries DT, FT, MT, and DMFT Periodontal disease Treatment need Prosthetic (denture wearers) Prosthetic need Overall treatment need	<b>a, b</b>
18.	High and low socioeconomic regions	Gholami et al 2012	Purposely selected A qualitative study including focus group discussions; provided an in-depth understanding of individual and group experiences and perception	Residents of Tehran 18 years and above N = 46	Perception about periodontal illness Attitude to prevention	<b>c, d, e</b>

\*Codes (a, b, c, d, e) refer to corresponding review sub-questions (as listed in Section 4.4) towards which the study has contributed data. a: What is the prevalence of oral diseases (dental caries, periodontal disease, and oral cancer) among adult residents of slum and non-slum urban settings of LMICs? b: What factors are associated with oral diseases in adults residing in the slum and other non-slum urban communities of LMICs? c: What are the perceptions of adult residents of slums and other non-slum urban settings of LMICs towards their oral health status? d: What forms of oral health care practices do adult residents of slums and other non-slum urban settings of LMICs engage in? e: What is the oral health care service utilization pattern of adult residents of slums and other non-slum urban residents in LMICs?; EA: Enumeration Areas; LGA: Local Government Area; CPI probe - Community Periodontal Index probe

The included studies were also sorted according to the continents and the countries where the studies were carried out. From Table 5.2. the included studies were conducted in eleven countries and three continents namely:

Countries: three from India, two from China, three from Iran, two from Nigeria, and one each from Malawi, South Africa, Malaysia, Bangladesh, Rwanda, Tanzania, Burkina-Faso, and Brazil.

Continents: ten in Asia, seven in Africa, and one in South America.

**Table 5.2: Distribution of included studies according to continents and countries**

S/N	Continent	Country	Setting(s) included / compared	Author	Year	Participants
1.	Asia	India	Urban / Urban slum	Patel et al	2017	People >10 years of age. (N = 300)
2.	Asia	Bangladesh	Urban slum	Hannan et al	2014	Participants of all age groups and sex (N = 3,904)
3.	Asia	India	Urban slum	Airen et al.	2014	Age range 5 – 64. (N = 143)
4.	Asia	China	Urban / Rural	Hong-Ying et al	2002	Whole population sample (N = 140,712)
5.	Asia	India	Urban / Rural	Handa et al.	2016	WHO's index ages and age groups of 5, 12, 15, 35-44, and 65-74 years (N = 810)
6.	Asia	China	Urban / Rural	Sun et al.	2018	Adult population 34 – 44 years of age (N = 4,410)
7.	Asia	Malaysia	Urban disadvantaged / National population	Jaafar et al.	2014	Adults 19 years & > household residents (N = 586)
8.	Asia	Iran	Urban / Rural	Hessari et al	2006	All 35- to 44-year-old Iranians living in Iran. (N = 8,301)
9.	Asia	Iran	Urban	Rezaei S et al	2017	Household head or 18 years and above (N = 894)
10.	Asia	Iran	High and low socioeconomic regions	Gholami et al	2012	Adult residents 18 years and above. FGDs conducted with a total of 46 participants
11.	Africa	South Africa	a nationally representative population	Olutola and Ayo-Yusuf	2012	Adults (≥16 years) (N = 2,907)
12.	Africa	Malawi	Whole country	Msyamboza et al.	2016	Ages 12, 15, 35–44 and 65–74 year olds. (N = 5,400)
13.	Africa	Nigeria	Whole country	Olusile et al	2014	Ages 18 to 81 (N = 7,630)
14.	Africa	Nigeria	Urban / Rural	Tobin and Ajayi	2017	WHO index ages 5–6, 12 and 35–44 years' age groups (N = 150)
15.	Africa	Rwanda	Urban / Rural	Morgan et al.	2018	Whole country 2–5, 6–11, 12–19, 20–39, and 40 and above years (N = 2,097)
16.	Africa	Tanzania	Rural / Urban	Masalu et al	2009	Adult respondents from the six geographic zones of the mainland (N = 1,759)
17.	Africa	Burkina Faso	Urban and rural	Varenne et al. 2004	2004	6 years (n = 424), 12 years (n = 505), 18 years (n = 492) and 35–44 years (n = 493) (N = 1,914)
18.	South America	Brazil	Urban	Costa et al.	2012	Adults 35 to 44 years of age

#### 5.4. Findings from quality assessment of included studies.

The methodological quality of all included studies in the review was evaluated by applying the relevant criteria in the MMAT tool (Hong *et al.*, 2018). A summary of the findings is described below and further details are shown in Appendix 5.1. For each included study, the assessment started with answering three screening questions, followed by questions specific to individual study design.

Screening questions: All included studies were given a "yes" score as they were all empirical studies, each with the clear research question(s) and each collected data that allowed their research questions to be addressed.

For qualitative studies: Only one included study fell into this category. The study set out to explore perceptions of periodontal health and illness and to examine attitudes and beliefs regarding the prevention of gum diseases among Iranian adults (Gholami *et al.*, 2012). An in-depth understanding of individual and group experiences and perceptions through FGDs was sought to reflect the diversity of different socioeconomic levels of interest in Tehran using purposive sampling method. Participants were recruited through announcements, for volunteers from which the final participants, who met the inclusion criteria were chosen. Based on participants' viewpoints, two major themes emerged from the study: "common perception of periodontal health and illness" and "attitude towards prevention". In its conclusion, a substantial need for oral health education for knowledge improvement and attitudinal change towards the prevention of periodontal disease was raised. Based on the quality assessment of this study, there was coherence between the qualitative data source, collection, analysis, and interpretation of the data presented. But the study was weak in external validity as it was female-dominated and based on purposive sampling method using volunteer participants. Moreover, the study did not give adequate information on the researchers' consideration of their impact on the wider context of the study methods/findings through reflexivity and these may have influenced the study's findings.

Regarding the quantitative descriptive studies: For all the 17 studies included in this category, the sampling strategies were relevant to the research question in each study. All of the measurements in each of the 17 included studies were appropriate for each research question and the statistical analysis was appropriate to answering the research questions. In general, there were variations in the criteria for diagnosis of oral diseases in that only one study utilized the latest WHO guidelines released in the year 2013 for oral disease diagnosis; many other studies utilized earlier versions of the WHO guidelines while a few did not use WHO

standardized method. These impacted on the comparability of findings from the different studies as there exist subtle differences in the diagnostic criteria and the outcome measures in the different versions of the WHO oral health assessment methods, which formed the basis for revisions. For example, reports on periodontal disease measures for most of the included studies were based on earlier versions of WHO basic oral health survey methods, which measured periodontal status by sextants or index teeth to derive overall prevalence, bleeding, calculus, shallow and deep pockets as outcome measures. Whereas, in the latest WHO version periodontal status measurement was modified to include assessment of gingival bleeding and recording of pocket scores for all teeth present rather than sextants or index teeth (Petersen, 2013). However, some level of comparability among the included studies was still achieved using overall periodontal disease prevalence.

Regarding the sample representativeness of the target population: the majority of included studies failed to report a response rate; three studies reported response rates which ranged between 84% and 87%. In eight studies a comparison of sociodemographic characteristics such as age and sex between the study sample and the sampling frame from which recruitment was done, and the results showed no major discrepancies and this gave them a good rating for sample representativeness of the target population and a low-risk rating for nonresponse bias. In two of the included studies there was insufficient evidence to show that the sample was representative of the target population, thus making the risk of response bias difficult to assess, therefore, a decision of “can’t tell” was rated. In the first study - conducted in Tanzania (Masalu *et al.*, 2009), two sites from two zones of the six geopolitical zones of the country were purposively selected to represent urban population but the details of the final participant selection process was not clear. In the second study which was conducted in Nigeria (Tobin & Ajayi, 2017), the sample size was not calculated, rather a number of subjects were chosen in each age group according to the WHO survey method but the recruitment of participants was by volunteer. The compliance with WHO guideline in terms of number of subjects (low risk) and the non-randomized nature of the recruitment process (high risk) made a clear rating challenging. There was high risk of non-response bias and lack of representativeness of the target population in the sample from one study conducted in Ahmedabad Municipal Corporation (AMC) (Patel *et al.*, 2017), in which the two wards studied were purposively selected. The risk of non-response bias was uncertain in one study (Airen *et al.*, 2014): although a sample size was estimated at 138, the final sample comprised 143 residents, an unspecified random sampling method was used and the sampling procedure was not clear,



neither was a response rate provided. In the remaining two studies included, the sample sizes were very large and the sampling procedure clear, thus earning a good rating.

#### 5.5. Study findings grouped according to sub-review questions

The series of tables 5.3 to 5.7 below show the key findings of the studies included in the review, classified according to sub-review questions.

##### 5.5.1. Prevalence of oral diseases

As shown in table 5.3, of the 12 studies that contributed data to this sub-review question, only three studies specifically involved slum settings. The rest were conducted mainly in urban settings with eight of the studies comparing their findings with rural settings. The prevalence of dental caries was variable across age groups, gender and socioeconomic class and ranged between 13% (Nigeria) and 76% (Central India) of the populations under survey. Overall caries prevalence appears generally lower relative to periodontal disease prevalence; however, some highly prevalent cases were observed in Rwanda where up to 54% of prevalence was reported. Similarly, within WHO index age categories, highly prevalent values were reported among 35-44-year-olds in China and Burkina Faso and among the 65-74-year-olds in China, and the prevalence appear to increase with higher index age categories. The Decayed Missing Filled Teeth (DMFT) which is a lifetime measure of caries experience of an individual is usually measured as means at population level. The DMFT values ranged between 0.26 and 12.7.

Regarding periodontal disease: of the five studies published after the release of WHO's latest (2013) manual version, only one that assessed oral disease prevalence utilized the latest WHO guideline. In all of the included studies periodontal disease affected participants of all ages, gender and socioeconomic standing but was more pronounced among the older age group. Its prevalence ranged between 65% and 99%. Of the various stages of periodontal disease, bleeding gum / gingivitis constituted the highest prevalence in all of the studies.

Of the three studies that compared between slum and non-slum urban settings or national average, the prevalence and severity of most oral diseases were generally higher in slum settings. However, the report from the study conducted in Malaysia was an exception as no evidence suggested a difference in the overall oral disease burden and treatment needs between slum and the non-slum or national average, apart from periodontal disease which was higher among the urban disadvantaged adult population. There is a preponderance of dental

trauma cases in urban settings relative to rural setting and among disadvantaged population groups.

**Table 5.3: What is the prevalence of oral diseases among adult residents of slum and non-slum settings of LMICs?**

S/N	First Author (Year) & Country of study	Population age range / sample size	Setting	Finding / Outcome					
				Caries		Periodontal disease			Others findings
				Overall Prevalence	Mean DMFT/ components	Overall prevalence	Bleeding gum/gingivitis	Pocket formation	
1.	Patel et al  2017  India	People >10 years of age,   300	urban / urban slum	Urban slum = 61.1%  Urban area = 47.4%.	NA	NA	Bleeding (Urban slum) = 8%  Bleeding (Urban area) = 8%.  Gingivitis (Urban slum) = 6.7%  Gingivitis (Urban area) = 13.3%.	N/A	Caries disease was more in slums relative to urban areas
2.	Hannan et al  2014  Bangladesh	Participants of all age groups and sex   3904	purely slum	NA	Mean DMFT = 3.01  DT = 2.10  MT = 0.91  FT = 3.11	Prevalence of normal gingiva = 4.1%	Gingivitis = 95.9%	NA	Prevalence of both moderate and severe gingivitis was higher among female than male
3.	Airen et al.  2014  Central India	Age range 5 – 64 year-   143	Purely slum	76.2%,	Mean DMFT was 2.54.  MT= 1.29 DT = 1.18 FT = 0.13	NA	NA	NA	Treatment needs: Restoration (57.5%) Extraction (32.2%) Pulp care (6.25%)
4.	Costa et al.  2012  Brazil	Adults 35 to 44 years of age representing adult population   1,150	Purely urban	Dental caries prevalence = 68.5%	DMFT $\geq$ 14 = high severity: mean 16.6, stand. Dev. = 6.973	NA	NA	N/A	Caries experience was not different between the eight cities surveyed (p = 0.133).

5.	Jaafar et al.  2014  Malaysia	Adults 19 years & older, household residents  586	Urban disadvantaged  Versus  National population	Urban 70.5%  national average quoted (89.5%)	12.7  DT = 2.66  MT = 8.73  FT = 1.27	97.1%	4.3%  Calculus = 47.3%	Pocket 4-5 mm = 22.9%  Pocket 6 mm or more = 19.6%	No evidence to suggest that the overall oral disease burden and treatment need in the urban disadvantaged adult population are higher than the national average, except for periodontal disease
6.	Msyamboza et al.  2016  Malawi	12, 15, 35–44 and 65–74 year old.  5400	Whole country  Urban / rural	Overall caries prevalence = 37.4 %  12 year-olds = 19.1%  15 year-olds = 21.9%  35–44 year-olds = 49.0%  65–74 year-olds = 49.2%  Overall Missing Teeth = 35.2%  Overall Filled Teeth = 6.5%	Mean DMFT = 2.68  among 12 year-olds, 15 year-olds, 35–44 year-olds and 65–74 year-olds = 0.67, 0.71, 3.11 and 6.87  DT = 1.03  MT: 1.54  FT = 0.11	NA	Bleeding gum prevalence = 23.5 %  12 year-olds = 13.0%  15 year-olds = 11.8%  35–44 year-olds = 30.8%  65–74 yr-olds = 36.1%	NA	Prevalence of dental caries and missing teeth in urban areas were as high as in the rural areas; all p > 0.05.
7.	Morgan et al.  2018  Rwanda	2–5, 6–11, 12–19, 20–39, and 40 and above years  2,097	Whole country  Combined  Urban/rural subgroup	Overall caries prev. = 54.3%.  Rural group exhibited higher caries experience and untreated caries	Mean DMFT = 3.19  DT = 1.36  MT = 1.80  FT = 0.82	NA	Plaque prevalence = 32.4%  Calculus prevalence = 60.0%	NA	Quality-of-life challenges due to oral diseases/ conditions including pain, difficulty chewing, self-consciousness, and difficulty participating in usual activities was reported by 63.9%, 42.2%, 36.2%, 35.4% of participants respectively

									Early dental care was indicated for 61.3% of the population while immediate treatment (urgent relief of pain or infection) was required by 5.4%.
8.	Hong-Ying et al 2002 China	5, 12, 15, 18, 35-44 and 65-74.  140,712	National oral health survey  Sub-group Urban/rural	Overall caries prevalence = Not given  Among 35-44-year-olds = 63%  65-74-year-olds = 64.8%	Overall Mean DMFT = 4.5  Among 35-44-year-olds = 2.1  65-74-year-olds = 12.4	NA	Gingival bleeding was 15.7%  The mean number of sextants per person with specific periodontal symptoms in adults 35 – 44yrs of age  Healthy gingiva = 1.2 Bleeding = 0.4 Calculus = 4.0	shallow pocket = 18.9%  deep pockets = 4.0%  Mean number of sextants per person with specific periodontal symptoms in adults 35 – 44yrs of age  Shallow pocket = 0.3 Deep pocket = 0.03	Gingival bleeding, shallow and deep pockets were lower in the rural sub-group relative to the urban sub-group
9.	Tobin O and Ajayi IO 2017 Nigeria	5–6, 12, and 35–44 years' age groups  150	Urban/rural	Overall dental caries was 13.0%.	Overall Mean DMFT = 0.26.  5–6 yrs = 0.30  12 yrs = 0.04  35–44yrs = 0.46	NA	Plaque = 66%  Calculus = 66%  Gingivitis = 30%	NA	Overall dental disease prevalence was 91.3%, rural / urban population was 93.3 / 89.3% (p>0.05).  There were more cases of trauma (87.5%) seen in urban than rural locations (p = 0.029).
10.	Handa et al. 2016	WHO index age groups of 5, 12, 15, 35-44, and 65-74 years  810	Urban / rural  Versus  National survey	Overall dental caries prev. = 44.9%  Missing due to caries = 29.4%  Filled teeth = 7.6%	Overall mean DMFT = 1.61  mean DMFT of 2.49 among urban people in the age	Periodontal diseases was 65%  and is less when compared to the national survey (89%)	Bleeding gum = 15.75%  Calculus = 30.70%	Shallow pocket = 5.86%  Deep pocket = 12.65%	46% of the population suffered malocclusions of which 21.19 % had the severe type.

	India				group of 35-44 yrs				Dental fluorosis = 46%, of which 11.23% had moderate and 9.6% had a severe type of fluorosis.  Treatment was found to be required among 83% of the population
11.	Sun et al. 2018  China	35 – 44 years of age  4,410	Total study population  Urban / rural	NA	NA	Overall Periodontal disease = 90.9%	Gingival bleeding = 87.4%,  Calculus = 96.7%	Prevalence of pocket 4-5mm = 45.8%  deep pocket ≥6mm = 6.9%,  clinical attachment loss >3mm = 33.2%.	Prevalence of bleeding, calculus, and PD = 4-5mm were slightly higher in the rural group while PD of > 4-5mm and clinical attachment loss were higher among the urban sub-group
12.	Hessari et al. 2007  Iran	35 – 44 years of age  8,301	Urban/rural	Decayed Teeth = 24%  Filled Teeth = 16%  Missing Teeth = 60%	Overall DMFT prevalence ≥1 = 98%  Mean DMFT = 11  FT = 1.8 MT = 6.6 DT = 2.6	Overall Periodontal disease = 99%	Gingival bleeding = 6%  Calculus = 40%	Shallow pocket = 43%  Deep pocket = 10%	715 (8%) had 1–3 DMFT, 3,458 (42%) 4–10 DMFT and 3,970 (48%) more than 10 DMFT
13.	Varenne et al. 2004  Burkina Faso,	6 years 12 years 18 years and 35–44 years  1914	A cross-sectional survey of ethnic and socioeconomic groups.  households in urban areas and on the recent population census in rural areas.	Age 6years = 38%  Age 12 = 28.5%  18-year = 53.9%  35–44-years = 72.8%	Age 12 = 0.7  18-year = 1.9  35–44-years = 6.3	NA	Score 2 (gingival bleeding and calculus)  Age 12 = 57%  18-year = 58%  35–44-years = 49%	NA	prevalence higher in urban than rural areas in all cases  No difference in gender for periodontal disease

N/A: not applicable – outcomes not examined/not reported. All prevalent values are combined population settings rates except otherwise stated

### 5.5.2. Factors associated with oral diseases

Age, oral hygiene behavior in terms of brushing frequency and regular visits to the dentist as well as the residential location were identified as risk factors for dental diseases. Its relationship with gender and residential location (urban/ rural, slum / non-slum) as reported in different studies, were multidirectional: while some studies identified a single direction, some identified an opposite direction and others reported that there was not enough evidence to support a relationship. Similar directions were seen for increasing age, less education, lower income, and poor oral hygiene as these favoured the increased prevalence of oral diseases (periodontal diseases and dental caries) across the eleven studies included, irrespective of region or residential setting. No notable difference was observed in the risk factors between different settings and/or between different countries.

From table 5.4, three (Airen *et al.*, 2014; Hannan *et al.*, 2014; Patel *et al.*, 2017) of the eleven studies addressing this review question involved a slum. One study (Patel *et al.*, 2017) reported higher disease prevalence in the slum site compared with urban non-slum site. The remaining two studies (Airen *et al.*, 2014; Hannan *et al.*, 2014) examined the slum populations exclusively.

**Table 5.4. What are the associated factors/ risk factors of oral diseases in adults residing in slum and non-slum urban settings of LMICs?**

S/N	First Author (Year) Country of study	Population age range / sample size	Setting	Finding / Outcome	Slum – urban difference
1	Patel et al 2017 India	People >10 years of age,  300	Urban / urban slum	Dental caries was found significantly associated with frequency of brushing and habit of mouth gargling in both urban and urban slum (p-value 0.011 and 0.0001): Dental caries being 4.6% and 22.0% among those who brush twice daily and those who don't in the urban area Being 3.3% and 14.0% among those who brush twice daily and those who don't in the slum area.  Dental caries being 5.3% and 10.7% among those who gaggle regularly and those who don't in the urban area Being 4.0% and 10.0% among those who brush gaggle regularly and those who don't in the slum area.  Incorrect pattern of brushing was also significantly associated with dental caries in both settings (p-value 0.0001 and 0.004). Brushing material and addiction to smoking and tobacco chewing were significantly associated with the development of dental caries.	More in urban slum areas

2	Hannan et al 2014 Bangladesh	Participants of all age groups and sex  3904	purely slum	Gender and age are important determinants of dental diseases.  Caries was found higher in males. Both decayed and missing components increased and filling components decreased with the progression of age.	NA
3	Airen et al. 2014 Central India	Age range 5 – 64 years  143	Purely slum	Males exhibited a significantly greater number of caries than females (P = 0.008).  Severe caries experience was more in those individuals who are not associated with any occupation (P = 0.048)	Caries prevalence was higher in the slums (76%) than in the general population which was reported to range between 50-60%
4	Jaafar et al. 2019 Malaysia	adults 19 years & older household residents  586	Urban disadvantaged / National population	Age, gender, and race influenced oral diseases.	No difference
5	Morgan et al. 2018 Rwanda	2–5, 6–11, 12–19, 20–39, & 40 &> yrs  2,097	Whole country  Combined rural and urban	Caries experience varied significantly with age (increased with increasing age), level of education geographical location (p < .05). Untreated caries varied significantly with age, and geographical location (p < .05) but not by education level (p > .05)	NA
6	Msyamboza et al. 2016 Malawi	12, 15, 35–44, and 65–74-year-olds.  5400	Whole country  Rural/ urban	Gender was an important risk factor. Toothache, dental caries and missing teeth were more common in females than males; 46.5 % vs 37.9 %, 40.5 % vs 32.4 %, 37.7 % vs 30.1 % respectively, all p < 0.05.  Prevalence of dental caries and missing teeth in urban areas were as high as in the rural areas; 33.3 % vs 37.4 % and 30.9 % vs 33.7 % respectively  Location (urban or rural) was not a risk factor for dental caries in this population.	Equal urban-rural settings
7	Costa SM et al. 2012 Brazil	Adults 35 to 44 years of age  1,150	Purely urban	Caries severity was significantly associated with increasing age, visit to the dentist, and lower-income  The prevalence of high caries severity among those aged 40 to 44 years was 1.15-fold (95%CI: 1.04 to 1.26) greater than among those aged 35 to 39 years.  A greater prevalence of high caries severity was found among those who frequently visited the dentist (PR = 1.18; 95%CI: 1.07 to 1.30) in comparison to those who did not make regular visits to the dentist.  A greater prevalence of high caries severity was also found among those with a lower income (PR = 1.11; 95%CI: 1.01 to 1.23)  Gender was not associated with dental caries in the multivariate analysis	NA
8	Sun et al. 2018 China	34 – 44 years of age  4,410	Total study population  Urban / rural	Gender (male), educational level, teeth brushing frequency, smoking, dental floss use potentially influence periodontal health status.	NA

9	Tobin O and Ajayi IO 2017 Nigeria	5–6, 12, and 35–44 years' age groups  150	Urban/ rural	There was no significant difference between having gingivitis, periodontitis, and bleeding gums and the different occupations ( $p > 0.05$ ).  The presence of calculus ( $p = 0.005$ ) and gingivitis (0.015) was more in males than females. The presence of plaque (0.001) and calculus (0.006) was significantly more among the skilled workforce.  There was no significant association between location and presence of an oral condition for all the oral conditions except trauma which had a p-value of 0.029, with the urban area having 7 (87.5%) out of the 8 cases.	No rural-urban difference
10	Hessari et al. 2006 Iran	35 – 44 years  8,301	Urban/ rural	The findings showed significant differences for dental and periodontal indices by socio-demographic factors and educational status  Having calculus or pocket was more likely to be present among men (OR = 1.8, 95% CI = 1.6–2.0) and illiterate subjects (OR = 6.3, 95% CI = 5.1–7.8).	
11	Hong-Ying et al 2002 China	5, 12, 15, 18,35-44 and 65-74.  140,712	National oral health survey  Urban/ rural	Prevalence rates of dental caries in adolescents and young adults tended to be high in urban areas, meanwhile, in old age, the mean caries experience was slightly higher for rural areas.  For adults, the caries figures were significantly higher for females than males (P=0.001)	Variable urban-rural difference

### 5.5.3. Attitudes, perception, and belief about oral health status

Regarding perception about oral health status: only three studies (Gholami *et al.*, 2012; Olusile *et al.*, 2014; Olutola & Ayo-Yusuf, 2012) matched this sub-review question: one qualitative study was conducted among high and low socioeconomic population groups in Tehran (Gholami *et al.*, 2012), while the remaining two were quantitative studies: one of which was conducted among a purely urban population (Olutola & Ayo-Yusuf, 2012) and the other, across the whole country (Olusile *et al.*, 2014). From all the studies, positive perception of oral health status was evident. In the qualitative study (Gholami *et al.*, 2012) conducted among high and low socioeconomic settings, the participants from both socioeconomic settings were generally satisfied with the value they attached to the maintenance of their oral health and disease prevention. The majority of participants in the other two studies also had a positive self-rating (good perception) about their oral health status. In one of the studies (South Africa), good perception about oral health status was more pronounced among younger age groups, male gender, higher education and having an employment (Olutola & Ayo-Yusuf, 2012).



**Table 5.5: What are the perceptions of adult residents of slums and other non-slum settings of LMICs towards their oral health status?**

S/N	First Author (Year)	Country of study	Population age range / sample size	Setting	Finding / Outcome
1	Gbolami et al 2012	Tehran, Iran	Residents of Tehran 18 years and older  46	High and low socioeconomic regions	Participants considered their oral health to play an important role in relation to general health and believed the same attention should be paid to oral health problems as to other general health problems  They had good attitudes towards the prevention of periodontal disease prevention and oral health
2	Olusile et al 2014	Nigeria	Ages 18 to 81  7,630	Whole country	Overall 21.2% of the participants perceived their oral health status as very good, 37.1% as good, 27.4% as fair, 9.0% as poor or very poor while the remaining were not sure of their oral health status.  76.3% (n = 2,067) perceived their oral health status as good
3	Olutola and Ayo-Yusuf  2012	South Africa	South African adults (≥16 years)  Participants in the 2007 SA Social Attitude Survey (SASAS).  2,907	A nationally representative sample of adults 16 years and older	Good self-rated oral health was significantly higher among males, younger age group, higher education, and employed respondents  Self-rated good oral health was also more common among those who lived in areas that did not have access to basic infrastructure such as piped water or electricity

#### 5.5.4. Oral health/ hygiene practices

All six studies addressing this review sub-question reported that the majority of each study population, practiced routine hygiene and home remedies for oral disease cure or prevention.

Of the six studies included, only one involved a slum setting, and a second, a qualitative study, involved high and low socio-economic groups. The studies reported the use of various substances for oral hygiene, commonest among which was toothpaste/toothbrush (81% and 95%- in non-slum / urban setting and 30% – 66% in the slum setting). Others include various indigenous methods of oral hygiene such as coal, toothpaste and finger, neem, mango leaves, snuff, salt, chewing stick as well as other indigenous materials. The frequency of mouth cleaning practice was varied: while some practiced once-daily mouth cleaning, others cleaned twice or more times. From the study involving a slum setting (Patel *et al.*, 2017), more people in the non-slum urban setting used the correct technique in brushing as well as a habit of brushing both morning and night, before going to bed. Among other studies (Table 5.6), more residents of the urban settings relative to those of the rural settings, utilized more toothbrushes and paste in mouth cleaning. Other tools used include, toothpowder and brush, chewing stick, toothpaste and finger, toothpowder and finger, neem, charcoal, sand, snuff, salt, and indigenous concoctions. Rural dwellers utilized more of native or indigenous mouth cleaning tools and materials relative to their urban counterparts.

**Table 5.6: What forms of oral health care practices do adult residents of slum and other non-slum settings of LMICs engage in?**

S/N	First Author (Year)	Country of study	Population age range / sample size	Setting	Finding / Outcome
1	Gbolami et al  2012	Tehran, Iran	Residents of Tehran 18 years and >  46	High and low socioeconomic regions	Rubbing the teeth with coal was believed to be a good method of maintaining oral hygiene  Home remedies reported to improve gingival problems included using baking soda dissolved in water as well as rinsing with warm salt water for gargling to prevent gum infection or boiled sumac to relieve gum problems.
2	Patel et al  2017	India	People >10 years of age,  300	Urban / urban slum	Brushing Materials in the urban area and slum respectively include toothpaste and brush (82% and 68%), toothpowder and brush (5% and 9%), toothpaste and finger (4% and 7%), toothpowder and finger (3% and 5%), Others (neem, coal, twang, etc.) (4% and 7%), Both indigenous material and toothpaste (1% and 4%). Mouth cleaning is Brushing Morning only (73% and 83%) or Morning and Night (27% and 17%). Change of Brush was at regular intervals (42% and 29%).  Only 25.7% and 11.8% of people used the correct brushing technique.
3	Msyamboza et al.  2016	Malawi	12, 15, 35–44 and 65–74 year olds.  5400	Whole country	39.8 % said they cleaned their teeth three times a day, 35.2 % said twice, 19.7 % said once a day and 2.9 % said they never cleaned their teeth. The use of fluoridated toothpaste was reported by 42.6 % of the participants.  No information was provided on the rural-urban variation in the participants' oral hygiene practices
4	Olusile et al  2014	Nigeria	Ages 18 to 81  7,630	Whole country	Older persons, residents in the northern zones of the country and less educated persons displayed poorer oral hygiene practices.  The oral hygiene tool used by the largest proportion of participants was the toothbrush and toothpaste (81% of participants)  Other tools used included chewing stick (9.6%), salt (0.6%), water only (0.5%) and cotton wool (0.3%). Some participants (5.6%) reported using multiple tools.  Only 10.5% of the participants reported using dental floss or other oral hygiene aids such as mouthwashes. Also, 42.0% of participants reported cleaning their mouths twice daily while 37.1% clean their mouths once a day.
5	Masalu JR et al  2009	Tanzania	Adult respondents from the six geographic zones of mainland  1759	Rural / Urban	Nearly 95%, of urban and 66.4% rural residents reported using factory-made toothbrushes with no significant differences between sexes in both settings. Toothpaste was reported to be used by 94.1% of urban and 66.4% of rural residents with no sex difference across localities of residence. The prevalence of charcoal use was 4.6% and 13.2% among urban and rural residents respectively with rural females than males more likely to brush their teeth using charcoal. a higher proportion of rural residents used miswak than their urban counterparts.
6	Handa et al.  2016	India	WHO index ages and age groups of 5, 12, 15, 35-44, and 65-74 years  810	Urban / rural	Results showed that 81.5% (440) of urban and 30.6% (83) of rural respondents in the sample were using toothbrushes and toothpaste whereas 18% (97) and 49.7% (134) of urban and rural areas respectively used toothpaste or powder with their finger. The use of charcoal, sand, snuff powder, etc., as oral hygiene aids are still moderately prevalent in the rural areas (11.8%)

### 5.5.5. Utilisation of dental services

Dental service utilization was assessed in terms of “ever utilised” and “utilisation within the preceding 12 months’ period”. Six studies matched the review sub-question, one of which was a qualitative study and involved high and low socioeconomic groups (Gholami *et al.*, 2012). Of the remaining studies, none focused on slum settings. The pattern of dental service utilisation was generally low. The majority that utilised such services did so because of a problem. The ‘ever utilisation’ rate ranged between 26% and 71% among three studies including the urban population, and between 60 and 72% in the two studies that looked at utilization rate within the 12-months' period (Olutola & Ayo-Yusuf, 2012; Rezaei *et al.*, 2018). From the qualitative study, the participants displayed good attitude towards regular dental visits, although the majority of such visits were for pain relief. A study (Rezaei *et al.*, 2018) identified household income, age, being a university graduate, self-rated poor oral health, and having dental insurance as factors that influenced participants’ dental visits (Table 5.7)

**Table 5.7: What is the oral health service utilization pattern of adult residents of slums and other non-slum urban residents in LMICs?**

S/N	First Author (Year)	Country of study	Population age range / sample size	Setting	Findings / Outcome		
					% ever utilized dental services	% Utilized dental service within past yr	Others
1	Gbolami et al  2012	Tehran, Iran	Residents of Tehran  18 years and above  46	High and low socioeconomic regions	N/A	N/A	The participants considered regular dental check-ups as important; however, further discussions revealed that they usually do not follow this behaviour due to lack of time, laziness, busy lifestyle, cost, and lack of dental insurance.
2	Rezaei S et al  2017	West Iran	Household head or 18 years and above  894	Purely urban	.N/A	60.3% and 9.9% reported visiting a dentist for dental treatment in the past year and for 6-monthly dental check-ups, respectively.	Household income, age, being a university graduate, self-rated poor oral health, and having dental insurance among the study participants influenced visits.

3	Morgan et al.  2018	Rwanda	2–5, 6–11, 12–19, 20–39, and 40 and above years  2,097	Whole country  Combined rural and urban	70.6%	NA	Of those who ever visited a dentist, 98.7% sought care because of pain.  Of those who responded to the question of why they were unable to access care, over half (60.3%) reported that cost was the major reason for not receiving care
4	Olusile et al  2014	Nigeria	Ages 18 to 81  7,630	Whole country	26.4%	NA	Older age and more skilled profession associated with ever visiting a dentist
5	Masalu JR et al  2009	Tanzania	Adult respondents from the 6 geographic zones of mainland  1759	Rural / Urban	49.6% of urban and 36.8% of rural residents ever visited a dental clinic	NA	More urban females than males more likely to visit the clinic ( $p < 0.05$ )  People with pain had a reduced likelihood of not attending dental treatment and more likely to drink alcohol
6	Olutola and Ayo-Yusuf  2012	South Africa	South African adults ( $\geq 16$ yrs)  Participants in the 2007 South African Social Attitude Survey (SASAS).  2,907	a nationally representative sample of adults 16 years and older	NA	71.8%	Those who reported dental attendance in the past year were less likely to have rated their oral health as good than those who did not

## 5.6. Chapter summary

Searches were undertaken of existing surveys conducted in all LMICs, to gain insight into the oral health issues affecting slums and other urban settings for the following reasons: current scarcity of comprehensive summary of pieces of evidence relevant to oral health in slum environments; scarcity of representative, scientific studies on oral health of slum populations and non-slum urban settings in Nigeria, the location of the accompanying epidemiological study for the thesis being conducted. Such information will be useful in identifying, understanding and proffering viable solutions to oral health-related issues in the slums of LMICs.

The searches were designed to optimize the chances of finding appropriate literature to accomplish the research goal for this thesis. The search sought to identify existing literature on

the prevalence of oral diseases, the determinants, perception, and practices as well as utilisation patterns of available oral health services as five distinct objectives for the review, in slums and non-slum urban settings of LMICs [Appendix 4.2].

Findings revealed few studies on oral health in relation to the slum environment with most from Asia, and few from sub-Saharan Africa. Although lessons can be learned from these studies, the majority did not compare slum and non-slum urban settings. Furthermore, since slums differ according to their classification and features, the approach to tackling the oral health care challenges arising in each slum will differ from region to region (Lilford *et al.*, 2019).

A total of eighteen studies met the inclusion criteria. Of these three studies involved slum setting in which only one compared slum and non-slum populations, while two others examined slum populations exclusively. Other included studies examined general urban and national population settings. The key findings are;

**Prevalence of oral diseases:** The most common diseases reported were dental caries, periodontal diseases. Others include oral cancers, dental fluorosis (white spots on teeth), dental trauma, and edentulism (tooth loss). The prevalence of dental caries varied across age groups, gender, and socioeconomic classes and ranged between 13% and 71% among the populations under survey. The mean Decayed Missing and Filled Teeth (DMFT), which is a mean measure of lifetime caries experience in a population ranged between 0.26 – 12.7. Periodontal disease prevalence also varied across age groups, gender, and socioeconomic class but was generally high in prevalence ranging between 65% and 99%. The associated risk factors for dental diseases were gender, income level, and location (urban/ rural, slum / non-slum). The majority of participants in the studies perceived their oral health status to be satisfactory. Good perception about oral health status was more pronounced among the younger age groups, male sex, higher socio-economic class, and having employment. All of the included studies on oral health practices reported that the majority of the study participants engaged in routine hygiene and home remedies for oral disease cure or prevention. Toothpaste and brushes were the commonest oral hygiene tools employed by most participants: (81% and 95%- in non-slum / urban setting and 30% – 66% in the slum or rural setting). Other tools used included toothpowder and brush, chewing stick, toothpaste and finger, toothpowder and finger, neem, charcoal, sand, snuff, salt, indigenous material, and toothpaste, etc. Mouth cleaning was mostly once and in the mornings. Dental service utilisation rate ranged between 26% and 71% among urban population and 60% and 72% in the two studies that looked at utilisation rate within 12 months.

## CHAPTER 6: RESEARCH METHODS FOR QUANTITATIVE SURVEY (WORK PACKAGE 2)

Please note: Chapters 6 and 7 form the basis for the peer-reviewed journal article titled- “*Prevalence and determinants of oral health conditions and treatment needs among slum and non-slum urban residents: Evidence from Nigeria*” (Osuh *et al.*, 2022)

### 6.1. Chapter overview

This chapter presents the research methodology of the quantitative survey of the thesis. It features the objectives, statement of hypothesis, design, study area and sites, sample size determination, sampling strategy and justification, research setting, research team, consent and permissions, as well as originality of research.

### 6.2. Research Objectives

Research objective 2: To determine the prevalence of oral diseases, treatment needs and oral health behaviour among adult residents of the slum and the non-slum urban study sites.

Research objective 3: To examine the associated factors for oral diseases among the adult residents of the slum and the non-slum urban study sites.

### 6.3. Statement of hypothesis

Null: There is no difference in the dental health of the residents of the slum and the non-slum urban settings. (hypothesis H0)

Alternative: There is a difference in the dental health of residents in the slum setting when compared with residents of the non-slum urban setting. (hypothesis H1). The underlying assumption is that the slum dwellers take less cariogenic diet than non-slum city inhabitants while the non-slum residents exhibit better dental hygiene and had better access to dental health care. (Aikins & Braimoh, 2015; Gautam *et al.*, 2012; Locker, 2000; Patel *et al.*, 2017; Sanders *et al.*, 2006).

#### 6.4. Research design

Descriptive cross-sectional survey with an analytical comparison between the slum and the non-slum sites.

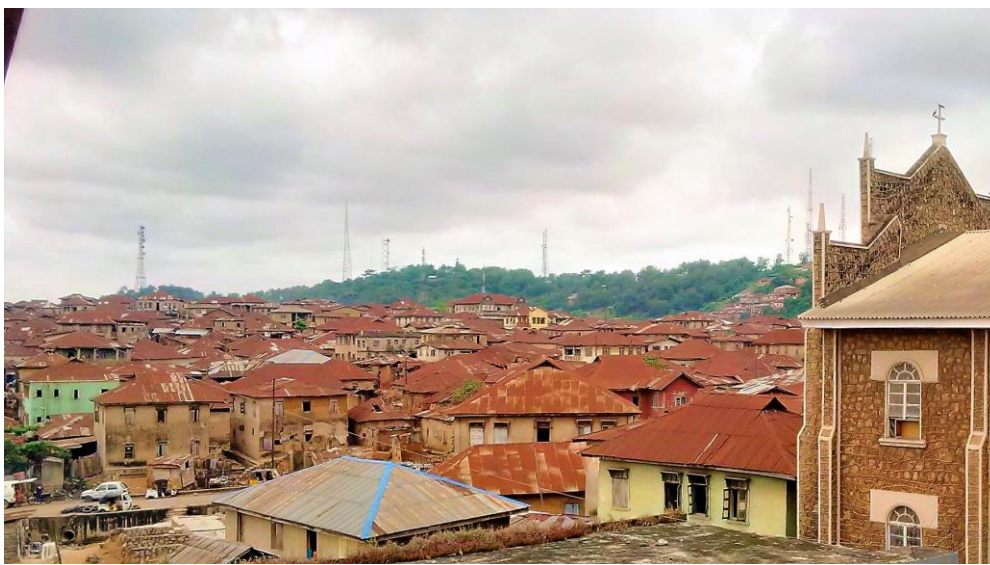
#### 6.5. Study Area

The study was conducted in Ibadan, the capital city of Oyo State, South-Western part of Nigeria, sub-Saharan Africa. Ibadan is an ancient city occupied by predominantly the Yoruba ethnic group.

#### 6.6. Selection of Study Sites and Description

##### 6.6.1. The slum site

Idikan community was the slum site identified for the study. The community was purposively selected being a part of the slum communities selected for study in a larger multi-country study, funded by the National Institute for Health Research (NIHR) Global Health Research Unit (GHRU) on Improving Health in Slums, a project off-shoot of which this thesis is associated. Idikan community is one of the ancient communities located within the high-density residential districts found at the inner core (old town) of Ibadan in Ibadan North West Local Government Area (LGA), Oyo State, Nigeria. The community is unplanned in terms of urban development as shown in picture 6.1.



Picture 6.1. Idikan Community, a slum setting in Ibadan, Oyo State, Nigeria. December 4, 2018

### 6.6.2. Non-slum site

Okeado Community is one of the areas within Ibadan Southwest Local Government Area (IBSWLGA), Ibadan, Oyo State. It is located within the medium density residential districts of the LGA and in close proximity to two hotspot areas with respect to commercial activities, within Ibadan City. The LGA is dominated by the Yoruba's and other tribes and they all engage in different types of economic activities. The community is reasonably planned in terms of urban development as shown in picture 6.2.



Picture 6.2: A residential street in Okeado Community, a non-slum setting in Ibadan, Oyo State, Nigeria. December 4, 2018

#### 6.6.2.1. The non-slum site selection process.

The larger survey in the NIHR, GHRU project did not cover non-slum areas, but the inclusion of a non-slum urban population site in this PhD study was considered crucial for comparison of findings with the slum site, in order to fulfill research objectives 2 and 3 of the thesis. Existing health surveys, such as the Demographic and Health Surveys and Multi-Indicator Cluster Surveys that use sampling frames taken from censuses, did not have a consensus on what a non-slum was and were unable to distinguish between slum and non-slum clusters in urban



areas (Lilford *et al.*, 2019; UN-Habitat, 2017), more so in Ibadan. A delineation exercise was therefore carried out with assistance of staff from the National Population Commission, Ibadan office to mark out the non-slum sites in Ibadan and select a suitable one for this study. The selection process entailed the following considerations:

1. An operational definition of slum was utilized for this study in order to exclude all slum settings in Ibadan city (both established and emerging slums) during our selection process. This operational definition of slum (UN-HABITAT, 2004) included not having access to one or more of the following: Durable housing of a permanent nature that protects against extreme climate conditions; Sufficient living space which means not more than three people sharing the same room; Easy access to safe water in sufficient amounts at an affordable price; Access to adequate sanitation in the form of a private or public toilet shared by a reasonable number of people; Security of tenure that prevents forced evictions.
2. Years of existence: This is because most dental diseases are chronic events lasting years, up to a lifetime. Since the study focused on the adult population, the site must be in existence for at least 20 years to allow long enough tenancy for exposure to the environment.
3. Existing residential zones of Ibadan: This is in relation to the population densities in each zone because high density residential zones were predominantly slums. As such the medium and low- density residential zones were considered appropriate for the non-slum urban site comparator.
4. Income level: This was also considered to exclude areas in the city with a concentration of very high-income earners. This is so as to make the study sites of interest similar in some respect such as in their income-earning capabilities.

Consequently, Okeado (non-slum) area (Fig 6.2), emerged as the site of choice for non-slum in the project.

#### 6.7. Data source

Primary data was obtained from adult residents of Idikan (slum setting) and Okeado area (non-slum setting) who were 18 years and above using questionnaires and oral health examination.

## 6.8. Sample size (SS) determination

**Research objective 2:** To determine the prevalence of oral diseases, treatment needs and oral health behaviour among adult residents of the slum and the non-slum urban study sites: The minimum SS required for the survey was calculated using the formula for estimating single proportions.

Previous studies, representative of adults in the targeted communities were not found, thus estimates of proportions for input into the SS calculation were obtained from similar populations in other parts of Nigeria. Although these studies were gender based, they are used for SS calculation in the absence of studies covering both genders, acknowledging there may be potential gender differences as reported in some of the previous literature (Kissa *et al.*; Lukacs, 2011b; Patro *et al.*, 2008; Shaffer *et al.*, 2015; Susin *et al.*, 2014).

Prevalence rates of 75.4% for periodontal disease and 12.8% for dental caries among adult population groups were reported previously (Lawal & Alade, 2017; Umoh & Azodo, 2012) and were applied. The SS required to estimate the prevalence of oral diseases and treatment needs to be within 5% points level of precision is given by the formula (Bartlett *et al.*, 2001; Taherdoost, 2017):  $N = (Z\alpha^2 \times PQ) / d^2$ . Where N is the minimum sample size,  $Z\alpha$  is the standard normal deviate corresponding to a 2-sided level of significance of 5%, P = prevalence of periodontal disease (75.4%) and dental caries (12.8%), Q = 1 – P, and d is the desired level of precision = 5%

- For periodontal disease: N = 317; For dental caries: N = 190

To compare the oral disease burden, treatment needs and health care seeking behaviour of adult residents between the two sites, the minimum number of participants required to compare the proportion with oral disease between the two slums was obtained using the formula for comparing two proportions (Bartlett *et al.*, 2001; Taherdoost, 2017):  $N = (Z\alpha + Z1-\beta)^2 (p1(1-p1) + p2(1-p2)) / (p1-p2)^2$ . Where  $Z\alpha$  = standard normal deviate corresponding to 5% level of significance = 1.96,  $Z1-\beta$  = standard normal deviate corresponding to a power of 80% = 0.84,  $p1$  = proportion with dental caries in slum setting (site 1) = 12.8%,  $p2$  = proportion with dental caries in the non-slum setting (site 2), assumed 10% higher than slum (site1) = 12.8+10 = 22.8% , N = minimum SS in each of the two groups. After adjusting for 10% non-response, the SS in each group = 254 participants

- For periodontal disease where  $p_1$  (prevalence) = 75.4%, a minimum of 274 participants will be needed in each site.
- For treatment-seeking behaviour, where  $p_1$  (prevalence) = 26% (Okunseri *et al.*, 2004), a minimum of 372 participants will be required in each site.

**Research objective 3:** To determine the association between oral disease and risk factors (e.g. diet, oral hygiene practices, tobacco or alcohol use) at 5% level of significance and 80% power, the following formula was used (Bartlett *et al.*, 2001; Taherdoost, 2017):

$$N = (Z_{\alpha} + Z_{1-\beta})^2 PQ / d^2$$
 where N is the minimum SS required for each site,  $Z_{\alpha}$  is the standard normal deviate corresponding to a 2-sided level of significance of 5%,  $Z_{1-\beta}$  = standard normal deviate corresponding to a power of 80% = 0.84. P is prevalence of periodontal disease (75.4%) and dental caries (12.8%),  $Q = 1 - P$ , and d is the desired level of precision = 5%. For periodontal disease:  $N = 646$ ; For dental caries:  $N = 389$

Therefore, the SS adopted for the study was the highest value obtained in all the SS calculations for objectives 2 and 3. The minimum SS required in each of the slums and the non-slum urban setting was **646**. This was rounded off to **650** participants each for the slum and the non-slum communities.

## 6.9. Mapping of study sites for sampling

### 6.9.1. Idikan Community (slum community) site

From the ethically approved protocol for the larger NIHR GHRU survey (Bakibinga *et al.*, 2019), there were 1,923 structures or buildings in the area delineated as the slum community (Idikan). The structures were extracted from a very high-resolution satellite image covering the community. While the footprints of structures were visible on the image, the use to which these structures were put could not be discerned, hence the conduct of 'ground truthing' activity in the NIHR GHRU study to ascertain those that were residential. The ground truthing involved physical on-the-spot visit to verify structures identified from the satellite image and to gather additional information. It also provided an opportunity to carry out house listing in Idikan community. At the end of the ground truthing exercise, a total of 708 (36.8%) structures were confirmed as residential structures (Fig. 6.1). The 708 residential structures identified therefore formed the sampling frame, from which 650 structures were randomly selected (see section 6.11).

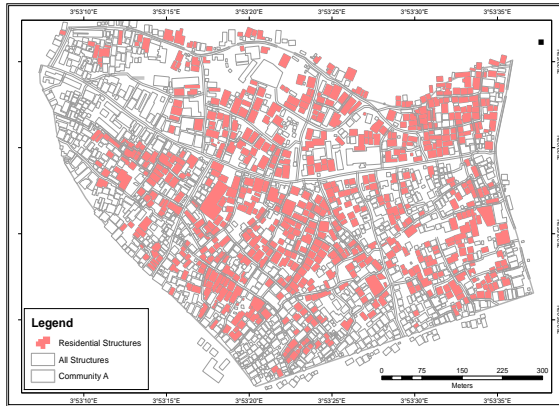


Figure 6.1: Residential Structures in Idikan Community

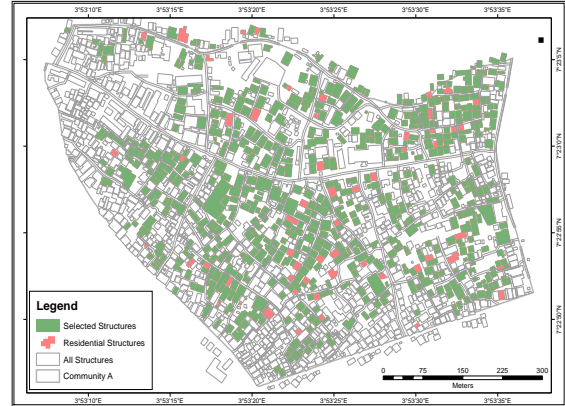


Figure 6.2: Randomly selected residential structures in Idikan included into the study

#### 6.9.2. Okeado Community (non-slum community) site

As non-slum settings were not part of the larger NIHR GHRU survey, a more detailed but largely similar method to the mapping done in the slum setting was adopted for the selection of participants. To begin with, the boundaries of Okeado non-slum area was determined together with the staff of the National Population Commission (NPopC) who were familiar with the community. Then, the boundaries were identified on Google Map from where it was digitized (Fig. 6.3). All the structures within the delineated area were digitised from a very high-resolution satellite image (Fig. 6.3). A total of 3711 building footprints were in the area delineated as Okeado non-slum area. From the total of 3711 digitised building footprints, 1000 building footprints were randomly selected, using the random sample algorithm contained in Quantum GIS software (Fig. 6.4). The choice of 1000 building footprints was made based on the NPC staff's recommendation that about 70% of the buildings in the community was residential.

The comparatively higher number of structures selected in the Okeado compensated for the buildings which were non-residential (shops, clubs, hotels, and other commercial buildings) since ground truthing was not done.



Figure 6.3: High-resolution satellite image of Okeado Community

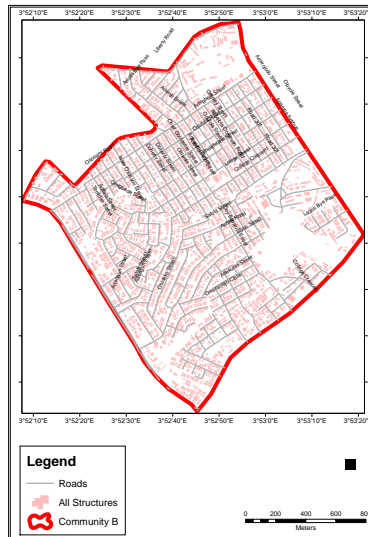


Figure 6.4: Extracted structures in Okeado Community

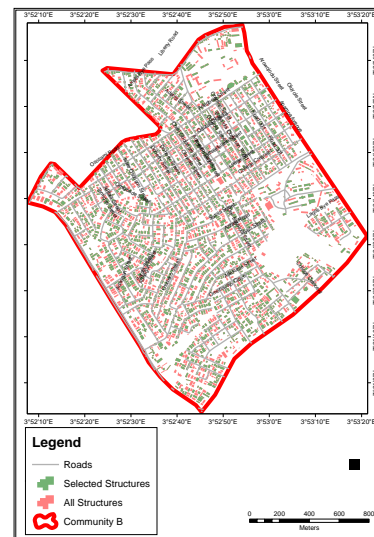


Figure 6.5: Randomly selected structures in Okeado Community

## 6.10. Sampling strategy

### Multistage Sampling Technique.

The multi-stage sampling design is a complex form of cluster sampling in which two or more levels of units are embedded, one in the other. It involves the use of various methods of probability sampling in a most effective and efficient approach such that a step by step movement from a broad sample to a narrow sample is achieved. Two basic steps are usually involved in each level: listing and sampling. This multistage sampling technique was considered for this study because of its applicability in inquires involving a broad geographical area, or the entire country. (Acharya *et al.*, 2013; Etikan & Bala, 2017; Taherdoost, 2016).

## 6.11. Process of Selection

*First stage:* From the 708 and 1000 structures selected respectively from Idikan (slum) and Okeado (non-slum), 650 structures from each were randomly selected using the random selection algorithm in Quantum GIS software (Fig. 6.2 and 6.5). Households in these structures became the research targets (Fig. 6.2 and 6.5).

*Second stage:* Using the Geographic Positioning System (GPS) aided by the local internet network, an inventory of all households within each selected building structure were created, then one household per building was randomly selected using the OpenDataKit (ODK) client application.

*Last stage:* An inventory of all adults in the selected household was created from which one eligible adult participant was randomly selected, again, using ODK software and then enrolled in the study.

#### 6.12. Inclusion criteria

These included participants who were available on the day of the visit and who were willing to participate in the study. They also had to be at least 18 years of age and must be resident in the area for at least one year.

#### 6.13. Exclusion criteria

Visitors, guests, house staff, and chronically ill patients were all excluded from the study.

#### 6.14. Training and calibration of research assistants

##### 6.14.1. Data collection teams and schedule

There were ten teams of Research Assistants (RAs) each comprising a dentist and an experienced recording clerk. The dentists were fresh dentistry graduates from the University of Ibadan while the recording clerks were Masters and PhD students of the same University. Each member of the team wore an identifying tag or ID card.

##### 6.14.2. Training

All the RAs were trained on the research protocol. They were made familiar with the objectives of the study, trained in the use of structured questionnaires, in contacting prospective respondents and in introducing the study objectives while assuring participants of

confidentiality. RAs were carefully trained in reading out questions as written and following the instructions in the interview schedule in appropriate styles of inquiry and probing, in recording exactly what is said, and maintaining an interview style that introduces no bias to the responses of the study participants. They were also trained to understand, interpret, apply the criteria and codes for various oral diseases and its recording in line with WHO standards (Petersen, 2013).

#### 6.14.3. Calibration of the examiners

Oral examination was performed by the ten dentists who were trained for the research exercise. The dentists were trained on the use of the diagnostic criteria and interpretation of the WHO assessment form. They were evaluated on their ability to use the criteria (as described in Table 6.1) using 10 volunteers at the dental centre, University College Hospital (UCH), Ibadan. Examiners' interrater variability was tested for various oral health conditions, in which 10 examiners interpreted 10 different scenarios for the oral health outcomes. Percentage agreement and Gwet's AC1 index were used to measure interrater variability of researchers for diagnosing the oral health conditions. Statistical analysis was carried out using Stata version 16.1. For dental caries, there was 77% agreement (Gwet's index: 0.71). For periodontal pocket formation, there was 66% agreement (Gwet's index: 0.49). For filled teeth, there was 94% agreement (Gwet's index: 0.94). For gingival attachment loss, there was 67% agreement (Gwet's index: 0.50). For dental fluorosis, there was 80% agreement (Gwet's index: 0.74). For dental erosion, there was 86% agreement (Gwet's index: 0.84). For dental trauma, there was 96% agreement (Gwet's index: 0.96).

**Table 6.1: Criteria for diagnosis of oral health conditions (Petersen, 2013)**

	<b>Diagnosis</b>	<b>Description</b>
Dentition Status	Sound crown	A crown was coded as sound (0) if it showed no evidence of treated or untreated clinical caries
	Dental caries	Established carious lesions. Present when a lesion in a pit or fissure, or on a smooth tooth surface, had an unmistakable cavity, undermined enamel, or a detectably softened floor or wall. A tooth with a temporary filling, or one which was sealed but also decayed, was also included in this category if the crown was destroyed by caries and only the root was left. The tooth was scored as crown caries only.
	Filled Teeth	Presence of permanent restorations that has no detectable secondary caries or caries on the other surfaces of the tooth. Temporary filling was recorded as filled if it had no secondary caries or caries on the other surfaces of the tooth. A tooth with a lost or defective restoration and had no signs of caries on it was regarded as filled.
	Missing Teeth	A tooth extracted as a result of caries. A tooth was also regarded as missing if it was lost as a result of any other reason other than caries and coded as such e.g. periodontal disease, trauma, etc. A tooth was judged as un-erupted if it did not erupt at all and was coded accordingly.
Periodontal status	Gingival bleeding and periodontal pockets	<p>All teeth in the mouth were examined for absence or presence of gingival bleeding and periodontal pockets; pocket depth was measured with the WHO's CPI probe using a sensing force that was be no more than 20 g.</p> <p>Gingival bleeding scores were recorded using the following codes: 0 = Absence of condition; 1 = Presence of condition; 9 = Tooth excluded and X = Tooth not present</p> <p>Pockets were recorded using the following code: 0 = Absence of condition; 1 = Pocket 4–5 mm; 2 = Pocket 6 mm or more; 9 = Tooth excluded and X = Tooth not present.</p>
Others	Loss of attachment	Recorded by dividing the mouth in sextants, defined by tooth numbers: 18–14, 13–23, 24–28, 38–34, 33–43, and 44–48. The extent of loss of attachment was recorded using the CPI probe and applying the following codes: 0 = 0–3 mm; 1 = 4–5 mm (Cemento-Enamel Junction (CEJ) within black band); 2 = 6–8 mm (CEJ between upper limit of black band and 8.5 mm ring); 3 = 9–11 mm (CEJ between 8.5 mm and 11.5 mm ring); 4 = 12 mm or more (CEJ beyond 11.5 mm ring); X = Excluded sextant; 9 = Not recorded.
	Enamel Fluorosis	The appearance of usually bilaterally symmetrical lines which tend to show a horizontal striated pattern across the tooth. Coding was done on the basis of the two most severely affected teeth. Findings were recorded using Dean's fluorosis index criteria: 0 = Normal - when enamel surface appears smooth, glossy and usually of pale creamy or white colour; 1 = Questionable - when the enamel shows slight aberrations in the translucent normal enamel and which may range from a few white flecks to occasional spots; 2 = Very mild - when small, opaque, paper-white areas are seen scattered irregularly over the tooth but involving less than 25% of the labial tooth surface; 3 = Mild - when white opacities of the enamel involve more than 25% but less than 50% of the tooth surface; 4 = Moderate - when the enamel surfaces show marked wear, and brown staining is seen frequently as disfiguring feature; 5 = Severe - when the enamel surfaces are observed to be severely affected and the hypoplasia is so marked that the general form of the tooth may be affected. It will also show pitted or worn areas and brown stains will be widespread; the teeth will often have a corroded appearance; 8 = Excluded (e.g. a crowned tooth) 9 = Not recorded
	Dental Erosion	Formed as a result of a loss of enamel tissue by exposure to acids which may come from dietary sources or may be intrinsic, i.e. in individuals suffering from bulimia, gastro-oesophageal reflux or heavy alcohol consumption and chronic vomit. Codes used: where the crown of a tooth shows an erosion lesion at different levels: 0 = No sign of erosion; 1 = Enamel lesion; 2 = Dentinal lesion; 3 = Pulp involvement. The severity of dental erosion will be recorded according to the tooth with the highest score of erosion, in addition to the number of teeth involved.



Dental Trauma		Presents in the form of tooth fracture. Fracture to the teeth are coded as follows: 0 = No sign of injury; 1 = Treated injury; 2 = Enamel fracture only; 3 = Enamel and dentine fracture; 4 = Pulp involvement; 5 = Missing tooth due to trauma; 6 = Other damage; 9 = Excluded tooth. In addition to the degree/status of trauma, the severity of dental trauma will also be measured in terms of the number of teeth involved.
Oral mucosal lesions		The oral mucosa and soft tissues in and around the mouth were examined in the following sequence: labial mucosa and labial sulci (upper and lower); labial part of the commissures and buccal mucosa (right and left); tongue (dorsal and ventral surfaces, margins); floor of the mouth; hard and soft palate and alveolar ridges/gingiva (upper and lower). Findings were recorded using the following codes: 0 = No abnormal condition; 1 = Malignant tumour (oral cancer); 2 = Leukoplakia; 3 = Lichen planus; 4 = Ulceration (aphthous, herpetic, traumatic); 5 = Acute necrotizing ulcerative gingivitis (ANUG); 6 = Candidiasis; 7 = Abscess; 8 = Other condition (specify if possible) (e.g. keratosis; and Koplick spots; 9 = Not recorded
Denture Status		This was based on the presence of removable dentures for each jaw. The following codes will be used: 0 = No denture; 1 = Partial denture; 2 = Complete denture; 9 = Not recorded
Intervention urgency		Findings were entered using the codes: 0 = No treatment needed; 1 = Preventive or routine treatment needed; 2 = Prompt treatment including scaling needed; 3 = Immediate (urgent) treatment needed due to pain or infection of dental and/or oral origin; 4 = Referred for comprehensive evaluation or medical/dental treatment (systemic condition)

## 6.15. Questionnaire

The questionnaire for this study [Appendix 6.1] was adapted from the questionnaire used in the larger NIHR GHRU survey as well as the WHO's Adult Oral Health Survey tool (Petersen, 2013). The questionnaire was translated into the native (Yoruba) language and back-translated to the English language. Participants responded to a structured, and standardized questionnaire which was interviewer-administered. Information generated include participants' socio-demographic information; age, gender, current marital status, highest level of education, work status and history of residential status. Other information gathered included: health insurance, digital communication, household characteristics, household income and expenditure and oral health care spending, experience of dental problem within the last 12-month period, dental treatments obtained, dental health status and well-being, self-assessment of oral health status, oral health habits, risk behaviour (consumption of sugary foods and drinks, type and frequency of use of tobacco, and consumption of alcohol), dental hygiene practices (frequency of tooth cleaning, use of aids for oral hygiene, use of toothpaste containing fluoride), utilization of dental services (dental visits, reason for dental visit), experience of pain/discomfort from teeth and mouth, experience of reduced quality of life due to oral problems.

#### 6.16. Oral examination

Oral examination was performed by the dentist in each team of Research Assistants. Mouth examination was carried out with the aid of visual and tactile senses. The teeth were examined systematically from the first to the fourth quadrant. Diagnosis of conditions were made in accordance with the standard WHO criteria for oral health surveys (Petersen, 2013) and findings were recorded on the WHO standardized assessment format [Appendix 6.2] which had been prepared on the tablet computers. The following information were obtained from all participants: dentition status, periodontal status; loss of attachment; enamel fluorosis; dental erosion; dental trauma; oral mucosal lesions; denture status (fixed or removable dentures); intervention urgency and need for referral.

#### 6.17. Pretest

A pre-test of the study was conducted at a community located in the University of Ibadan with over 50 randomly selected buildings and households. The exercise verified the veracity of information obtained from the satellite imagery by physical on-the-spot visit of 50 buildings (5 buildings per team) and gathering of other useful information on the Q-field (an Android application for collecting field data), built for GIS (Geographic Information System). The sampling processes to obtain the final participants using the ODK software were tested. The duration of questionnaire completion and the oral examination along with its recording into the tablet computer were recorded. Ambiguities in the questionnaire were also noted and promptly reviewed. These steps were taken to achieve consistency and a systematic approach to implementation of the survey.

#### 6.18. Data collection exercise and consent

Following the random selection of an eligible household member to be included in the study, the data collection teams visited the selected household to meet the selected person. If the selected adult was available, he/she was enrolled in the survey and when not available, a second and up to a third visit (if needed) was made. During the meeting, the number of visits before a successful meeting was noted, then detailed information about the project was shared including their roles, and clarifications were provided, where needed. Following the explanation, they were each given the participant information leaflet [Appendix 6.3] which

contained a contact telephone number for use by participants who required further explanation or who had a query. Before each survey exercise, the participant was asked about his willingness to participate in the research and if so, was invited to complete and sign a consent form [Appendix 6.4] after reading the terms and conditions. The signed "consent forms" were collected from participants who agreed to participate in the study before research administration. To ensure the confidentiality of participants, each participant was anonymized. Participants were made aware of their rights to withdraw from the study freely at any time, however, nobody opted to withdraw at any point throughout the period of the survey exercises. Following collection of the signed consent form, a good location with adequate light and sitting arrangement was identified in the home environment with the assistance of the participant. The participant was then seated on a regular chair and the questionnaire was administered by the trained recording clerk while the dentist prepared for the oral examination (light source - headlamp, fresh tray of sterile and sealed set of examination instruments, wooden spatula, sterile gloves, and face mask). Following the administration of the questionnaire, oral examination was performed by the dentist, and findings were entered into the prepared tablets by the recording clerk. On the few occasions (8 times) that the participants declined to partake in the research exercise, the reasons for declining were noted and the process was discontinued. Thereafter, another eligible member within the same household was randomly selected as a replacement for the person that declined.

At the end of the exercise, participants were each given a tube of toothpaste and a toothbrush, in appreciation of their time in the study. None of the participants was paid for participating.

#### 6.19. Length of time for data collection

Each team of researchers saw and obtained data from a minimum of 5 participants (i.e. 5 different buildings/ households) each day. They worked in the evenings on Mondays, Tuesdays and Wednesdays, worked in the mornings on Thursdays, and worked full day from Friday to Sunday (days of less work and school activities in study sites). As such, data collection for the two sites was completed within two months.

## 6.20. Data Validation Process

Questionnaires were checked for errors and omissions before the oral examination of each participant on the field. Random “on the spot” checks on 10% of interviews were performed for early identification of inconsistencies each day and these were promptly corrected. In addition, survey data were checked for internal consistency each day such that all inconsistent questionnaires were returned to the field for prompt correction.

## 6.21. Data Management

The information generated was collected electronically using a tablet device installed with an application known as the Open Data Kit (ODK) Collect on the field using the ‘ODK Collect’ software in password-protected devices. Data collected was automatically encrypted locally (using PGP encryption) on the tablet and then uploaded to Warwick's server when the tablet is online, and immediately deleted from the device.

Once the survey was completed and marked as finalised, it was encrypted using Pretty Good Privacy PGP encryption and no longer accessible from the tablet. When the tablet is online this encrypted data was uploaded to the data aggregation server.

A cloud-based server provided by Digital Ocean hosts the ‘ODK Aggregate’ and only serves as an aggregation point for encrypted field data. Digital Ocean is a GDPR-compliant provider approved by the University of Warwick for the NIHR GHRU for Improving Health in Slums. It only provides the cloud server and has no access to the contents of the server and do not perform any processing or other data-related activities. Only the researcher (Mary Osuh) and the data manager from the NIHR GHRU at the University of Warwick had access to the server which required a private key. Data was downloaded in xls file format from this server to a University of Warwick computer using ‘ODK Briefcase’ for analysis and linkage using the private key managed by the researcher. When not in use these data were re-encrypted using AES-256 encryption and stored on the University of Warwick Storage Now service. Downloaded data in xls file format was imported into SPSS version 23.0 software package where it was cleaned and data errors checked and corrected before analysis began.

All personally identifiable information (such as name and address) were stored separately from other information obtained through the questionnaire survey and oral examination. These pieces of information could only be linked through re-identification keys, which are kept by the

researcher with strict control for access. The keys were destroyed when there was no longer need to identify participants. No personal data (except the consent forms) was kept beyond the point when individual questionnaire surveys / oral examinations had been completed for this study.

Indirectly identifiable data such as oral examination findings were pseudonymized during data collection and replaced with the participant's number. The key to identification were stored separately and securely to safeguard participants' identities. The keys were destroyed when there was no longer need to identify participants so that all data became fully anonymised. The completely anonymised data set, was password protected and made available to selected project researchers at the University of Warwick. The data will be kept and retained for a minimum of 10 years in accordance with the Retention Framework for Research data and Records in the United Kingdom.

The thumb prints (another indirectly identifiable data) on consent forms where indicated will be kept securely alongside with the signed consent forms in locked cabinets at the University of Ibadan for a period of not more than 10 years.

#### 6.21.1. Outcome and explanatory variables

The outcome variables of primary interest were periodontal disease, dental caries, and level of treatment required. Secondary outcome variable was emergency dental care use.

Explanatory variables: These include socio-economic factors such as wealth index, oral health-related habits (frequency of consumption of cariogenic foods, tobacco, alcohol), oral health care behaviour- tooth brushing frequency (< or ≥ twice daily), alcohol consumption, tobacco use. and routine utilization of dental services.

#### 6.21.2. Data analysis

Socio-demographic characteristics, dietary behaviour and self-perceived oral health were described by place of residence (slum and non-slum) and for the sample overall. For categorical variables, counts and percentages were reported. For numeric variables means and standard deviations or medians and interquartile ranges were reported, as appropriate.

The prevalence of oral health conditions overall and by place of residence were determined. Chi-square tests and Mann Whitney tests were used to explore associations between socio-demographic and behaviour factors and oral health outcomes at 5% level of significance. Logistic regression was used to estimate the strength of association between sociodemographic and behaviour variables, place of residence and oral health outcomes. Appropriate tables and diagrams were drawn.

Some composite measures utilized in the study include:

Socio-economic class: The Wealth Index (WI) was used to measure the Socio-Economic Class (SEC) of participants' households (Fagbamigbe *et al.*, 2015; Latunji & Akinyemi, 2018; Mohanty, 2009). Wealth Index is a composite index composed of key asset ownership or income and expenditure; often used as a proxy indicator of the level of household wealth. Variables included were key asset ownership, household characteristics, and amenities such as toilet facilities, source of drinking water, materials used for the roof, floor or wall finish, ownership of radio, television, phones, mode of transportation (car, bicycle, motorcycle, donkeys), etc. Variables with low prevalence of <5% or higher than 95% were excluded from the analysis to restrict computations to more evenly distributed assets. Principal components analysis (PCA) was used to generate a factor score or indicator weights for each household based on ownership of certain assets. Based on the total factor score of each household, the respondents' households were grouped into wealth quintiles (poorest, poorer, average, wealthier, wealthiest) representing their socio-economic class (Fagbamigbe *et al.*, 2015; Latunji & Akinyemi, 2018; Mohanty, 2009). For the purpose of the analysis, the five wealth quintile categories were broadly categorized into three: the poorest and the poorer categories became Low SEC, 'average' remained as Middle SEC while the wealthier and the wealthiest categories became High SEC.

Frequency of cariogenic food consumption: This was determined by responses related to eight food items in a question using six options reflecting different levels of consumption: 6 - several times a day / 5 - every day / 4 - several times a week / 3 - several times a month / 2 - once a month / 1 - seldom or never. Each of the response options is assigned a corresponding score (Petersen, 2013). An individual's score is obtainable by summing the scores for all the items to obtain a continuous variable (range 8-48) (Nurelhuda *et al.*, 2013). The mean score across the two sites was derived and used as cut off to produce a binary output of less and more frequent intake (Cade *et al.*, 2002; Nurelhuda *et al.*, 2013).

Alcohol intake: Alcohol intake within prior 30 days was also determined using mean number of drinks by those who drank across the two sites as cut-off to produce a binary output into moderate and excessive alcohol intake (Tjønneland *et al.*, 1999).

During the analysis, oral health in the slum versus non-slum area was compared with the following aims: To find out whether and to what extent differences in oral health conditions may occur across slum versus non-slum areas; if any difference between the slum and non-slum areas could simply be attributed to age and gender differences; to examine known determinants (risk factors) of oral diseases by location; to examine the influence of each risk factor on oral conditions net of age, gender, and location. To this end, the relationship between place of residence and oral health findings, particularly the key outcomes (dental caries, periodontal pocket and dental trauma) were examined. Dental caries and periodontal pocket formation were selected for further analyses because of their well-known competing risk for tooth loss in the general adult population (Akhter *et al.*, 2008; Gilbert *et al.*, 2002; Silva Junior *et al.*, 2019; Susin *et al.*, 2005).

Logistic regression was undertaken to determine whether particular risk factors such as alcohol use, tobacco use, diet, and oral hygiene habits have a relationship with the place of residence and oral health outcomes. This is because of the significant roles these risk factors play, independently or collectively in the development of oral diseases (Andlaw, 1978; Bellini *et al.*, 1981; Bernabé *et al.*, 2014; Peres *et al.*, 2016; Pitiphat *et al.*, 2003; Winn, 2001). Logistic regression models were run unadjusted and adjusted for age and sex (reference values - <35years and Male respectively). Odds ratios, 95% confidence intervals, and p-values were reported.

To explore possible causal pathways between residence location and oral health outcomes, two major risk factors (cariogenic food consumption and tooth brushing frequency) were pre-specified as potential mediators and were further tested in mediation analyses. For example, whether a cariogenic food consumption mediates the relationship between place of residence and dental caries, was explored. These two risk factors were chosen as potential mediators on the basis of traditional dental knowledge as well as their known mediating roles in other situations for example tooth brushing as a mediator between cognitive impairment and oral health outcome (Lee *et al.*, 2016) and nutrition as a mediator between oral and systemic disease (Ritchie *et al.*, 2002). Mediation analysis was performed using generalized structural equation modeling (*gsem* command in Stata). The total effect, direct effect, and indirect effect

were calculated using the nonlinear combination command (*nlscom*). The proportion of the relationship mediated was calculated by taking the proportion of the indirect effect divided by the total effect. The effect values from the non-linear combination command were then transformed to odds ratios by taking the exponential. All effects were reported with 95% confidence intervals and p-values.

## 6.22. Originality / Uniqueness of research

This study set out to assess the determinants of oral diseases and oral health care needs of residents of slums and compared the finding with a non-slum urban setting in Ibadan, Nigeria.

The study is unique in its design for the following reasons:

A randomly sampled household survey is a key tool in the assessment of public health status globally. The use of a geographical information system (GIS) software coupled with the global positioning system (GPS) technology has unique advantages in the achievement of reliable and representative household samples useful for such community health surveys. The technology-assisted approach particularly favours the selection of buildings and households located in dense urban areas eg. slums and in new residential developments where it is rarely feasible to conduct a comprehensive door-to-door survey of every individual or household unit (Improving Health in Slums Collaborative, 2019; Kondo *et al.*, 2014; Levy & Lemeshow, 2013). The method incorporates high precision spatial sampling features which eliminate sampling biases thereby allocating samples efficiently (Buja & Menza, 2013). My study combined the use of GIS and GPS soft-wares applications in the oral health surveys conducted in an urban slum located in Ibadan, a city in Nigeria, sub-Saharan Africa. This oral health study design is an innovation in oral health studies in Nigeria. Oral health surveys in the entire LMICs that utilized representative samples of populations are few and are mainly conducted among easily accessible population groups.

A second unique feature of this study is that the oral health data obtained from the survey conforms to the latest version of WHO (Petersen, 2013) oral health survey manual in the assessment of oral health status. To the best of my knowledge, it is the first of its kind to utilize the version in oral health assessment in slums and comparing findings with non-slum settings. Findings should enhance easy comparison of results from oral health surveys among populations affected with dental diseases globally



Lastly, this study compared the survey findings and outcomes between the slum and a non-slum setting by utilizing similar methods through its sampling and data collection processes to enhance scientific comparison. To the best of my knowledge, this is the second and currently the largest study to compare findings between slum and non-slum settings and first of its kind to combine quantitative dataset with qualitative dataset in a mixed-methods design in the LMICs of the world.

## CHAPTER 7: QUANTITATIVE SURVEY RESULTS (WORK PACKAGE - 2)

### 7.1. Chapter overview

This chapter presents the results of the quantitative survey of the thesis. It features descriptive statistics of participants' characteristics, crude and standardized rates (adjusted for age and sex) for oral health conditions, findings from logistic regression to explore factors associated with oral health conditions, as well as structural equation modelling exploring causal pathways.

### 7.2. Participants' baseline characteristics

A total of 1,357 participants were included in this study, evenly distributed between the slum (n=678) and non-slum (n=679) residences. Overall, there were more females than males in both the slum and non-slum sites in an approximate ratio of 1:2 for Male : Female [Table 7.1]. The average age is higher among the slum residents, the median age in the slum was 45 years (IQR: 32 to 50 years) compared to non-slum residents where median age was 38 years (IQR: 29 to 50 years). On participants' highest level of educational attainment, a much higher proportion of people in the slum setting had no education or had only primary school education compared to those in the non-slum setting. Together, these groups constituted 50% in slum site and 15% in the non-slum site. Using the quintiles derived from the Wealth index, almost 60% of the slum dwellers were of the low socio-economic class (SEC) (poor category) compared to about 20% of the residents in the non-slum setting. The majority of participants in each residential setting (slum and non-slum) had settled in the environments for more than 20 years [Table 7.1].

Table 7.1. Study participants baseline characteristics and habits by place of residence.

Characteristic	Slum (n=678)	Non-slum (n=679)
<b>Male</b>	245 (36.1)	234 (34.5)
<b>Age</b>		
<35 years	192 (28.3)	260 (38.3)
*35 – 44years	127 (18.7)	186 (27.4)
45 – 54 years	114 (16.8)	109 (16.1)
55 – 64 years	102 (15.0)	61 (9.0)
*65 – 74years	88 (13.0)	40 (5.9)
75 years and above	55 (8.1)	23 (3.4)
<b>Current marital status</b>		
Married	437 (64.5)	458 (67.5)
Living together but not married	9 (1.3)	13 (1.9)
Divorced or separated	34 (5.0)	7 (1.0)
Widowed	110 (16.2)	50 (7.4)
Never-married and never lived together	88 (13.0)	151 (22.2)
<b>Highest educational level</b>		
No education	175 (25.8)	42 (6.2)
Primary school	179 (26.4)	61 (9.0)
Secondary school	285 (42.0)	301 (44.3)
Post-secondary school	32 (4.7)	183 (27.0)
University education	7 (1.0)	92 (13.5)
<b>Currently working</b>	533 (78.6)	552 (81.3)
<b>Length of time of residence in neighbourhood</b>		
1-10 years	102 (15.0)	203 (29.9)
11-20 years	103 (15.2)	80 (11.8)
>20years	473 (69.8)	396 (58.3)
<b>Wealth Index quintiles (socio-economic class)</b>		
1st quintile (lowest/ poorest)	231 (34.1)	40 (5.9)
2nd quintile (lower/ poorer)	167 (24.6)	105 (15.5)
3rd quintile (middle)	157 (23.2)	114 (16.8)
4th quintile (higher/ richer)	97 (14.3)	175 (25.8)
5th quintile (highest/ richest)	26 (3.8)	245 (36.1)

\*35 – 44years: WHO standard age group for surveillance of oral health conditions in adults. Data for the age group, affords planners and decision-makers to assess the full effect of dental caries, the level of severe periodontal involvement, and the general effects of oral health in adults (Petersen, 2013)

\*65 – 74years: WHO standard age group for surveillance of oral health conditions in the elderly. Data from this age group is useful to estimate the manifestation of oral disease from a life course perspective (Petersen, 2013)

### **7.3. Prevalence of oral health conditions – Research objective 2**

#### **7.3.1. Common oral health conditions**

From the crude rates, the commonest oral health conditions among participants in both locations were dental caries, gingival (gum) bleeding, periodontal pocket, periodontal attachment loss and dental trauma [Table 7.2]. A detail report of all the oral health conditions among participants, represented by their number and prevalence according to their residential sites are as shown in Table 7.2. Most of the oral health conditions (8 out of 11), namely: carious teeth, filled teeth, gingival bleeding, periodontal pocket formation, attachment loss, dental erosion, dental trauma, and oral mucosal lesions were more prevalent among residents of the slum setting. Only “missing teeth”, enamel fluorosis as well as denture use outcomes were less prevalent in the slum relative to the non-slum setting. Periodontal diseases, irrespective of the stage (gingival bleeding, periodontal pocket or periodontal attachment loss), were collectively, more prevalent among residents of the slum (522, 77.0%) when compared to the residents of the non-slum setting (374, 55.1%).

Following the adjustment of the rates for age and sex, the adjusted prevalence of all oral health conditions among the participants, according to their residential settings are also shown in Table 7.2. The adjusted rates were very similar to crude rates between the slum and non-slum residents for these oral health conditions: dental caries, filled teeth, and enamel fluorosis. Whereas for dental erosion, the difference was turned from statistically significant difference to no significant difference. However, substantial changes (increased difference) were noted following age and sex adjustments for missing teeth and denture use, and these were statistically significant ( $p < 0.05$ ) with higher prevalence in the non-slum setting.

Table 7.2: Oral health outcomes by residence showing numbers and % unless stated otherwise with age and sex adjusted.

Oral Examination Outcomes		Rates	Slum (N=678)	Non-Slum (N=679)	Total (N=1,357)	P- value
<b>Caries experience</b>	Dental Caries	Crude Adjusted	181 (26.7) (24.2)	154 (22.7) (21.3)	335 (24.7)	0.086 0.108
	Missing Teeth	Crude Adjusted	91 (13.4) (9.5)	97 (14.3) (12.5)	188 (13.9)	0.645 0.005
	Filled Teeth	Crude Adjusted	15 (2.2) (2.4)	7 (1.0) (1.1)	22 (1.6)	0.085 0.073
<b>Life time caries experience</b>	DMFT* – Mean (SD)		1.1 (2.7)	1.3 (3.1)	1.2 (2.9)	
<b>Periodontal disease</b>	Periodontal Disease (Total)	Crude Adjusted	522 (77.0) (75.1)	374 (55.1) (55.2)	896 (66.0)	<0.001 <0.001
	Gingival Bleeding	Crude Adjusted	506 (74.6) (73.2)	357 (52.6) (52.9)	863 (63.6)	<0.001 <0.001
	Periodontal Pocket	Crude Adjusted	153 (22.6) (20.0)	105 (15.5) (14.3)	258 (19.0)	0.001 0.002
	Attachment Loss	Crude Adjusted	97 (14.3) (8.6)	36 (5.3) (4.9)	133 (9.8)	<0.001 <0.001
<b>Dental erosion</b>	Dental Erosion	Adjusted	67 (9.9) (6.6)	44 (6.5) (6.0)	111 (8.1)	0.022 0.303
<b>Dental trauma</b>	Dental Trauma	Crude Adjusted	218 (32.2) (28.1)	140 (20.6) (18.7)	358 (26.3)	<0.001 <0.001
<b>Oral mucosal lesions</b>	Oral Mucosal Lesions	Crude Adjusted	20 (2.9) (2.7)	9 (1.3) (1.2)	29 (2.1)	0.039 0.045
<b>Enamel fluorosis</b>	Enamel Fluorosis	Crude	25 (3.7)	31 (4.6)	56 (4.1)	0.416
		Adjusted	(5.1)	(5.3)		0.395
<b>Denture use</b>	Denture Use	Crude Adjusted	6 (0.9) (0.5)	7 (1.0) (1.1)	13 (0.9)	0.783 0.009
<b>Level of treatment required</b>	No Treatment Required	Adjusted	18 (2.7) (3.9)	37 (5.4) (6.3)	55 (4.1)	
	Routine tx. rqd.	Adjusted	420 (61.9) (67.3)	453 (66.7) (67.7)	873 (63.5)	
	Prompt tx. rqd.	Adjusted	194 (28.6) (22.8)	148 (21.8) (20.5)	342 (25.2)	
	Urgent Treatment Needed	Adjusted	42 (6.2) (5.8)	40 (5.9) (5.4)	82 (6.0)	
	Referred*	Adjusted	4 (0.6) (0.3)	1 (0.1) (0.1)	5 (0.4)	0.003 0.021

\* DMFT- decayed, missing or filled teeth; tx rqd\*- treatment required; Referred\*- comprehensive evaluation or medical/dental treatment (systemic condition); Routine tx rqd- Required preventive or routine treatment; Prompt- Prompt treatment required (including scaling); Urgent- required immediate (urgent) treatment needed due to pain/ infection of dental and oral origin. All p-values were obtained from Pearson Chi-Square test.

#### 7.3.2. Level of dental treatment required

From Table 7.2 the levels of dental treatment required among the residents of the slum and the non-slum settings respectively revealed: very few participants (3% versus 5%) had no need for dental treatment. Routine treatment was required in 62% versus 68%, prompt treatment was required in 29% versus 22% and urgent treatment was required in 6.2% versus 5.9%. Prompt and urgent levels of treatment, were required in 35% versus 27%, collectively. Overall, very few participants, more in the slum relative to the non-slum setting (0.6% versus 0.1%) were referred for comprehensive evaluation or medical/dental treatment (systemic condition).

#### 7.4. Oral health behaviour

Tooth cleaning “at least twice daily” was similar but slightly lower among participants who resided in slum settings compared to those who resided in the non-slum settings (24% versus 27%). Fewer slum residents used toothbrush (78% versus 95%) and toothpaste (85% versus 97%) than their non-slum counterparts to clean their mouths. The majority of participants in the slum and the non-slum settings perceived the oral health of the teeth (78% versus 89%) and gums (80% versus 89%) as good. Participants’ alcohol consumption level was reportedly low in both residential sites: 10% versus 13% of the residents in the slum and non-slum sites respectively consumed alcohol moderately, while 2% versus 4% were categorized under excessive intake of alcohol [Table 7.3].

Tobacco use was higher in slum compared to non-slum residences (13% versus 9%) while consumption of high frequency cariogenic diet was less common in the slum compared to non-slum residences (44% versus 50%) [Table 7.3].

Table 7.3. Participants oral health behaviour by place of residence.

<b>Oral health behavior</b>	<b>Slum (n=678)</b>	<b>Non-slum (n=679)</b>
<b>Ever seen a dentist</b>	117 (17.3)	161 (23.7)
<b>How long ago was it since you saw a dentist</b>		
Within 12 months period	21 (3.1)	36 (5.3)
>1year but ≤ 2 years	7 (1.0)	9 (1.3)
> 2years	89 (13.1)	116 (17.1)
Never saw a dentist	561 (82.7)	518 (76.3)
<b>Reason for dental visit</b>		
Urgent attention	113 (96.6)	156 (96.9)
Routine check / treatment	4 (3.4)	5 (3.1)
<b>Best reason for never seeing a dentist</b>	<b>(n=561)</b>	<b>(n=518)</b>
Fear	107 (19.1)	81 (15.6)
Expensive	151 (26.9)	111 (21.4)
Dental problems not severe	94 (16.8)	65 (12.6)
Use alternatives	78 (13.9)	55 (10.6)
Never had a dental problem	131 (23.3)	206 (39.8)
<b>Felt pain/ discomfort from teeth or mouth within the past 12 months</b>	471 (69.5)	453 (66.7)
<b>Felt need for dental care in the past 12 months</b>	87 (12.8)	133 (19.6)
<b>Source for last dental health care</b>		
Medical doctor	27 (4.0)	9 (1.3)
Nurse	47 (6.9)	16 (2.4)
Midwife	11 (1.6)	6 (0.9)
Dentist	23 (3.4)	39 (5.7)
Dental health vendor	90 (13.3)	14 (2.1)
Traditional/ native doctor	50 (7.4)	6 (0.9)
Chemist / pharmacist	247 (36.4)	287 (42.3)
Self-medication	52 (7.7)	96 (14.1)
Never had dental problem	131 (19.3)	206 (30.3)
<b>Best reason for the choice of last dental care source</b>		
Nearness	71 (10.5)	62 (9.1)
Don't know where else	7 (1.0)	12 (1.8)
Affordable (cheap)	206 (30.4)	137 (20.2)
Known efficacy / expertise	65 (9.6)	89 (13.1)
First aid	166 (24.5)	164 (24.2)
Recommendation from someone	32 (4.7)	9 (1.3)
Never had a need	131 (19.3)	206 (30.3)
<b>Cost was a reason for ever avoiding seeking prescribed dental treatment among previous users</b>	17 (14.5)	20 (12.4)
<b>Frequency of mouth cleaning / day</b>		
At least twice daily	163 (24.0)	184 (27.1)
<b>Teeth cleaning aids</b>		
Toothbrush	531 (78.3)	644 (94.8)
Chewing stick	114 (16.8)	17 (2.5)

Toothbrush and chewing stick combination & others	33 (4.9)	18 (2.7)
<b>Use toothpaste to clean the teeth</b>		
Yes	576 (85.0)	659 (97.1)
Sometimes	15 (2.2)	6 (0.9)
No	87 (12.8)	14 (2.1)
<b>Tooth paste contains fluoride</b>		
Yes	436 (64.3)	532 (78.4)
Sometimes	5 (0.7)	5 (0.7)
No	10 (1.5)	8 (1.2)
I don't know	140 (20.6)	120 (17.7)
I don't use toothpaste	87 (15.3)	14 (2.9)
<b>Main drinking water source</b>		
Piped/ tap water	31 (4.6)	47 (6.9)
Borehole	74 (10.9)	283 (41.7)
Well/ spring/ tanker or cart supply	5 (0.7)	8 (1.2)
Rainwater	64 (9.4)	10 (1.5)
Sachet/ bottled water	504 (74.3)	331 (48.7)
<b>Self-perception of current teeth health (Good)</b>	531 (78.3)	601 (88.5)
<b>Self-perception of current gum health (Good)</b>	539 (79.5)	605 (89.1)
<b>Alcohol intake</b>		
Didn't drink alcohol (last 30 days)	594 (87.6)	570 (84.0)
Moderate intake	69 (10.2)	85 (12.5)
Excessive intake	15 (2.2)	24 (3.5)
<b>Ever used tobacco</b>	89 (13.1)	63 (9.3)
<b>More frequent cariogenic food consumption</b>	295 (43.5)	338 (49.8)

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#### 7.5. Dental service utilization

Overall, utilisation of dental service was low in both sites. Fewer residents in the slum relative to the non-slum setting (17.3% versus 23.7% respectively) had ever visited the dentist. Of these visits, only 3% versus 5% (slum versus non-slum) made appointment visits within 12 months prior to data collection. Almost all participants who visited the dentist (97% in both locations) sought care for urgent reasons. Many (70% versus 67%) reported feeling dental pain within the past 12 months, and much fewer (13% versus 20%) felt a need for dental care within the same period in the slum and non-slum respectively. Fifteen percent versus 12% of those that ever-utilized dental services in the slum and non-slum respectively, avoided seeking treatment for recommended dental procedure because of cost. Care or advise for dental



related problems was last sought from the chemist or pharmacist among the majority of participants in both settings (36% versus 42%). Major reasons for seeking care from the source were affordability (30% versus 20%) and as first aid (25% versus 24%). [Table 7.3].

## 7.6. Hypothesis testing

Based on findings from the main outcomes: periodontal disease (gingival bleeding, periodontal pocket and attachment loss), dental trauma and treatment need showed statistically significant higher prevalence rates in the slum, relative to the non-slum urban setting ( $P < 0.05$ ) [Table 7.2]. Therefore, the null hypothesis is rejected. However, for dental caries, the null hypothesis is not rejected as the difference in prevalence between the slum and the non-slum sites respectively was not statistically significant ( $p = 0.086$  and  $0.108$  - crude and age-sex adjusted rates respectively). Notwithstanding, the direction of the small (4%) difference in caries observed between the two settings is consistent with other key outcomes in the study, and the magnitude may be considered clinically significant and hence warrant further exploration.

## 7.7. Factors associated with oral health conditions (Objective 3)

### 7.7.1. Association between place of residence and common oral health conditions

Findings from the association between place of residence and common oral health conditions have largely been presented in section 7.3.1 - common oral health conditions. It revealed a higher prevalence of many of the oral diseases among the slum residents' relative to their non-slum counterparts. These include gingival bleeding, periodontal pocket, attachment loss, dental erosion, dental trauma and oral mucosal lesions ( $p < 0.05$ ). It also includes dental caries, missing teeth, filled teeth, enamel fluorosis and denture use ( $p > 0.05$ ). However, the DMFT, missing teeth and denture use outcomes were more prevalent in the non-slum setting. The magnitude of differences between the slum and the non-slum settings with respect to disease prevalence such as caries, periodontal pocket and oral mucosal lesions are modest at about 4, 7 and 2 percentage points respectively, but significant with respect to gingival bleeding and dental trauma (20%, 12% respectively).

### **7.7.2. Exploration of association between participants' characteristics and common oral health conditions by cross-tabulation**

The associations between key participant characteristics (age, sex, socioeconomic class – SEC defined by Wealth Index categories and educational level) and the common oral health conditions – dental caries including caries experience, periodontal diseases (gingival bleeding, pocket formation, attachment loss) and dental trauma were explored using cross-tabulation. Findings from associations within each of the two study sites (slum and non-slum) and combined are reported in the sub-sections following.

#### **7.7.2.1. Association between participants' characteristics and dental caries**

The association between participants' characteristics and dental caries are reported in Table 7.4. There were significant differences in dental caries and caries experience between males and females (with outcomes worse among females) in the non-slum site but no significant difference was observed in the slum site. The prevalence of caries increased with increasing age among the younger age categories in both settings but began to drop after the 45-54 years' age category in the non-slum and overall ( $p < 0.05$ ). Prevalence of caries did not appear to be influenced by participants' level of education ( $p > 0.05$ ). But DMFT seems higher among people with no/low level of education.

Table 7.4: Association between patient characteristics and caries showing numbers and % unless stated otherwise.

Oral health conditions	Characteristic	Variables	Residential location		Total (1,357)
			Slum (678)	Non-slum (679)	
			<b>Cases 181 (26.7)</b>	<b>Cases 154 (22.7)</b>	<b>335 (24.7)</b>
Dental caries	Sex	Male	62 (25.3)	42 (17.9)	104 (21.7)
		Female	119 (27.5)	112 (25.2)	231 (26.7)
			p = 0.538	p = 0.033	p = 0.060
	Age	<35 years	38 (19.8)	43 (16.5)	81 (17.9)
		Adult age group (35 – 44yrs)	37 (29.1)	49 (26.3)	86 (27.5)
		45 – 54 years	37 (32.5)	33 (30.3)	70 (31.4)
		55 – 64 years	29 (28.4)	16 (26.2)	45 (27.6)
		Elderly age group (65 – 74yrs)	27 (30.7)	7 (17.5)	34 (26.6)
		75 years and above	13 (23.6)	6 (26.1)	19 (24.4)
			p = 0.149	p = 0.038	p = 0.002
	SEC	Low	96 (24.1)	29 (20.0)	125 (23.0)
		Middle	55 (35.0)	28 (24.6)	83 (30.6)
		High	30 (24.4)	97 (23.1)	127 (23.4)
			p = 0.027	p = 0.649	p = 0.040
	Highest educational level	No education	56 (32.0)	9 (21.4)	65 (30.0)
Primary school		45 (25.1)	13 (21.3)	58 (24.2)	
Secondary school		71 (24.9)	67 (22.3)	138 (23.5)	
Post-secondary/ University		9 (23.1)	65 (23.6)	74 (23.6)	
		P=0.326	p = 0.964	p = 0.273	
			<b>Cases 245 (36.1)</b>	<b>Cases 216 (31.8)</b>	<b>Cases 461 (34.0)</b>
Dental caries experience (DMFT)**	Sex	Male	82 (33.5)	60 (25.6)	142 (29.6)
		Female	163 (37.6)	156 (35.1)	319 (36.3)
			p = 0.277	p = 0.012	p = 0.013
	Age	<35 years	47 (24.5)	48 (18.5)	95 (21.0)
		Adult age group (35 – 44yrs)	47 (37.0)	66 (35.5)	113 (31.1)
		45 – 54 years	48 (42.1)	48 (44.0)	96 (43.0)
		55 – 64 years	40 (39.2)	29 (47.5)	69 (42.3)
		Elderly age group (65 – 74yrs)	42 (47.7)	17 (42.5)	59 (46.1)
		75 years and above	21 (38.2)	8 (34.8)	29 (37.2)
			p = 0.002	p < 0.001	p < 0.001
	SEC	Low	141 (35.4)	38 (26.2)	179 (33.0)
		Middle	65 (41.4)	43 (37.7)	108 (39.9)
		High	39 (31.7)	135 (32.1)	174 (32.0)
			p = 0.221	p = 0.138	p = 0.070
	Highest educational level	No education	79 (45.1)	14 (33.3)	93 (42.9)
Primary school		65 (36.3)	23 (37.7)	88 (36.7)	
Secondary school		90 (31.6)	90 (29.9)	180 (30.7)	
Post-secondary/ University		11 (28.2)	89 (32.4)	100 (31.8)	
		p=0.021	p = 0.667	p = 0.008	

\*35 – 44 years: WHO standard age group for surveillance of oral health conditions in adults. Data for the age group, affords planners and decision-makers to assess the full effect of dental caries, the level of severe periodontal involvement, and the general effects of oral health in adults (Petersen, 2013)

\*65 – 74 years: WHO standard age group for surveillance of oral health conditions in the elderly. Data from this age group is useful to estimate the manifestation of oral disease from a life course perspective (Petersen, 2013)

\*\*Dental caries experience (DMFT: Decayed + Missing + Filled): 0 versus 1 – 32.

All p-values were obtained from Pearson Chi-Square tests ( $\chi^2$  test).

### 7.7.2.2. Association between participant characteristics and periodontal diseases

The relationship between participant characteristics and periodontal disease conditions (gingival bleeding, periodontal pocket and attachment loss) within the different sites and overall are shown in Table 7.5. Overall, sex and age group did not appear to be associated with gingival bleeding. There appeared to be no marked difference in gingival disease prevalence among different socio-economic classes (SEC). While no significant association was seen within individual site, the combined data suggested that the prevalence was lower in high SEC group. On educational level, similar to the SEC there was no significant association seen in individual sites, but the overall data suggests a decline with increasing level of education ( $p < 0.05$ ). Periodontal pocket was found to be commoner among the male participants in the non-slum setting. Attachment loss was commoner among males, and showed a general increase with increasing age except for the oldest age group ( $p < 0.05$  each) both in individual sites and from overall data. Attachment loss was also noted to decline with better educational level among the slum residents and from the overall data ( $p < 0.05$ ).

Table 7.5: Association between participant characteristics and periodontal diseases

Oral health conditions	Characteristic	Variables	Residential location		Total
			Slum (678)	Non-slum (679)	
Gingival bleeding			<b>Cases = 506 (74.6)</b>	<b>Cases = 357 (52.6)</b>	<b>Cases = 863 (63.6)</b>
	Sex	Male	186 (75.9)	132 (56.4)	318 (66.4)
		Female	320 (73.9)	225 (50.6)	545 (62.1)
			$p = 0.562$	$p = 0.147$	$p = 0.114$
	Age	<35 years	137 (71.4)	138 (53.1)	275 (60.8)
		Adult age group (35 – 44yrs)	96 (75.6)	101 (54.3)	197 (62.9)
		45 – 54 years	86 (75.4)	56 (51.4)	142 (63.7)
		55 – 64 years	78 (76.5)	37 (60.7)	115 (70.6)
		Elderly age group (65–74yrs)	70 (79.5)	16 (40.0)	86 (67.2)
		75 years and above	39 (70.9)	9 (39.1)	48 (61.5)
			$p = 0.716$	$p = 0.295$	$p = 0.326$
	Wealth quintile (SEC)	Low	284 (71.4)	74 (51.0)	358 (65.9)
		Middle	126 (80.3)	58 (50.9)	184 (67.9)
		High	96 (78.0)	225 (53.6)	321 (59.1)
		$p = 0.160$	$p = 0.588$	$p = 0.017$	
Highest educational level	No education	135 (77.1)	22 (52.4)	157 (72.4)	
	Primary school	139 (77.7)	34 (55.7)	173 (72.1)	
	Secondary school	206 (72.3)	163 (54.2)	369 (63.0)	
	Post-secondary/ University	26 (66.7)	138 (50.2)	164 (52.2)	
		$p = 0.310$	$p = 0.758$	$p < 0.001$	
Periodontal pocket formation			<b>Cases 153 (22.6)</b>	<b>Cases 105 (15.5)</b>	<b>Cases = 258 (19.0)</b>
	Sex	Male	52 (21.2)	46 (19.7)	98 (20.5)
		Female	101 (23.3)	59 (13.3)	160 (18.2)
			$p = 0.530$	$p = 0.028$	$p = 0.316$
Age	<35 years	31 (16.1)	28 (10.8)	59 (13.1)	

		Adult age group (35 – 44yrs)	31 (24.4)	34 (18.3)	65 (20.8)
		45 – 54 years	24 (21.1)	22 (20.2)	46 (20.6)
		55 – 64 years	30 (29.4)	9 (14.8)	39 (23.9)
		Elderly age group (65 – 74yrs)	27 (30.7)	7 (17.5)	34 (26.6)
		75 years and above	10 (18.2)	5 (21.7)	15 (19.2)
			p = 0.041	p = 0.145	p = 0.002
	<b>SEC</b>	Low	81 (20.4)	16 (11.0)	97 (17.9)
		Middle	38 (24.2)	15 (13.2)	53 (19.6)
		High	34 (27.6)	74 (17.6)	108 (19.9)
			p = 0.205	p = 0.127	P = 0.674
	<b>Highest educational level</b>	No education	46 (26.3)	8 (19.0)	54 (24.9)
		Primary school	42 (23.5)	9 (14.8)	51 (21.3)
		Secondary school	57 (20.0)	39 (13.0)	96 (16.4)
		Post-secondary/ University	8 (20.5)	49 (17.8)	57 (18.2)
			P=0.451	p = 0.384	p = 0.038
<b>Attachment loss</b>			<b>Cases 97 (14.3)</b>	<b>Cases 36 (5.3)</b>	<b>Cases 133 (9.8)</b>
	<b>Sex</b>	Male	52 (21.2)	18 (7.7)	70 (14.6)
		Female	45 (10.4)	18 (4.0)	63 (7.2)
			p = 0.000	p = 0.044	p < 0.001
	<b>WHO age group</b>	<35 years	5 (2.6)	3 (1.2)	8 (1.8)
		Adult age group (35 – 44yrs)	9 (7.1)	4 (2.2)	13 (4.2)
		45 – 54 years	11 (9.6)	5 (4.6)	16 (7.2)
		55 – 64 years	21 (20.6)	8 (13.1)	29 (17.8)
		Elderly age group (65 – 74yrs)	25 (28.4)	9 (22.5)	34 (26.6)
		75 yrs and above	26 (47.3)	7 (30.4)	33 (42.3)
			p < 0.001	p < 0.001	p < 0.001
	<b>SEC</b>	Low	52 (13.1)	8 (5.5)	60 (11.0)
		Middle	23 (14.6)	3 (2.6)	26 (9.6)
		High	22 (17.9)	25 (6.0)	47 (8.7)
			p = 0.406	p = 0.370	p = 0.411
<b>Highest educational level</b>	No education	44 (25.1)	3 (7.1)	47 (21.7)	
	Primary school	25 (14.0)	11 (18.0)	36 (15.0)	
	Secondary school	26 (9.1)	11 (3.7)	37 (6.3)	
	Post-secondary/ University	2 (5.1)	11 (4.0)	13 (4.1)	
		p < 0.001	p < 0.001	p < 0.001	

All p-values were obtained from Pearson Chi-Square test ( $\chi^2$  test).

### 7.7.2.3. Association between participant characteristics and dental trauma

The relationship between participant characteristics and dental trauma as observed in the two sites are shown in Table 7.6. Dental trauma appears similar between males and females. The prevalence of dental trauma was markedly increased with increasing age in both settings and from the overall data ( $p < 0.05$  each). It also showed a higher prevalence among people with primary or no education in the non-slum ( $p < 0.05$  each) and an increasing trend among residents of the slum setting with improved SES ( $p < 0.05$  each) [Table 7.6].

Table 7.6: Association between participant characteristics and dental trauma showing numbers and % unless stated otherwise.

Oral health conditions	Characteristic	Variables	Residential location		Total
			Slum (678)	Non-slum (679)	
Dental trauma			<b>Cases = 218 (32.2)</b>	<b>Cases = 140 (20.6)</b>	<b>Cases = 358 (26.4)</b>
	Sex	Male	79 (32.2)	56 (23.9)	135 (28.2)
		Female	139 (32.1)	84 (18.9)	223 (25.4)
			p = 0.969	p = 0.122	p = 0.266
	Age	<35 years	45 (23.4)	28 (10.8)	73 (16.2)
		Adult age group (35– 44yrs)	38 (29.9)	32 (17.2)	70 (22.4)
		45 – 54 years	34 (29.8)	31 (28.4)	65 (29.1)
		55 – 64 years	43 (42.2)	20 (32.8)	63 (38.7)
		Elderly age group (65– 74yrs)	36 (40.9)	15 (37.5)	51 (39.8)
		75 yrs and above	22 (40.0)	14 (60.9)	36 (46.2)
			p = 0.005	p < 0.001	p < 0.001
	SES	Low	111 (27.9)	27 (18.6)	138 (25.4)
		Middle	55 (35.0)	23 (20.2)	78 (28.8)
		High	52 (42.3)	90 (21.4)	142 (26.2)
			p = 0.008	p = 0.765	p = 0.583
	Highest educational level	No education	70 (40.0)	9 (21.4)	79 (36.4)
		Primary school	62 (34.6)	24 (39.3)	86 (35.8)
Secondary school		80 (28.1)	64 (21.3)	144 (24.6)	
Post-secondary/ University		6 (15.4)	43 (15.6)	49 (15.6)	
		P=0.005	p = 0.001	p < 0.001	

All p-values were obtained from Pearson Chi-Square test ( $\chi^2$  test).

### 7.7.3. Exploration of associations between place of residence and risk factors and oral health conditions using logistic regression

The odds of having more frequent consumption of cariogenic diet were not significantly different but were numerically lower by 10% (OR=0.90, 95% CI 0.72 to 1.13) for people who reside in the slum compared to the non-slum residents. A slightly lower percentage of participants cleaned their teeth at least twice daily in slum residences compared to non-slum residences (24% versus 27%). Even after adjusting for age and sex, the odds of tooth cleaning at least twice daily in slum were not significantly different but were numerically lower by 19% (OR=0.81, 95% CI: 0.63 to 1.04) compared to non-slum. The odds of having dental caries were not significantly different but numerically higher by 21% for people who lived in slums compared to non-slum residences (OR=1.21, 95% CI: 0.94 to 1.56); and 50% higher (OR=1.50, 95% CI: 1.13 to 1.98) for periodontal pocket formation following adjustment for age and sex. There was no relationship between place of residence and alcohol use and frequency of tooth cleaning after adjusting for age group and sex, except for tobacco use [Table 7.7].

Table 7.7: Logistic regression models to explore associations between the place of residence and 1) oral health conditions; 2) risk factors, unadjusted and adjusted for age group and sex.

Characteristic	Slum (n=678)	Non-slum (n=679)	Unadjusted odds ratio (95% CI) p-value	Adjusted odds ratio* (95% CI) p-value
<b>Oral health conditions</b>				
<b>Dental caries</b>	181 (26.7)	154 (22.7)	1.24 (0.97 to 1.59) p=0.087	1.21 (0.94 to 1.56) p=0.145
<b>Periodontal pocket formation</b>	153 (22.6)	105 (15.5)	1.59 (1.21 to 2.10) p=0.001	1.50 (1.13 to 1.98) p=0.005
<b>Risk factors</b>				
<b>Alcohol intake**</b>				
Didn't drink alcohol (last 30 days)	594 (87.6)	570 (84.0)	Reference	Reference
Moderate intake	69 (10.2)	85 (12.5)	0.78 (0.56 to 1.09) 0.147	0.75 (0.52 to 1.08) p=0.127
Excessive intake	15 (2.2)	24 (3.5)	0.60 (0.31 to 1.15) 0.126	0.68 (0.34 to 1.34) p=0.265
<b>Ever used tobacco</b>	89 (13.1)	63 (9.3)	1.48 (1.05 to 2.08) p=0.025	1.59 (1.11 to 2.30) p=0.012
<b>More frequent cariogenic food consumption</b>	295 (43.5)	338 (49.8)	0.78 (0.63 to 0.96) p=0.021	0.90 (0.72 to 1.13) p=0.365
<b>Tooth cleaning (at least twice daily)</b>	163 (24.0)	184 (27.1)	0.85 (0.67 to 1.09) p=0.197	0.81 (0.63 to 1.04) p=0.099

\* Adjusted age group and sex. \*\* Multinomial logistic regression used and relative-risk ratios reported

#### 7.7.4. Exploration of association between risk factors and oral health conditions

Associations between potential risk factors including cariogenic diet, alcohol use, tobacco use, and frequency of tooth cleaning and oral health conditions were reported unadjusted and adjusted for age group and sex [Tables 7.8 and 7.9]. The odds of having dental caries were not significantly different but numerically higher by 28% (OR=1.28, 95% CI:0.97 to 1.69) for people who clean their teeth at least twice daily compared to less than twice daily, adjusting for age and sex. The odds of having periodontal pocket formations were numerically higher by 103% (OR=2.03, 95% CI:0.97 to 4.22) for people who had an excessive intake of alcohol compared to no alcohol intake, although this did not reach statistical significance. The odds of

periodontal pocket formation were not significantly different but were numerically higher by 28% (OR=1.28, 95% CI:0.95 to 1.73) for people who clean their teeth at least twice daily compared to less than twice daily, adjusting for age and sex.

**Table 7.8:** Logistic regression models to explore associations between dental caries and risk factors, unadjusted and adjusted for age group and sex

	Dental caries/Total (%)	Unadjusted odds ratio (95% CI) p-value	Adjusted odds ratio (95% CI) p-value
<b>Cariogenic diet</b>			
Less frequent	180/724 (25%)	reference	reference
More frequent	155/478 (25%)	0.98 (0.77 to 1.26) p=0.873	1.02 (0.79 to 1.32) p=0.882
<b>Alcohol intake</b>			
Didn't drink alcohol (last 30 days)	297/1164 (26%)	reference	reference
Moderate intake	26/154 (17%)	0.59 (0.38 to 0.92) p=0.020	0.66 (0.42 to 1.05) p=0.082
Excessive intake	12/39 (31%)	1.39 (0.65 to 2.59) p=0.461	1.57 (0.76 to 3.24) p=0.225
<b>Tobacco use</b>			
Never used	301/1205 (25%)	reference	reference
Ever used	34/152 (22%)	0.87 (0.58 to 1.30) p=0.482	0.96 (0.63 to 1.46) p=0.836
<b>Tooth cleaning frequency</b>			
< twice daily	237/1010 (23%)	reference	reference
≥ twice daily	98/249 (28%)	1.28 (0.97 to 1.69) p=0.075	1.28 (0.97 to 1.69) p=0.079

#### 7.7.5. Validity check for logistic regression

Assumptions of logistic regression were checked for each of the models reported above. All models had binary outcomes; little or no multicollinearity was found between independent variables; the influence of outliers did not affect the results and the observations were independent.



**Table 7.9:** Logistic regression models to explore associations between periodontal pocket formation and risk factors, unadjusted and adjusted for age group and sex.

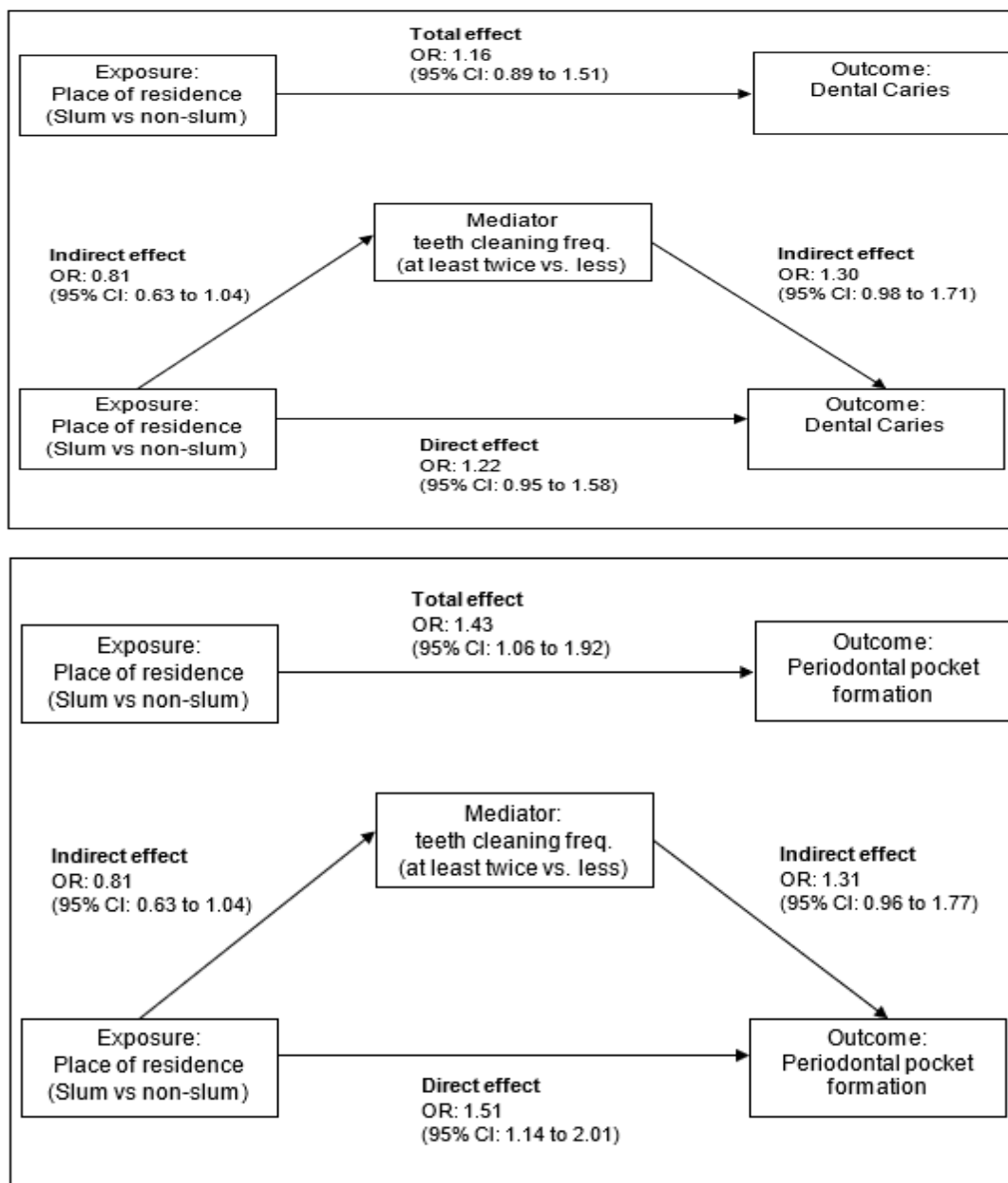
	Periodontal pocket formation/Total (%)	Unadjusted odds ratio (95% CI) p-value	Adjusted odds ratio* (95% CI) p-value
<b>Cariogenic diet</b>			
Less frequent	169/724 (23%)	reference	reference
More frequent	89/633 (14%)	0.54 (0.41 to 0.71) p<0.001	0.58 (0.44 to 0.78) p<0.001
<b>Alcohol intake</b>			
Didn't drink alcohol (last 30 days)	218/1164 (19%)	reference	reference
Moderate intake	28/154 (18%)	0.96 (0.62 to 1.49) p=0.870	0.94 (0.59 to 1.50) p=0.802
Excessive intake	12/39 (31%)	1.93 (0.96 to 3.87) p=0.064	2.03 (0.97 to 4.22) p=0.059
<b>Tobacco use</b>			
Never used	226/1205 (19%)	reference	reference
Ever used	32/152 (21%)	1.16 (0.76 to 1.75) p=0.497	1.12 (0.72 to 1.74) p=0.608
<b>Teeth cleaning frequency</b>			
< twice daily	181/1010 (18%)	reference	reference
≥ twice daily	77/347 (22%)	1.31 (0.97 to 1.76) p=0.081	1.28 (0.95 to 1.73) p=0.109

## 7.8. Mediation analysis

### 7.8.1. Mediation via tooth cleaning frequency

The odds of having dental caries were not significantly different but numerically higher by 22% for people who live in the slum compared to non-slum residence (OR=1.22, 95% CI:0.95 to 1.58); and the odds were significantly higher by 51% in the slum (OR=1.51, 95% CI:1.14 to 2.01) for periodontal pocket formation, after adjusting for tooth cleaning frequency, age and sex [direct effects, Figure 7.1, Table 7.10]. The odds for at least twice daily tooth cleaning were not significantly different but were numerically lower by 19% (OR=0.81, 95% CI:0.63 to 1.04) in slum compared to non-slum residences, adjusting for age and sex [indirect effect]. The odds of having dental caries were not significantly different but numerically higher by 30% (OR=1.30, 95% CI:0.98 to 1.71). The odds for periodontal pocket formation were not significantly different but numerically higher by 31% (OR=1.31, 95% CI:0.96 to 1.77) for cleaning teeth at least twice

daily compared to less, adjusting for place of residence, age, and sex [indirect effect]. There was no evidence tooth cleaning frequency mediated the relationship between place of residence and dental caries (OR=0.95, 95%CI:0.87 to 1.03 [total indirect effect], estimated 38% mediated) or periodontal pocket formation (OR=0.95, 95%CI:0.86 to 1.04 [total indirect effect], estimated 15% mediated).



**Figure 7.1.** Casual pathways between oral health conditions (dental caries and periodontal pocket formation) and place of residence with frequency of tooth cleaning as a potential mediator, controlling for age group and sex.

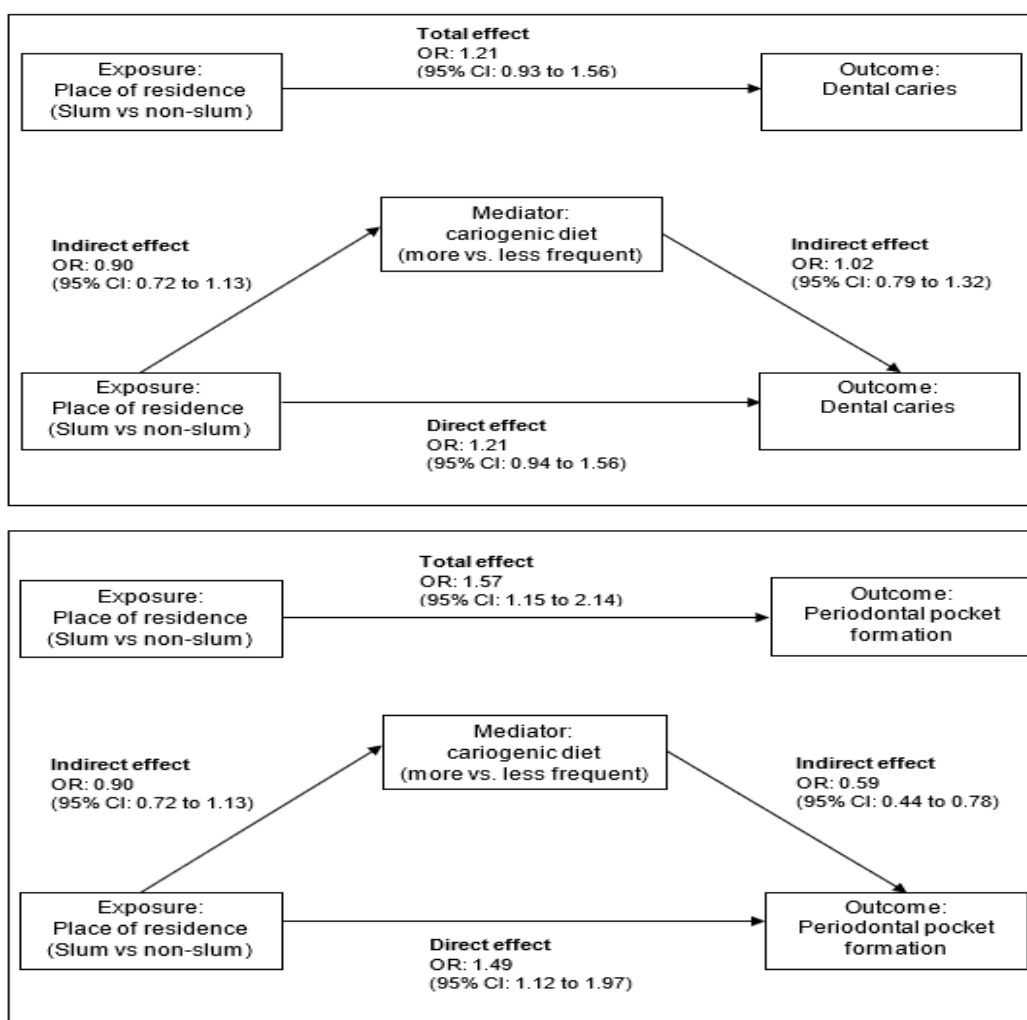
**Table 7.10.** Generalized structural equation modeling to explore potential mediator frequency of tooth cleaning on the relationship between oral health outcomes and place of residence. Analysis adjusted for age group and sex.

Effect	Odds ratio (95% CI) p-value
<b>Dental caries as outcome</b>	
<b>Direct effect</b>	
Place of residence → Dental caries	1.22 (0.95 to 1.58) p=0.123
<b>Indirect effects</b>	
Place of residence → Tooth cleaning frequency	0.81 (0.63 to 1.04) p=0.096
Tooth cleaning frequency → Dental caries	1.30 (0.98 to 1.71) p=0.067
Total indirect effect	0.95 (0.87 to 1.03) p=0.224
<b>Total effect</b>	
Place of residence → Dental caries	1.16 (0.88 to 1.51) p=0.288
<b>Percentage mediated</b>	
<b>Periodontal pocket formation as outcome</b>	
<b>Direct effect</b>	
Place of residence → Periodontal pocket formation	1.51 (1.14 to 2.01) p=0.004
<b>Indirect effects</b>	
Place of residence → Tooth cleaning frequency	0.81 (0.63 to 1.04) p=0.096
Tooth cleaning frequency → Periodontal pocket formation	1.31 (0.96 to 1.77) p=0.085
Total indirect effect	0.95 (0.86 to 1.04) p=0.225
<b>Total effect</b>	
Place of residence → Periodontal pocket formation	1.43 (1.06 to 1.92) p=0.017
<b>Percentage mediated</b>	
15%	

### 7.8.2. Mediation via cariogenic diet

The odds of having dental caries were not significantly different but numerically higher by 21% higher for people who lived in the slum compared to non-slum residents (OR=1.21, 95% CI:0.94 to 1.56); and were significantly higher by 49% in the slum (OR=1.49, 95% CI:1.12 to

1.97) for periodontal pocket formation, after adjusting for cariogenic diet, age and sex [direct effects]. The odds of having a more frequent cariogenic diet were not significantly different but were numerically lower (OR=0.90, 95% CI 0.72 to 1.13) for people in slum compared to non-slum residences.



**Figure 7.2.** Casual pathways between place of residence and oral health outcomes (dental caries and periodontal pocket formation) with cariogenic diet as a potential mediator, controlling for age group and sex.

There was very little difference in the odds of having dental caries (OR=1.02, 95% CI 0.79 to 1.32) between people with more and less frequent consumption of cariogenic diet. The odds of having periodontal pocket formation was 41% lower (OR=0.59, 95% CI:0.44 to 0.78) for

having a more frequent cariogenic diet compared to less, adjusting for place of residence, age and sex [indirect effect]. There was no evidence cariogenic diet mediated the relationship between place of residence and dental caries (OR=1.00, 95% CI:0.97 to 1.02 [total indirect effect], estimated 1% mediated) or periodontal pocket formation (OR=1.06, 95% CI:0.93 to 1.19 [total indirect effect], estimated 12% mediated). Figure 7.2, Table 7.11

**Table 7.11.** Generalized structural equation modeling to explore potential mediator of cariogenic diet on the relationship between dental outcomes and place of residence. Analysis adjusted for age group and sex.

Effect	Odds ratio (95% CI) p-value
<b>Dental caries as outcome</b>	
<b>Direct effect</b>	
Place of residence → Dental caries	1.21 (0.94 to 1.56) p=0.144
<b>Indirect effects</b>	
Place of residence → Cariogenic diet	0.90 (0.72 to 1.13) p=0.364
Cariogenic diet → Dental caries	1.02 (0.79 to 1.32) p=0.853
Total indirect effect	1.00 (0.97 to 1.02) p=0.855
<b>Total effect</b>	
Place of residence → Dental caries	1.21 (0.93 to 1.56) p=0.149
<b>Percentage mediated</b>	
1%	
<b>Periodontal pocket formation as outcome</b>	
<b>Direct effect</b>	
Place of residence → Periodontal pocket formation	1.49 (1.12 to 1.98) p=0.006
<b>Indirect effects</b>	
Place of residence → Cariogenic diet	0.90 (0.72 to 1.13) p=0.364
Cariogenic diet → Periodontal pocket formation	0.59 (0.44 to 0.78) p<0.001
Total indirect effect	1.06 (0.93 to 1.19) p=0.380
<b>Total effect</b>	
Place of residence → Periodontal pocket formation	1.57 (1.15 to 2.14) p=0.004
<b>Percentage mediated</b>	
12%	

## 7.9. Summary of findings

Participants' characteristics: A total of 1,357 participants were included in the study, and these were evenly drawn from both slum and non-slum settings. There were more females than males in both the slum and non-slum sites in an approximately equal Female to Male ratio (2:1 each). Participants' average and median ages were higher in the slum setting relative to their non-slum counterpart. Half of the slum residents compared to 15% of the non-slum residents had primary or no school education as their highest educational attainment. Similarly, more than half of the slum dwellers and about one-fifth of the non-slum residents were of the low socio-economic group.

Oral health outcomes: The prevalence of key oral health conditions in slum and non-slum are as follows: dental caries (27% vs 23%), gingival bleeding (75% vs 53%), periodontal pocket (23% vs 16%), dental trauma (32% vs 21%). When adjusted for age and sex, similar direction in gradient to that obtained for the crude rate were noted, albeit with smaller difference in magnitudes. The association was not found significant for caries but for periodontal pocket, attachment loss, and dental trauma, the association were found significant. All the key oral health conditions were more prevalent among residents in the slum setting than in the non-slum resident counterparts. All oral health conditions were found commoner among the females except caries disease. Periodontal disease (gingival bleeding in particular) was the most prevalent dental disease and affects more than half of the population in the two settings. Mean DMFT measure was low in both sites. Very few participants, more in the non-slum than in the slum (small difference), required no form of dental treatment. Significant proportion of the participants, more in the slum than in the non-slum setting, required the prompt and urgent level of dental treatment.

Hypothesis testing: Null hypothesis is rejected as there is a difference in the general dental health of residents in the slum and non-slum urban settings, and this favoured the non-slum residents ( $P < 0.05$ ). The difference in the prevalence of dental caries was in the same direction but was not statistically significant.

Oral health behaviour: The majority of participants in the slum and the non-slum settings perceived the oral health as good. The practice of tooth cleaning "at least twice daily" was generally low, and even lower among the residents of the slum setting compared to those who

resided in the non-slum settings. Relatively, a smaller proportion of the slum residents used toothbrush and paste to clean their mouths than their non-slum counterparts.

Utilization of dental services: About one-fifth of participants in either settings, ever visited a dentist. Of these, an even much smaller proportion of residents (slum less than non-slum) made a visit within 12 months prior to data collection. Dental visits among the users were mainly for urgent needs or purposes. The majority from both settings sought care or advice for dental related problems from the chemist or pharmacist. Perceived high cost, fear and perceived sense of no dental problem were identified major barriers among the never users. More than one-tenth of previous dental service users (slum >non-slum) ever avoided doing prescribed dental procedures because of cost.

Factors associated with the oral health conditions: Overall, there was a higher prevalence of the key oral health conditions among males except for dental caries. The key oral health conditions were also shown to generally increase with age, and generally reduced with improvement in the level of education among participants both collectively and from the individual study settings.

Logistic regression analyses showed that residents of the slum setting had 20% and 50% more chance of having dental caries and periodontal pocket respectively. Although slum dwellers were less likely to consume cariogenic diet and brush at least twice daily, there was little evidence that tooth cleaning frequency and more frequent cariogenic food consumption mediated the relationship between place of residence and dental caries or periodontal pocket formation. The lack of evidence on mediating effect may partly reflect the relatively small observed differences in tooth cleaning practice, cariogenic diet consumption, and dental caries between slum and non-slum populations.

## **CHAPTER 8: QUALITATIVE RESEARCH METHODS (WORK PACKAGE - 3)**

### 8.1. Chapter overview

This chapter is the qualitative research methods section of the Ph.D. thesis. It features the aim, research question, objectives, and an overview of the research methods and data analysis.

### 8.2. Aim

The chapter addresses the fourth and last objective of the PhD research, aimed at examining the slum dwellers' perspectives on oral health, care practices and their experiences about seeking care, finally capturing their suggestions for improvement.

### 8.3. Research question

What are the perceptions, practices, and experiences of slum dwellers about their oral health, and care-seeking and suggestions on improving access to timely care?

### 8.4. Objectives

1. To examine the slum dwellers' views about their common dental ailments
2. To describe the practices of the slum dwellers towards oral health care.
3. To identify the slum dwellers' barriers and enablers to seeking dental health care from care facilities
4. To explore their oral health needs and recommendations for improving timely access to dental health care.

### 8.5. Research design

This was an exploratory qualitative study using face-to-face focus group discussions with representatives of households in Idikan, a slum community in Ibadan, Oyo State, South Western part of Nigeria.



## 8.6. Study setting

Idikan community is a densely populated area comprising mainly people of Yoruba tribe or ethnicity. It is located in the heart of the ancient city of Ibadan along an old tarred road, wending towards the commerce beehive, where many of residents work as traders. Most families in the community are polygamous with large family sizes comprising grandfathers, uncles, aunts, and grandchildren, all living in small apartments or rooms, located within a larger family compound. The structures are permanent but mostly run-down, with poor sanitation and refuse-filled drains. The area is poorly planned with a limited road network (Ahmed *et al.*, 2020; Onanubi *et al.*, 2017). There is a small clinic affiliated with the Dental Centre of the University College Hospital (UCH) that provides Primary Oral Health Care (POHC) and referral services for the community dwellers. There are also numerous patent medicine stores (places where individuals without formal pharmacy training sells orthodox pharmaceutical products to people with or without doctors' prescription on a retail basis and purely for profit) and medicine vendors as well as traditional healing homes in the area, all of which are accessible to members of the community (Ahmed *et al.*, 2020; Brieger *et al.*, 2004; Onanubi *et al.*, 2017; Osamor & Owumi, 2010).

The structure of Idiakn community had some key characteristics which were considered in the sampling method:

1. The community has no clear socio-cultural division in how it is organized spatially. Dwellings appear to be fairly homogenous in nature, having no known socio-cultural or historical settlement pattern in the residential arrangement (Onanubi *et al.*, 2017).
2. The community is made up of many small clusters of compounds (extended family setting) known in the native Yoruba language as "Agbo-ile". Agbo-ile is a collection of rooms or apartments occupied by family or household members (ebi) or people who are related in one way or the other.
3. A compound may have more than one household within it (Onanubi *et al.*, 2017; Oyejide & Osinusi, 1990).
4. Lastly, each compound is headed by a "Baale", also known as the father of the compound. The Baale usually represents his compound regarding any matter at the central community level. A list of all the existing compounds in the community was available upon request from any of the Baales.

### 8.7. Sampling Frame

Following several visits to the community and discussions with key decision-makers, a comprehensive list containing the names of all the compounds within the community was obtained. There were a total of 42 compound names on the list. A leader in the community who also served as a gatekeeper to the community facilitated the process. The list provided was reviewed by all stakeholders present and a final set of 40 compound names was agreed upon, two names were excluded as they were no longer considered residential family compounds.

### 8.8. Sampling strategy and justification

One out of every four compounds (25%) in the community was randomly selected by balloting and included in the study (total of 10 compounds). Given the homogeneous nature of the community and the resources available to conduct the study, the researcher considered that a quarter of the total compounds that made up the community would be a fair spread and representation of the entire community.

From each of the randomly selected compounds, the head Baale was designated the gateway to reaching appropriate participants. Using their knowledge of the compound, the Baale purposively selected compound representatives to participate in the study.

The purposive sampling method is commonly deployed in qualitative research for the identification and selection of individuals who are especially knowledgeable about or have experience of a phenomenon of interest (Cresswell & Plano Clark, 2011; DeCarlo, 2018; Patton, 2002). Its advantages include the provision of the justification to make generalisations from the sample that is being studied; usefulness in qualitative research studies with multiple phases that involves different sampling techniques because of its wide range of non-probability sampling technique options. A major disadvantage of the purposive sampling is that it can be highly prone to researcher bias. However, this could be overcome where judgements have been based on clear criteria. Secondly, the subjective and non-probability nature in its unit selection may pose a potential challenge in defending the representativeness of the sample. But if different units were selected, the results and any generalisations may have been the same (Sharma, 2017). Another sampling method that may be utilized for this study is the convenience sampling technique. In this technique study participants are selected on the basis

of their ease of accessibility. Although this method is relatively easy and inexpensive, it is prone to high chances of sampling error (Bhardwaj, 2019).

The Baales were asked to select family members with a leading role in decision making about the health and wellbeing of the household, particularly in oral health and care seeking. In addition to their knowledge and experience, such individuals were selected for their availability, willingness to participate, and ability to communicate their experiences and opinions in an articulate, expressive, and reflective manner (Bernard, 2002). Purposive sampling has the potential to yield richness (information power) in focus group discussions (FGDs), while exploring a range of views, themes, and possibilities in a population. As such, while the random selection of the compounds sought to ensure representativeness and adequate distribution of the samples, the purposive selection approach of the focus group participants intended to yield richness in the results (Malterud *et al.*, 2016).

#### 8.9. Sampling process

All visitations made to the ten compound heads were with the permission of the community "gatekeeper" who also accompanied the researcher and was on hand to answer questions, as detailed information about the research was presented to the Baale. Each Baale was requested to nominate four members of his compound using the inclusion criteria as guide.

#### 8.10. Participants- Inclusion criteria

Purposive sampling was used to select participants who met the following criteria:

- Member of a household who is resident in the community, because they are the most appropriate to give reliable information on the dental health and well-being of members of the households within the community (Patton, 2002).
- Adults between the ages of 25 and 64 years who control household resources. It is believed that ultimate decisions within households will be in line with the decisions of the person who controls household resources (Angel-Urdinola & Wodon, 2010). From the United Nations provisional guidelines on standard international age classifications (United Nations, 1982), these are economically active adult males and females within the 25 to 64 years age category.
- Knowledgeable and have experience in terms of decision-making with respect to the general health and well-being of members of the household.

This study therefore included adult household members from different families within a compound who were economically active, and participated actively in making health decisions for their household. This was done to ensure a sizeable number of about ten participants from different households per focus group session.

#### 8.11. Recruitment of participants

Individual nominees' consent was sought through telephone calls and physical visits. Invitation letters, which were prepared in both English and Yoruba, were delivered in person by the researcher based on nominees' preferred Language. The letter delivery was also accompanied by a copy of the "participant information leaflet" – PIL [Appendix 8.1]. During the visit, the researcher took time to read through and explain each document to the nominees. Afterwards, the nominees were encouraged to familiarize themselves with the documents and seek clarification if required using the contact provided at the bottom of the information leaflet. A repeat visit before the data collection exercise was deemed necessary if a participant contacted the researcher in search of further information or clarification after going through the documents, but no one required a repeat visit.

Reminders about the scheduled FGD meetings were made through phone calls and visits with the assistance of the gatekeeper, whose presence encouraged participation. Visitations were also made in some instances when no response was received from phone callings.

#### 8.12. Focus Group Discussions

The FGD sessions were stratified along age group and gender: age group because of the culture of respect for elders that is widely practiced in the community; and gender because of the patriarchal system of the community (Asiyanbola, 2005; Asiyanbola, 2001; Olawoye *et al.*, 2004). By segregating the population into different age groups and gender, it was expected that participants would more freely express opinions that might be suppressed or withheld in a society or community of patriarchal dominance (Asiyanbola, 2005; Asiyanbola, 2001; Olawoye *et al.*, 2004). This measure was taken to encourage diversity in ideas and opinions, from different age groups within the adult category and gender, as well as the diversity of rich cultural insight from groups (O.Nyumba *et al.*, 2018).

The Focus groups therefore comprised:

- 1) Older men of ages 45-64 years x 1 group,
- 2) Younger men of ages 25- 44 years, x 2 groups
- 3) Older women of ages 45-64 years x 1 group and
- 4) Younger women of ages 25 – 44 years x 2 groups.

All invitees turned up for their appointments. All the FGDs were conducted in one of the halls (a popular choice) owned by the community. Being in a central location within the community, the venue was easily accessible to all, and it was comfortable enough, private, quiet and free from distractions (Bloor, 2001). The setting had a conducive atmosphere because it was community-owned and not associated with any particular organization. The intention was for participants to be at liberty to express their opinions in a familiar and neutral space.

#### 8.13. Research Team

The FGDs were facilitated by a team comprising the researcher herself as one of the facilitators, a male facilitator who was conversant with Yoruba and experienced in conducting FGDs and an assistant (note-taker). The assistant's role was to observe non-verbal interactions and the impact of the group dynamics, as well as to document the general content of the discussion, thereby supplementing the data from audio recording (Kitzinger, 1994).

The team was trained on the details of the research and was fully involved in the research activities which included advanced discussion with invited participants in order to gain their commitment towards attendance at sessions and in good time, as well as the setting up of meeting venue and equipment.

#### 8.14. The Focus Group Discussion (FGD) process

The meetings were conducted in English and Yoruba Languages. A potential linguistic barrier was identified before the conduct of the research and was promptly addressed. The Yoruba Language fluency of the main researcher, a non-indigene of the study region, could be best described as the “general professional proficiency’ level according to the U.S. Government Proficiency Ratings (Jackson & Kaplan, 1999) i.e. the researcher was able to speak accurately with enough vocabulary to handle social and professional discussions within the field of dentistry, although with the likelihood of challenges with accent and understanding subtle and

nuanced phrases. The identified potential challenge necessitated the engagement of the second facilitator (discussed in section 8.13), a native of the region whose addition was also expected to compensate for the researcher's language challenge. The FGD sessions lasted an average of 50 minutes (range 40–60 minutes). All discussions were recorded using a digital recorder. Participants' consent for voice recording was obtained before each session (Kitzinger, 1994).

A discussion guide [Appendix 8.2] was used for all sessions, covering needs, practices, and experiences of the slum dwellers about their oral health, and care seeking. Open questions were supported with some possible prompts that could be explored further.

At the beginning of each FGD session, the participants were welcomed, given a brief introduction about the meeting, the process and the audio recordings. The purpose of the research and its conduct were explained, giving opportunities for questions and clarifications. Following the participants' thorough understanding of the research, we emphasized their rights to withdraw at any time, then explained that once their data had been collected, they would not be able to withdraw the data because they would be fully anonymized. But we reiterated our intention to keep responses confidential in our reporting. Thereafter, they were requested to fill in the Informed Consent forms [Appendix 8.3] forms that were previously given to them.

A brief form on sociodemographic characteristics (name of household and compound, age, sex, marital status, and whether or not they took decisions regarding the general health and well-being of members of the family or household members) was distributed for the participants to fill in. Thereafter, the participants were each given a pseudonym (new names by which they were known during the meeting for anonymity) and were asked to memorize them. The unique identifier was also written on tags that were pinned to each participant's dress. This was followed by an explanation of the ground rules. Participants were encouraged to ask questions to which answers were provided.

The FGD then commenced with opening questions, then, introductory questions and the FGD guiding questions (Kitzinger, 1994; Krueger & Casey, 2002). Participants were reminded that they were free to participate and also to withdraw at any point. Facilitators encouraged participants to offer their own perspective, using prompts such as "what do you think?" "What are your views?" "Can we share your opinion?" etc. They were also reminded to contact the investigator on the address provided in the Participant Information Leaflet (PIL), at any time, particularly if they were unhappy about anything or wished to complain about anything that happened during the discussion.

At the end of each session, refreshments (bottle of soft drink and a snack) were served. Then, the participants were each given a tube of toothpaste and a toothbrush, in appreciation of their time in the study. None of the participants was paid for participating in the FGDs.

#### 8.15. Data handling

All audio recordings were recorded in a digital format, and these were mainly in the Yoruba language. Recordings were encrypted and stored securely, backed up with password protection in the researcher's personal computer with access passwords as well as the University of Warwick server, accessible to the researcher. Once this was done securely, the data were removed from the recorder. The recordings will be deleted after 3 years by the researcher (Dr, Mary Osuh). The soft anonymised copies will be kept for 10 years according to the University of Warwick guidelines. Paper records such as consent forms have been stored securely in a locked cabinet in an office at the University of Ibadan. Only the researcher and the supervisors will have access to the data generated.

Recordings were transcribed verbatim then translated into the English Language by a professional translator (expert), as is expected of standard practice and, because, I the researcher, am a non-indigene of Yoruba, who is averagely fluent with the speaking and understanding of the native Language. The translated English language version document was given to another expert who back-translated it into Yoruba language and compared it with the original audio recordings for cleaning and correction. The final document in English was then analysed by the researcher using qualitative data analysis software ATLAS.ti (Qualitative Scientific Software, Berlin; V7), with guidance from a software expert.

#### 8.16. Data analysis

Data analysis involves a process of reducing and organizing data generated in research, in order to produce findings that can be interpreted (Burns & Grove, 2010). My data analysis process required me (the researcher) to become immersed in the data in order to preserve the uniqueness of each participant's experience while building an understanding of the phenomenon under study (Burns & Grove, 2010). Data analysis began with listening to the audio recordings of the focus group sessions. This was followed by reading and rereading the verbatim transcriptions and translations (Burrows & Kendall, 1997; Henning *et al.*, 2004).

The FGD guide was developed around concepts drawn from the literature, which provided the basis for the key themes. The thematic analysis was structured around these key concepts, while also allowing for emergent issues conducive to the development of new themes. Thematic analysis is commonly used in health care research. It is considered foundational approach for qualitative data analysis that can be used across a range of epistemologies and research questions due to its high flexibility (Nowell *et al.*, 2017; Pope & Mays, 2020). It allows data to be identified, analysed, organised, described and reported as themes thus enabling researchers who use different research methods to communicate with each other (Braun & Clarke, 2006; Burrows & Kendall, 1997; Nowell *et al.*, 2017; Pope & Mays, 2020).

The researcher's own pre-conceptions of the phenomena under study were identified, which were shaped by professional experience as a dentist, general assumptions and cultural factors. These factors, which could influence the data interpretation, were suspended as much as possible by consciously inhibiting own meanings and interpretations (bracketing) in order to enter into the world of the participants (Tesch, 1992).

The process of analysing the data was highly iterative and involved several cycles. The first cycle involved reading all the transcripts for data familiarisation. I read and re-read all data until I felt immersed in the data and achieved a "sense of the whole". Then I identified all "meaning units"- a word or phrase, sentence or paragraph that described a specific phenomenon of interest, through the transcript, and decided on which were relevant to the research questions (Burrows & Kendall, 1997; Tesch, 2013).

In the next cycle, coding and re-coding of data items was performed to discover emerging patterns and new ideas. The coding process also involved a first and second cycle coding. In the first cycle, codes were given to text that conveyed an idea – ranging from a single word to a full sentence. Then second cycle coding which involved coding exact same units and longer passages of texts and sometimes a reconfiguration of the codes themselves (Rogers, 2018; Saldaña, 2015). Following up from the emerging patterns, the emergent themes were repeatedly refined and some sub-themes became obvious. Then the coding scheme was produced, codes were grouped, linked, and sorted under these categories following the objectives of this study [Appendix Figure 8.4]. The themes and sub-themes were then described, in an attempt to examine how they relate by mapping them into a diagram to facilitate interpretation [Appendix Figure 8.4]. The key issues were teased out, the themes were developed and summarised and the data compared from across groups. All processes involving judgment about coding and organisation, interpretation of data, theme development,



contextualization of quotes to illustrate themes from data generated as well as writing up the text were all done by me- the researcher (Nowell *et al.*, 2017; Starks & Brown Trinidad, 2007).

To minimize subjectivity in the coding and minimize bias in the interpretation of the data, additional researchers, experienced in qualitative studies were involved: Prof Gbemisola Oke of the University of Ibadan evaluated the process; then Dr. Bronwyn Harris of the University of Warwick, supervised the conduct of analysis. Both researchers independently checked the codes and themes and held discussions until consensus was achieved.

## CHAPTER 9: QUALITATIVE RESEARCH RESULTS SECTION

### 9.1. Chapter overview

This chapter presents the results from the qualitative section of the Ph.D. research. It features an overview of the participants, key themes, findings and summary of the results, as well as the researcher's reflections.

### 9.2. Overview of research conduct

The Focus Group Discussion (FGD) meetings took place between September and October 2019. A total of 58 participants took part in six focus group sessions, including five participants (each in a different FGD) who were not originally invited but had accompanied an invited member of their compound to the discussion [Table 9.1]. Their inclusion did not seem to affect the dynamics of the group. Every selected compound was represented and each nominated household member attended the scheduled meeting. All FGD meetings were conducted in one of the halls (a popular choice) owned by the community.

Overall, appreciable levels of enthusiasm were displayed in all the discussion sessions. Although there was no major divergence in the views expressed by the participants, women participants generally gave a more vivid description of their personal experience of oral health related issues as well as with family members, compared to men. This robustness of response may have been facilitated by the stratification by gender, which sought to prevent female voices from being subsumed in the patriarchal atmosphere that may have pervaded mixed-gender sessions. The views of most participants within the older age group seemed to favour traditional oral health care practices as compared to the younger age group. As with the gender stratification, the age stratification approach deployed in this study sought to encourage expression of opinions from different generations and this accounted for a rich mix of culture, tradition and beliefs in the data generated. In two of the six groups, there were one and two extremely vocal persons who initially appeared to be dominating. However, the situation was tactfully managed by the facilitators to create opportunity for others to express their opinions (Smithson, 2000). As a result, a feeling of consensus was developed within each group, demonstrating positive group dynamics.

### 9.3. Results - Participants' characteristics

The 58 participants were aged between 25 and 59 years, distributed evenly between each gender group. There was equal male and female representation. Forty of the participants were married, while two participants were living-in partners. Four were widowed, eight had never been married and four were divorced. From the brief form filled in, all participants identified that they were decision-makers regarding the general health and well-being of members of the family or household members [Table 9.1].

**Table 9.1 Characteristics of participants (N=58).**

Characteristic	Sub-type	Number
Compounds		10
Households	Families	53
	Accompanying compound members	5
Gender	Male	29
	Female	29
Age range		25 – 59 years
Marital status	Married	40
	Living-in partners but not married	2
	Widowed	4
	Divorced	4
	Never married	8
Take decisions regarding the general health and well-being of members of my household		58
Population per group	FGD1- Younger female	9
	FGD2- Older female	11
	FGD3- Younger male	8
	FGD4- Older male	11
	FGD5- Younger female	9
	FGD6-Younger male	10

### 9.4. Organisation of themes and sub-themes

In the following sections, the themes and sub-themes identified from the FGDs are presented in relation to the objectives, namely:

- Common dental ailments and perceived causes
- Care practices: self-care practices, relief remedies, and their reasons.
- Care seeking barriers and enablers: treatment-seeking experience
- Needs, suggested measures and recommendations to improving timely access to dental health care

## 9.5. Objective 1: common dental ailments and perceived causes

### 9.5.1 Common dental ailments

A general observation across all focus group sessions was an atmosphere of excitement as participants competed to respond to the questions about their personal experience or that of a household member, regarding dental ailments.

**“Akokoro”**- In the course of discussion in all groups, the name “akokoro” came up in the discourse on sub-categories of common dental ailments. There was subtle argument among the participants on what exact condition “akokoro” was supposed to represent. Some argued that the name referred to the presence of tooth decay or hole in the teeth, with or without associated pain. Some described it as any form of pain from the mouth. Others argued that “akokoro” was the native name for gum diseases. Although argument in favor of tooth decay dominated most sessions, discussants generally agreed that “akokoro” could culminate in abscess formation and swollen jaw. Most of the discussants referred to akokoro as a dental disease associated with extreme discomfort. A few, however, identified it as the causative organism for some mouth diseases, positing that the specific cause of a hole in the tooth was tooth worms, and was thus different from akokoro. A few others disagreed as they believed they were the same.

In responding to the dental ailments that commonly afflict household members, the participants catalogued an array of common oral ailments, including: dental pain which was top on the list, followed by bleeding gums, tooth sensitivity, hole in the tooth, dental stains, fractured teeth and mobile teeth.

#### 9.5.1.1. Pain

Pain of dental origin was by far the most common oral health problem identified by the participants. Most of the descriptions were about the intensity and severity of the pain, where pictures of extreme pain with severe or grave consequences – even death - were painted. From the descriptions, the origin of the pain could be the hard tissue (teeth) and/or soft tissue (gums).

*“I have seen a lot of people that ‘passed on’(died) just because of teeth problems. Akokoro, is that not what they call toothache? Ah! if akokoro issues affect a person, or if you have*

*seen someone that has akokoro, he or she will feel that he will not see or witness another day on earth just because of the pain". FGD4\_older\_Male\_P3*

*"This akokoro (referring to toothache) issues, hmm! (shakes his head) many of us have been disturbed by teeth pain o!". FGD4\_Older\_MaleP4*

*"What I know about that tooth decay is that, it is not something you can bear, my mother had it, there was a day she called us and told us that the pain had become unbearable and she is about to lose her life". FGD2\_Older\_female\_P10*

*"Regarding mouth issue, I don't have any, but I have an issue with my teeth, whenever I am chewing, I always feel the pain under my tooth so even just of recent, I went to remove it because I was not feeling comfortable".*

Facilitator: (laughs) so how many teeth have you removed now?

*Respondent: "Up to like four teeth". FGD2\_Older\_FemaleP1*

They all seemed to agree that pain was sometimes associated with swelling.

*"I have seen one of our brothers that had akokoro issues it resulted in a big (swollen) mouth". FGD3\_Younger\_MaleP2*

*"If akokoro grabs (affects) anyone, the person will agree that God does not have two names! (a phrase commonly used to describe someone in deep trouble). The mouth will be swollen with pus discharge. The pain is usually much" FGD3\_Older\_MaleP1*

#### 9.5.1.2. Gum bleed and other forms of discharge

Bleeding while brushing was another problem identified by many of the participants.

*"At times when someone is brushing his teeth blood will gush out.... also whenever I want to brush my teeth blood will gush out" FGD4\_older\_male\_P9*

Some participants did not associate this with pain.

*"My first encounter with teeth issue, there was a time when I finished brushing my teeth and when I pressed the gums it will bring out blood and some particles without paining me" FGD5\_Younger\_female\_P2*

#### 9.5.1.3. Shock-like sensation (tooth sensitivity)

Tooth sensitivity, albeit less common than pain and bleeding, was also identified by many of the participants in all groups.

*“Shocking teeth, is a major issue, when I drink water, I feel it on my teeth”.* **FGD1\_Younger Female\_P8**

While describing this condition, some likened the feeling to an ache, a few others described it as a shock-like sensation. In some of the cases, a trigger was identified, for example acidic foods or drinks and water.

*“What I noticed on my teeth was that whenever I take or eat oranges my teeth, it will start paining me seriously. Also, if I drink cold soft drinks like coke and others, if I drink anything that has a lot of lemon inside my teeth will be paining me”.* **FGD4\_older\_Male\_P1**

*“Yes, I have experienced dental pain and people around me too, so it is not new to me at all, I had akokoro (Toothache) issues to the extent that when I drink water, I will feel pain and I am over 40 years now”* **FGD1\_Younger\_Female\_P2**

*“What I want to say is that, anytime I take cold water, I feel a sharp pain that goes down to my throat”.* **FGD2\_Older\_Female\_P2**

#### 9.5.1.4. Tooth decay, Hole in the teeth (dental caries)

Dental caries was also identified as a common dental ailment. While some referred to it as a hole in the tooth, others simply called it decayed tooth.

*“Akokoro is very common o! not just with us in here (referring to the community), I believe everywhere too! As it affects the adults, the children are not spared. I can say it is the main dental problem sha! That all the teeth will have spoilt (decayed)”*

**FGD5\_Younger\_FemaleP10**

*“My own is not akokoro o! I had a piece of meat stuck in between my teeth then I tried to remove it using an object to force it out, it now left a hole under my tooth. That gave me the sign that I had damaged my tooth as a sharp pain followed subsequently, it was a small hole initially, then, suddenly it became a wide and deep hole. So I went to the hospital and they took a picture of it and showed me how deep the hole was. That was caused by the*

*teeth worm, so it is not akokoro (tooth decay) that caused it (the participants affirms)".*

**FGD2\_Older\_FemaleP5**

#### 9.5.1.5. Fractured teeth (broken teeth)

Some of the participants identified fractured tooth as their most common dental problem or challenge.

*"The problem I had with my teeth in the past was that my tooth got broken from the gum".*

**FGD6\_Younger\_MaleP3**

*"For me, I observed that two out of the remaining teeth in my mouth had broken. It got to a time that whenever I ate something with that side of the mouth, I would feel pain. The two teeth started paining me more, if something touched the two teeth, it would turn to a headache. So, I went to the dental clinic in ...(named) and they removed it for me and I am better till now.... FGD4\_Older\_MaleP7.*

#### 9.5.1.6. Discoloured or black teeth (dental stains)

Tooth discolouration was also identified as an oral health challenge but with much less significance than the earlier mentioned dental health problems.

*"The teeth are very important and add beauty to the body. Some people are less than 40 years and their teeth are blackish, it is not good looking at all, it should be that, when you wake up in the morning, you should brush, but some people will say that 'when you wake up in the morning, brush' and do not specify if you should brush in the morning or night, but it is good to brush the teeth clean. What even, is the cause of the black teeth?"*

**FGD1\_Younger\_FemaleP3.**

#### 9.5.1.7. Mobile teeth

Mobile tooth was also identified as a dental problem or challenge.

*"My own issue was I used to have a slack (mobile) tooth. It used to pain me whenever I ate with it. I have waited for so long for the tooth to heal but to no avail, so I went to the dentist to remove it for me" FGD4\_Older\_MaleP11*

#### 9.5.2. Perceived causes of oral health problems

Participants were asked what they thought caused the identified dental health problems. Poor dental hygiene and habits, ignorance, and supernatural forces were suggested.

##### 9.5.2.1. Poor dental hygiene

Most people mentioned poor dental hygiene as a major cause of dental health problems. Many discussants traced the foundation to childhood and the early formation of poor dental hygiene habits. Most seemed to blame the parents or guardians for setting people on a path of bad hygiene that persists throughout their lives.

*“Poor dental hygiene that starts from the newborn period will affect the individual throughout life, manifesting in different forms of oral health problems”*

**FGD2\_Older\_FemaleP10**

*“Poor parental guidance too contributes greatly to the dental problems commonly seen today”* **FGD1\_Younger\_FemaleP3**

Some participants spoke confidently about the measures they took to avoid oral diseases such as regular cleaning of their mouths.

*“I think for those children (referring to those with poor dental health), it is because they don’t wash their teeth well, that is why it bleeds. if they wash their teeth well, it will not bleed”*

**FGD2\_Older\_FemaleP11**

*“I think we should take responsibility and not blame this on parents, we should clean our teeth every day and properly and many of these dental problems will be far from us”.*

**FGD1\_Younger\_FemaleP9**

##### 9.5.2.2. Low level of awareness

Some respondents suggested that parental ignorance about when to begin mouth cleaning for children plays a major role. Some warned that failure to institute dental cleaning at the right time (before complete tooth eruption) would be a catalyst for future dental problems.



*“... when children start teething, I think it starts from there. When these children are about 6 months, and they start giving the child food, they should also use cotton wools to clean the mouth of the child from this point, they should not wait till the child has erupted all the teeth, by then it may be too late”*

Facilitator: Is that ignorance too?

*“Yes, it is ignorance, they say the child is too young, and therefore, they don't need to brush”* **FGD5\_Younger\_FemaleP1**

*“...like an 18 months old chewing gum, it is bad. Then, children use a toothbrush that is not suitable for their ages, these are parts of the problems.* **FGD2\_Older\_FemaleP7.**

#### 9.5.2.3. Excessive consumption of sugary foods

Some of the participants believed that dental problems are caused by frequent consumption of sugary foods

*“My daughter has dental problems as we speak and I know it is caused by her excessive sweets and sweet foods intake, even chewing gums. Her mouth is always. She indulges so much in anything sweet”.* **FGD1\_Younger\_FemaleP1**

*“Eating junks, always! especially the sugary ones... Whoever indulges in such habit will not likely escape dental problems and not just dental problems only, even the entire body...”.* **FGD4\_Older\_MaleP2**

#### 9.5.2.4. Poor dental habits

An overwhelming majority identified the use of teeth as bottle opener, a dental habit that is widely practiced in Nigeria and that could lead to dental health related problems.

*“I use my teeth to open drinks. My friends and I am sure, many of us seated here do too. It was only recently that I felt my tooth crack while opening a bottle of drink, and that marked the beginning of my dental problem. It progressed from the feeling of shock to pain, and then involved many teeth”.* **FGD2\_Older\_FemaleP5**

People listed consequences of bottle opening ranging from fracture of teeth to jaw dislocation.

*“...Some of us use our teeth to open soft drinks. This has serious implications. I have seen someone that used his teeth to open a soft drink and immediately he had jaw dislocation. Initially, he was self-medicating, the native way. Later, his whole mouth was affected and when they took him to the hospital the doctor said they will operate his mouth. Just to open a drink of #70, he had to pay #700,000 for surgery, to correct the dislocation....”*

**FGD4\_Older\_MaleP5**

#### 9.5.2.5. Spiritual/ supernatural causes

Some participants suggested that supernatural/ spiritual powers were behind dental health ordeals or challenges.

*“Spiritual forces may be responsible for dental problems. When the deities are offended, they could attack one with cancer for example. May we not offend them”*

**FGD4\_Older\_MaleP7**

*“Hm! When the powers that be, takes offense in one, they can hit their victim using something as simple as smelly mouth, simple but that has the capability of preventing the person from progressing in life. May we not offend those that cannot forgive us in life”*

**FGD3\_Younger\_MaleP2**

#### 9.5.2.6. Hereditary or familial causes:

Some of the participants cited heredity as a likely cause of dental problems

*“As for me, I believe dental problems are inherited. If you look well, you will see a pattern in the family”*

**FGD6\_Younger\_MaleP9**

*“I think dental problems run in the family”*

**FGD5\_Younger\_FemaleP8**

9.6. Objective 2: care practices: hygiene practices, relief remedies, reasons for engaging in remedies and effects of use of the remedies

9.6.1. Dental self-care (hygiene) practices

From the discussants' general responses to the question on oral health practices, it was clear that most understood that the importance of brushing was towards upholding good oral hygiene practice.

*"when we wake up, it is a must to brush our teeth, some people use brush with close up (a type of toothpaste). I personally, use brush and close up. You know, there is no one who will wake up and not want to care for their mouth in the morning. Before you eat, even if it is pap (soft or semi-liquid food made from grains of corn), you must brush your teeth first. That is the way I understand it". (FGD2\_Older\_FemaleP2).*

*"A way we can care for our mouth is to brush the teeth twice daily"*  
**(FGD3\_Younger\_MaleP5)**

*"I believe for the children with bleeding gums, it is because they don't clean their teeth well, that is why it is bleeding if they wash their teeth well, it will not bleed"*  
**FGD2\_Older\_FemaleP7.**

However, tooth cleaning by brushing seemed to be the only oral hygiene practice they were aware of and many seemed to clean just once daily. Different tooth cleaning aids were used in cleaning the teeth.

*"A mixture of ground glass with wood ash is effective for cleaning the mouth, even when you grind ordinary charcoal, it is as good"* **FGD1\_Younger\_FemaleP3**

*"When we clean our mouth, first thing in the morning and do it well with whatsoever mouth cleaning tool is used in the family or compound, we are good to go"*  
**FGD3\_Younger\_MaleP7**

Facilitator: do you also repeat mouth cleaning in the night?

*"No!!, why? there will be no need for that. I know the teaching is different, but it all has no meaning. Just wastes!..."*

*"Some use "epa ljebu" (a dentrifice), they use it to wash their teeth, while other people use ash, put it on their brush and clean their teeth with it"* **FGD2\_Older\_FemaleP1**

*“Some of us use “Orin ata”. It is a chewing stick. It is spicy and if you are using it to brush, you will feel its hotness. It cleans the mouth thoroughly and prevents diseases*

**FGD2\_Older\_FemaleP1**

Facilitator: why do you use the chewing stick?

*“Like I said, it is highly medicinal and even a lot cheaper compared to your toothbrush*

**FGD2\_Older\_FemaleP1**

*“Tooth brush is for the young people and the learned, my household use it but the chewing sticks are just perfect for me* **FGD4\_Older\_MaleP10**

Facilitator: So how do you feel in your mouth and about your oral health in general?

*“I feel great! I tell you these things work!* **FGD4\_Older\_MaleP10**

*“I feel healthy”* **FGD2\_Older\_FemaleP1**

*“Of course! I feel good in my mouth”* **FGD3\_Younger\_MaleP7**

#### 9.6.2. Relief remedies

Various remedies for pain were suggested, including self-medication, other forms of self-care practices (local remedies, herbal mixtures and concoctions), chemist (patent medicine store), and visiting a dental clinic.

##### 9.6.2.1. Self-medication

The category of self-medication included an array of over-the-counter medicines, purchased by participants for the treatment of common dental problems.

*“For pain or swelling, we first use Beecham Ampiclox (an antibiotic), then if you can chew the white vitamin c on the part affected, it will dry up [the pain]*

**(FGD1\_Younger\_FemaleP1).**

*“The paracetamol method is common too, our people, use novalgin, or paracetamol. Just place any of these on the aching tooth and that will be the end of discomfort”*

**(FGD2\_Older\_FemaleP1).**

*“Codeine is also used”* **(FGD2\_Older\_FemaleP8)**

Facilitator: the codeine you mentioned ma, how is it applied?

*“Same way! (Referring to how the other medications were used), just hold it on the aching teeth and that will be the end of it” (FGD2\_Older\_FemaleP8)*

#### 9.6.2.2. Other forms of self-care practices

Other self-care practices included non-pharmaceutical remedies that work through achieving better hygiene measures at home.

*“I use hot water and salt solution, I put it on it (the tooth), then swallow paracetamol tablet, it gives relief” (FGD2\_Older\_FemaleP1)*

*“A child with bleeding gums for example, a way we can treat the bleeding is to brush the teeth twice daily and this will stop” (FGD5\_Younger\_FemaleP5)*

*“it is going to about two years now, when I have suffered toothache especially the one on this my front tooth. Although, I didn’t go to any hospital for medical treatment, someone recommend toothpaste (oral B) for me. I bought and applied it and it worked for me. Since then till now, I didn’t feel the pains again. FGD1\_Younger\_FemaleP8*

*“When my tooth issue started with me, the pain was serious. Someone advised me to get local gin and hold it at the corner of the tooth for some time and it worked”.*

**FGD1\_Younger\_FemaleP2**

*“There are some children who have gum bleed problems, I usually tell them to use warm water and salt to gargle the mouth” FGD2\_Older\_Female\_P1*

*“When you feel a pain on your tooth, you can apply the close-up toothpaste and the pain will disappear, then maxima (toothpaste) is also good, it does same thing”.*

**FGD2\_Older\_Female\_P3**

Some local remedies included non-pharmaceutical products such as use of tobacco (snuff), cow’s urine and battery fluid.

*“We sometimes use ‘didi, asa’ (tobacco-snuff) Yes! (she affirms), it is placed on the teeth where it hurts, and that’s it” FGD2\_Older\_Female\_P7*

*“Then there is cow’s urine, you can also use it, you just put it on the teeth, it works for teeth problems” FGD6\_Younger\_Male\_P2*

*“I hear some people use battery fluid for tooth ache problems. I haven’t had reason to try*

*it though, but I know it can also be used for whitlow (a painful and highly contagious boil or infection on the fingers) to dry it. But you must be careful to not use too much of it (referring to the battery fluid) in any of these cases”* **FGD1\_Younger\_Female\_P2**

The description of some local remedies was in the form of local mixtures and concoctions. Here, forms of foods and drinks are prepared by combining different ingredients, (mostly locally sourced) to be used as traditional remedy to provide relief or cure for dental related problems. These may be prescriptions or preparations by the traditional healers.

*“When I had a toothache, I used a mixture of regal gin, and “ata Ijosi” (dry pepper from Jos, Nigeria) and placed it just at the center of my aching tooth, held it there for a few minutes and the swelling burst and the pain disappeared.* **FGD3\_Younger\_Male\_P1**

*“I know of a mixture of salt and alligator pepper; it helps”* **FGD4\_Older\_Male\_P10**

*“A mixture of ‘Oral B’ (toothpaste), with a powdered tooth paste, like ‘Jim’ too helps to relieve dental pain”* **FGD5\_Younger\_Female\_P10**

*“That herbal paste, it has been mentioned before, the powdered one in small containers. Errmm! It is called teething mixture; it works very well for any form of dental problem”*

**FGD5\_Younger\_Female\_P11**

*“Another one is ‘Ogun efu’.* **FGD2\_Older\_Female\_P5**

Facilitator: what is that, what does it look like and what is it used for?

*“It is sold around by vendors. It is hot and spicy, it has items like alligator pepper, dry pepper, and some other things like that, and it also has gin, it is used for any mouth related disease, just hold the mixture in your mouth for a while, that’s all”*

**FGD2\_Older\_Female\_P8**

*“When I had dental pain, I used traditional soap (native black soap mixed with other things and usually prepared or prescribed by a traditional healer) to cure it. I didn’t go to any hospital. I only came here today because I was invited. It was then that I heard about the presence of a dental clinic around here for the first time. That is all”.*

**FGD6\_Younger\_Male\_P3**

Facilitator: Sir, can you tell us about the constituents of this traditional soap that you used?

*“Atare, ata ijosi, white alum, konafuru and the usual black soap, ehen! (he affirms) you will mix them together to wash the teeth.* **FGD6\_Younger\_Male\_P3**

He continued *“Another option is to mix ata ijosi dudu ti ko pon (unripe, dried pepper from Jos, Nigeria), with seaman (gin). Shake the mixture well and hold at the corner of your tooth. Do not swallow it oh (he warns), hold it there for some minutes then spit it out.*

**FGD6\_Younger\_Male\_P3**

*“When my brother had teeth problem a neighbour went all the way to IITA (an Institute) area to buy some plants. He mixed the plants with some other stuff and squeezed the combination to produce a liquid which he gave to my brother, he asked my brother to not swallow it o! (he stressed) that he should just hold it at the corner of the mouth where, it hurts. Then after thirty minutes when my brother spat out the liquid. I personally saw live worms crawling from what he spat out”.* **FGD6\_Younger\_Male\_P4**

#### 9.6.2.3. Chemist / patent medicine store

This category of actions taken towards relief from dental related issue was informed by prescriptions or advice from patent medicine store attendants, usually without a doctor’s prescription.

*“When my tooth pained me, I didn’t go to the hospital then o! I went to a chemist for treatment instead, and I was given a mixture of medicines. Plenty like this, I don’t know the names...”* **FGD3\_Younger\_Male\_P8**

*“One can also use Ampiclox- the Beecham type o! (she stressed) for tooth problems, you can tell those chemist people, they know how to mix the medicines together”.*

**FGD1\_Younger\_Female\_P6**

Moderator: why Beecham Ampiclox?

*“It works better and faster”* **FGD1\_Younger\_Female\_P6**

#### 9.6.2.4. Dental clinic facility

Sometimes, remedy advice was sought and obtained from a dental clinic facility.

*“If anyone had a tooth ache, we usually direct them to go to [name of location], immediately”*

**FGD1\_Younger\_Female\_P7**

Facilitator: Where is [name of location]?

*“The dental clinic place in this [name of location] community is the place called [names location], when people have dental issues, we direct them to the place. Even me that is the place I use”* **FGD1\_Younger\_Female\_P9**

*... here, you know we are close to you, so it is different, we naturally go to [name of location] for our dental problems...* **FGD2\_Older\_FemaleP11**

However, use of the dental clinic facility for dental related problems was often a last resort for many, sought only after other remedial options had failed.

*“My own issue was I use to have a slack (mobile) tooth and it used to pain me whenever I ate with it. I waited for so long for the tooth to heal on its own and even tried many things but to no avail, so I went to the dentist to remove it for me” ... Now, I can eat very well, even meat and other types of food but not bones o!* **FGD4\_Older\_MaleP11**

*“I now go to [name of location] whenever there is need for dental care, after our native methods did not yield anything. Even the one or two times my grandchildren had need for dental care; I counselled my daughter to take them to [name of location]. As a matter of fact, I followed them there (referring to dental clinic)”* **FGD3\_Older\_MaleP7**

*“... since then, whenever I had dental related issues I patronize this our dental clinic here in (names place) for treatment”.* **FGD4\_Older\_MaleP5**

### 9.6.3. Reasons for engaging in self-care remedies

The FGDs explored the reason behind the choice of different remedies from the participants. The responses varied from ease of access, to use as a first aid measure, their perception of efficacy as well as affordability.

#### 9.6.3.1. Nearness (easily accessible)

Some of the responses fitted a “quick fix from the nearest source” situation.

Facilitator: okay, why did you choose to go to a chemist first?

*“when I was feeling a terrible pain in my tooth, and I couldn’t bear the pain anymore and the chemist was nearby.* **FGD3\_Younger\_Male\_P8**



#### 9.6.3.2. Immediate relief or first aid

Many participants admitted that the various alternative sources of care and local remedies provided immediate or instant relief, although some believed this effect lasted for only a short while.

*“...when a pain becomes unbearable, the next thing is to find something, anything that can provide relief, our people believe it is in order to try out one of the things mentioned, first, in search of help, but if they don't get the help they desperately need, then, they go on to other options, it is just for immediate relief”* **FGD2\_Older\_Female\_P1**

#### 9.6.3.3. Perceived efficacy

Some discussants expressed confidence in the efficacy of the remedies.

*... yes of course there are changes, improvement even, I feel better, if not, I will not be able to stand here today. The mixture is very effective.* **FGD4\_older\_MaleP9**

*“When I used the native medicine (from the traditional healer), it worked very well for me. That is why I shared it with others who had dental problem to use and they also testified to its effectiveness. Even the traditional soap, I gave some of it out to help someone who had dental related problem and the person got a relief. So these things work, don't underestimate them o!”* **FGD6\_Younger\_Male\_P3**

#### 9.6.3.4. Affordability

For some participants, self-remedy was a cheaper option than seeking care at a dental clinic facility.

*“Since there is no money, there is nothing one can do, so we resort to taking alternatives like the ones mentioned, whose prices are a lot cheaper. So generally, it is money”* **FGD2\_Older\_Female\_P1**

*“May we not experience any health challenge o (people chorused-Amen). But generally speaking, if a child is ill, everyone says 'take care, go to the hospital' but the mother of the child knows that she can't afford the money to take the child to the hospital, someone may even offer to lend her some money, and some hospitals will not even accept the child until the deposit is fully paid. So this is why such a person will likely end up with the herb sellers and traditional healers since their charges are usually much less”.*

## FGD5\_Younger\_Female\_P1

### 9.6.4. Effects of use of self-care remedies

Some perceived the effects positively (included in earlier section), but others identified negative consequences including: doubts about efficacy, potential to worsen health condition and complications, leading to death.

#### 9.6.4.1. Not effective / of minimal effectiveness

Some discussants expressed disappointment and doubt about the effectiveness of certain self-care and traditional measures

*“Yes, I used the native treatment but there was no change because the pain didn’t go. It just provided relief for about 15 to 30 minutes”.* **FGD4\_Older\_MaleP3**

*You see those native herbs? It is deceitful when it comes to akokoro issues or anything that pertains to teeth problem. It just doesn’t work. It only provides transient relief.*

**FGD4\_Older\_MaleP4**

A participant acknowledged that he did not experience any relief from pain until he took paracetamol.

*“thank you. As the previous person said it happened (referring to dental pain) to me too and they advised me to use a native mixture of local gin with Atare. It was just like when someone is drinking ordinary alcohol. It didn’t work at all. So I decided not to use the native treatment again. Whenever I felt pain again, I used paracetamol and the pain disappears. Even when I developed a swelling afterwards, I still used paracetamol and it went down. So I have stopped, I will not use the native treatment again”.* **FGD3\_Younger\_MaleP6**

*“I once used a substance from inside a bottle. I bought it from a “Hausa” (a major tribe in Nigeria) vendor. Hausas are the ones that usually sell it, I can’t remember its name now, but I know that “asa taaba” (a tobacco product) is one of the materials used to prepare it. You also hold it (the product) in your mouth, although they say it is very powerful but it didn’t work for me”.* **FGD6\_Younger\_MaleP7**

*...It works for some people but never worked for me. I think it is my body system. That is why I go to hospital to seek medical treatment for my teeth problems.*

**FGD2\_Older\_FemaleP4**

*“Me, I have used the traditional treatment and known how it works. It is better for*

*someone to make a wise choice in seeking appropriate treatment from a dental clinic because I have personally received several disappointments from native or traditional treatment methods” FGD3\_Younger\_MaleP9*

*...I have used several native treatments which didn't work, I ended up in a dental clinic that time after everything” FGD2\_Older\_FemaleP4*

#### 9.6.4.2. Potential to worsen health condition

Fears about the likelihood of some of these remedies causing harm to some organs in the body and even worsening the oral health condition were also expressed.

*“... when they come to us for some acid (works as battery charger) fluid to use for dental treatment, I personally always advise them not to use acid water because it can endanger their life. This acid can eat up their gums and cause serious damages to internal organs when accidentally ingested. I usually advise against its use” FGD6\_Younger\_MaleP5*

#### 9.6.4.3. Death

Some discussants explained that death could result from indiscriminate use of certain remedies. Across all FGDs, there was general agreement that death could be an outcome of using battery fluid and was to be discouraged.

*“I saw it (use of battery fluid) kill someone that had eye problem. He was advised to apply battery water to it. He woke up in heaven (died). Our people believe that battery water kills disease. But it is at a high risk. So, it not advisable to use battery water.*

**FGD4\_Older\_MaleP1**

*“That was the same thing one of my sisters did and died, the husband complained about the [tooth] pain the wife was going through, then he was advised to use the battery fluid, she applied it and the thing corroded her intestines, that was how she died, that's how they teach people wrong things since then no one uses it again”. FGD6\_Younger\_FemaleP7*

*“... Yes, we are aware of it (use of battery fluid) but we don't advise people to use battery water for any form of treatment because it has killed in the past. It is not the best solution.*

**FGD2\_Older\_FemaleP3**

9.7. Objective 3: treatment-seeking experience- the barriers and enablers to accessing care

From the narration of the experiences of the participants during care seeking, certain factors were identified as barriers to accessing appropriate dental care, while others were seen as enablers.

9.7.1. Barriers to accessing dental care from care facility

Barriers to accessing dental care included; lack of money, fear of charges (unaffordable fees), lack of awareness of the presence of dental services nearby and even for those that knew that dental services were available, unwillingness to utilize the services.

9.7.1.1. Lack of money

Lack of money was identified as a major barrier to accessing dental care in care facilities. Participants complained that they didn't have money and that the amount of money required to pay for the kinds of treatments obtainable in the dental care facilities was beyond their reach.

*"It is because of money o! You know, when you don't have money, you can't do anything. Someone has said it here earlier that he could not further his treatment at hospital (the dental service run from the hospital) all because of money. So, no money is the major factor"* **FGD3\_Younger\_MaleP6**

*"For many people, it is money, they don't have money, there is no money anywhere"* **FGD5\_Younger\_FemaleP8**

*"money is the main issue; it hinders us"* **FGD4\_Older\_MaleP7**

*"...I brought someone here some time ago, he had an accident, the teeth were out of place, when I got him to dental clinic, the bill they gave us (quoted) was around #14,000 to #15,000. We tried to raise money as the boy hadn't any money on him, he simply told me, he got any money he would rather use it to feed himself. He resigned to his fate. Till now the young man is still going around with the teeth out of place like that... So there is no money!"* **FGD4\_Older\_MaleP5**

#### 9.7.1.2. Fear of perceived high treatment bills

The thoughts of receiving huge treatment bills at dental care facilities was a source of fear thus acting as a barrier to accessing appropriate dental health care.

*“Or if the treatment can be free, it will make people to go the dental clinic more, because there will be no fear associated with expected treatment bill or thoughts of how much they will be asked to pay” FGD2\_Older\_FemaleP2*

*“Yes o! their bills around here (referring to the dental clinic) are too high for some of us to bear. The thoughts of it alone is discouraging. So they should please help us and do something about it. FGD3\_Younger\_MaleP8.*

*“...money too is a serious challenge, there are times when our people will wish to seek care from the hospital but we fear for the kind of money they will request, we don't have it.” FGD2\_Older\_Female\_P1*

Even some discussants who had previously used the dental care facilities identified unaffordable costs as a barrier to re-accessing care. The participants' responses seemed to suggest that the total cost of dental treatment was usually unaffordable.

*“the cost for tooth replacement is high and that is why I have not done it, I should have done it long ago because this one (tooth) is just there, nothing is supporting it again, money is the challenge, when we got there (dental clinic), the amount was beyond my reach, if you start it (prosthetic tooth services) up here and can do something about the cost, we will very much appreciate it. FGD2\_Older\_FemaleP11*

One discussant identified multiple payment points for items such as for card, consultation, treatment, and drugs as separate payments contributing to the huge bills incurred.

*“Yes, o! you pay for many different things there. You pay for card, you pay to see doctor, you pay for treatment and you even pay for medicine. By the time you are out. Your pockets are empty” FGD1\_Younger\_FemaleP7.*

#### 9.7.1.3. Fear of the pain from tooth extraction

The recollection of unpleasant experience from a previous tooth extraction was identified as another barrier to accessing care from dental care facilities. Discussants suggested that a painful experience discourages repeat visits and possibly encourages patients to resort to alternatives during subsequent dental care needs.

*“One of the challenges is the pain that one goes through during the tooth removal. The sight of the instruments alone is very scary. You get panic attacks frequently in that place (referring to the dental clinic)” FGD4\_Older\_MaleP6*

9.7.1.4. Dissatisfaction with ‘extraction only’ service

Participants expressed dissatisfaction with the fact that tooth extraction was often the only remedy offered to address any and all complaints presented at the existing dental clinic in the community, hence the clamor or request for treatment modalities other than extraction. A discussant specifically presented the plea on behalf of others in the group for more robust, non-extractive treatment options. Although they could not name the options, they maintained that any measure to retain their teeth in their mouth was better than extraction. Furthermore, it was suggested that an alternative to tooth extraction would eliminate the fear associated with pain, thus increasing appropriate dental care seeking behaviour within the community. This view was widely held by discussants in most FGD sessions.

*“What we want the government to do for us is to ensure a way of treatment that will ease the teeth pain or that will cure it because we don’t want to remove our teeth again... the pain is too much. I have removed one of my teeth in the clinic here which I don’t want to remove it then. It is now affecting me even till now because another one didn't grow so if there is an alternative I think we will prefer it”. FGD5\_Younger\_FemaleP9.*

*“we don’t want to remove our teeth again. ...We want other solutions, something that can stop the pain but keep our teeth in our mouth and affordable too. They should please assist us in our community”. FGD4\_Older\_MaleP4*

9.7.1.5. Lack of awareness about the existence of a dental care facility in the community. Lack of awareness of the existence of a dental care facility in the community pervaded most sessions.

*“Some people don’t know there is a place (referring to the dental clinic) like that here (referring to the community) except for those of us who live close by. For example, recently my sister came to me and said she was in pain from toothache and said she didn’t know where to go. I had to personally take her to the dental clinic for them to remove the tooth. So some people are not aware of dental clinic presence in this community.*

**FGD5\_Younger\_FemaleP6**

*“En.. before, we were not aware of its (referring to dental clinic) presence here. But now we know, we will patronize it” FGD6\_Younger\_MaleP2*

A few others however, pointed out that it may be new residents in the community who are unaware of the presence of a clinic.

*“I don’t agree, there is no one that can confidently say that he or she is not aware of dental clinic services in our community except the person who just moved into the neighbourhood. Well, it all boils down to the same thing. Please help us out with this periodic awareness programme” FGD2\_Older\_FemaleP9*

9.7.1.6. Misinformation about the services offered in existing government clinic

Some discussants suggested that unawareness and some degree of misinformation about the function and types of services available at the existing government clinics, constituted a major barrier to seeking dental care by many.

*Me I know there is a dental clinic, but I always thought the place was built for the benefit of our fathers and mothers. Whenever I or my family needed dental care, I usually go to either ... or .... (named teaching hospitals or state hospital). To me, it didn’t appear they could offer much (referring to varied services). So I just never bothered visiting the place.*

**FGD 5\_Younger\_MaleP9**

*“I believe this place (pointing at dental clinic) was built for the benefit of our fathers. As for me if I want to receive any treatment I will go to (the teaching hospital) simply because I am not aware that some treatments are available in the place”.*

**FGD3\_Younger\_MaleP2**

9.7.2. Enablers to accessing dental care from care facility

Some factors were identified as enablers to the use of services at existing health care facilities. These included nearness (proximity) to their homes, friendly staff, and prompt service delivery.

9.7.2.1. Nearness (proximity)

Closeness of the facility to the people was identified as an important enabler to accessing dental care. The fact that a government dental care facility was present in the community was given as a notable illustration. However, participants decried the limited scope of care being offered, judging by the frequent referrals from these facilities to higher levels.

*“What I like about this place (dental centre) is its closeness. But whenever we are referred from here to the...or ... (mentioned names of teaching hospitals and secondary health care facilities), hmmm! These places are far o! The teaching hospital in particular is far, and very stressful, this place is better, please!”* **FGD3\_Younger\_MaleP2.**

9.7.2.2. Friendly staff

A warm welcome and friendly disposition by clinic staff towards clients was also identified as an enabler for subsequent visits.

*“During my own visit, not only were my teeth well treated, they also lectured me on the ways to manage my oral health immediately after treatment and after healing”.*

**FGD3\_Younger\_MaleP7**

*“My own experience was okay o! I didn’t have any further problem after the treatment... I brought one of my children to complain about his teeth. The doctor took us inside, removed the tooth and gave us some medicines to use. He also told us about using warm salt water solution. Since the treatment, there has never been any dental problem again with my child”* **FGD5\_Younger\_FemaleP9.**

9.7.2.3. Prompt service

Prompt response and timely service delivery from care providers were also considered enablers of utilization of dental care services.

*“My own experience is that, when I got here I made my complaint about my teeth and they responded to it without delaying me and told me what I should do”.*

**FGD4\_Older\_MaleP5.**

*“They don’t delay at all! Immediately I got there then, I presented my complaint. They patiently explained my options to me and they asked me to make a choice of the*



*treatment. I chose to remove the tooth. Although I met a lot people at the clinic on that day, we were all attended to quite promptly..." FGD1\_Younger\_FemaleP9.*

9.8. Objective 4: perceived needs and suggested measures and recommendations for improving timely access to dental health care

The discussants shared their perspectives of oral health care needs within the community. They suggested measures that may enhance access to dental care. These included the need for a range of treatment options, provision of free or subsidized medications, need for increased visibility and oral health education programmes, among others.

9.8.1. Wider range of treatment options

The need for a better equipped dental care facility, with dentists from different sub-specialties, for a wider range of services, spanning prosthetic tooth replacement to a more robust service delivery system within the community, was expressed.

*"We need more health care centers especially dental centers and doctors that are experts in different parts of the body (dental sub-specialties) and that will also prevent us from removing our teeth as well as the treatment that will cure dental pain forever in our community". FGD4\_Older\_MaleP4*

*"We need dentists in this community. We know they are in 'orita mefa' (teaching hospital) and that place is too far for many of us to access. So we want more of them with different capabilities (sub-specialties) in our community" FGD5\_Younger\_FemaleP4*

Do you have any particular subspecialty in mind?

*"We want plastic teeth made in our clinics here if we can have it here it is good, but you know, it is easier from here than we go for it in... (named teaching hospital)" FGD4\_Older\_MaleP1*

*"As the matter of teeth replacement, what I mean is plastic teeth, they should be able to do that there (referring to the dental clinic- olokun) also, so that we don't think of going far for it" FGD2\_Older\_FemaleP1*

9.8.2. Reduced cost or free care

Participants explained that community members would make better use of the clinic if the cost of care was reduced.

*“if the amount they charge can be reduced, you will see more people use the dental clinic, it is the money that has made people stay back... if with just a little amount of money, you will get the care you need, people will come, and may we not be sick”*  
**FGD1\_Younger\_FemaleP9.**

*“...We are not saying don't collect money, just that it shouldn't be too much... and then they should not collect money before treatment, treat first before you ask for money”*  
**FGD2\_Older\_FemaleP2**

*“They should not bill so high, there is no way the money will not be there”.*  
**FGD1\_Younger\_FemaleP6**

A few others wanted dental treatments to be provided to them at no cost at all.

*“I think the cost of treatments should actually be made free”* **FGD2\_Older\_FemaleP11**

9.8.3. Readily available medicines and drugs at discounted rates

The discussants also expressed the desire to have readily available, affordable or discounted medications and prescription drugs within the clinics.

*“I want the government to provide enough drugs that we can use to treat our teeth. Make it available in all the hospitals especially in this our local clinic here in our community”.*  
**FGD5\_Younger\_FemaleP4**

*“We need drugs at discounted rates and lecture on this (dental health care) at least once in every three or six months”.* **FGD2\_Older\_FemaleP11**

*“I have nothing except those that are in charge should ensure that there are enough clinics with sophisticated equipment and drugs at affordable prices, once we get to the hospital for treatment there will not be any delay, we want to receive an instant treatment to ease our stress”.* **FGD4\_Older\_MaleP3**

9.8.4. Need for increased visibility

Participants recommended visible signage to increase awareness about the existence of the government dental health facility be made.

*“Me, I don’t think there is a signboard to inform or direct people to the dental clinic in the neighbourhood. If there is then it must be small and hidden. I suggest that a very big one be done, and placed in a strategic place to notify people of the availability of dental health services and activities here and possibly other small ones (signboards) to give direction. I believe this will improve awareness”* **FGD6\_Younger\_Male**

*“Some people don’t know there is a place (dental facility) like this here, except for those of us who live close by....”* **FGD1\_Younger\_FemaleP2.**

9.8.5. Oral health education talks

Participants were unanimously in favour of increased oral health literacy.

*“We need awareness and educative lectures on oral health issues”.*

**FGD5\_Older\_FemaleP9**

*“Like ma, this type of discussion on the oral health issues of our people, we are having was because you invited us. En! (Affirmative), that is what we want, from time to time”.*

**FGD2\_Older\_MaleP4**

Most of the participants admitted to having limited knowledge on oral health matters.

*“some of us have not received any lecture on this before and we are interested”.*

**FGD6\_Younger\_MaleP9**

*“the only thing is that I was not aware of what you said that we should come for our checkup at least once, in six months, we were not informed of this before”.*

**FGD3\_Younger\_MaleP8**

9.8.6. Community outreach programmes

Many participants requested more engagement with the dental health care team through their various sub-population groups and associations as well as through home visits. This in their

opinion, should improve community awareness of oral health matters.

*“There was a time that the people (dental personnel) used to do community outreach, they go around from house to house to raise awareness, but it was over a long time ago”*

**FGD2\_Older\_FemaleP1**

*“that is what I want to say too, that you should go out into the community, just the way you have come here,... to talk about oral health, and we honoured your invitation, if they can do that, more people will attend dental services, because some people may not know that this kind of thing is available”* **FGD2\_Older\_FemaleP3**

*“...So, my suggestion is that they should create awareness from house to house or street by street, informing people about this place and the kind of treatments they offer...”* **FGD3\_Younger\_MaleP2**

#### 9.8.7. Periodic mouth screening exercises at the community level

Discussants also suggested periodic dental health screening to identify those in need of care and to avoid late diagnosis/presentation

*“What I want to say is that you know our teeth are very important to us so if the federal government can organize a program that will go around to do teeth checkup for us once in three months”*. **FGD4\_Older\_MaleP3**

Interviewer: Do you want them to come to your house for the check-up or you won't mind going to visit the nearest clinic for the check-up or what?

*“We will come to the hospital once we are notified or awareness is raised....”*

**FGD4\_Older\_MaleP3**

*“We are supposed to have had this kind of meeting long before now”*

**FGD4\_Older\_MaleP7**

A discussant said he was not aware of the need for a biannual check-up at the clinic, adding that community members would be willing to embrace preventative services

*“Oh, I see, we are supposed to come for our checkup once in six months, ehen! I didn't know o!”* **FGD4\_Older\_MaleP6**

## 9.9. Summary of FGD Findings

This study was an exploratory qualitative study using face-to-face focus group discussions with representatives of households in a defined slum area of Ibadan, Oyo State, Nigeria. Participants were experienced in taking decisions regarding the health care of their household members and were adult male and female community residents aged between 25-44 years and 45 to 64 years. The study aimed at examining the slum dwellers' perceptions, practices, and experiences of their oral health care, and care-seeking. All participants displayed enthusiasm. More vivid description of personal and family experiences about oral health were observed in the female sessions. The older men and women's views seemed to favour more traditional oral health practices compared to the younger ones.

On common dental ailments, perceived causes and relief remedies: In all the sessions, people were affected by a range of common dental diseases such as dental pain, tooth sensitivity, bleeding gums, tooth decay, mouth odour, gum disease and tooth fracture. Poor dental hygiene and habits, frequent consumption of sugary diets, ignorance, and supernatural forces, were identified as possible causes of dental problem. Most of the participants practiced various forms of self-remedies to achieve relief from dental illness. This included self-medication using over-the-counter medicines purchased from chemist shops, other forms of non-pharmaceutical practices such as warm-salt-water solution and application of toothpaste, local remedies such as use of gin, tobacco, battery fluid or cow urine/dung on the ailing tooth, native remedies such as various mixtures and concoctions. Reasons given for self-treatment included: ease of access to the remedies, as first aid measures, perceived efficacy as well as affordability. However, some participants expressed reservations about the efficacy and potential hazards and complications ending in death. Only a few considered the option of visiting a dental clinic for their dental health challenges, and this was often only as a last resort. Mouth cleaning was mostly once daily using toothbrush and paste. Other cleaning tools were ground glass, wood ash, charcoal, "epa ljebu" (a dentrifice), and "orin ata" (chewing stick).

On their treatment-seeking experience, the barriers to accessing care from dental care facilities included lack of money, unaffordability of service charges, distance and lack of awareness about available dental care facilities/ nearby services, and fear of extreme treatment measures (extraction). Among the few users of dental health care facilities, nearness (proximity) of the existing care facility, friendly staff, and prompt service delivery were identified as enabling factors.

Regarding participants' perceived needs, and recommendations for improving timely access to dental health care, the following measures were suggested: need to widen the range of treatment options and services available in the clinics, provision of free or subsidized medications, need for increased visibility for existing/ available dental care facilities and oral health education programmes, among others.

#### 9.10. Research trustworthiness and rigour

Trustworthiness describes the extent to which qualitative research findings are an honest or authentic reflection of the personal experiences of the phenomenon under investigation (Barbour, 1998; Curtin & Fossey, 2007). According to Rossman and Rallis, *"trustworthiness comprises competent practice and ethical considerations for the participants with an underlying demand that the relational matters involved in any research before-grounded and privileged"* (Rossman & Rallis, 2003; Rossman & Rallis, 2010).

An active reflexive process was utilised in order to increase the trustworthiness of my research findings. I was constantly monitoring the effects of my professional background as a dentist by assessing and reassessing my contributions in the FGDs, bracketing my biases and attitudes, as well as ensuring FGD discussions were central to the research process itself in order to gain a deeper insight into the investigation and ensure that the focus remains on the research and the participants (Parker & Tritter, 2006; Patnaik, 2013). For example, within two of the six discussion groups there were one and two extremely vocal persons who appeared to be dominating voices during the discussion sessions. I had to respectfully inform these people that their inputs were highly appreciated, however, that we would also like to hear from the others (Parker & Tritter, 2006; Smithson, 2000). This step had to be taken so the rest of the participants were not excluded in the discussion and at the same time free expression and further contribution to topics by these extremely vocal participants were not discouraged in line with standard practice (Smithson, 2000). As a result, a feeling of consensus was developed within each group which demonstrated positive group dynamics. As each guiding question was presented before the group, and a discussion initiated, the ensuing interaction generated a consensus of opinion, which was then confirmed and documented and obtained in a standard practice (Parker & Tritter, 2006; Sim, 1998).

The coding and analyses in the study were personally undertaken by the researcher (me) while all activities were checked by my academic supervisors through regular supervisory contacts. The codes and themes generated from the study were discussed until consensus was

achieved, to establish credibility and avoid bias in the interpretation of the data. The data analysis was carried out by two researchers (the researcher and a qualitative data expert) independently and the results were compared.

Furthermore, the possibility for FGD participants to validate the study findings (member checking) was made known to them, as a measure to enhance trustworthiness. Participants were encouraged to contact the investigator on the address provided in the Participant Information Leaflet (PIL), at any time, particularly, if they were not satisfied about something or wished to complain about anything that happened during the discussion. To date no complaint was received from any of the participants.

#### 9.11. Reflexivity

According to Parahoo, reflexivity may be defined as a continuous process of reflection by the researcher on his or her own values, preconceptions, behaviour or presence and those of the participants, which can affect the interpretation of responses (Parahoo, 2014). This process of introspection (reflections) is thorough and carefully done in order to minimize or prevent such influence on the research process. Reflexivity is a crucial strategy in the process of generating information from qualitative research as it enables a critical reflection on the kind of knowledge created and how that knowledge is produced (Ahmed et al., 2011; Guillemin & Gillam, 2004). In line with standard procedures, I sought to acknowledge my roles as a participant and insider in my study research process and not merely as an outsider whose interest was just to observe a phenomenon of interest among a group of people (Finlay & Gough, 2008). When this research commenced, my meeting with the invited participants in each of the six sessions was greeted with so much excitement as they seemed delighted at the sight of a dentist, i.e. me. Being a dentist myself, I am aware that my professional background, healthcare training, values, opinions and experiences have shaped the whole research cycle – from the study conception, through creation of data gathering tools, data collection, analysis and reporting of the data (Patnaik, 2013). This has allowed me to apply a particular set of insights which facilitated the focus group discussions and the interpretation of participants' responses (Krueger, 2014).

My professional work as a community dentist involves dental research and service provision to underserved populations and slum communities. This experience motivated me to explore possibilities of improving the oral health outcomes of slum dwellers. My interests were not only research oriented, but also aimed at building capacity, in knowledge and skills for my country.

Therefore, I studied my participants as individuals connected to me in one way or the other in anticipation of impacting them in a meaningful way. In several instances, my professional training facilitated participants acceptance of the call to participate in the focus group interaction. Some even seized the opportunity to open conversation on their personal dental health issue as well as for their household members and some referrals were made. All the foregoing were scrutinized in my interaction with the participants in my study (Patnaik, 2013). More generally, being a dentist, I was sometimes horrified to listen to accounts of home care remedies such as battery acid and cow urine that I know to be potentially harmful to the dental health as well as the general health and well-being but had to maintain my composure so as not to discourage the flow of information during the discussion or appear judgmental.

#### 9.12. Study bias

The researcher in qualitative research is part of the research and therefore a potential source of bias, hence all research decisions were made with this in mind. For example: participants may overtly want to please me (one of their dentists) by taking part in the qualitative research processes. This could potentially be problematic as they may seek to participate only in a positive way. Hence the engagement of the services of a skilled, experienced, group facilitator or moderator, who was also fluent in the local language (Yoruba). Being a male, his presence also made those participating in the male groups in particular feel more comfortable. As he was not a dentist, this helped to offset the potential bias introduced by my professional background and experience. The group sessions were moderated, keeping the discussions focused and without interference. We ensured that each participant had ample opportunity to contribute, allowed differences of opinions to be voiced fairly, prevented domination of discussions by one member (by laying emphasis from the outset, the importance of hearing a range of views), and encouraged reticent participants to speak (Bloor, 2001).

Additionally, a potential source of bias was noted from the Baales (heads) being the nominator of eligible study participants from each household in their respective compounds. The limitation of such selection method include vulnerability to potential bias in judgment. Thus, there was reliance on the Baales' sense of judgment, alone, about who they considered to possess the desirable attributes for inclusion into the study as I had no control over whom the Baale (compound head) nominated from all eligible persons in his compound to participate in the study, as the researcher. Although this was not much of a concern considering that no



particular motive was noted during discussions with the Baales after the selections were made. Moreover, the random selection method which was deployed for the selection of the compounds themselves, sought to ensure representativeness and adequate distribution of the samples. The purposive sampling method, when properly done, has the merits of yielding richness (information power) in focus group discussions (FGDs).

## **Chapter 10: Integration of studies' findings, interpretation and Implications**

### 3.3. Overview of chapter

This chapter discusses the integration of the quantitative and the qualitative studies under a mixed-methods framework as well as the interpretation and the implications of findings.

### 10.2. Data integration

The purpose of this thesis was to determine the prevalence of oral diseases, associated factors, and health care needs among urban residents in Nigeria and to explore the perceptions, practices, and experiences of slum dwellers about their oral health and care-seeking pattern. This was achieved by collecting quantitative and qualitative data simultaneously in a parallel convergent mixed-methods design (Fetters *et al.*, 2013). As explained in chapter 3, the use of a mixed-methods design for this research provided deeper understanding of the burden of oral diseases and oral health needs of the slum residents.

The quantitative data were integrated with the qualitative data using the joint display approach (Fetters *et al.*, 2013). This allowed the quantitative and the qualitative data to be brought together through a visual means to draw out new insights beyond the information gained from the separate quantitative and qualitative results (Fetters *et al.*, 2013). Data integration revealed largely congruent and complementary findings between the quantitative and the qualitative studies.

### 10.3. Main study domains

The domains considered and which answered the research questions and the objectives of the thesis include prevalence of oral health conditions, associated factors or determinants of dental diseases, oral health care practices, utilization of dental services, and oral health care needs.

In this chapter, I have summarized the main findings from the quantitative and qualitative studies for each of these domains, starting with the quantitative and then the qualitative studies. I then compared or integrated the findings from both data sources such that the fitness of the findings was described in three possible scenarios: confirmation, expansion, and discordance

(Fetters *et al.*, 2013). Thereafter, I discussed the findings in each domain, comparing them with existing literature, then, the implications of the findings were highlighted. The reporting style is in line with that utilized by Classen (Classen *et al.*, 2007).

### 10.3.1. Prevalence of oral health conditions

A summary of the common oral health conditions identified from both the quantitative and the qualitative data from the slum as well as their comparison are as shown in Table 10.1. In the table, detailed descriptions were provided on some of the dental ailments as well as the severity of their discomforts. The detailed descriptions provided opportunity for further exploration into perceived causes of oral diseases and care remedies (discussed in subsequent sections). Further exploration was with a view to strengthening the plan for appropriate community-based, health promotion interventions for the slum residents.

Table 10.1: Common oral health conditions

Quant	Qual	Integration of quant and qual data from the slum	Slum VS non-slum data compared
<b>Common oral diseases</b> <b>Normative finding</b>	<b>Experiences</b>		
Gum/ gingival bleeding (75%)	Gum bleed and or discharge from the gums	Complementarity in findings  Normative findings (quant) are consistent with participants' responses in the FGDs.	Slum > Non slum  Differences were modest
Dental trauma (32%)	Fractured/ broken teeth		
Dental caries (27%)	Holes in the teeth Pain from the tooth	Description of pain, and visible holes on the teeth featured prominently in most discussion sessions, further confirming the prevalence of caries among the slum residents.  Varying degrees of periodontal disease (gum discharge, bleeding gum, mobile teeth) were most frequently mentioned in all discussions thus confirming its high prevalence	Following adjustment for age and sex, caries difference between the two locations became even smaller (P>0.05).  Periodontal pocket difference remained large (P<0.05)
Periodontal pocket (23%)	Mobile tooth		
Mean DMFT (1.1)	Discoloured teeth		
Complete absence of oral diseases was detected in only about 3% of slum residents			

Data presented in the first column focus on the slum site, whereas data comparing slum versus non-slum are summarized in the last column. Quant – Quantitative; Qual- Qualitative

*Discussion:* The oral health challenges and their corresponding high prevalence found among slum dwellers in this study are comparable to reports from available literature worldwide (Kassebaum *et al.*, 2015; Kaste *et al.*, 1996; Watt & Petersen, 2012). The fact that these diseases are mostly chronic, often silent, and slowly progressive in nature (Akpata, 2004; Peres *et al.*, 2019; Petersen, 2004; Varenne, 2012; WHO., 2020), often render them prone to neglect by affected persons (Okunseri *et al.*, 2004; Varenne *et al.*, 2006). Slum dwellers recorded higher prevalence rates relative to their non-slum residents' counterparts, although the difference was modest. The observed pattern of distribution would seem to mimic the general distribution pattern of non-communicable diseases and risk factors associated with ill-health such as diabetes mellitus, smoking, obesity, that were reported as preponderant in disadvantaged communities in previous studies (Kyobutungi *et al.*, 2008; Marlow *et al.*, 2015; Mberu *et al.*, 2016).

According to the Global Burden of Disease study in 2010 (Marcenes *et al.*, 2013), the global overall prevalence of dental caries for all ages combined stands at approximately 35%. With about 27% caries prevalence among adult slum dwellers from this study, the value falls within the lower range. This lower prevalence value, may be explained in part by the fact that my study considered only coronal caries in the general adult population; root caries which are commonly found among the elderly population were not considered. Other likely determinants of the lower prevalence rates may include; lower consumption of sugar (Ismail *et al.*, 1997), as well as indigenous caries prevention measures practiced within disadvantaged communities (Olusile *et al.*, 2014). Such preventive self-care practices, such as use of "Orin ata" (a type of chewing-stick), "epa ljebu" (a local dentrifice), ground charcoal or wood ash were revealed in the qualitative study of this research as part of the preventive self-care practices (discussed in detail in the oral health practices section). The difference in the prevalence of caries observed between the slum and the non-slum locations was not significant, even after adjusting for age and gender. However, when the estimated prevalence of dental caries from my study (27% and 23% in the slum and non-slum urban settings respectively) were compared with a similar study in India (Patel *et al.*, 2017), which reported 61% and 47% in respective settings, the difference was marked. This may be because the Indian study population cuts across children and adult age categories, while data from my study was from an adult population only. Caries is the most common oral disease found among children while among the adult population, it is periodontal disease (Petersen, 2013). In addition, whereas in my study a random selection of participants was deployed, a purposive selection method known to increase selection bias (Etikan *et al.*, 2016) was adopted for the Indian study.

About three-quarters of the slum population in this study had periodontal disease. This comprised gingival bleeding of 75%; periodontal pocket formation (4 mm and above) of 23% and an attachment loss (>4 mm) of 14%. Previous studies in different settings that included slums have utilized various criteria in the assessment of periodontal disease prevalence: Community Periodontal Index of Treatment Needs (CPITN), Clinical Attachment Level (CAL), and/or probing depth (PD). Although the reported prevalence rates varied, these were similarly high (Hannan *et al.*, 2014; Jaafar *et al.*, 2014; Nazir *et al.*, 2020; Patel *et al.*, 2017). By findings that periodontal disease affected close to three-quarters of the slum dwellers and about half of the non-slum residents, my study has further added to the evidence that a heavy burden of periodontal disease is borne by populations in LMICs particularly those residing in slums. My study findings were again dissimilar to those reported in the aforementioned study in India: Patel *et al.*, 2019 found that the prevalence for the various stages of periodontal disease was much lower, and the residents of the slum setting were faring better than their non-slum resident counterparts on gingivitis, while having equal prevalence for gingival bleeding (Patel *et al.*, 2017). The reason for the very low prevalence in that study may be their purposively selected (Etikan *et al.*, 2016) and relatively small (300) population and that their sample were drawn from across the ages (children and adults). The difference in the prevalence of periodontal pocket observed between the slum and the non-slum locations in my study was statistically significant, and remained so, even after adjustment for age and sex. This may be due to the proportionately poorer oral hygiene measures, poorer socioeconomic status and less education as well as higher age distribution observed among the slum dwellers in my study (Gundala & Chava, 2010; SALVI *et al.*, 1997). Overall, data in the literature on population oral health surveys among adult residents of LMICs as well as that from qualitative experiences is sparse, and more data/studies are needed to make more concrete comparison.

*Implication-* Using a mixed-methods study design, the high prevalence of common oral diseases namely periodontal disease, dental caries as well as dental trauma in slum environments has been established. Quantitative findings suggest differences between slum and non-slum dwellers with the former having worse oral health outcomes. The observed burden in oral diseases in my study suggests that participants may benefit from preventive dental health programmes, developed and implemented through oral health policies that take into account differences in geographic locations and socioeconomic circumstances in populations (Kamberi *et al.*, 2016). The programmes could focus on preventive oral health education, related to dietary and oral hygiene practices, and improved access to toothbrushes

and fluoridated pastes in order to promote appropriate oral health behaviour. Similarly, the prevalence and pattern of oral diseases observed in my study settings necessitates a shift in the way the dental profession and government respond in terms of dental work force constitution. As there is inadequate dental workforce to tackle the oral health needs of the population (Medical and Dental Council of Nigeria, 2017), other primary health care workers can be trained and utilized. Their expanded roles may assist in providing basic oral health care needs among underserved and deprived communities through existing primary health care (PHC) facilities (Beiruti & Palenstein Helderman, 2004; Braimoh & Umanah, 2014). Such workers can be trained on the use of the Basic Package of Oral Care (BPOC), a simple dental care package designed by WHO using the principles of PHC to provide dental needs (emergency, preventive and curative dental care) for populations within the confines of minimum resources (Reddy *et al.*, 2017; Watt *et al.*, 2019) to augment dentists impact and coverage of the underserved communities.

#### 10.3.2. Associated factors or determinants of dental diseases

A summary of the associated factors of dental diseases identified both quantitatively and qualitatively as well as integration of the findings is shown in Table 10.2. In both sites, the use of alcohol, and tobacco, frequent consumption of cariogenic diet, and the act of tooth brushing at least twice daily were generally low, in both sites. However, other than for alcohol use, the direction of these influences on oral disease, was not as expected in the quantitative analysis. For example, there was little evidence that tooth cleaning frequency mediated the relationship between place of residence and dental caries or periodontal pocket. Perhaps the quality of brushing rather than the frequency of brushing could be a potential explanation.

*Discussion:* As illustrated in Table 10.2, the slum environment may have influenced the poor oral health outcomes observed in the slum setting. The influence of a disadvantaged residential environment or setting on the general/systemic health condition of residents has been reported (Kyobutungi *et al.*, 2008; Marlow *et al.*, 2015; Mberu *et al.*, 2016). Hence the higher oral disease prevalence found in the slum study site is not a surprise. A similar finding was also reported from the available literature (Patel *et al.*, 2017) that compared oral diseases between slum and non-slum environments. The higher oral disease burden found in slum in my study lends support to studies that reported a high level of dental diseases and poor oral health status

among people living in socioeconomically deprived conditions (Adeniyi *et al.*, 2012; Petersen *et al.*, 2005; Squassi *et al.*, 2008).

Table 10.2: Associated factors of oral diseases

Quant	Qual	Integration of quant and qual data from the slum	Slum and non-slum data compared
<b>Associated factors</b>	<b>Perceived causes for the dental problems</b>		
Dental caries was found. This was: <ul style="list-style-type: none"> <li>- More common among the female gender.</li> <li>- Less prevalent among those with improved educational status, use of tobacco, alcohol and cariogenic foods consumption.</li> <li>- Not clearly associated with socioeconomic status by wealth index.</li> </ul>	Poor dental hygiene habit (improper/ lack of mouth cleaning).  Excessive intake of sugary foods.  Poor habits such as using the teeth as bottle openers.	Confirmation within the two data sets regarding: <ul style="list-style-type: none"> <li>- alcohol use</li> </ul> Discordance within the two data sets: <ul style="list-style-type: none"> <li>- frequent intake of cariogenic foods.</li> <li>- poor dental hygiene habit</li> </ul> From qualitative insights, participants' perception of low level of dental health literacy and poor dental habits to dental diseases further complements the quantitative findings.	Access to clean/ safe drinking water source and the use of fluoridated toothpaste is similar but worse in slum  The odds of having periodontal pocket and caries increased by half and 21% respectively, among the people who lived in slums compared to non-slum residents, after adjusting for age and sex.
Periodontal diseases in general were: <ul style="list-style-type: none"> <li>- associated with the male gender,</li> <li>- increased with higher socio-economic status,</li> <li>- reduced with better education, and</li> <li>- less frequent with cariogenic foods consumption.</li> </ul>	Dental health illiteracy especially of mothers or guardians (ignoring dental hygiene in the children at early ages).		
Both pocket formation and attachment loss increased with increasing age.			
Odds of having periodontal pockets increased by 28% for people who cleaned their teeth at least twice daily compared to less and doubled for people who engaged in excessive intake of alcohol compared to no intake at all. Cleaning teeth $\geq 2/day$ had about 30% higher chance of having caries and periodontal pocket.	Supernatural forces (when one offends the deity).		

Data presented in the first column focus on the slum site, whereas data comparing slum versus non-slum are summarized in the last column. Quant – Quantitative; Qual- Qualitative

Anecdotal evidence from my clinical practice similarly supports available literature. Possible explanations may include limited access to oral health facilities, lower income level compared to amongst non-slum residents, which may result in unaffordability of recommended cleaning materials such as the right toothbrush, frequency of change of toothbrush, fluoridated toothpaste and access to clean water (Adegbembo, 1994; Adeniyi *et al.*, 2012; Osibogun, 2004). Moreover, my qualitative study revealed high prevalence of alternative measures to tooth cleaning (other than toothbrush and toothpaste), and elaborated on the practice of self-care remedies for dental ailments among the slum residents.

Consistent with other studies, most oral diseases in this study were associated with increasing age and less education (Hannan *et al.*, 2014; Sun *et al.*, 2018). Studies have long established the influence of age on not just oral diseases, but on general health and well-being (Åstrøm *et al.*, 2006; Kirkwood & Austad, 2000). Using the WHO index age and age group categorization for surveillance of oral health conditions, the mean measure of caries experience (DMFT), increased with increasing age. The higher prevalence of active caries which was found among the adult age group compared to the elderly age-group was anticipated since many carious lesions in the elderly age group are usually arrested (areas of decay that have stopped progressing and are inactive) (Fure, 2003). The Missing teeth (MT) component which increases with increasing age (Jaafar *et al.*, 2014; Namal *et al.*, 2008) and as observed in my study to be higher among the elderly age-group, may have contributed to most of the DMFT index in the group, thus, explaining the higher DMFT values among the elderly group than among the adult group

The differential influence of gender on dental diseases has been well reported in literature (Antunes *et al.*, 2003; Ferraro & Vieira, 2010; Lukacs, 2011a; Lukacs & Largaespada, 2006; Martinez-Mier & Zandona, 2013). The higher proportion of dental caries found among females in my study was consistent with a finding from a country-wide population based oral health study conducted in Malawi (Msyamboza *et al.*, 2016). Other studies also confirmed a higher female risk for caries (Antunes *et al.*, 2003; Martinez-Mier & Zandona, 2013). Possible reasons for this may include their earlier eruption of permanent teeth, different salivary composition and flow rate, hormonal fluctuations, dietary habits, genetic variations, and particular social roles among their family as well as systemic diseases that are associated with caries and found to have an association with the female gender (Antunes *et al.*, 2003; Ferraro & Vieira, 2010; Lukacs, 2011a; Lukacs & Largaespada, 2006; Martinez-Mier & Zandona, 2013). Periodontal disease, unlike caries, is largely reversible and women's knowledge, attitudes and behaviours towards oral health (Al-Ansari & Honkala, 2007; Genco, 1996) may have contributed to why, in my study, they fared better than their male counterparts in periodontal disease prevalence. This finding is similar to other studies which reported higher prevalence of periodontal pockets and attachment loss among males (Hessari *et al.*, 2007; Sun *et al.*, 2018), thus confirming existing reports on the relationship (Alam *et al.*, 2012; Genco, 1996)

Access to clean drinking water in terms of fluoride content, plays a significant role in caries prevention (Akpata *et al.*, 2009; Petersen *et al.*, 2005; World Health Organization, 2008). The main source of fluoride is water, while other sources include food, industrial exposure, drugs,



and cosmetics (Hardwick *et al.*, 2000). For the prevention of caries, the WHO, specified a fluoride concentration level of 0.5 mg/L (equivalent to 0.5 parts per million [ppm]) in drinking water and a tolerance limit of 1.5 mg/L (Petersen *et al.*, 2005; World Health Organization, 2008). In Nigeria's tropical environment, a fluoride level of 0.3 – 0.6 ppm in drinking water was recommended depending on fluoride ingestion from other sources (Akpata *et al.*, 2009). Although my study did not assess the fluoride concentration in participants' drinking water, available studies revealed that the majority of drinking water sources in Nigeria contained 0.3 mg/L or less of fluoride (Akpata *et al.*, 2009; Ibiyemi & Ibiyemi, 2021). Access to clean drinking water is generally a challenge for a large proportion of the Nigerian population and particularly worse in slum environments (Akpabio *et al.*, 2021; Aliu *et al.*, 2021). The non-recognition of slums in official discourses often limit their consideration in the planning of essential public services such as water (Akpabio *et al.*, 2021). The aforementioned may explain why the commonest source of drinking water in both the slum and non-slum areas in our study is packaged water (sachet/ bottle water) followed by borehole. Available reports have confirmed these water sources as clean drinking water sources with adequate fluoride concentration (Akpata *et al.*, 2009; Ani *et al.*, 2020). The use of fluoridated toothpaste in conjunction with good oral hygiene is recommended for the prevention of caries (Toumba *et al.*, 2019). The majority of my study participants reported use of fluoridated toothpaste in cleaning their mouth and most of the commercially available toothpastes in Nigeria have the recommended standard of fluoride concentration of 1000 – 1500 ppm (Cury & Tenuta, 2014; Ibiyemi & Ibiyemi, 2021; Wright, 2010). The fluoride range is considered both beneficial against caries and safe against dental fluorosis for any age if toothpaste was the individual's sole source of fluoride. Therefore, a combination of access to clean/ safe drinking water source and the use of fluoridated toothpaste by the majority of participants in my study probably make up for the low fluoride content available in the regions' ground water. Therefore, there may be justification to shift focus to other causes of caries such as dietary (Oke, 2007), cleaning habits and other risk factors (Okeigbemen & Ibiyemi, 2020).

Other dental disease risk factors include cariogenic diet consumption, alcohol use, tobacco use, and frequency of tooth cleaning. Although the use of alcohol and tobacco were found to be generally low in my quantitative analysis, the use of alcohol, in particular and sometimes snuff (tobacco) were mentioned in many mixtures and native concoctions used in the relief or prevention of dental pain from the qualitative data. In WHO report on their second international collaborative study, that compared oral health care systems, many of low-income and minority groups believed that alcohol and tobacco (snuff) were potent in preventing or relieving dental

problems and as such used them for these purposes (Cohen *et al.*, 2007). This belief may have encouraged the risk behavior in users. Even with the reported low consumption of alcohol among participants in this study, the expected positive link between alcohol use and severity of periodontal disease (pocket formation and attachment loss) (Shepherd, 2011; Tezal *et al.*, 2004) was demonstrated. However, there was an unexpected finding regarding the influence of cariogenic diet consumption, tobacco use and minimum of twice daily tooth cleaning as these were found to be protective of dental caries and pocket formation, even though their influence on dental diseases is well established (Petersen *et al.*, 2005).

Previous studies have linked the pattern of sugar consumption (Lula *et al.*, 2014; Moreira *et al.*, 2021; Sidi & Ashley, 1984) and tooth brushing (Frandsen, 1986; Kumar *et al.*, 2016) with periodontal disease. The protective effect observed in this study may partly reflect the relatively small observed differences in tooth cleaning practice, cariogenic diet consumption, and dental caries between slum and non-slum populations. The unexpected finding may be due to the effect of unknown confounders which require further investigation. A minimum of twice-daily cleaning habits may have been adapted by those who felt vulnerable to dental problems, and thus were inclined to taking protective action against dental diseases. The unexpected finding may also indicate issues related to self-reported measures of cariogenic diet consumption and tooth cleaning practice, and the grouping of exposure for these variables. For example, how the respondents' self-reported brushing frequencies approximate their actual tooth brushing behavior is not clear.

The act of tooth brushing is complex as it combines many other variables such as the duration of brushing, the design and quality of the brush, the brushing method and the toothpaste (if fluoridated) used (Asadoorian, 2006; Ashley, 2001; Frandsen, 1986; Kumar *et al.*, 2016). I have used brushing at least twice daily as the threshold for defining higher versus lower frequency of tooth cleaning and found that the odds of having dental caries was 30% higher and periodontal pocket formation was 31% higher for  $\geq 2$ /day tooth cleaning compared to less, after adjusting for place of residence, age, and sex. By contrast, previous studies have associated the habit of brushing less than 2 times/ day with an increased caries occurrence compared to  $\geq 2$ /day brushing (Holmes, 2016; Patel *et al.*, 2017). It is worth noting that the participants in Patel's study were purposively selected and associations rather than causal relationships were reported, while in the review study by Holmes, ambiguity in the evidence for a clear association between the effect of tooth brushing frequency and dental caries was reported. Overall, in the two studies similar to others (dos Santos *et al.*, 2018; Reisine & Psoter, 2001), reports linking

the act of tooth brushing at least twice daily with reduced caries incidence in adult population are either weak or inconclusive. An available report even suggested that the effect might be similar with brushing at least once daily (Kumar *et al.*, 2016). A possible explanation for these findings may be that the act of tooth brushing, at least twice daily is just one of the often recommended measures by dentists for the achievement of individual oral hygiene (Attin & Hornecker, 2005; Ganss *et al.*, 2009). Other measures include developing healthy dietary and oral health habits (Gondivkar *et al.*, 2019) and professional cleaning (Park *et al.*, 2018). These, in addition to quality in the act of tooth brushing itself (Asadoorian, 2006; Ashley, 2001; Frandsen, 1986; Kumar *et al.*, 2016), with the right cleaning frequency, are all considered essential and play a significant role in achieving the level of hygiene that can be effective against oral diseases (Attin & Hornecker, 2005; Ganss *et al.*, 2009). Unfortunately, the potential influence of these individual effects could not be separated in my study because it is a cross-sectional observational study. Longitudinal, interventional studies may be required to properly assess a causal effect. Overall, the factors associated with dental diseases identified from my quantitative survey were similar to reports from other studies that found a higher caries prevalence associated with females (Msyamboza *et al.*, 2016), and lower-income populations (Costa *et al.*, 2012).

*Implications-* Poor living condition as exhibited in the slum setting are established as a risk factor for dental disease prevalence. However, understanding the roles of alcohol use, and frequent intake of cariogenic diet as well as the low frequency of tooth brushing as risk factors for dental disease would require further studies. This is because my hypotheses regarding key determinants of oral health conditions in slum versus non-slum urban settings were not supported by the data I gathered. The qualitative study has enriched our understanding of the community's perceived determinants of dental diseases that require prompt attention including misconceptions about "supernatural forces" or 'tooth worms' causing dental caries.

### 10.3.3. Oral health care practices

A summary of the slum residents' oral health care practices identified from the quantitative survey, insights from the qualitative data, as well as integration of the findings are shown in Table 10.3. The table also summarizes participants' perception about their oral health state, brought together with their practices for easy comparison because of its established link with oral health practices (Jones *et al.*, 2001; Olutola & Ayo-Yusuf, 2012; Turrell *et al.*, 2007).

Table 10.3: Oral health care practices and perception about oral health state

<b>Quant</b>	<b>Qual</b>	<b>Integration of quant and qual data from the slum</b>	<b>Slum and non-slum data compared</b>
<b><i>Mouth cleaning</i></b>	<b><i>Mouth cleaning</i></b>		
<ul style="list-style-type: none"> <li>- One-fifth cleaned their mouths at least twice daily</li> <li>- Most common cleaning device: toothbrushes and paste</li> <li>- Other cleaning tools: toothbrush combination with, chewing sticks, dental floss, and toothpicks.</li> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>- Once daily cleaning</li> <li>- Toothbrushes and paste commonly used.</li> <li>- Indigenous mouth cleaning implements: mixture of ground glass with wood ash, ground charcoal, "epa ljebu" (a local dentrifice), wood ash and toothbrush, "Orin ata" (a type of chewing-stick)</li> </ul>	Confirmation, expansion and complementarity	<p>Slum &lt; Non slum</p> <p>Slum residents 19% less likely to brush at least twice daily relatively</p> <p>More of the slum residents (17% versus 3%) engaged in other cleaning materials (majorly chewing sticks)</p>
<b><i>Perception about oral health state</i></b>	<b><i>Perception about oral health</i></b>		
<ul style="list-style-type: none"> <li>- High perception of oral health state by the majority</li> </ul>	<ul style="list-style-type: none"> <li>- Insights suggestive of disease-free oral health states in many</li> </ul>	Confirmation	Slum > Non slum
<b><i>Routine dental visits</i></b>	<b><i>Dental visits</i></b>		
<ul style="list-style-type: none"> <li>- 17% ever visited a dentist</li> <li>- Only 3.4% of dental visits were preventive</li> </ul>	<ul style="list-style-type: none"> <li>- Visits were occasional and not preventive</li> </ul>	Confirmatory	<p>Higher proportion ever visited a dentist in non-slum (24%)</p> <p>Equally low level of visits for preventive reason</p>
<b><i>Source of last dental care</i></b>	<b><i>Remedies for dental ailments</i></b>		
<p>Majorly chemist or pharmacist.</p> <p>Others include:</p> <ul style="list-style-type: none"> <li>- Dental health care vendor</li> <li>- Traditional/ native doctor</li> <li>- Self- medication</li> <li>- Nurse</li> <li>- Medical doctor</li> <li>- Midwife</li> </ul>	<ul style="list-style-type: none"> <li>- Self-medication with over-the-counter prescriptions (usually antibiotics and analgesics); warm saltwater solution, tobacco (snuff), cow's urine, battery fluid, traditional soaps, herbal mixtures, and concoctions.</li> </ul>	Confirmatory Expansion	Slum < Non-slum (36% versus 42%) source dental care from the chemist or pharmacist.
<b><i>Best reason for choice of last dental care source</i></b>	<b><i>Reasons for using remedies</i></b>		
<p>Majorly:</p> <ul style="list-style-type: none"> <li>- Affordability and</li> <li>- First aid measure</li> </ul> <p>Other reasons include:</p> <ul style="list-style-type: none"> <li>- Perceived efficacy or expertise</li> <li>- Nearness</li> </ul>	<ul style="list-style-type: none"> <li>- ease of access</li> <li>- first-aid measure</li> <li>- perceived efficacy</li> <li>- affordability</li> </ul>	<p>Confirmatory</p> <p>Qualitative data supports the quantitative data and provides complementary descriptions</p>	<p>Affordability (30% versus 20%)</p> <p>First aid (25%versus 24%)</p>

Data presented in the first column focus on the slum site, whereas data comparing slum versus non-slum are summarized in the last column. Quant – Quantitative; Qual- Qualitative

*Discussion:* The practice of good oral hygiene is the foundation upon which most oral diseases can be prevented (Bakdash, 1995). Professional recommendations for the achievement of individual oral hygiene often include tooth brushing at least twice daily (Attin & Hornecker, 2005; Ganss *et al.*, 2009). The use of toothpaste and brush by the majority in this study is consistent with reports from other studies conducted in LMICs (Gholami *et al.*, 2012; Handa *et al.*, 2016; Masalu *et al.*, 2009; Msyamboza *et al.*, 2016; Olusile *et al.*, 2014; Patel *et al.*, 2017), in which at least 81% of the participants used toothpaste and a brush for mouth cleaning.

With regards to brushing frequency, tooth brushing at least twice daily is professionally recommended to contribute to individual oral hygiene (Attin & Hornecker, 2005; Ganss *et al.*, 2009). I found that only a small proportion of my study participants engaged in at least twice daily mouth cleaning across both settings. Qualitative insights from this study revealed tradition, habits and low level of exposure to dental health information available from school or the media and these may have played a role (Bashiru & Anthony, 2014; Olusile *et al.*, 2014). The low prevalence of mouth cleaning was in stark contrast with that obtained from Malawi (Msyamboza *et al.*, 2016) where the figure is much higher (49% versus 25%).

A surprising revelation from the Malawian study is that about 40% reported brushing their teeth three or more times a day, although this practice did not seem to translate into lower caries prevalence among them. Perhaps they adopted an illness perception approach to their situation which may have encouraged overt treatment adherence in a bid to avoid further complications (Sirri *et al.*, 2013).

Various types of tooth cleaning implement other than toothbrushes and paste were identified from qualitative data among the slum dwellers. Some of the items were similar to those reported from other studies: charcoal and “miswak” in Tanzania (Masalu *et al.*, 2009), cotton wool, salt and water only in Nigeria (Olusile *et al.*, 2014), charcoal, sand, snuff powder, “neem”, twang in India and Tehran (Gholami *et al.*, 2012; Handa *et al.*, 2016; Msyamboza *et al.*, 2016).

However, some practices such as grinding a glass (bottle) for use as a mouth cleaning tool, were not common in other study reports. Such practice has potentially deleterious health implications. Insights from the qualitative data complemented the quantitative data in providing possible reasons for use of other cleaning agents compared to a toothbrush and these included perceived medicinal properties and less cost. Qualitative data also provided complementary descriptions of other mouth cleaning tools deployed in the slum, including potentially harmful implements, which were usually sourced locally.

The use of dental floss in mouth cleaning was extremely low in all the studies mentioned above. The low or non-use of dental floss is in line with my finding that only 1% of participants used floss. Overall, my finding of a modest difference in favour of the non-slum setting in terms of oral health practices (mouth cleaning frequency and implements) was consistent with the only available study that compared oral health practices between slum and non-slum residents (Patel *et al.*, 2017).

One of the key recommendations in preventive dentistry is to have an oral examination on a routine basis (Patel *et al.*, 2010). Consequently, dental attenders can be characterized into two groups: routine and preventive oriented, and non-routine and problem-oriented attenders (Gilbert *et al.*, 2000). Studies have shown that routine dental clinic attendance is positively associated with tooth retention and improves the Oral-Health-Related-Quality-of-Life (OHRQoL) measure among adults (Åstrøm *et al.*, 2014; Cunha-Cruz *et al.*, 2004). Low dental literacy level coupled [Table 10.5] with the high positive perception of oral health state (Adunola *et al.*, 2019; Sohn & Ismail, 2005) as confirmed from both my quantitative and qualitative studies may be responsible for the very low routine use of dental services observed in my study. Positive perception of oral health state was similarly reported by other studies conducted in Nigeria and South Africa (Olusile *et al.*, 2014; Olutola & Ayo-Yusuf, 2012). From these studies, the majority of participants had a negative attitude towards routine dental service utilization, because they believed that a visit is made to the dentist only when there is a problem, and in many of these cases, that extreme treatment measures (extraction) are indicated.

In LMICs, a high prevalence of dental diseases combined with low utilization of routine professional dental care, presupposes the use of alternative remedies for self-care among them, including among township residents in Cameroon (Agbor & Azodo, 2011) and among patients attending dental clinics in Jordan (Sawair *et al.*, 2009). These studies reported a wide variety of self-care strategies used as remedies for relieving dental pain or ailment. As with my study, remedies employed ranged from seemingly harmless to dangerous substances. While studies in LMICs investigating the use of dental self-care remedies among slum populations are scarce, many other studies have examined the same from the general urban population. Findings from parts of Nigeria have identified the use of a saline wash, herbal preparations, antibiotics, and battery water as self-care remedies (Oke *et al.*, 2011). From the same study, reference was also made to some ill-defined "worms" as causative agents of all oral health problems. In Cameroon, substances such as petrol and vinegar, tobacco, urine, alum, ice-

pack, and 'touch and go' were used as self-care remedies (Agbor & Azodo, 2011). In Sudan, commonly used self-care remedies included cloves, herbal remedies, and 'over the counter' medicines (Ahmed *et al.*, 2017) whereas in Tehran, baking soda dissolved in water, warm salt water, and boiled sumac are commonly used as dental self-care remedies (Gholami *et al.*, 2012). The reasons attributed to use of self-care remedies for dental ailments include availability, perceived efficacy, and cost (Agbor & Azodo, 2011; Ahmed *et al.*, 2017; Sawair *et al.*, 2009), and these are very consistent with the findings from my study. Although self-medication may be considered acceptable for some health conditions, great caution should be applied as there may be negative consequences (Hernandez-Juyol & Job-Quesada, 2002; Wingate *et al.*, 2001). Consequences may stem from poor or wrong diagnosis, wrong dose, use of contraindicated medications, use of a toxic or harmful substance, and adverse reactions (Indermitte *et al.*, 2007).

*Implication-* Few people practiced a minimum of twice daily mouth cleaning. The majority of the participants (particularly in the slum setting) perceived their oral health as good and preventive dental attendance was almost non-existent. A health education programme may encourage the appropriate use of dental services. Such action is crucial to create a sense of responsibility and empower people to take control of their own oral health. As part of the efforts of Community Dentists and allied staff, geared towards improving dental literacy among disadvantaged populations, the current preventive oral health messages delivered in outreaches should emphasize the importance of routine dental checks, including awareness messages about the dangers of some deleterious practices, as revealed from this study especially to discourage the use of locally sourced cleaning materials such as grinding glass, which can be potentially hazardous. This is because, some of the dental self-care remedies are potentially hazardous, and some of the products can be fatal eg. battery fluid.

### 10.3.4. Utilization of dental services

A summary of the slum residents' pattern of utilization of dental services identified from the quantitative data, insights from the qualitative data, as well as integration of the findings are shown in Table 10.4.

Table 10.4: Utilization of dental services

Quant	Qual	Integration of quant and qual data from the slum	Slum and non-slum data compared
<b>Utilization of dental services</b>		<b>Dental visits</b>	
- 17% ever utilized a dental service	- Occasional visits by a few.	Qualitative insights complement the quantitative findings regarding use of dental services	Slum < Non-slum (17% vs 24%)
- Reason for visit was pain driven in 97%	- Problem driven - Often as a last resort.		Slum = Non slum (97% each)
<b>Experienced pain/ discomfort from teeth or mouth recently (within a prior 12 months period)</b>			
- 70% felt pain and discomfort from mouth	Accounts of recent experiences given	Confirmatory and complementarity	Similar (68%) in the non-slum
<b>Felt need for dental care in the past 12 months</b>			
- 13% felt a need for dental care	Vivid accounts from some participants	Confirmatory and complementarity	7% more in non-slum
<b>Barriers to seeking dental care from professional care facilities</b>			
- Expensive (27%) - Perceived lack of dental problem (23%) - Fear of anticipated pain (19%) - Dental problem not severe enough (17%) - Have alternatives (14%)	- Perceived high cost - Dental pain phobia - dissatisfaction with 'extraction only'	Confirmatory	Generally, slum > non-slum except for "Never had dental problem" - 14% higher in non-slum
<b>Ever avoided seeking the professional dental care needed because of perceived high cost</b>			
- 15% of previous users avoided seeking recommended care because of perceived high cost	Vivid accounts of experience from some participants in respect of perceived high treatment bills given to them	Confirmatory and complementarity	3% less in non-slum

Data presented in the first column focus on the slum site, whereas data comparing slum versus non-slum are summarized in the last column. Quant – Quantitative; Qual- Qualitative



*Discussion:* I found a modest difference in favour of the non-slum setting in terms of utilization of dental services. This was consistent with the only available study that compared oral health practices between slum and non-slum residents (Patel *et al.*, 2017). Overall, data from my study suggested that the majority of slum and non-slum residents had never visited a dentist. This is similar to previous studies conducted on samples of Nigerian population (Adeniyi & Oyapero, 2020; Olusile *et al.*, 2014). The prevalence of dental pain within a 12-months period among the slum dwellers (70%) was higher than those obtained from Tanzania (mainland residents comprising of urban and rural population) which reported 59% (Kikwilu *et al.*, 2008) and that from Burkina Faso (urban residents) which was 34% (Varenne *et al.*, 2006). However, utilization of dental facilities within the same period among the slum dwellers (3%) was quite low. Unfortunately, there is no corresponding data from the studies in Tanzania and Burkina-Faso. When compared with high-income countries, about 40–80% of the adults would have visited a dentist within one year (Chen *et al.*, 1997; Kiyak & Reichmuth, 2005; Petersen, 1995). A study in the West of Iran (an LMIC country) equally reported a high utilization rate- 60% (Rezaei *et al.*, 2018). This might be because the majority (62%) rated their oral health as poor and 95% of them had health insurance coverage. Demand for health care is largely dependent on the patient's perception of a need to seek care (Ekanayake *et al.*, 2001). The low utilization for dental services may be influenced by many factors such as low prioritization of oral health care by patients (attitudes), lack of time and self-medication (Dany *et al.*, 2017). The level of awareness in my study was very low- the few residents attending the community dental clinic had limited knowledge of the treatment options and were leaning solely on the health care provider to suggest the appropriate care for their oral health conditions (Ekanayake *et al.*, 2001). Based on data from my focus group discussions (FGDs), slum residents generally assumed that tooth extraction was the only service provided in dental clinics. The dissatisfaction with 'extraction only' services was clearly connected to perceived associated pain, hence the appeal by residents for other treatment modalities. The FGDs further suggested that the few dental visits made by the slum dwellers were often a last resort – when tooth extraction may well be the most appropriate treatment for the presenting condition (Lo *et al.*, 2001; Osuh *et al.*, 2014). Late presentation may also arise from the fact that these diseases are often silent such that the sufferer may not be aware (Akpata, 2004; Peres *et al.*, 2019; Petersen, 2004; Varenne, 2012; WHO., 2020). Consequently, the disease is neglected, until complications set in (Okunseri *et al.*, 2004; Varenne *et al.*, 2006). Even in situations of mild symptomatic dental problems, the fact that many people do not associate fatality with oral diseases often leads to a delay in their seeking of care (Dany *et al.*, 2017).

Dental phobia, that is fear associated with anticipated pain from tooth extraction, was also identified as a barrier to seeking dental care from other studies (Ajayi & Arigbede, 2012; Armfield *et al.*, 2007; Denloye *et al.*, 2004). Many people delayed presenting at a clinic because they are apprehensive. This situation is particularly of importance for the health system and health promotion purposes.

*Implication:* From my study, the use of professional oral health care services is very low in urban settings of Nigeria and worse among the slum residents. The wide disparity between having pain or discomfort from teeth within 12 months and scarce use of professional care within the same period suggests widespread use of alternatives among the study participants. Insights from the qualitative data revealed considerable reliance on self-care remedies for dental health challenges. This may be responsible for their failure to seek professional care as suggested by the fact that the few who sought professional care did so only when other measures failed. This therefore, lays credence to the call for targeted efforts in the planning of oral health education and health promotion programmes for the slum residents.

Affordability is a well-recognised barrier for utilization of health care services, more so for dental services (Airen *et al.*, 2014; Ajayi & Arigbede, 2012). This recommendation will be tackled in detail in the next section in this chapter (oral health needs, below).

My study also highlights specific areas for intervention in disease prevention and oral health promotion among the residents of a slum in Nigeria. Individuals with dental phobia pose unique challenges to the dental team and should be carefully managed with special skills (Armfield & Heaton, 2013). Clinically, management of dental phobia may require a greater level of understanding, good communication, and assurance of a phased treatment approach as well as several non-pharmacological anxiety management practices to enable dental practitioners provide care to anxious or fearful children and adults (Armfield & Heaton, 2013). Dental health care professionals should, as a measure to improve access to dental health services, make an effort to support, encourage and allay dental fears and anxiety among the population. Research efforts should also be intensified towards developing new methods of examination and treatment including instruments geared towards a painless dental experience in order to tackle fear of dentistry among people (Lindsay & Jackson, 1993). Above all, health education and motivation programmes to encourage individuals to seek care early in order to avoid the complications that ultimately limit their treatment options (Al-Jundi, 2004) as well as awareness about dangers in using potentially harmful substances as self-care remedies are highly needed

for the slum residents. It is hoped that these measures will facilitate access to timely dental health care and ultimately improve the well-being of the slum residents.

### 10.3.5. Oral health care needs

A summary of the slum residents' oral health care needs identified from the quantitative data, insights from the qualitative data, as well as of the integration of findings from both the quantitative and qualitative data are shown in Table 10.5. The table also features the slum versus non-slum comparison in findings.

Table 10.5: Oral health care needs

Quant	Qual	Integration of quant and qual data from the slum	Slum and non-slum data compared
<b>Oral health treatment needs</b>			
- 97% had normative treatment needs	- Some participants expressed felt oral health care needs with vivid experience	Normative needs support the felt need and expanded on its specific details	Slum = Non slum (97% each)
- 35% had immediate and urgent treatment needs			slum > non-slum
<b>Other oral health needs</b>			
<b>Suggested measures of improving access to dental health care</b>			
- Reduced cost of care (inferred need)	- reduced cost of dental care. - improved oral health literacy - oral health enlightenment programmes including dental health screening - a wider range of treatment options - availability of medicines	Qualitative insights provided expansion and complementarity to the quantitative study	

Data presented in the first column focus on the slum site, whereas data comparing slum versus non-slum are summarized in the last column. Quant – Quantitative; Qual- Qualitative

*Discussion:* Different levels of professionally verified oral health needs (normative needs) were identified through oral examination of the slum residents (quantitative data), while insights about the participants' perspective (felt needs) of their oral health needs were freely expressed during FGD sessions (Bradshaw, 1972). Central to the planning, provision, and evaluation of

any health services, the concept of need should be taken into account for effective and result-oriented intervention programmes (Ekanayake *et al.*, 2001). Normative and felt needs, which are parts of the key components of the concept of need, are required to holistically address oral health needs of any given population (Dany *et al.*, 2017; Ekanayake *et al.*, 2001; Watson, 2002). This is because they facilitate judicious use of scarce resources as well as enhance acceptance. In assessing the normative oral health needs of the slum dwellers, I observed that almost all residents had varying degrees of dental treatment needs. Yet, despite this huge burden, their dental care-seeking habit (expressed need) was very low. Thus, a gap existed between the actual oral health needs of the slum residents and their demand for dental care. Such gap could only be connected through a qualitative investigation combined with quantitative measures for accuracy of information (Classen *et al.*, 2007; Cresswell & Plano Clark, 2011). As such, it would be wrong to assume that the slum residents had low needs for dental health services based on their 'low utilization of dental services' (expressed need) only. Qualitative insights revealed a lack of awareness about available services coupled with misinformation about the types of services rendered (extraction only) as well as perceived high cost of care, all of which explain the 'low level of expressed needs' for dental services among the slum residents. The fact that the slum residents expressed a need to increase the level of their oral health literacy, and appealed for lower charges on oral care services, is further receptiveness to accept experts' advice for improving their oral health and well-being.

According to the WHO method published in 2013, the intervention urgency or treatment need specifies a recommended level of treatment for acute oral health problems and the need for immediate referral for special care (Petersen, 2013). From my study, participants in both settings had high needs for oral healthcare and most of the needs related to preventive/routine treatments. This was followed by prompt/immediate treatment needs, then urgent-treatment needs, and referred treatment needs. The high need for dental treatment recorded in this study agrees with reports from studies conducted among similar disadvantaged populations (Airen *et al.*, 2014; Handa *et al.*, 2016; Hannan *et al.*, 2014; Hessari *et al.*, 2007; Jaafar *et al.*, 2014; Patel *et al.*, 2017; Varenne *et al.*, 2006). These studies have utilized different measures including the unmet dental treatment needs, untreated oral health conditions or the Community Periodontal Index of Treatment (CPITN) to derive the types and degree of dental treatments required by the study participants, and these independently revealed high treatment needs. Only one study (Morgan *et al.*, 2018), a national oral health survey conducted in Rwanda, utilized the WHO (2013) method in categorizing treatment needs of study participants. In this study, prompt dental care was indicated for 61.3% of the population while immediate treatment

(urgent relief of pain or infection) was required by 5.4% (Morgan *et al.*, 2018). A study conducted in an urban setting in Brazil similarly, revealed a high dental caries prevalence (68%) (Costa *et al.*, 2012), which also signifies a high unmet rate of caries treatment need. Irrespective of the criteria used or study setting involved, the dental treatment needs were high in all studies. In my study, when the level of treatment required was compared between the two residential locations, more slum dwellers required the “prompt” and “urgent” levels of care, while more non-slum residents required the preventive/routine levels of dental treatments. A significant proportion of participants in my study had different stages of periodontal disease and this signifies poor oral hygiene status. High prevalence of gingival bleeding was observed in both younger and older age groups and the value was much higher in slum residents when compared with their non-slum counterparts. Again, this finding supports other reports that people living in socioeconomically deprived condition (slum) have high level of dental diseases and poor oral health status (Adeniyi *et al.*, 2012; Petersen *et al.*, 2005; Squassi *et al.*, 2008). This is because slum residents, by reason of their lower social strata and environment have limited access to appropriate oral health care. Untreated dental diseases lead to eventual tooth loss. Early loss of teeth can cause impaired function of mastication leading to impaired digestion and malabsorption of nutrients thus affecting an individual’s general health and well-being (Hannan *et al.*, 2006).

In tackling the dental treatment needs in Nigerian slums, reviewing the dental workforce becomes valuable in order to utilise what is currently available judiciously. While it is projected that Nigeria will have produced a total of about 6,000 dentists by 2022 (Medical and Dental Council of Nigeria, 2017), this number is still considered grossly inadequate to cater for the oral health needs of a country with population of over 200 million. One response to the increasing demand for dental care in the presence of a shortage of dentists, involves the planning of, and resourcing, a dental workforce with adequate skill mix (Solomon, 2009). The term ‘skill-mix’ refers to the mix of posts, grades or occupations, experience, knowledge and skills-set needed for each job within the organization to achieve its objectives (Buchan & Dal Poz, 2002). In this case, it will entail training and utilising nurses, health officers, hygienists, and therapists as well as other primary health care workers for expanded roles to provide basic oral health care through the existing primary health care (PHC) facilities (Beirut & Palenstein Helderman, 2004; Braimoh & Umanah, 2014), among underserved and deprived communities. It will also involve equipping the primary health care facilities (described in previous sections 10.3.1) with materials needed to deliver basic oral health care services. Mobile and portable

dental services is another viable option. Mobile dental delivery system uses a dentally equipped van to take sophisticated oral health services to the doorsteps of the deprived and underserved population in order to cater for their basic oral health needs (Ganavadiya *et al.*, 2014; Jackson *et al.*, 2007). The model has been successfully implemented in both developing and developed countries (Hamilton, 2007; Othman & Razak, 2010; Vashishtha *et al.*, 2014). This model also has the potential to solve the disparity in the distribution of dentist population, which is largely concentrated in the affluent urban areas currently, at the expense of the disadvantaged areas (Ganavadiya *et al.*, 2014; Jackson *et al.*, 2007)

Cost or affordability was another subject of concern for slum dwellers (as seen in both the quantitative and qualitative data sets). In low-income communities such as slums, paying for dental services may be a low priority relative to the struggle for food and shelter (Wallace & MacEntee, 2012). It is well known that the traditional treatment for common dental diseases is costly relative to the treatment of other common systemic diseases even in high-income countries (Petersen, 2003). The expensive nature of dental treatment has remained a barrier to accessing oral health care globally and particularly in LMICs with their limited resources and lack of robust medical insurance, many dental treatment procedures are considered luxury (Petersen, 2003). Unaffordability of care has been identified in many studies which looked at the role of cost in dental healthcare-seeking behaviour (Ajayi & Arigbede, 2012; Kadaluru *et al.*, 2012; Varenne *et al.*, 2006). These studies all reported cost as a barrier which resulted in patients being unable to seek professional dental care. In a report from south-west Nigeria, a decline in clinic attendance was reported following an increase in dental treatment charges (Denloye *et al.*, 2004). By contrast, when there is a form of subsidization scheme or a health insurance plan that includes dental treatments (Bayat *et al.*, 2006; Suominen-Taipale & Widström, 2000), timely visits for dental care services are facilitated.

*Implication-* Overall, the following key strategies may improve timely access to dental care among slum residents:

*Correct information and knowledge about oral health care* which will enable individuals make appropriate decisions regarding oral health: The residents' expression of willingness to increase their oral health literacy level, and learn about appropriate oral health practices and available services, is a good signal. Emphasis should therefore be placed on educating slum residents about their oral health, its influence on their overall well-being and the appropriate

use of dental health care facilities, during the routine outreach activities in various sub-population settings. This may help change perceptions and a generally negative disposition of residents towards utilization of oral health services.

*Constituting and resourcing a dental workforce with adequate skill-mix:* In low resource settings, there is need to prioritize the oral health of slum residents because of its benefit in controlling major chronic diseases of public health concerns in a cost-effective manner (Singla *et al.*, 2016; Watt, 2005). Therefore, resources in terms of finance and workforce with adequate skill-mix as previously explained need to be considered. As such, constituting a dental workforce with adequate skill-mix, as described in earlier section (section 10.3.1- Implications) to meet the high demand for oral health care as well as routine dental screening programmes are imperative while the dental personnel should be motivated to work in slum settings.

*Mobile dental delivery system:* Will enable transportation of a dentally equipped van with staff to deliver oral health services to the slum residents at their doorsteps (Ganavadiya *et al.*, 2014; Jackson *et al.*, 2007). Successful models are available from similar environments to replicate (Hamilton, 2007; Othman & Razak, 2010; Vashishtha *et al.*, 2014).

*A community-based health insurance scheme* such as the National Health Care Insurance Scheme can be positioned to address the inequity occasioned by cost or affordability on the general urban populace. Presently the scheme has challenges: finance, awareness, trust in the schemes, hence many are yet to enroll into the programme (Adewole *et al.*, 2016; Odeyemi, 2014). Government and all relevant stakeholders in health should intensify efforts to encourage people's acceptance of the scheme, through awareness education and the right policies. They should also work to expand the coverage of the scheme to include more dental related problems so that dental health care can be more affordable. A suggestion is hereby made that following enrollment on the scheme by the people, the government should pick up the entire health insurance bill for a specified period of time. Such gesture will expose the people (subscribers) to the benefits of the scheme before they are weaned to commence a counterpart funding. It is hoped that this approach will better encourage acceptance of the scheme among the people.

It should be noted that to convince the policymakers and stakeholders in health to accept the suggested solutions and recommendations, a health economic analysis would be required.

## **Chapter 11: Thesis summary, limitations, implications, and future work plans**

### 11.1. Chapter overview

This chapter summarizes the thesis and highlights the limitations, challenges and strengths of adopting a mixed methods design. The future research prospects in each section are also considered in this chapter.

### 11.2. Thesis Summary

This Ph.D. research set out to assess the prevalence of oral diseases, the associated factors and oral health care needs of residents of slums and compared the findings with residents of non-slum urban settings in Nigeria. The study was a mixed-methods study using a parallel convergent study design.

*Narrative review:* The starting point for the research was an explorative review on the subject area from which the research questions were developed and refined, and the objectives and research design determined.

*Systematic review:* Given the lack of contemporary, evidence-based, and comprehensive summary of evidence relevant to oral health in slum settings and the paucity of oral health studies in relation to slums of Nigeria and Africa, I began the first phase of the thesis with systematic review of the literature conducted in the LMICs (Work Package 1) with a view to gaining insight into the oral health issues of slums and other urban settings in the region. Such a review of information is also important because health care providers and policymakers integrate relevant evidence in rational decision-making that can positively impact on oral health and well-being of populations (Mulrow, 1994). The findings of the review provided some evidence about oral health issues in LMICs from which comparisons can be drawn to support oral health policy decisions in Nigeria. From the evidence, periodontal disease and dental caries are still the most common oral diseases affecting both slum and non-slum urban settings. The prevalence and burden of diseases vary widely but are generally high in urban settings in LMICs including slums, and there is paucity of evidence that compared slum with non-slum settings.



*Mixed methods: Quantitative component:*

For the quantitative study section (Work Package 2), I explored the prevalence of oral diseases, treatment needs, and associated factors among adult residents of a slum setting and compared the findings with a non-slum urban setting in Nigeria. This was with a view to obtaining current information on oral disease burden in the study areas and to inform the planning of an appropriate oral health intervention strategy to meet the people's oral health care needs. From the results, the most prevalent oral health outcomes in the two settings studied were dental caries, gingival bleeding, and periodontal pocket formation. Generally, oral health outcomes were worse among participants residing in the slum setting relative to their counterparts in the non-slum. Although the observed differences were modest for most oral health conditions, the difference was large and significant for bleeding gum and periodontal pocket formation. The majority of residents of the slum and non-slum (97% vs 94% respectively) had need for different level of dental treatments. Dental service utilization was generally low and problem-driven.

*Mixed methods: Qualitative component*

In the qualitative section of the study (Work Package 3), slum dwellers' perspectives about their oral health needs, practices, and experiences in care-seeking were explored. This was with the view that such information can assist in the development of appropriate and focused interventions relevant to the oral health needs of the slum community and to fill a knowledge gap, given no known study to date has examined this perspective among the population and setting. Findings revealed that slum residents were affected by a range of common dental ailments such as dental pain, tooth sensitivity, bleeding gums, tooth decay, mouth odour, gum disease, and tooth fracture. Perceived causes included poor dental hygiene and habits, ignorance, and supernatural forces. Relief remedies included over-the-counter medicines, use of the warm-salt-water solution, application of some toothpaste, use of gin, tobacco, and cow urine/dung, as well as various mixtures and concoctions. Only a few participants considered the option of visiting a dental clinic facility for their dental health problems, and this was often only as a last resort. Mouth cleaning was usually done daily and some used local cleaning agents such as ground glass, charcoal, "epa ljebu" (a local dentrifice), wood ash, and "Orin ata" (a chewing stick type). Barriers to accessing care from dental care facilities identified included lack of money, unaffordability of service charges, and fear of extreme treatment measures (extraction). Suggested measures for improving timely access to dental health care included the need for a wider range of treatment options, provision of free or subsidized

treatments and medications, as well as oral health education and awareness-raising programmes.

*Mixed methods: Integration in interpretation*

The quantitative and qualitative researches were integrated in interpretation through joint display. Coherence of findings was described in terms of confirmation, expansion, and discordance (Fetters *et al.*, 2013). Summary of findings (by study domains) included:

*Prevalence of common oral health conditions:* Confirmation within the two data sets regarding a high burden of the following conditions: gum/ gingival bleeding, dental trauma, dental caries, and periodontal pocket formation in decreasing order of prevalence.

*Associated factors:* Confirmation within the two data sets regarding being a resident in a disadvantaged community (slum), and alcohol use. Evidence from quantitative is not sufficient to support the claims from the qualitative data on the association between frequent intake of cariogenic foods and poor hygiene practice on oral disease prevalence.

*Oral health practices:* Confirmation regarding once daily frequency of mouth cleaning and use of toothbrush and paste and the major tools used, high positive perception about oral health state, almost non-existent routine dental visits, use of chemist or pharmacist as the most common alternative dental care source, other sources include dental health care vendor, traditional/ native doctor, self-medication, nurse and medical doctor and midwife as well as confirmation within the two data sets on affordability as the best reason for choice of alternative dental care source.

*Dental service utilization:* confirmation within the two data sets regarding the low and problem driven utilization of dental services. Confirmation within the two data sets on perceived high cost of care and anticipated pain as barriers for seeking dental care. Findings from the qualitative data provided complementarity to quantitative data with life experiences.

*Oral health care needs:* the verified normative needs of participants (higher levels of prompt and urgent treatment needs), lent support to their felt needs. Qualitative insights provided complementarity to quantitative data (inferred need) on the need for reducing the cost of dental care as well as expansion on the participants' oral health needs. For example, need for improved oral health literacy and wider range of dental treatment options.

However, some limitations and strengths were noted which may affect the interpretation and application of findings. These are outlined below.

### 11.3. Adequacy of the research method in the systematic review

#### 11.3.1. Research limitations and strengths

*Limitations:* The term “slum” did not feature in many studies involving oral health. The name “slum” is an evolving phenomenon, which describes specific residential characteristics or settings. It is possible that some previous studies on oral health were conducted in settings similar to slum, yet they were not so labelled (Lilford *et al.*, 2019). Possibly even more so, authors may have deliberately used other terms such as informal settlement or deprived urban communities etc to describe the slum area (Dovey *et al.*, 2021). Therefore, in the review, I, as much as possible included all available synonyms for slums both in English and local languages (eg. suburb or ghetto or downtown or bidonville or barek or inner city or busbee or challis or shack or cherek bete or d'agata or outskirts or ghettos or katsas or lobban or shantytown or musique or tanaka or saudis or tugurio or usuku or modolo or watts or zopadpattis etc.) [Appendix 4.1] to capture as many relevant studies as possible in the review, and thus the search yield was greatly expanded. I also searched beyond the main medical databases in the grey literature. I performed reference checking and contacted experts in the field, and utilized studies from conference abstracts. Furthermore, I set up auto alerts in most databases which enabled the inclusion of a few more studies that were published after the search was first conducted.

The variations that exist in the context of slums (classification and feature) both within and between countries in the LMIC regions (Lilford *et al.*, 2019) were not taken into consideration in study selection. Such variations may have influence on oral health outcomes. Furthermore, the heterogeneity in the study objectives and designs made clear comparisons in the review, challenging. Some studies failed to provide details about their population and design. Variations in the measurement of the indicators of oral diseases, in particular, affected comparison between countries. Data were also not complete for some of the oral disease indicators. However, despite these limitations, this is the first systematic review that attempted to compare oral health outcomes across LMICs and with the aid of the MMAT (Hong *et al.*, 2018) quality assessment tool and data synthesis guided by the SWiM guideline (Campbell *et al.*, 2020), it was possible to compare oral health conditions in slums of LMICs. Regarding limitations occasioned by heterogeneity in the study objective, and design, two reviewers were involved in making decisions for the studies selected, data extracted, and the quality assessment of included studies. In this way, bias was minimized and the trustworthiness of the process was enhanced. In one case, we contacted a study author for clarification on their design - a step taken to further ensure that the inclusion criteria were thoroughly adhered to.

This review was limited to articles written in the English language hence it is possible that some literature may have been missed. However, I made an exception for occasions where the English version options of articles were available.

Strengths: This systematic review is the first to assess oral disease burden, the determinants, healthcare-seeking behaviour, and service utilization in a slum and non-slum urban setting of LMICs. The breadth of the review scope, range of adult participants and all reported outcomes, in terms of the prevalence of oral disease, key determinants, and practices are all strengths of the review. The evidence base was expanded by bringing together oral health studies conducted in urban disadvantaged settings relative to the general urban settings in order to inform policy guidelines and direction in reducing oral health inequality. It also contributes to the emerging literature on slum health. It further highlighted the paucity of representative population oral health surveys, especially among marginalized or disadvantaged population groups.

#### 11.4. Adequacy of the quantitative research section of the thesis

##### 11.4.1. Research limitations and strengths

Limitations: First, the study was carried out in only one slum and one non-slum area, and so the findings may not be representative of all slums in Nigeria. However, selecting a slum setting that is representative of all slums may be difficult since slums differ, one from another with specific implications for the intervention approach (Lilford *et al.*, 2019). Second, the cross-sectional design precludes causal inferences, hence only associations can be drawn.

However, the study has some major strengths and these include:

To the best of my knowledge, this is the first community oral health study in a slum setting to use GIS software with GPS technology to derive a random sample of buildings in dense urban areas such as the slums. In slums, it is rarely feasible to conduct a comprehensive door-to-door survey of every individual or household unit, that can ensure representativeness (Improving Health in Slums, 2019; Kondo *et al.*, 2014; Levy & Lemeshow, 2013), hence the adoption of this approach which is also an innovation in oral health studies (Yeboah *et al.*, 2021).

The latest in the series of WHO oral health survey manuals (Petersen, 2013) was used in the assessment of public oral health status. This enhances easy comparison of results from oral health surveys among populations globally, both in the now and in the future.

Lastly, this study is the second and currently the largest in the LMICs to compare oral health survey findings among adults residing in the slum and non-slum setting, utilizing similar methods through its sampling and data collection processes to enhance the validity of comparison. Thus, as of today, this study provides the largest dataset in this respect.

## 11.5. Adequacy of the qualitative research section of thesis

### 11.5.1. Research limitations and strengths

I acknowledge the possibility of bias introduced by the Baales (compound heads) during the purposive selection process of FGD participants. But from discussions following, there seem to be no obvious motivation from any of the Baales, hence the issue of selection bias may not be of particular concern. Moreover, the random nature of the compounds included into the study was representative enough to avoid any bias from the purposive selection method that was done afterwards.

Strengths: this study is the first to explore the perspectives of slum dwellers about their oral health needs, their perception, practices, and experiences of oral health, and care-seeking in a bid to improve their oral health and well-being.

## 11.6. The conduct of the thesis study

### 11.6.1. Practical challenges and limitations

The three researches (systematic reviews, quantitative and qualitative study) contained in this thesis including analysis and integration of findings from the researches were all personally conducted by me, the researcher. The enormous work contained in each of the three research components, expected to be completed within the timebound PhD programme, was complicated by the long period of lock-down due to the COVID-19 pandemic. The study was therefore conducted under immense pressure with attendant potential risk of bias and errors. The soundness and trustworthiness of the entire study were however, not compromised due to my personal preparedness, experience and skills, as a highly motivated and passionate

academic and professional. Moreover, I acknowledge that a doctoral research work is undertaken independently. As such I was psychologically prepared for challenges. Similarly, my quest to collect reliable data that can facilitate the planning of oral health for underserved populations, and reduce oral health inequality influenced me to take some measures aimed at minimizing any unforeseen errors, eliminating bias and judiciously managing time. The quantitative data collection was conducted with assistance from a team of research assistants who were all satisfactorily calibrated for the study. The qualitative data collection was co-facilitated by an experienced and trained male group facilitator who was also fluent in the local language (Yoruba). This served as balance to my (researcher) feminine gender through the FGD sessions. Analysis of all data was my responsibility as the researcher, assisted by an independent data analyst for the quantitative and the qualitative data. The resulting findings were thereafter compared while preserving the internal soundness of the project. Adding further to the credibility of this thesis, is the ever-open line of communication between me and the body of eminent supervisors and advisers at every stage.

The general applicability of findings to slum populations in Nigeria and LMICs must be done with caution. As previously explained, slums are not homogenous but differ in accordance with classification and features with implications for development (Lilford *et al.*, 2019). Consequently, any policy approach to tackling health challenges in each slum may need to differ subtly. The inclusion of systematic review sought to enable rich insight and opportunity to draw comparison within and between slums in LMICs, but there was dearth of literature on oral health in slums and only one study compared between slum and non-slums thus posing a potential limitation.

Other challenges: specific challenges were encountered with the COVID-19 pandemic outbreak. In my study and practice as a community dentist, as well as within the study communities, the effects of measures introduced to contain its spread including lockdowns were greatly felt. During the period of lockdown, movement was restricted and my access to the internet from my home was limited. As a health care worker, watching some of my colleagues succumb to the infection was a scare, some of them eventually lost their lives to the dreaded disease, despite all measures in place. Sadly, I came down with the disease and the sickness lasted for about five weeks. It was such a horrific experience that affected my emotional and mental well-being, thus resulting in a temporary stop in the PhD work. Thankfully, the period was short-lived. The thoughts of the prospects, provided to me through this PhD scholarship opportunity, to add value to the lives of the people living in the

disadvantaged community setting were constant in me and gave me the needed courage to fight and keep faith. I hope these findings provide useful policy direction that can improve the oral health and well-being of disadvantaged population groups.

#### 11.6.2. Strengths of the study

Using the mixed methods approach in tackling the research question, enabled the generation of stronger evidence through convergence and corroboration of findings. Insights were gained that would otherwise be missed with a single method, providing a richer understanding of the oral health practices and their detailed description including the use of harmful substances for mouth cleaning and self-care remedies.

#### 11.6.3. The implication of findings on practice

Owing to the fact that these study findings are obtained from a combination of qualitative and quantitative research, the information derived affords a more complete knowledge and understanding necessary to inform theory and practice. This should facilitate the development of appropriate intervention strategies that can effectively tackle oral diseases in the slums, and impact favourably on the current oral health policies in Nigeria. For example: information derived from the normative needs of participants is important for planning the resources and staffing required to meet identified needs among slum dwellers. The planning of dental services (preventive and emergency) should be based on a broad, patient-derived understanding of the need for the services, a perspective that the mixed methods design in this study has afforded. Dentists need to appreciate the barriers and challenges faced by patients in order to facilitate constructive interpersonal interactions. This more holistic approach to care may encourage preventative care seeking within formal health facilities as opposed to reactively attending to their only patients' complaints, thus caring for both the patient and the presenting problem. Intervention efforts especially with improved access to care should be intensified for slum populations.

In order to promote preventive dental care service use in the slum, residents need be convinced about their oral health need (felt need) first; only then are they likely to seek care. There is therefore, need to educate the population about their oral health, its influence on general health

and well-being, and how to make maximum use of facilities available, to promote oral health among them. Positively influencing residents' attitudes and perceptions about oral health and services while addressing issues with affordability and accessibility may assist with minimizing the striking difference between felt and normative needs. This may lead to increased utilization of routine dental care (Ekanayake *et al.*, 2001). It may be helpful to organize routine oral health outreach programmes, oral health awareness and promotion campaigns, mobile dental services, as well as oral disease screening services in order to improve the slum residents' access to care.

Lessons from innovative oral health survey method: A good understanding of the specific context of the slum environment and the potential effect on the oral health of residents is needed to plan an effective oral health intervention strategy. Community dentists and indeed all dental public health professionals should take advantage of the innovation in community oral health surveys that utilizes GIS and GPS technology to achieve reliable household samples through random selection of buildings from dense urban areas such as the slums. This advantage of the new method is particularly unique for household surveys, over the traditional door-to-door survey which is labour intensive, thereby increasing the risk of collecting samples that are non-representative of the target population.

#### 11.6.4. Implications for stakeholders and policymakers in health

Stakeholders and policymakers in health should extend their understanding about the uniqueness of slum environment on general health to oral health. Oral health in Nigeria (Adeniyi *et al.*, 2012; Akpata, 2004) and globally (Benzian *et al.*, 2021; Watt *et al.*, 2019) has long been neglected in terms of planning and service delivery even as one of the basic components of Primary Health Care (PHC). The inclusion of oral health service components into all existing PHC facilities should be looked into more seriously with emphasis on low-resource settings, including the slums. The concept of "skill mix" should be considered because of the benefits to health care coverage for a health specialty area whose staffing levels are currently too low for the population size. This will go a long way in making dental care more accessible to underserved populations.

The Medical and Dental Council of Nigeria, the regulatory body entrusted with the training and practice of dental professionals, should consider the oral health in slum as a different entity from those of urban non-slum and rural dwellers. Posting of doctors in residency training from both medicine and dentistry specialties into slum settings, as is done in urban (general) and



rural health postings may make health care accessible to slum residents and greatly reduce the oral health inequality gradient between slums and non-slum residential settings.

There is lack of regulations around the use of hazardous substances like battery fluid as a self-care practice for dental health relief. Policymakers need to regulate or control the availability of battery fluids within communities where their use may be extended for pain relief for tooth or body infection (whitlow) and establish appropriate standards and policies around vulnerable populations and communities where its use can be abused. Beyond oral health improvements, such a move may further reduce the incidence of acid bath vendetta that is sometimes seen in similar communities (Abayomi & Olabode, 2013; Sen, 1998).

#### 11.6.5. Implications of the project for future research

The opportunities for conducting further research from this study are broad:

The present study contributes evidence about oral health in a well-defined slum setting as different from a non-slum setting. The topic area was hitherto under-researched, and this study being the first in Nigeria, and the largest among LMICs, therefore provides opportunities for further mixed methods research for comparison.

Results from the systematic review provides a baseline from which further research can advance. Findings indicated paucity of oral health research in relation to slum population across LMICs as a whole. Researchers in oral health should be encouraged into studies among representative groups of adults residing in slums as well as national populations using standardised tools for the assessment of oral health. Using a standardized tool eg. the latest WHO oral health assessment manual (2013) may prevent the challenges encountered in the attempt to make comparisons between studies included in this systematic review. It may facilitate future review assessment of studies from different countries and settings, thereby ensuring a meaningful contribution of such studies to a growing evidence base on oral health in slum populations.

The introduction of GIS and GPS technologies into this oral health survey has impacted positively on reliable household samples from a dense population area, while opening a whole new opportunity for a largely untapped research subject on oral health. Its deployment in future research may facilitate the validation of findings from this study and explore broader perspectives which will increase the transferability of findings to the wider slum population groups. For example, the roles of frequent cariogenic diet consumption and tooth cleaning

frequency in the occurrence of dental diseases were not confirmed in the mediation analyses in my quantitative study. Further studies of longitudinal design are recommended to understand the real relationship of these variables on dental disease development. On a wider scope, the possibility for cross-disciplinary collaborations is conceivable with oral-health research. Future research collaborations are encouraged with other disciplines such as science, art, engineering, computer science and information technologies as they apply to research questions to bridge knowledge gaps, for generating emerging scientific ideas and hypothesis, as well as innovative techniques and tools in oral health.

Findings from the qualitative section of this research can be used to structure and guide future oral health studies in this area. Key informant interviews may be required to fully understand the oral health behaviour of the slum residents. Topic areas should include: the pathway to care, various methods of oral self-care practices and their efficacy, as well as the effect of culture and belief on oral disease development, can be researched in order to gain a better understanding of how they shape access and barriers to care.

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Appendix 3.1: Biomedical and Scientific Research Ethics Committee (BSREC) Ethics approval letter



Tuesday, 23 July 2019

**Dr Mary Osuh**  
WMS  
University of Warwick  
Coventry  
CV4 7AL

Dear Dr Osuh,

**Ethical Application Reference: BSREC 37/18-19**

**Title: Determinants of Oral Diseases and Oral Health Care Needs in Slums: A comparative study with non-slum urban settings in Nigeria**

Thank you for submitting your revisions to the Biomedical and Scientific Research Ethics Committee (BSREC) for consideration. We are pleased to advise you that, under the authority delegated to us by the University of Warwick Research Governance and Ethics Committee, **full approval for your project is hereby granted.**

Before conducting your research it is strongly recommended that you complete the on-line Research Integrity training:

[www.warwick.ac.uk/ritraining](http://www.warwick.ac.uk/ritraining). Support is available from the BSREC Secretary.

In undertaking your study, you are required to comply with the University of Warwick's Research Code of Practice:

[https://warwick.ac.uk/services/ris/research\\_integrity/code\\_of\\_practice\\_and\\_policies/research\\_code\\_of\\_practice/](https://warwick.ac.uk/services/ris/research_integrity/code_of_practice_and_policies/research_code_of_practice/)

You are also required to familiarise yourself with the University of Warwick's Code of Practice for the Investigation of Research Misconduct:

[https://warwick.ac.uk/services/ris/research\\_integrity/research\\_misconduct/codeofpractice\\_research\\_misconduct/](https://warwick.ac.uk/services/ris/research_integrity/research_misconduct/codeofpractice_research_misconduct/)

You must ensure that you are compliant with all necessary data protection regulations:

<https://warwick.ac.uk/services/idc>

Please ensure that evidence of all necessary local permissions is provided to BSREC prior to commencing your study.

Please also be aware that BSREC grants **ethical approval** for studies. The seeking and obtaining of all other necessary approvals is the responsibility of the investigator.

Any substantial changes to any aspect of the project will require further review by the Committee and the PI is required to notify the Committee as early as possible should they wish to make any such changes. The BSREC Secretary should be notified of any minor amendments to the study.

May I take this opportunity to wish you the very best of luck with this study.

Yours sincerely

pp. 

Dr David Ellard  
Chair, Biomedical and Scientific Research Ethics Committee

Appendix 3.2: Oyo State Research Ethics Review Committee approval letter

TELEGRAMS.....

TELEPHONE.....



**MINISTRY OF HEALTH**  
**DEPARTMENT OF PLANNING, RESEARCH & STATISTICS DIVISION**  
**PRIVATE MAIL BAG NO. 5027, OYO STATE OF NIGERIA**

Your Ref. No. ....

All communications should be addressed to

the Honorable Commissioner quoting

Our Ref. No. AD 13/479/ 1247

7<sup>th</sup> May, 2019

The Principal Investigator,  
Department of Periodontology and Community Dentistry,  
College of Medicine,  
University of Ibadan,  
Ibadan.

**Attention: Osuh Mary**

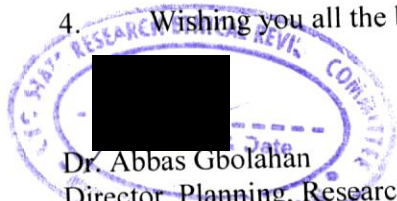
**ETHICS APPROVAL FOR THE IMPLEMENTATION  
OF YOUR RESEARCH PROPOSAL IN OYO STATE**

This is to acknowledge that your Research Proposal titled: "Determinants of Oral Diseases and Oral Health Care Needs in Slums: A Comparative Study with Non-slum Urban Settings in Nigeria." has been reviewed by the Oyo State Ethics Review Committee.

2. The committee has noted your compliance. In the light of this, I am pleased to convey to you the full approval by the committee for the implementation of the Research Proposal in Oyo State, Nigeria.

3. Please note that the National Code for Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations, in line with this, the Committee will monitor closely and follow up the implementation of the research study. However, the Ministry of Health would like to have a copy of the results and conclusions of findings as this will help in policy making in the health sector.

4. Wishing you all the best.



Dr. Abbas Gbolahan  
Director, Planning, Research & Statistics  
Secretary, Oyo State, Research Ethics Review Committee

Appendix 4.1: Details of web address and link for each database search strategy details and results for all electronic databases and journals and grey literature

Data base	Link	Search	Date	Hits
PUBMED	<a href="https://pubmed.ncbi.nlm.nih.gov/advanced/">https://pubmed.ncbi.nlm.nih.gov/advanced/</a>  <a href="https://pubmed.ncbi.nlm.nih.gov/?term=longguerya8ad9b1abbe2d97a69c9&amp;size=200">https://pubmed.ncbi.nlm.nih.gov/?term=longguerya8ad9b1abbe2d97a69c9&amp;size=200</a>	<p>Search: (((((((((dental caries) OR (periodontal disease)) OR (oral cancer)) OR (dental fluorosis)) OR (dental trauma)) OR (dental erosion)) AND (((((((dental health survey or oral health survey) OR (prevalence or incidence)) OR (risk factors or associated factors)) OR (oral health or hygiene practices)) OR (oral health or hygiene practices)) OR (interviews or qualitative research or focus group discussions)) OR (oral health beliefs or myths or attitudes or knowledge)) OR (oral health service utilization or access to oral health services))) AND (((poverty area) OR (slum or suburb or sub-urban or favela or baladi or bandas de mieri or barraco or ghetto or downtown or informal settlement or barrio marginal or barrio or bidonville or barek or inner city or busbee or challis or shack or cherek bete or d'agata or outskirts or ester or galdos or gecekondou or ghettos or krishi or shah or kalyan or katsas or lobban or loteamento or medina chouaib or morro or mudun safi or shantytown or musique or shanty town or solares or tanaka or saudis or tugurio or usuku or modolo or watts or zopadpattis)) OR (non-slum or urban non slum or metropolis or township or municipal or municipality or civic or city or city centre or city center))) AND (((developing country) OR (Third world country)) OR (LMIC)) OR (Low and middle income country)) OR (Africa or Asia or Caribbean or West Indies or South America or Latin America or Central America)) AND ((English[Language]) AND ("2000/01/10"[Date - Publication] : "2020/07/15"[Date - Publication]))</p>	15/07/2020 07:46:46	1,764
Embase	<p>OVID</p> <p><a href="https://ovidsp.pd1.ovid.com/sp-4.06.0a/ovidweb.cgi">https://ovidsp.pd1.ovid.com/sp-4.06.0a/ovidweb.cgi</a></p>	<p>Database: Embase Classic+Embase &lt;1947 to 2020 Week 26&gt; Search Strategy:</p> <p>-----</p> <ol style="list-style-type: none"> <li>1 exp dental caries/ or dental caries*.mp. (60344)</li> <li>2 exp periodontal disease/ or exp periodontitis/ or exp gingivitis/ or periodontal disease*.mp. (111352)</li> <li>3 exp mouth cancer/ or oral cancer*.mp. or exp mouth tumor/ (127420)</li> <li>4 exp dental fluorosis/ or fluorosis/ or dental fluorosis*.mp. (4849)</li> <li>5 exp tooth injury/ or exp tooth fracture/ or dental trauma*.mp. (12254)</li> <li>6 dental erosion*.mp. (1227)</li> <li>7 health survey/ or oral health survey*.mp. (197268)</li> <li>8 oral disease epidemiology*.mp. or exp mouth disease/ or exp epidemiology/ (4063443)</li> <li>9 prevalence*.mp. or exp prevalence/ (1080643)</li> <li>10 incidence*.mp. or exp incidence/ (1307531)</li> <li>11 exp risk factor/ or risk factors*.mp. (1259872)</li> <li>12 exp dental care/ or attitude to health/ or oral health practice*.mp. or exp mouth hygiene/ (316781)</li> <li>13 dental prevention/ or prevention/ or prevention*.mp. or exp tertiary prevention/ or exp secondary prevention/ or exp caries prevention/ or exp primary prevention/ (1908028)</li> <li>14 exp semi structured interview/ or exp interview/ or interview*.mp. or exp structured interview/ or exp unstructured interview/ (516860)</li> <li>15 exp qualitative research/ or qualitative research*.mp. (86095)</li> <li>16 exp health care utilization/ or exp "facilities and services utilization"/ or utilization*.mp. (395441)</li> <li>17 exp health care access/ or health service access*.mp. (61622)</li> <li>18 exp developing country/ or developing country*.mp. (99934)</li> <li>19 (Afghanistan or Albania or Algeria or Angola or Antigua or Barbuda or Argentina or Armenia or Armenian or Aruba or Azerbaijan or Bahrain or Bangladesh or Barbados or Benin or Byelarus or Byelorussian or Belarus or Belorussian or Belorussia or Belize or Bhutan or Bolivia or Bosnia or Herzegovina or Hercegovina or Botswana or Brasil or Brazil or Bulgaria or Burkina Faso or Burkina Fasso or Upper Volta or Burundi or Urundi or Cambodia or Khmer Republic or Kampuchea or Cameroon or Camerouns or Cameroon or Camerons or Cape Verde or Central African Republic or Chad or Chile or China or Colombia or Comoros or Comoro Islands or Comores or Mayotte or Congo or Zaire or Costa Rica or Cote d'Ivoire or Ivory Coast or Croatia or Cuba or Cyprus or Czechoslovakia or Czech Republic or Slovakia or Slovak Republic or Djibouti or French Somaliland or Dominica or Dominican Republic or East Timor or East Timur or Timor Leste or Ecuador or Egypt or United Arab Republic or El Salvador or Eritrea or Estonia or Ethiopia or Fiji or Gabon or Gabonese Republic or Gambia or Gaza or Georgia Republic or Georgian Republic or Ghana or Gold Coast or Greece or Grenada or Guatemala or Guinea or Guam or Guiana or Guyana or Haiti or Honduras or Hungary or India or Maldives or Indonesia or Iran or Iraq or Isle of Man or Jamaica or Jordan or Kazakhstan or Kazakh or Kenya or Kiribati or Korea or Kosovo or Kyrgyzstan or Kirghizia or Kyrgyz Republic or Kirghiz or Kirgizstan or Lao PDR or Laos or Latvia or Lebanon or Lesotho or Basutoland or Liberia or Libya or Lithuania or Macedonia or Madagascar or Malagasy Republic or Malaysia or Malaya or Malay or Sabah or Sarawak or Malawi or Nyasaland or Mali or Malta or Marshall Islands or Mauritania or Mauritius or Agalega Islands or Mexico or Micronesia or Middle East or Moldova or Moldavia or Moldovan or Mongolia or Montenegro or Morocco or Ifni or Mozambique or Myanmar or Myanma or Burma or Namibia or Nepal or Netherlands Antilles or New Caledonia or Nicaragua or Niger or Nigeria or Northern Mariana Islands or Oman or Muscat or Pakistan or Palau or Palestine or Panama or Paraguay or Peru or Philippines or Phillipines or Philippines or Poland or Portugal or Puerto Rico or Romania or Rumania or Roumania or Russia or Russian or Rwanda or Ruanda or Saint Kitts or St Kitts or Nevis or Saint Lucia or St Lucia or Saint Vincent or St Vincent or Grenadines or Samoa or Samoan Islands or Navigator Island or Navigator Islands or Sao Tome or Saudi Arabia or Senegal or Serbia or Montenegro or Seychelles or Sierra Leone or Slovenia or Sri Lanka or Ceylon or Solomon Islands or Somalia or South Africa or Sudan or Suriname or Surinam or Swaziland or Syria or Tajikistan or Tadjikistan or Tadjikistan or Tadzjik or Tanzania or Thailand or Togo or Togolese Republic or Tonga or Trinidad or Tobago or Tunisia or Turkey or Turkmenistan or Turkmen or Uganda or Ukraine or Uruguay or USSR or Soviet Union or Union of Soviet Socialist Republics or Uzbekistan or Uzbek or Vanuatu or New Hebrides or Venezuela or Vietnam or Viet Nam or West Bank or Yemen or Yugoslavia or Zambia or Zimbabwe or Rhodesia).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word] (2414870)</li> </ol>	27/6/2020	1,369

		<p>20 (Africa or Asia or Caribbean or West Indies or South America or Latin America or Central America).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word] (369556)</p> <p>21 third world country*.mp. (186)</p> <p>22 exp lowest income group/ or exp low income country/ or income*.mp. or exp middle income country/ or exp middle income group/ (188362)</p> <p>23 LMIC*.mp. (5931)</p> <p>24 exp poverty/ or slum*.mp. (50812)</p> <p>25 (suburb or sub-urban or favela or baladi or baladi or bandas de mieri or barraco or ghetto or downtown or informal settlement or barrio marginal or barrio or bidonville or barek or inner city or busbee or challis or shack or cherek bete or d'agata or outskirts or ester or galdos or gecekondou or ghettos or krishi or shah or kalyan or katsas or lobban or loteamento or medina chouaib or morro or mudun safi or shantytown or musique or shanty town or solares or tanaka or saudis or tugurio or usuku or modolo or watts or zopadpattis).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word] (350302)</p> <p>26 (non-slum or urban non slum or metropolis or township or municipal or municipality or civic or city or city centre or city center).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word] (231943)</p> <p>27 1 or 2 or 3 or 4 or 5 or 6 (302193)</p> <p>28 7 or 8 or 9 or 10 (4883690)</p> <p>29 11 or 12 or 13 or 14 or 15 or 16 or 17 (4013809)</p> <p>30 28 or 29 (7589517)</p> <p>31 18 or 19 or 20 or 21 or 22 or 23 (2746037)</p> <p>32 24 or 25 or 26 (615742)</p> <p>33 27 and 30 and 31 and 32 (1917)</p> <p>34 limit 33 to (english language and yr="2000 - 2020") (1369)</p>		
<b>HINARI</b>	<a href="https://login.research4life.org/tacsqr/Oextranet_w/ho_int/hinari/en/journals.php">https://login.research4life.org/tacsqr/Oextranet_w/ho_int/hinari/en/journals.php</a>	((LMIC) OR (developing countries)) AND ((slum or poverty areas) OR (suburb or sub-urban or favela or baladi or bandas de mieri or barraco or ghetto or downtown or informal settlement or barrio marginal or barrio or bidonville or barek or inner city or busbee or challis or shack or cherek bete or d'agata or outskirts or ester or galdos or gecekondou or ghettos or krishi or shah or kalyan or katsas or lobban or loteamento or medina chouaib or morro or mudun safi or shantytown or musique or shanty town or solares or tanaka or saudis or tugurio or usuku or modolo or watts or zopadpattis) OR (non-slum or urban non slum or metropolis or township or municipal or municipality or civic or city or city centre or city center)) AND ((oral health survey) OR (oral disease epidemiology) OR (prevalence or incidence) OR (risk factors) OR (oral health practice) OR (oral health service utilization) OR (oral health behaviour) OR (qualitative research) OR (qualitative interview))	17/4/2020	510
<b>Medline</b>	<a href="https://ovidsp.dc1.ovid.com/sp-4.07.0b/ovidweb.cgi">https://ovidsp.dc1.ovid.com/sp-4.07.0b/ovidweb.cgi</a>	<p>Database: Ovid MEDLINE(R) &lt;1946 to June Week 5 2020&gt;</p> <p>Search Strategy:</p> <p>-----</p> <p>1 exp DMF Index/ or exp Dental Caries/ or dental caries*.mp. (51124)</p> <p>2 exp Alveolar Bone Loss/ or exp Periodontal Diseases/ or periodontal disease*.mp. or exp Gingivitis/ or exp Periodontitis/ (90847)</p> <p>3 exp Precancerous Conditions/ or exp Mouth Neoplasms/ or oral cancer*.mp. (114503)</p> <p>4 exp Fluorosis, Dental/ or dental fluorosis*.mp. (2800)</p> <p>5 exp Tooth Fractures/ or exp Tooth Injuries/ or exp Tooth Avulsion/ or dental trauma*.mp. (10687)</p> <p>6 exp Tooth Erosion/ or dental erosion*.mp. (2990)</p> <p>7 exp Dental Health Surveys/ or dental health survey*.mp. or exp Oral Health/ (35991)</p> <p>8 exp Prevalence/ or prevalence*.mp. (622197)</p> <p>9 exp Incidence/ or incidence*.mp. (771360)</p> <p>10 exp Risk Factors/ or risk factors*.mp. (969857)</p> <p>11 exp Health Knowledge, Attitudes, Practice/ or exp Oral Hygiene/ or exp Dental Care/ or oral health practice*.mp. (159439)</p> <p>12 exp Tertiary Prevention/ or exp Secondary Prevention/ or prevention*.mp. or exp Primary Prevention/ (1638614)</p> <p>13 exp Qualitative Research/ or interviews*.mp. (198377)</p> <p>14 exp Focus Groups/ or focus group*.mp. (43001)</p> <p>15 exp Culture/ or beliefs*.mp. (198932)</p> <p>16 myths*.mp. (5139)</p> <p>17 exp "Patient Acceptance of Health Care"/ or health care utilization*.mp. (156029)</p> <p>18 exp Health Services Accessibility/ or health service access*.mp. (110546)</p> <p>19 developing country*.mp. or exp Developing Countries/ (77639)</p> <p>20 (Afghanistan or Albania or Algeria or Angola or Antigua or Barbuda or Argentina or Armenia or Armenian or Aruba or Azerbaijan or Bahrain or Bangladesh or Barbados or Benin or Byelarus or Byelorussian or Belarus or Belorussian or Belorussia or Belize or Bhutan or Bolivia or Bosnia or Herzegovina or Hercegovina or Botswana or Brasil or Brazil or Bulgaria or Burkina Faso or Burkina Fasso or Upper Volta or Burundi or Urundi or Cambodia or Khmer Republic or Kampuchea or Cameroon or Camerouns or Cameron or Camerons or Cape Verde or Central African Republic or Chad or Chile or China or Colombia or Comoros or Comoro Islands or Comores or Mayotte or Congo or Zaire or Costa Rica or Cote d'Ivoire or Ivory Coast or Croatia or Cuba or Cyprus or Czechoslovakia or Czech Republic or Slovakia or Slovak Republic or Djibouti or French Somaliland or Dominica or Dominican Republic or East Timor or East Timor or Timor Leste or Ecuador or Egypt or United Arab Republic or El Salvador or Eritrea or Estonia or Ethiopia or Fiji or Gabon or Gabonese Republic or Gambia or Gaza or Georgia Republic or Georgian Republic or Ghana or Gold Coast or Greece or Grenada or Guatemala or Guinea or Guam or Guiana or Guyana or Haiti or Honduras or Hungary or India or Maldives or Indonesia or Iran or Iraq or Isle of Man or Jamaica or Jordan or Kazakhstan or Kazakh or Kenya or Kiribati or Korea or Kosovo or Kyrgyzstan or Kirghizia or Kyrgyz Republic or Kirghiz or Kirgizstan or Lao PDR or Laos or Latvia or Lebanon or Lesotho or Basutoland or Liberia or Libya or Lithuania or Macedonia or Madagascar or Malagasy Republic or Malaysia or Malaya or Malay or Sabah or Sarawak or Malawi or Nyasaland or Mali</p>	15/07/2020	661

		<p>or Malta or Marshall Islands or Mauritania or Mauritius or Agalega Islands or Mexico or Micronesia or Middle East or Moldova or Moldavia or Moldovan or Mongolia or Montenegro or Morocco or Ifni or Mozambique or Myanmar or Myanma or Burma or Namibia or Nepal or Netherlands Antilles or New Caledonia or Nicaragua or Niger or Nigeria or Northern Mariana Islands or Oman or Muscat or Pakistan or Palau or Palestine or Panama or Paraguay or Peru or Philippines or Philipines or Phillipines or Phillipines or Poland or Portugal or Puerto Rico or Romania or Rumania or Roumania or Russia or Russian or Rwanda or Ruanda or Saint Kitts or St Kitts or Nevis or Saint Lucia or St Lucia or Saint Vincent or St Vincent or Grenadines or Samoa or Samoan Islands or Navigator Island or Navigator Islands or Sao Tome or Saudi Arabia or Senegal or Serbia or Montenegro or Seychelles or Sierra Leone or Slovenia or Sri Lanka or Ceylon or Solomon Islands or Somalia or South Africa or Sudan or Suriname or Surinam or Swaziland or Syria or Tajikistan or Tadjhikistan or Tadjikistan or Tadjhik or Tanzania or Thailand or Togo or Togolese Republic or Tonga or Trinidad or Tobago or Tunisia or Turkey or Turkmenistan or Turkmen or Uganda or Ukraine or Uruguay or USSR or Soviet Union or Union of Soviet Socialist Republics or Uzbekistan or Uzbek or Vanuatu or New Hebrides or Venezuela or Vietnam or Viet Nam or West Bank or Yemen or Yugoslavia or Zambia or Zimbabwe or Rhodesia).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (1636830)</p> <p>21 (Africa or Asia or Caribbean or West Indies or South America or Latin America or Central America).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (243797)</p> <p>22 third world country*.mp. (91)</p> <p>23 LMIC*.mp. (3188)</p> <p>24 (low and middle income countries*).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (11663)</p> <p>25 exp Poverty Areas/ or slum*.mp. (7842)</p> <p>26 (suburb or sub-urban or favela or baladi or bandas de mieri or barraco or ghetto or downtown or informal settlement or barrio marginal or barrio or bidonville or barek or inner city or busbee or challis or shack or cherek bete or d'agata or outskirts or ester or galdos or gecekondu or ghettos or krishi or shah or kalyan or katsas or lobban or loteamento or medina chouaib or morro or mudun safi or shantytown or musique or shanty town or solares or tanaka or saudis or tugurio or usuku or modolo or watts or zopadpattis).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (126643)</p> <p>27 (non-slum or urban non slum or metropolis or township or municipal or municipality or civic or city or city centre or city center).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (145954)</p> <p>28 1 or 2 or 3 or 4 or 5 or 6 (258985)</p> <p>29 7 or 8 or 9 or 10 (2022113)</p> <p>30 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 (2261859)</p> <p>31 29 or 30 (3843329)</p> <p>32 19 or 20 or 21 or 22 or 23 or 24 (1761705)</p> <p>33 25 or 26 or 27 (270246)</p> <p>34 28 and 31 and 32 and 33 (983)</p> <p>35 limit 34 to (english language and yr="2000 - 2020") (661)</p> <p>*****</p>		
CRD DARE Database	<a href="https://www.crd.york.ac.uk/CRDWeb/HistoryPage.asp">https://www.crd.york.ac.uk/CRDWeb/HistoryPage.asp</a>	<p>1 (developing country) IN DARE FROM 2000 TO 2020 15</p> <p>2 (third world country) IN DARE FROM 2000 TO 2020 0</p> <p>3 (low and middle income country) IN DARE FROM 2000 TO 2020 9</p> <p>4 (slum) IN DARE FROM 2000 TO 2020 3</p> <p>5 (suburb or sub-urban or favela or baladi or bandas de mieri or barraco or ghetto or downtown or informal settlement or barrio marginal or barrio or bidonville or barek or inner city or busbee or challis or shack or cherek bete or d'agata or outskirts or ester or galdos or gecekondu or ghettos or krishi or shah or kalyan or katsas or lobban or loteamento or medina chouaib or morro or mudun safi or shantytown or musique or shanty town or solares or tanaka or saudis or tugurio or usuku or modolo or watts or zopadpattis) IN DARE FROM 2000 TO 2020 324</p> <p>6 (Africa or Asia or Caribbean or West Indies or South America or Latin America or Central America) IN DARE FROM 2000 TO 2020 668</p> <p>7 (non-slum or urban non slum or metropolis or township or municipal or municipality or civic or city or city centre or city center) IN DARE FROM 2000 TO 2020 72</p> <p>8 (dental caries) IN DARE FROM 2000 TO 2020 125</p> <p>9 (periodontal disease) IN DARE FROM 2000 TO 2020 44</p> <p>10 (oral cancer) IN DARE FROM 2000 TO 2020 26</p> <p>11 (dental fluorosis) IN DARE FROM 2000 TO 2020 4</p> <p>12 (dental trauma) IN DARE FROM 2000 TO 2020 4</p> <p>13 (dental erosion) IN DARE FROM 2000 TO 2020 2</p> <p>14 (oral health survey) IN DARE FROM 2000 TO 2020 0</p> <p>15 (health survey) IN DARE FROM 2000 TO 2020 49</p> <p>16 (oral disease epidemiology) IN DARE FROM 2000 TO 2020 0</p> <p>17 (disease epidemiology) IN DARE FROM 2000 TO 2020 63</p> <p>18 (prevalence) IN DARE FROM 2000 TO 2020 1296</p>	06/07/2020	3

		<p>19 (incidence) IN DARE FROM 2000 TO 2020 3546</p> <p>20 (risk factors) IN DARE FROM 2000 TO 2020 3295</p> <p>21 (health care practice) IN DARE FROM 2000 TO 2020 16</p> <p>22 (health care beliefs) IN DARE FROM 2000 TO 2020 0</p> <p>23 (beliefs) IN DARE FROM 2000 TO 2020 89</p> <p>24 (myths) IN DARE FROM 2000 TO 2020 3</p> <p>25 (practices) IN DARE FROM 2000 TO 2020 326</p> <p>26 (interview) IN DARE FROM 2000 TO 2020 206</p> <p>27 (qualitative research) IN DARE FROM 2000 TO 2020 160</p> <p>28 (prevention) IN DARE FROM 2000 TO 2020 7948</p> <p>29 (utilization) IN DARE FROM 2000 TO 2020 527</p> <p>30 (access) IN DARE FROM 2000 TO 2020 580</p> <p>31 #1 OR #2 OR #3 OR #6 685</p> <p>32 #4 OR #5 OR #7 390</p> <p>33 #8 OR #9 OR #10 OR #11 OR #12 OR #13 193</p> <p>34 #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #26 OR #27 OR #28 OR #29 OR #30 13777</p> <p>35 #31 OR #32 1067</p> <p>36 #33 AND #34 AND #35 3</p>		
<b>Essential Health Links</b>	<a href="https://www.hivsharespace.net/resource-library">https://www.hivsharespace.net/resource-library</a>	<p>Oral health survey <a href="https://www.hivsharespace.net/search?search_api_fulltext=oral+health+survey&amp;type=All&amp;sort_by=created&amp;sort_order=DESC&amp;x=0&amp;y=0">https://www.hivsharespace.net/search?search_api_fulltext=oral+health+survey&amp;type=All&amp;sort_by=created&amp;sort_order=DESC&amp;x=0&amp;y=0</a></p> <p>Oral OR dental health survey <a href="https://www.hivsharespace.net/search?search_api_fulltext=oral+health+survey&amp;type=All&amp;sort_by=created&amp;sort_order=DESC&amp;x=0&amp;y=0">https://www.hivsharespace.net/search?search_api_fulltext=oral+health+survey&amp;type=All&amp;sort_by=created&amp;sort_order=DESC&amp;x=0&amp;y=0</a></p> <p>No dental health related topics on the page</p>	06/07/2020	17  No result found
<b>African Index Medicus (AIM)</b>	<a href="https://index.medicus.afro.who.int/aim/opac_css/index.php?vl=more_results&amp;autolevel1=1">https://index.medicus.afro.who.int/aim/opac_css/index.php?vl=more_results&amp;autolevel1=1</a>	392 electronic documents or title(s) found 'oral or dental health survey OR beliefs OR myths OR practices OR utilization of dental services	07/07/2020	392
<b>BabelMesh</b>	<a href="https://babelmesh.nlm.nih.gov/search.php?from=eng&amp;com=">https://babelmesh.nlm.nih.gov/search.php?from=eng&amp;com=</a>	oral OR dental health survey AND slums	08/07/2020	401
<b>ELDIS</b>	<a href="https://www.eldis.org/search?query=oral+OR+dental+health+survey+OR+practices+OR+beliefs+OR+myths+OR+utilization+of+dental+facility&amp;theme=C563&amp;country=A1159&amp;object_type%5BDocument%5D=Document&amp;region=&amp;publication_year_from=2000&amp;publication_year_to=2020&amp;publisher=&amp;perpage=100&amp;sort=publication_date_desc&amp;op=Go&amp;form_build_id=form-YbbTEpT62zcwnbdP3ALEflu6s3PfeU_GHQAXHQInrkY&amp;fo">https://www.eldis.org/search?query=oral+OR+dental+health+survey+OR+practices+OR+beliefs+OR+myths+OR+utilization+of+dental+facility&amp;theme=C563&amp;country=A1159&amp;object_type%5BDocument%5D=Document&amp;region=&amp;publication_year_from=2000&amp;publication_year_to=2020&amp;publisher=&amp;perpage=100&amp;sort=publication_date_desc&amp;op=Go&amp;form_build_id=form-YbbTEpT62zcwnbdP3ALEflu6s3PfeU_GHQAXHQInrkY&amp;fo</a>	<p>No dental health related fields in the Focus Topics Outputs are country specific</p> <p>Searching documents for 'oral OR dental health survey OR practices OR beliefs OR myths OR utilization of dental facility' with a thematic focus on <b>Health</b> in Nigeria</p>	07/07/2020	0



	<a href="#">rm_id=idscontent_form</a>			
<b>Bioline International</b>	<a href="http://www.bioline.org.br/search?search_target=all_pub&amp;search_string=oral+or+dental+health+survey">http://www.bioline.org.br/search?search_target=all_pub&amp;search_string=oral+or+dental+health+survey</a>	oral or dental health survey OR beliefs OR myths OR practices OR utilization of dental services oral, dental, health, survey, slum oral or health survey slum	08/07/2020	0 0 10 49
<b>Reference checking</b>				
<b>contacting experts in the field</b>				
<b>studies from conference abstracts</b>				
			<b>Total</b>	3,526
			<b>After deduplication</b>	3,011

Appendix 5.1: Summary of ratings of included study in relation to MMAT items and reasons for justification

S/N	Study	SS calc	Sampling method	Sampling technique	Response rate	Sample vs sampling frame	Overall rating	Reason
1	Hannan et al, 2014	No evidence	Not clear	Cluster random sampling	Not given	No reference frame given	Good	Large sample size
2	Jaafar et al 2014	No evidence	Not clear	Simple random sampling	Not given	No major discrepancy	Good	Low risk of non-response bias
3	Patel et al. 2017	No	Not clear	Unspecified random sampling technique	Not given	Not given	Low	High risk of non-response bias
4	Gholami et al. 2012	No	NA	Purposive sampling	Not given	Not given	Low	High risk of non-response bias
5	Rezaei et al 2018	Yes 1,067	Clear	Systematic random sampling	84%	No major discrepancy	High	Low risk of non-response bias
6	Costa et al, 2012	Yes 1150	Clear	Proportionate random sample	Not given	No major discrepancy	High	Low risk of non-response bias
7	Msyamboza et al 2016	Yes 5120	Clear	Multi-stage sample	Not given	No major discrepancy	High	Low risk of non-response bias
8	Olusile et al, 2014	No	Clear	Multi-stage sample	Not given	No major discrepancy noted	Good	Large sample, comparable to the proportion of the sample in the national population
9	Handa et al 2016	Yes 810	Clear	Multistage random sample	Not given	No obvious discrepancy	Good	Low risk of non-response bias
10	Tobin et al, 2017	No	Clear	Stratified cluster sampling	Not given	Not given	Can't tell	High risk of non-response bias
11	Airen et al. 2014	Yes 138	Not clear	Unspecified random sampling technique	Not given	Not given	Can't tell	An unspecified random sampling method was used and the sampling procedure was not clear, neither was a response rate provided
12	Morgan et al. 2018	No	Clear	Pathfinder stratified cluster methodologies provided in WHO Oral Health Surveys	Not given	No discrepancy	High	It was the country's National oral health survey
13	Olutola and Ayo-Yusuf 2012	Yes 2,791.	Clear	Multi-stage probability sampling strategy	87.5%	No discrepancy	High	nationally representative sample of adults population
14	Varenne et al. 2004	No	Clear	Multistage random sample	Not given	No discrepancy	High	It formed the epidemiological data for planning and evaluation of oral health care programmes
15	Hessari et al 2007	No	Clear	Stratified cluster random sampling followed the WHO guidelines	Not given	No discrepancy	High	data were part of a national survey conducted in Iran
16	Masalu et. al 2009	No	Clear	Purposive selection of villages to be included	84%	No discrepancy	Can't tell	national pathfinder cross sectional survey in Tanzania
17	Sun et al. 2018	Yes 4,410	Clear	Multistage stratified sampling	Not given	No discrepancy	High	The country's 4 <sup>th</sup> national oral health survey
18	Morgan et al. 2018	No	Clear	multistage cluster sampling	Not given	No discrepancy	High	Country's 2 <sup>nd</sup> national oral health survey. A very large sample size of 140,712

SS calc- Sample size calculation

## Appendix 6.1: Questionnaire tool



### Questionnaire (WP 2- Quantitative research)

**Study Title:** Prevalence and Determinants of Oral Diseases and Oral Health Care Needs in Slums: A comparative study with non-slum urban settings in Nigeria  
Dr Mary E. Osuh; Dr Yen-Fu Chen and Professor R. Lilford (University of Warwick).  
**Investigator(s):** Professor Emu T. Owoaje and Professor Gbemisola A. Oke (Public Health and Oral Health Experts respectively, University of Ibadan, Nigeria).

Location ID: \_\_\_\_\_

Start time: \_\_\_\_\_

Date: \_\_\_\_\_

Approach any adult in the selected building and obtain consent/permission

**OBTAINING** \_\_\_\_\_ **CONSENT** \_\_\_\_\_ **(Building)**  
Hello. My name is \_\_\_\_\_ My partner's name is \_\_\_\_\_ We are conducting a survey about the determinants of dental diseases and oral health care needs of people living in Idikan/ Oke ado. The information we collect will assist in planning appropriate oral health services for your area. Your building was randomly selected for the survey. I would like to ask you some questions about the number of households within this building. Thereafter, you will choose one household by ballot to participate in the study.

Do you have any questions at this time?

May I begin the process now?

Please give me the name(s) of all the households in this building?  
Represent on tablet computer device and let system randomly select one.

Approach any adult in the selected household and obtain consent/permission

**OBTAINING** \_\_\_\_\_ **CONSENT** \_\_\_\_\_ **(Household)**  
Hello. My name is \_\_\_\_\_ My partner's name is \_\_\_\_\_ We are conducting a survey about the determinants of dental diseases and oral health care needs of people living in Idikan/ Oke ado. Participants' oral health condition will be assessed using sterile materials. The information we collect will assist in planning appropriate oral health services for your area. Your building and household were randomly selected for the survey. I would like to ask you some questions about the number of adults within your household. Thereafter, you will choose one person by ballot to participate in the study.

Do you have any questions at this time?

May I begin the process now?



5. Never-married and never lived together

**"SCHOOL ATTENDANCE"**

6. Have you ever attended a school?"

1. No                      2. Yes

7. What is the highest level of school participant ever attended?

1. None
2. Primary
3. Junior Secondary School
4. Senior secondary school
5. Tertiary
6. Special needs school
7. Vocational/trade school
8. College, certificate
9. Don't Know
10. Refused to Answer

8. What is the highest grade you ever completed?

1. None
2. Primary 1
3. Primary 2/ Grade 1
4. Primary 3/ Grade 2
5. Primary 4/ Grade 3
6. Primary 5/ Grade 4
7. Primary 6/ Grade 5
8. Secondary Form 1
9. Secondary Form 2
10. Secondary Form 3
11. Secondary Form 4
12. Secondary Form 5
13. Junior Secondary School JSS 1
14. Junior Secondary School JSS 2
15. Junior Secondary School JSS 3
16. Senior Secondary School SS 1
17. Senior Secondary School SS 2
18. Senior Secondary School SS 3
19. Polytechnic
20. Technical school
21. Vocational/trade school
22. College, certificate
23. University

9. Are you currently working?

1. No                      2. Yes

10. Have you always lived in this area/neighbourhood?

1. No                      2. Yes

11. How long have you been living (continuously) in this area?

1. Years \_\_\_\_\_

2. Months \_\_\_\_\_

12. Where were you living before?
1. In the same area/neighbourhood
  2. In another "slum" area in this country
  3. In "non-slum" urban area in this country
  4. In a rural area in this country
  5. Outside the country

13. Where have you lived for most of your life
1. In the same area/neighbourhood
  2. In another "slum" area in this country
  3. In "non-slum" urban area in this country
  4. In a rural area in this country
  5. Outside the country

### HEALTH INSURANCE STATUS

14. Are you covered by any kind of insurance plan?"

1. No 2. Yes

15. Does the health insurance cover oral health?

1. No  
2. Yes  
3. I don't know

16. What type of health insurance are you covered by?

1. Mutual health organisation/community-based health insurance  
2. Health insurance through employer  
3. Social security  
4. Other privately purchased health insurance  
5. Others (Specify) \_\_\_\_\_

17. How much does your household pay for the health insurance each year?

Value \_\_\_\_\_

18. Are you covered by insurance because of your relationship to someone else who has health insurance?

1. Yes 2. No

19. Who is enrolled in the insurance plan that gives your health insurance cover? \_\_\_\_\_  
20. Do you carry at least one mobile phone day-to-day?"

1. No 2. Yes

21. Do you have access to and are you able to use a computer, tablet or other form of digital communication other than a mobile phone, day-to-day?

1. No
2. Yes
3. Most times
4. Occasionally through someone else's

22. How do you usually access a mobile phone?

1. No access
2. Ask another household member to communicate for you
3. Borrow a phone from another member of the household when needed.
4. Have access to my own phone
5. Business/ Call centre
6. Other (Specify)\_\_\_\_\_

23. How do you usually access the internet?

1. No access
2. Ask another household member to access it for you when needed.
3. Borrow a device from another member of the household when they need to use one
4. Have access to my own
5. Other (Specify)

#### HOUSEHOLD CHARACTERISTICS

I would like to ask you some questions about your dwelling or home."

24. What is the main source of drinking water for members of your household?

1. Piped into dwelling
2. Piped to yard/plot
3. Public tap/standpipe
4. Tube well or Borehole
5. Dugwell: Protected well
6. Dugwell: Unprotected well
7. Protected spring
8. Unprotected spring
9. Rainwater
10. Tanker truck
11. Cart with small tank
12. Surface water (river/dam/lake/pond/stream/canal/irrigation channel)
13. Bottled water
14. Other (Specify)

25. Where is that water source located?

1. In own dwelling
2. In own yard/plot
3. Elsewhere

26. How long does it take to go there, get water, and come back? \_\_\_\_\_

27. Who usually goes to this source to fetch the water for your household

1. Adult woman
2. Adult man
3. Female child
4. Male child
5. No one person usually fetches the water
6. Anyone in the Household

28. Do you share this source with other households?
1. No
  2. Yes
29. How many households use this source of water? \_\_\_\_\_
30. Do you do anything to the water to make it safer to drink?
1. No
  2. Yes
31. What do you usually do to make the water safer to drink?
1. Boil
  2. Add bleach/chlorine
  3. Strain through a cloth
  4. Use water filter (ceramic/sand/composite/etc.)
  5. Solar disinfection
  6. Let it stand and Settle
  7. Cover the water container
  8. Other (Specify)
  9. Nothing
32. What kind of toilet facility do members of your household usually use?
1. Flush/pour flush to piped sewer system
  2. Flush/pour flush to septic tank
  3. Flush/pour flush to pit latrine
  4. Flush/pour flush to somewhere else
  5. Flush/pour flush don't know where
  6. Ventilated improved pit latrine
  7. Pit latrine with slab
  8. Pit latrine without slab/Open pit
  9. Composting toilet
  10. Bucket toilet
  11. Hanging toilet/hanging latrine
  12. No facility/bush/field
  13. Other (Specify)
33. Do you share this toilet facility with other households?
1. No
  2. Yes
  3. I don't know
34. How many households use this toilet facility? \_\_\_\_\_
35. Does your household have the following? Please tick as many
1. Electricity
  2. Radio
  3. Television
  4. Mobile telephone
  5. Non-mobile telephone
  6. Refrigerator
  7. Cable TV
  8. Generating set
  9. Air conditioner
  10. Computer
  11. Electric iron
  12. Fan



36. What type of fuel does your household mainly use for cooking?
1. Electricity
  2. LPG
  3. Natural gas
  4. Biogas
  5. Parafin/Kerosene
  6. Coal, lignite
  7. Charcoal
  8. Fire wood
  9. Straw/shrubs/grass
  10. Agricultural crop
  11. Animal dung
  12. No food cooked in household
  13. Other (Specify) \_\_\_\_\_
37. Where is cooking usually done?
1. In a room used for living or sleeping
  2. In a separate room used as kitchen
  3. In a separate building used as kitchen
  4. Outdoor
  5. Other (Specify) \_\_\_\_\_
38. [MAIN MATERIAL OF THE FLOOR- RECORD OBSERVATION]
1. Natural floor: earth/sand
  2. Natural floor: dung
  3. Rudimentary floor: wood planks
  4. Rudimentary floor: palm/bamboo
  5. Finished floor: Parquet or polished wood
  6. Finished floor: vinyl or asphalt strips
  7. Finished floor: ceramic tiles
  8. Finished floor: Cement
  9. Finished floor: Carpet/rug
  10. Other (Specify) \_\_\_\_\_
39. [MAIN MATERIAL OF THE ROOF- RECORD OBSERVATION]
1. Natural roof: no roof
  2. Natural roof: thatch/palm leaf
  3. Rudimentary roof: rustic mat
  4. Rudimentary roof: palm/bamboo
  5. Rudimentary roof: wood planks
  6. Rudimentary roof: cardboard
  7. Finished roof: metal/zinc
  8. Finished roof: wood
  9. Finished roof: ceramic tiles
  10. Finished roof: cement
  11. Finished roof: roofing shingles
  12. Other (Specify) \_\_\_\_\_
40. [MAIN MATERIAL OF THE EXTERIOR WALLS RECORD OBSERVATION]
1. Natural walls: no walls
  2. Natural walls: cane/palm/trunks
  3. Natural walls: dirt (mud)
  4. Rudimentary walls: bamboo with mud
  5. Rudimentary walls: stone with mud

6. Rudimentary walls: plywood
7. Rudimentary walls: cardboard
8. Rudimentary walls: reused wood
9. Finished walls: cement
10. Finished walls: stone with lime/cement
11. Finished walls: brick
12. Finished walls: cement blocks
13. Finished walls: wood planks/shingles
14. Other (Specify) \_\_\_\_\_

41. How many rooms in your household are used for sleeping? \_\_\_\_\_

42. Does any member of your household own:

1. A watch
2. A bicycle
3. A motorcycle/okada
4. Marwa/ keke napep
5. A car
6. A truck

43. Does your household own this structure that we are in (house, flat, shack)?

1. No
2. Yes

44. Does your household own the land on which the structure (house, flat, shack) sits?

1. No
2. Yes

45. Does your household pay rent?

1. Owns the building
2. Pays rent/lease
3. No rent with consent of owner
4. No rent: squatting

46. Does any member of this household own any agricultural land?

1. No
2. Yes

47. Does this household own any livestock, herds, other farm animals or poultry?

1. No
2. Yes

48. Does any member of this household have a bank account?

1. No
2. Yes

49. In the past 7 days were there days when your household did not have enough food or money to buy food?

1. No
2. Yes
3. Not sure

50. How many days in the month do you have air time (for calls and SMS) for at least one mobile phone in the household

1. Everyday
2. Almost every day (over 21 days a month but not every day)

3. More than half the days (over 14 but not as many as 21)
  4. More than 7 days but less than 14
  5. Less than 7 days
  6. Never
51. How many days in the month does someone in the household have data or access to wifi (for accessing internet for searching the web, using social media or using Email) for at least one of your digital communication devices I the household (smart phone, laptop, tablet)?
1. Everyday
  2. Almost every day (over 21 days a month but not every day)
  3. More than half the days (over 14 but not as many as 21)
  4. More than 7 days but less than 14
  5. Less than 7 days
  6. Never

### HOUSEHOLD INCOME AND EXPENDITURE

In the last part of this section, I will ask you about the total income for the household in the last 30 days. I would like to know about all sources of income. I know it may be difficult to calculate that figure, but please do try to give as accurate an amount as possible. Remember that all information will be kept strictly confidential. This information is important to assess overall health and wellbeing of people in your household compared to other, similar households."

52. I would like you to tell me your best estimate of the TOTAL income that this household has had in the last 30 days. \_\_\_\_\_
53. How much did this household receive or earn from the following in the last 30 days?
- i. SALARIED/WAGE EMPLOYMENT
  - ii. BUSINESS
  - iii. SAVINGS
  - iv. AGRICULTURE
  - v. BORROWING
  - vi. FINANCIAL GIFT/SUPPORT FROM ANY SOURCE
  - vii. ANY OTHER SOURCE OF INCOME
1. Less than 5000 Naira
  2. 5000 – 9999 Naira
  3. 10000 – 14999 Naira
  4. 15000 – 19999 Naira
  5. 20000 – 24999 Naira
  6. 25000 – 29999 Naira
  7. 30000 – 50000 Naira
  8. Above 50000 Naira
  9. Not Applicable
  10. Other source of income (Specify)

54. How much in total did your household spend on the following items?

[IF RESPONDENT UNSURE, PLEASE PROMPT WITH "TO THE BEST OF YOUR RECOLLECTION" THEN "CAN YOU ESTIMATE APPROXIMATELY WHAT IT MIGHT HAVE BEEN?"]

- i. Food in the last 7 days
- ii. Energy (paraffin, charoal) in the last 7 days
- iii. Water in the last 7 days
- iv. Transport in the last 7 days
- v. Financial gift/support to others in the last 7 days?
- vi. Electricity in the last month
- vii. Health care in the last 30 days

- viii. Religious obligations in the last 30 days?
- ix. Rent in the last month
- x. School related expenses (school fees, scholastic materials) in the last 30 days?
- xi. Other in the last 7 days

- 1. Less than 5000 naira
- 2. 5000 – 9999 naira
- 3. 10000 – 14999 naira
- 4. 15000 – 19999 naira
- 5. 20000 – 24999 naira
- 6. 25000 – 29999 naira
- 7. 30000 – 50000 naira
- 8. Above 50000 naira
- 9. None

### HOUSEHOLD DENTAL HEALTH CARE SPENDING

I would like to ask you more specific questions about how much your household and all its members spent in cash or in-kind on all dental health care and services that you received. We want expenses in the last 3 months. If payment was in-kind, please estimate a monetary value. Please exclude costs to be reimbursed by insurance."

55a. Have you or any member of your household received dental healthcare and services within the last 3 months?

- 1. No
- 2. Yes

In the last 3 months, how much did your household spend on  
(Please exclude any reimbursements from insurance and transportation costs.)

55b. Registration and consultation fees in a dental clinic? \_\_\_\_\_

56. Dental health-care by traditional dentists? \_\_\_\_\_

57. Diagnostic procedures such as dental x-rays? \_\_\_\_\_

58. Medications or drugs (prescription, non-prescription, traditional, homeopathic) \_\_\_\_\_

59. Dental treatment/ procedure? \_\_\_\_\_

60. Post- operative dental procedures review appointments \_\_\_\_\_

61. Ambulance or other transport? \_\_\_\_\_

62. Costs associated with overnight stays in a hospital or health facility? \_\_\_\_\_

63. Any other health care products or services that were not included above? \_\_\_\_\_

64. In the last 12 months, have you borrowed from financial institutions, agencies (microfinance schemes, banks, money lenders...), or individuals to pay for any dental health expenditures?

- 1. No
- 2. Yes
- 3. Don't know

65. If you borrowed any money in the last 12 months to pay for dental health expenditures, are you expected to pay this back?

- 1. No
- 2. Yes
- 3. I didn't borrow any money

66. Have you started paying back the loan?

- 1. No
- 2. Yes
- 3. I didn't borrow any money

67. Are you repaying or have you repaid the loan as a one-off payment or in instalments?

- 1. No
- 2. Yes
- 3. I didn't borrow any money

68. How Much Did you pay back? Value \_\_\_\_\_

69. What is the monthly repayment on the loan including interest? Value\_\_\_\_\_

In the last 12 months have you used or attempted to use your mobile phone or other digital communication device (e.g.: laptop, tablet) to access oral health information, advice or care for yourself where information about your oral health was received or given?"

70. Which ways of accessing oral health advice or information have you used?

1. Contacted someone (via text message, chat website, e-mail, video call etc.)
2. Researched oral health information without speaking to someone (via Google, health website etc.)
3. I have not accessed oral health information in the past 12 months

71. Who did you receive this information from or what service did you use to get this information?

1. Medical Doctor
2. Nurse
3. Midwife
4. Dentist
5. Physiotherapist or chiropractor
6. Traditional medicine practitioner
7. Pharmacist, druggist
8. Users and/or provider of health-related app.

72. Please provide name of person/organization/website/social media site and phone number or web address/e-mail address? \_\_\_\_\_

73. Have you had any problems when using your mobile phone or other device for this purpose?

1. No airtime/data/ wifi
2. Poor connectivity/signal
3. Device not sufficiently charged
4. No response from the person/organization contacted
5. Received
6. Unable to find the information needed on web/social media
7. Unable to read the relevant text found
8. Others specify
9. Not applicable

74. Why did you choose to get health information this way?

1. I could seek the health information, advice or care at a time I chose
2. I could seek the health information, advice or care in a place I chose
3. The problem was urgent
4. The problem was not urgent
5. Service providers are cordial
6. I would not have to wait at a facility
7. I trust the provider
8. I needed more information than I usually receive from a health worker
9. I had no money to get to see a health worker
10. It was cheaper than going to see a health worker
11. I had more privacy during the communication than when seeing a health worker
12. I did not want other people to know I was seeking health, information advice/ care
13. This was the only option that was available at that time
14. Others please specify\_\_\_\_\_
15. Not applicable

75. Which reason best describes why you needed this contact? -----

76. Was there a cost associated accessing this health advice or information?

1. No 2. Yes

77. Thinking about the last time you last accessed health advice or information, how much did you or your family / household members pay (Do not include cost of airtime/data) -----

78. Overall, how satisfied were you with the information, advice or care you received?

- 0. Not applicable
- 1. Very dissatisfied
- 2. Dissatisfied
- 3. Neither satisfied nor dissatisfied
- 4. Satisfied
- 5. Very satisfied

79. Did you seek information, advice or care about the same problem from an oral health care worker face-to-face after this digital contact?

1. No 2. Yes 3. Not applicable

#### **DENTAL TREATMENT SEEKING BEHAVIOUR**

80a. Have you ever seen a dentist before?

1. No 2. Yes

80b. What dental treatment(s) did you receive? Please tick as many.

- 1. Tooth extraction
- 2. Tooth filling
- 3. Root canal treatment
- 4. Had crowns
- 5. Had bridges
- 6. Had removable dentures
- 7. Had implants
- 8. Had scaling and polishing
- 9. Had a swelling removed
- 10. Had teeth aligned (orthodontic treatment)
- 11. Had fractured jaw aligned
- 12. Had my teeth bleached
- 13. Others please specify
- 14. Not applicable

80c. If you had never seen a dentist, what reason do you consider the best reason why you never did?

- 1. I use alternatives
- 2. I never had any dental problem
- 3. I hear it is usually costly
- 4. My dental problems are not severe enough
- 5. Fear of anticipated pain / instruments / dentists
- 6. I have seen a dentist before

80d. Have you needed dental health care in the last 12 months (whether/ not you received it)?

- 1. Yes
- 2. No
- 3. Refused
- 4. Never needed a dental care

81. Within the past 12 months, was there a time when you needed dental care but could not get it at that time?

1. Yes
2. No
3. Refused
4. Never needed a dental care

82. Which reason(s) best explains why you did not get the dental health care you needed? (Tick as many as applied).

1. Could not afford the cost of the visit
2. No transport available
3. Could not afford the cost of transport
4. You or your child were previously badly treated
5. Could not take the time off work too busy or had other commitments
6. The dental health care provider's drugs or equipment were inadequate
7. The health care provider's skills were inadequate
8. You did not know where to go
9. You tried but were denied health care
10. Could not afford the cost of treatment
11. Did not want to spend the money
12. My Health Insurance (NHIS) did not cover the procedures
13. Dental clinic is too far away
14. Clinic not open at convenient times
15. Another dentist recommended not doing it
16. Afraid of the procedure (injection)
17. I do not like dentists
18. They were wasting my time
19. I did not think anything serious was wrong
20. I expected the dental problem to go away on its own
21. Refused
22. Can't remember.
23. Others please specify

83. Have you ever avoided having some of the dental treatment that was recommended for you because of the cost of the procedure(s)?"

1. Yes
2. No
3. Refused
4. Not applicable

#### **DENTAL TREATMENT**

84. In total, how many times did you receive dental health care or consultation in the last 12 months?  
Value \_\_\_\_\_

85. What dental treatment(s) did you receive within the last year? Tick as many.

1. Tooth extraction
2. Tooth filling
3. Root canal treatment
4. Had crowns
5. Had bridges
6. Had removable dentures
7. Had implants
8. Had scaling and polishing
9. Had tumours removed
10. Had teeth aligned (orthodontic treatment)
11. Had fractured jaw aligned

12. Had tooth bleached
13. Others please specify \_\_\_\_\_
14. Not applicable

86. Which was the last (most recent) place/facility you received dental health care/treatment in the last 12 months?

1. Private dental clinic or facility
2. Public/Government owned hospital
3. Charity or church run dental clinic
4. Traditional Healer
5. Dental health care vendors
6. Pharmacy
7. Other (Specify) \_\_\_\_\_
8. Never received a dental treatment

87. Please name the provider / facility Name: \_\_\_\_\_

88. Who was the person/ professional you saw for your last dental health problems?

1. Medical Doctor
2. Nurse
3. Midwife
4. Dentist
5. Dental Health care vendor
6. Traditional medicine practitioner [USE LOCAL NAME]
7. Pharmacist or chemist
8. Self-medication
9. Never had dental problem
10. Others please specify \_\_\_\_\_

89. Which reason(s) best describes why you chose this source above for your dental health care?

1. Nearness / closeness of the source to me
2. Do not know where else to go
3. Cheap (low cost) affordable
4. Known efficacy/ professional expertise
5. As a first aid measure
6. I got the recommendation from someone
7. Never had a dental care need
8. Other (Specify) \_\_\_\_\_

90. Was this visit to the person/ professional above for a chronic (ongoing) condition, new condition, both, or routine check-up?

1. Chronic
2. New
3. Both
4. Routine check-up
5. Other (Specify) \_\_\_\_\_
6. Not applicable

91. Which reason best describes why you needed this visit?

1. Emergency relief of dental pain
2. First aid following a fall or an accident (domestic or road traffic)
3. Had an appointment/ booked/ scheduled
4. Routine dental check- up/ scaling and polishing
5. General advice
6. Others please specify \_\_\_\_\_



7. Not applicable

92. Thinking about your last professional dental health care visit, how did you get there?

1. Private vehicle
2. Public transportation
3. Taxicab
4. Ambulance or emergency vehicle
5. Bicycle
6. Walked
7. Other (Specify) \_\_\_\_\_
8. Not applicable

93. About how long did it take you to get there in hours and minutes? Value \_\_\_\_\_

94. About how long did you wait between arrival and first consultation with a dental health professional (in hours and minutes)? \_\_\_\_\_

95. Who paid for this most recent visit? \_\_\_\_\_

1. Respondent
2. Spouse / Partner
3. Son / Daughter
4. Another family member
5. Non-family member
6. Mandatory insurance scheme
7. Voluntary insurance scheme
8. It was free
9. Anyone else?"
10. Not applicable

96. Thinking about your last visit, how much did you/ your family/ household members pay for:

- i. Dentist's fees: \_\_\_\_\_
- ii. Medicines: \_\_\_\_\_
- iii. Tests: \_\_\_\_\_
- iv. Transport: \_\_\_\_\_
- v. Other (Specify): \_\_\_\_\_

97. About how much in total was paid out-of- pocket for this dental Visit? Value \_\_\_\_\_

98. Overall, how satisfied were you with the care you received during your last visit?

0. Not applicable
1. Very dissatisfied
2. Dissatisfied
3. Neither satisfied nor dissatisfied
4. Satisfied
5. Very satisfied

For your last visit to a dental clinic, how would you rate the following:

Give your response using the following for questions 99 to 105: (1) Very good // (2) Good // (3) Moderate // (4) Bad // (5) Very bad // (6) Not applicable

99. The amount of time you waited before being attended to? \_\_\_\_\_
100. Your experience of being treated respectfully? \_\_\_\_\_
101. How clearly health care providers explained things to you? \_\_\_\_\_
102. Your experience of being involved in making decisions for your treatment? \_\_\_\_\_
103. The way the health services ensured that you could talk privately to providers? \_\_\_\_\_
104. The ease with which you could see a health care provider you were happy with? \_\_\_\_\_

105. The cleanliness in the health facility? \_\_\_\_\_

**DENTAL HEALTH STATUS AND WELLBEING**

106. In general, would you say your dental health is:

1. Poor
2. Fair
3. Good
4. Very good
5. Excellent

107. Compared to one year ago, how would you rate your dental health in general now?

1. Much better than one year ago
2. Somewhat better now than one year ago
3. About the same
4. Somewhat worse now than one year ago
5. Much worse now than one year ago

108. During the past 12 months, did your teeth or mouth cause any pain or discomfort?

1. No
2. Yes
3. I don't know
4. Not applicable

109. Do you have any form of dental prosthesis on you?

1. No
2. Yes

110. What type of dental prosthesis are you wearing?

- i. A partial denture?
- ii. A full upper denture?
- iii. A full lower denture?
- iv. Orthodontic appliance?
- v. Dental Implant?
- vi. Dental Crown?
- vii. Dental bridge work?
- viii. Palatal obturators?
- ix. I am not using a dental prosthesis.

111. How would you describe the state of your teeth?

1. Excellent
2. Very good
3. Good
4. Average
5. Poor
6. Very poor
7. I Don't know

112. How would you describe the state of your gums?

1. Excellent
2. Very good

3. Good
4. Average
5. Poor
6. Very poor
7. I Don't know

113. How often do you clean your teeth?

1. Never
2. Once a month
3. 2–3 times a month
4. Once a week
5. 2–6 times a week
6. Once a day
7. Twice a day
8. More than twice a day

114. Which of the following do you use to clean your teeth? Please tick as many

- i. Toothbrush
- ii. Wooden toothpicks
- iii. Plastic toothpicks?
- iv. Thread (dental floss)
- v. Charcoal
- vi. Chew-stick (pako)
- vii. Others please specify

115. If you use a toothbrush, how long does it last before you change it

1. One month
2. Two to three months
3. More than 3 months
4. Whenever it wears out
5. I do not use toothbrush

116. Please answer the following using

(1) Yes // (2) Sometimes // (3) No // (4) I don't know //

- i. You use toothpaste to clean your teeth
- ii. You use a toothpaste that contains fluoride

117. From whom did you seek dental health service the last time you needed dental health care?

1. Self- medication
2. Chemist/ pharmacy prescription
3. Traditional healer
4. A nurse
5. A medical doctor
6. A Dentist
7. Did not receive dental care
8. Native dental care vendor
9. Relatives/friends/neighbour's advice
10. Never had dental problem

118. How long is it since you last saw a dentist?

1. Less than 6 months

2. 6–12 months
3. More than 1 year but less than 2 years
4. 2 years or >but < 5 years
5. 5 years or more
6. Never received dental care

119. What was the reason for your last visit to the dentist?

1. Consultation/advise
2. Pain/ trouble with teeth, gums/ mouth
3. Treatment/ follow-up treatment
4. Routine check-up/treatment
5. Don't know/don't remember

120. Because of the state of your teeth or mouth, how often have you experienced any of the following problems during the past 12 months? Give your response in terms of the following?

1. Very often // 2. Fairly often // 3. Sometimes // 4. No // 5. Can't remember

- i. Difficulty in biting foods
- ii. Difficulty chewing foods
- iii. Difficulty with speech/trouble or pronouncing words
- iv. Dry mouth
- v. Felt embarrassed due to appearance of teeth
- vi. Felt tense because of problems with teeth or mouth
- vii. Have avoided smiling because of teeth
- viii. Had sleep that is often interrupted
- ix. Have taken days off work
- x. Difficulty doing usual activities
- xi. Felt less tolerant of spouse or people who are close to you
- xii. Have reduced participation in social activities

121. How often do you eat or drink any of the following foods, even in small quantities? Give your response in terms of the following:

Several times a day (6) // Every day (5) // Several times a week (4) // Once a month (3) // Several times a month (2) // Seldom or never (1).

- i. Fresh fruit
- ii. Biscuits, cakes (funkaso), puff puff
- iii. Pies, buns, chinchin, rolls
- iv. Sugar/ honey drinks (kunu, koko)
- v. Yoghurts eg. fura de nunu, wara
- vi. Sweets/ gum /kokonut
- vii. Soft drinks: Coke, zobo etc
- viii. Tea/Ogi/ kamu with sugar
- ix. Bread (dried) with akara, dodo

122. How often do you rinse(gaggle) your mouth with water immediately after consuming the foods in Q121 above?

1. Always
2. Very often
3. Sometimes
4. Rarely
5. Never
6. Refused

123. How often do you use any of the following? Give your response in terms of the following:

Every day (1) // Several times a week (2) // Once a week (3) // Several times a month (4) // Seldom or on occasions (5) // Never (6)

- i. Cigarettes
- ii. Jedi (white paper wrap)
- iii. Pipe (ikoko)
- iv. Chewing tobacco
- v. Snuff (Tabba)
- vi. Shisa
- vii. Weed (Igbo, Ganja)
- viii. Marijuana
- ix. Pawpaw leaves
- x. Betel quid (betel leave+areca nut +lime)
- xi. Chewing gutka (betel quid + tobacco)
- xii. Mouth wash
- xiii. Others please specify

124. During the past 30 days, on the days you drank alcohol, how many drinks did you usually drink per day?

0. Less than 1 drink
1. 1 drink
2. 2 drinks
3. 3 drinks
4. 4 drinks
5. 5 or more drinks
6. Did not drink alcohol during the past 30 days

125. Did you consume bottled water for any more than 20% of your water needs during your time of stay here?

1. No
2. Yes

Thank you for your time.

Now we shall move on to the oral examination session.

Appendix 6.2: WHO oral health assessment form



# World Health Organization

## Oral Health Assessment Form for Adults, 2013

### Annex 1

	Leave blank		Year	Month	Day		Identification No.	Orig/Dupl	Examiner															
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<b>General information:</b>		<b>Sex</b> 1=M, 2=F		<b>Date of birth</b>				<b>Age in years</b>																
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<b>Community</b> (geographical location)	(34)	<input type="text"/>	<input type="text"/>	(35)	<b>Location</b> Urban (1) Periurban (2) Rural (3)	<input type="text"/>	(36)																	
<b>Other data</b> _____	(37)	<input type="text"/>	<input type="text"/>	(38)	<b>Other data</b> _____	(39)	<input type="text"/>	<input type="text"/>	(40)															
<b>Other data</b> _____	(41)	<input type="text"/>	<input type="text"/>	(42)	<b>Extra-oral examination</b> _____	(43)	<input type="text"/>	<input type="text"/>	(44)															

<b>Dentition status</b>	<b>Permanent teeth</b>																																																																																																												
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# World Health Organization

## Oral Health Assessment Form for Adults, 2013

<p><b>Loss of attachment</b></p> <p><b>Severity</b>          0 = 0–3 mm          1 = 4–5 mm    Cemento-enamel junction (CEJ) within black band          2 = 6–8 mm    CEJ between upper limit of black band and 8.5 mm ring          3 = 9–11 mm   CEJ between 8.5 mm and 11.5 mm ring          4 = 12 mm or more   CEJ beyond 11.5 mm ring          X = Excluded sextant          9 = Not recorded</p> <p>* Not recorded under 15 years of age</p>	<p><b>Index teeth</b></p> <table style="margin: auto; border-collapse: collapse;"> <tr> <td></td> <td style="text-align: center;">17/16</td> <td style="text-align: center;">11</td> <td style="text-align: center;">26/27</td> <td></td> </tr> <tr> <td style="text-align: right;">(173)</td> <td style="text-align: center;"><input style="width: 30px; height: 30px;" type="text"/></td> <td style="text-align: center;"><input style="width: 30px; height: 30px;" type="text"/></td> <td style="text-align: center;"><input style="width: 30px; height: 30px;" type="text"/></td> <td style="text-align: left;">(175)</td> </tr> <tr> <td style="text-align: right;">(176)</td> <td style="text-align: center;"><input style="width: 30px; height: 30px;" type="text"/></td> <td style="text-align: center;"><input style="width: 30px; height: 30px;" type="text"/></td> <td style="text-align: center;"><input style="width: 30px; height: 30px;" type="text"/></td> <td style="text-align: left;">(178)</td> </tr> <tr> <td></td> <td style="text-align: center;">47/46</td> <td style="text-align: center;">31</td> <td style="text-align: center;">36/37</td> <td></td> </tr> </table>		17/16	11	26/27		(173)	<input style="width: 30px; height: 30px;" type="text"/>	<input style="width: 30px; height: 30px;" type="text"/>	<input style="width: 30px; height: 30px;" type="text"/>	(175)	(176)	<input style="width: 30px; height: 30px;" type="text"/>	<input style="width: 30px; height: 30px;" type="text"/>	<input style="width: 30px; height: 30px;" type="text"/>	(178)		47/46	31	36/37		<p><b>Enamel fluorosis</b>    <input style="width: 30px; height: 30px;" type="text"/> (179)</p> <p><b>Severity</b>          0 = Normal          1 = Questionable          2 = Very mild          3 = Mild          4 = Moderate          5 = Severe          8 = Excluded (crown, restoration, "bracket")          9 = Not recorded (unerupted tooth)</p>
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(176)	<input style="width: 30px; height: 30px;" type="text"/>	<input style="width: 30px; height: 30px;" type="text"/>	<input style="width: 30px; height: 30px;" type="text"/>	(178)																		
	47/46	31	36/37																			

<p><b>Dental erosion</b></p> <p><b>Severity</b>    <input style="width: 30px; height: 30px;" type="text"/> (180)</p> <p>0 = No sign of erosion          1 = Enamel lesion          2 = Dentinal lesion          3 = Pulp involvement</p> <p><b>Number of teeth affected</b></p> <p>(181) <input style="width: 30px; height: 30px;" type="text"/> <input style="width: 30px; height: 30px;" type="text"/> (182)</p>	<p><b>Dental trauma</b></p> <p><b>Status</b>    <input style="width: 30px; height: 30px;" type="text"/> (183)</p> <p>0 = No sign of injury          1 = Treated injury          2 = Enamel fracture only          3 = Enamel and dentine fracture          4 = Pulp involvement          5 = Missing tooth due to trauma          6 = Other damage          9 = Excluded tooth</p> <p style="text-align: right;"><b>Number of teeth affected</b></p> <p>(184) <input style="width: 30px; height: 30px;" type="text"/> <input style="width: 30px; height: 30px;" type="text"/> (185)</p>
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<p><b>Oral mucosal lesions</b></p> <table style="width: 100%;"> <tr> <td style="width: 50%;"><input style="width: 30px; height: 30px;" type="text"/> (186)</td> <td style="width: 50%;"><input style="width: 30px; height: 30px;" type="text"/> (189)</td> </tr> <tr> <td><input style="width: 30px; height: 30px;" type="text"/> (187)</td> <td><input style="width: 30px; height: 30px;" type="text"/> (190)</td> </tr> <tr> <td><input style="width: 30px; height: 30px;" type="text"/> (188)</td> <td><input style="width: 30px; height: 30px;" type="text"/> (191)</td> </tr> </table> <p><b>Condition</b></p> <p>0 = No abnormal condition          1 = Malignant tumour (oral cancer)          2 = Leukoplakia          3 = Lichen planus          4 = Ulceration (aphthous, herpetic, traumatic)          5 = Acute necrotizing ulcerative gingivitis (ANUG)          6 = Candidiasis          7 = Abscess          8 = Other condition (specify if possible)          9 = Not recorded</p> <p><b>Location</b></p> <p>0 = Vermillion border          1 = Commissures          2 = Lips          3 = Sulci          4 = Buccal mucosa          5 = Floor of the mouth          6 = Tongue          7 = Hard and/or soft palate          8 = Alveolar ridges/gingiva          9 = Not recorded</p>	<input style="width: 30px; height: 30px;" type="text"/> (186)	<input style="width: 30px; height: 30px;" type="text"/> (189)	<input style="width: 30px; height: 30px;" type="text"/> (187)	<input style="width: 30px; height: 30px;" type="text"/> (190)	<input style="width: 30px; height: 30px;" type="text"/> (188)	<input style="width: 30px; height: 30px;" type="text"/> (191)	<p><b>Denture(s)</b></p> <p style="text-align: center;"><b>Upper</b>                      <b>Lower</b></p> <p style="text-align: center;"><input style="width: 30px; height: 30px;" type="text"/> (192)    <input style="width: 30px; height: 30px;" type="text"/> (193)</p> <p><b>Status</b></p> <p>0 = No denture          1 = Partial denture          2 = Complete denture          9 = Not recorded</p>
<input style="width: 30px; height: 30px;" type="text"/> (186)	<input style="width: 30px; height: 30px;" type="text"/> (189)						
<input style="width: 30px; height: 30px;" type="text"/> (187)	<input style="width: 30px; height: 30px;" type="text"/> (190)						
<input style="width: 30px; height: 30px;" type="text"/> (188)	<input style="width: 30px; height: 30px;" type="text"/> (191)						

<p><b>Intervention urgency</b></p> <p>0 = No treatment needed          1 = Preventive or routine treatment needed          2 = Prompt treatment (including scaling) needed          3 = Immediate (urgent) treatment needed due to pain or infection of dental and/or oral origin          4 = Referred for comprehensive evaluation or medical/dental treatment (systemic condition)</p>	<p><input style="width: 30px; height: 30px;" type="text"/> (194)</p>
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## Appendix 6.3: Participant information leaflet (Quantitative)



### Participant Information Leaflet

#### Work package 2 (Quantitative research)

<b>Study Title:</b>	Determinants of Oral Diseases and Oral Health Care Needs in Slums: A comparative study with non-slum urban settings in Nigeria
<b>Investigator(s):</b>	Dr Mary E. Osuh; Dr Yen-Fu Chen and Professor R. Lilford (University of Warwick). Professor Eme T. Owoaje and Professor Gbemisola A. Oke (Public Health and Oral Health Experts respectively, University of Ibadan, Nigeria).

#### Introduction

You are invited to take part in a research study. Before you decide, you need to understand why the research is being done and what it would involve for you. Please take the time to read the following information carefully. Talk to others about the study if you wish.

Please ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

#### Who is organising and funding the study?

This research study is being undertaken in association with a larger international study titled National Institute for Health Research (NIHR) Global Health Research Unit on Improving Health in Slums. The study is being organised as a PhD research project for Mary Osuh in the University of Warwick, UK.

Funding for the project is provided by the NIHR Global Health Research Unit on Improving Health in Slums.

#### What is the study about?

The study will find out how common oral diseases are, the types and the factors that encourage their development. It will also look into the various things that you do to help yourself to overcome or prevent the diseases.

The information you provide will be helpful to the health care planners and other researchers to design appropriate type of oral health intervention programme and services that will improve your oral health and that of your entire community.

#### What would taking part involve?

Taking part in the study will involve the following:

Access to your personal information relevant to the study using questionnaires. These will include: Your background information, characteristics of your household, household income and expenditures on oral health care, experience of dental problem within 12 months' period, dental treatments obtained, your own assessment of your oral health status, oral health habits, oral disease risk behaviour, quality of life and care seeking behaviour.

Thereafter, the state of your oral health will be determined by examining your mouth. This part will be done by qualified dentists with the aid of sterile materials.

The research exercise is a one-off and will take a maximum of about 50 minutes (30 minutes for questionnaire, 10 minutes for oral examination and the rest of the time for answering the questions that you may have from reading this leaflet.

**Do I have to take part?**

No. Participation in this study is completely voluntary and choosing not to take part will not affect you or your dental health care, in any way.

We will describe the study to you using the information sheet which we will also give you to keep. If you choose to participate, we will ask you to sign a consent form to confirm that you have agreed to take part.

You will be free to withdraw at any time, without giving a reason and this will not affect your medical, social care, or legal rights at all in any way.

Further details about withdrawing from the study are provided later on in this document.

**What are the possible benefits of taking part in this study?**

As a participant in the study, you will be offered a free dental consultation during the oral examination section. If you are found to have dental problems on examination and have need for immediate attention, you will be referred to the University College Hospital services with a unique identifier that would aid subsidized cost of care. Subsidized cost of care will be in terms of cost of treatments reduced by half for the study participant. Such treatments are limited to procedures such as scaling and polishing, and simple extractions (removal of teeth). Others who do not require urgent dental treatment shall benefit from oral hygiene practices reinforcement and education.

Above all, information gathered from the study will help in the planning of context appropriate oral health care service for your people.

**What are the possible disadvantages, side effects or risks, of taking part in this study?**

There is no foreseeable side effect or risk that will be involved by virtue of participation in this study. The study involves a questionnaire session and an oral screening/ examination session. The mouth examination exercise is a safe and painless process. Sterilized instruments and disposable materials will be used in its conduct. The mouth examination will be performed by qualified dentists who has received further training for this research process.

**Expenses and payments**

If you choose to take part in this research study, there will be no cost to you, nor will you receive any payments for participating. But as a token of appreciation for your time in participation in the study, you will receive a tube of toothpaste and a toothbrush.

**Will my taking part be kept confidential?**

Yes, the information you give will be kept strictly confidential. The data that will be published from it will not allow the individual participants to be identified, so that the fact that you participated in the study is kept confidential.

Data collected will be automatically changed into secured codes that are not recognizable by people other than the researchers on the tablet and then uploaded to the server when the tablet is online, and deleted from the device.

Your data will be kept securely with the University of Warwick as the Data Controllers. The University is committed to protecting the rights of individuals in line with Data Protection Legislation. The data will be kept and retained for a minimum of 10years in accordance with the Retention Framework for Research data and Records in the UK.

Paper records such as your consent form will be stored securely in a locked cabinet in an office at the University of Ibadan. Only authorised individuals will have access to the data generated in this study.

**What will happen to the data collected about me?**

As a publicly-funded organisation, the University of Warwick have to ensure that it is in the public interest when we use personally-identifiable information from people who have agreed to take part in research. This

means that when you agree to take part in a research study, such as this, we will only use your data (obtained from questionnaire and oral examination) in the ways needed to conduct and analyse the research study.

We are committed to protecting the rights of individuals in line with data protection legislation and Research Data Management policy of the University of Warwick.

Any personally identifiable information (such as your name and address) will be stored separately from other information obtained through the questionnaire survey and oral examination. These pieces of information can only be linked through re-identification keys, which are kept by the researcher with strict control for access. The keys will be destroyed as soon as there is no longer need to identify participants.

No personal data (except the consent forms) will be kept beyond the point when individual questionnaire surveys / oral examinations and focus group discussions have been completed for this study

Indirectly identifiable data such as oral examination findings will be pseudonymized during data collection. This means all indirect identifiers will be removed from the research data and will be replaced with a participant number. The key to identification will be stored separately and securely to the research data to safeguard your identity. The keys will be destroyed as soon as there is no longer need to identify participants so that all data become fully anonymised. Once the survey and oral examination is completed and marked as finalised it is encrypted using PGP encryption and no longer accessible from the tablet. The completely anonymised data set, will be password protected and made available to selected project researchers at the University of Warwick.

The thumb prints (another indirectly identifiable data) on consent forms where indicated will be kept securely alongside with the signed consent forms in locked cabinets at the University of Ibadan for a period of not more than 10 years.

### **Data Sharing**

There will be no data sharing from the University of Warwick.

Your information will be managed in specific ways in order for the research to be reliable and accurate. The University of Warwick has in place policies and procedures to keep your data safe.

This data may also be used for future research, including impact activities following review and approval by an independent Research Ethics Committee and subject to your consent at the outset of this research project.

For further information, please refer to the University of Warwick Research Privacy Notice which is available here: <https://warwick.ac.uk/services/idc/dataprotection/privacynotices/researchprivacynotice> or by contacting the Information and Data Compliance Team at [GDPR@warwick.ac.uk](mailto:GDPR@warwick.ac.uk).

### **What will happen if I don't want to carry on being part of the study?**

Participation in this study is entirely voluntary. Refusal to participate or withdrawal of your participation from the study at any time without giving a reason will not affect you in any way – your medical, social care, or legal rights will not be affected at all. If you decide to take part in the study, you will need to sign a consent form, which states that you have given your consent to participate.

If you agree to participate, you may withdraw from the study at any time without it affecting you in any way.

You have the right to withdraw from the study completely and decline any further contact by study staff after you withdraw.

You will be able to contact the research staff listed in the information leaflet to request withdrawal from the study, if you so desire. If this occurs before anonymisation of the data (that is, before we delete the re-identification key mentioned above), all your information will be deleted. It will often not be possible to withdraw your data which has already been collected after they have been anonymised.

To safeguard your rights, we will use the minimum personally-identifiable information possible and keep the data secure in line with the University's Information and Data Compliance policies.

### **What will happen to the results of the study?**

The study results will help us to learn more about how common oral diseases are, what type of oral health care treatment you need and how you have tackled the oral health problems in the past. Comparisons will then be of findings obtained from your community with that of another community to learn the differences.

A thorough understanding of the situation will serve as a useful information which will facilitate the development of appropriate programmes that will improve the oral health of slum residents in Nigeria.

The results may also be submitted to academic journals for publication and discussed at global conferences which aim to improve oral health of residents of slums and non-slum urban settings of low- and middle-income countries.

Data will also be used for the purposes of future research.

### **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 37/18-19

### **Who should I contact if I want further information?**

If you need any further information or have any questions about any aspect of the study, or your participation in it, not answered by this participant information leaflet, please contact:  
Dr Mary E. Osuh on [Mary.Osuh@warwick.ac.uk](mailto:Mary.Osuh@warwick.ac.uk) and Dr Yen-Fu Chen on [Y-F.Chen@warwick.ac.uk](mailto:Y-F.Chen@warwick.ac.uk)

### **Who should I contact if I wish to make a complaint?**

Any complaint about the way you have been dealt with during the study or any possible harm you might have suffered will be addressed. Please address your complaint to the person below, who is a senior University of Warwick official entirely independent of this study:

#### **Head of Research Governance**

Research & Impact Services

University House

University of Warwick

Coventry

CV4 8UW

Email: [researchgovernance@warwick.ac.uk](mailto:researchgovernance@warwick.ac.uk)

Tel: 024 76 522746

If you wish to raise a complaint on how we have handled your personal data, you can contact our Data Protection Officer, Anjali Bajaj, Information and Data Director who will investigate the matter:  
[DPO@warwick.ac.uk](mailto:DPO@warwick.ac.uk).

If you are not satisfied with our response or believe we are processing your personal data in a way that is not lawful you can complain to the Information Commissioner's Office (ICO).

**Thank you for taking the time to read this Participant Information Leaflet**

Appendix 6.4: Consent form (Quantitative)



**CONSENT FORM**

**Study Number: Work Package 2 (Quantitative Research)**

**Participant Identification Number for this study:** \_\_\_\_\_

**Title of Project:** Determinants of Oral Diseases and Oral Health Care Needs in Slums: A comparative study with non-slum urban settings in Nigeria

**Name of Researcher(s):** Dr Mary Ebelechukwu OSUH (PhD Student).

**Supervisors:** Dr Yen-Fu CHEN and Professor Richard LILFORD (University of Warwick). Professor Eme T. OWOAJE and Professor Gbemisola A. OKE (Public Health and Oral Health Experts respectively, University of Ibadan, Nigeria). Please initial all boxes

1. I confirm that I have read and understand the information sheet on Work Package 2, dated 26<sup>th</sup> of March 2019, V1.1 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, without my medical, **social care, education, or legal rights** being affected.
3. I understand that **relevant sections of my dental notes from examination and** data collected during the study, may be looked at by individuals from The University of Warwick, from regulatory authorities (**or from a relevant NHS Trust**), where it is relevant to my taking part in this study. I give permission for these individuals to have access to my data.
4. I also consent to the use of my photographs if need be in the study.
5. I am happy for my data to be used in future research.
6. I agree to take part in the above study.

\_\_\_\_\_  
Name of Participant giving consent

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature/ thumb print

\_\_\_\_\_  
Name of Person taking consent

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

Appendix 7.1: Variable distribution table showing number and percentages (N = 1357)

Variable	Value	Slum 678 (%)	Non-slum 679 (%)	Total (%)	p- value
Ever had a need for dental care in past 12 months	Yes	87 (12.8)	133 (19.6)	16.2	0.001
Ever felt pain/ discomfort from teeth or mouth within the past 12 months	No	188 (27.7)	216 (31.8)	29.8	
	Yes	471 (69.5)	453 (66.7)	68.1	
	I don't know	17 (92.8)	9 (1.8)	2.1	
Ever avoided a dental care because of cost	Yes	17 (45.9)	20 (54.1)	2.7	0.620
Self- reported Description of state of teeth	Excellent	68 (10.0)	88 (13.0)	11.5	
	Very good	130 (19.2)	205 (30.2)	24.7	
	Good	333 (49.1)	308 (45.4)	47.2	
	Average	117 (17.3)	64 (9.4)	13.3	
	Poor	29 (4.3)	13 (1.9)	3.1	
	Very poor	1 (0.1)	1 (0.1)	0.1	
	Summary	531 (78.3)	601 (88.5)	83.4	0.000
Self- reported description of state of gums	Excellent	72 (10.6)	102 (15.0)	12.8	
	Very good	122 (18.0)	203 (29.9)	23.9	
	Good	345 (50.9)	300 (44.2)	47.5	
	Average	121 (17.8)	67 (9.9)	13.9	
	Poor	17 (2.5)	5 (0.7)	1.6	
	Very poor	1 (0.1)	2 (0.3)	0.2	
	Summary	539 (79.5)	605 (89.1)	84.3	0.000
Frequency of mouth cleaning / day	At least twice daily	163 (24.0)	184 (27.1)	25.6	0.197
Teeth cleaning aids	Toothbrush	531 (78.3)	644 (94.8)	86.6	
	Chewing stick	114 (16.8)	17 (2.5)	9.7	
	Toothbrush and chewing stick	27 (4.0)	18 (2.7)	3.3	
	Others (wooden tooth picks, floss)	6 (0.9)	0 (0.0)	0.4	
Use toothpaste to clean the mouth	Yes	576 (85.0)	659 (97.1)	91.0	
	Sometimes	15 (2.2)	6 (0.9)	1.5	
	No	87 (12.8)	14 (2.1)	7.5	
Tooth paste contains fluoride	Yes	436 (64.3)	532 (78.4)	71.3	
	Sometimes	5 (0.7)	5 (0.7)	0.7	
	No	10 (1.5)	8 (1.2)	1.3	
	I don't know	140 (20.6)	120 (17.7)	19.2	
	I don't use paste	87 (15.3)	14 (2.9)	7.4	
Ever seen a dentist	No				
	Yes	117 (17.3)	161 (23.7)	20.5	0.003
How long ago was it since you last saw a dentist	Within 12 months period	21 (3.1)	36 (5.3)	4.2	
	>1year but ≤ 2 years	7 (1.0)	9 (1.3)	1.2	
	> 2years	89 (13.1)	116 (17.1)	15.1	
	Never saw a dentist	561 (82.7)	518 (76.3)	79.5	
Reason for dental visit	Urgent attention	113 (16.7)	156 (23.0)	19.8	
	Routine treatment	4 (0.6)	5 (0.7)	0.7	
	Never visited	561 (82.7)	518 (76.3)	79.5	
Number of alcohol drinks per day	Less than 1 drink	6 (0.9)	11 (1.6)	1.3	

	1 drink	29 (4.3)	36 (5.3)	4.8	
	2 drinks	25 (3.7)	28 (4.1)	3.9	
	3 drinks	5 (0.7)	6 (0.9)	0.8	
	4 drinks	4 (0.6)	5 (0.7)	0.7	
	5 or more drinks	16 (2.4)	23 (3.4)	2.9	
	Did not drink alcohol during the past 30 days	593 (87.5)	570 (83.9)	85.7	
Alcohol use within last 30 days	Yes	84 (12.4)	109 (16.1)	14.2	
Excessive alcohol intake	Yes	15 (17.9)	24 (22.0)	20.2	
Tobacco use	Ever	89 (13.1)	63 (9.3)	11.2	
Frequency of Cariogenic foods consumption	More frequent intake	295 (43.5)	638 (49.8)	46.6	

Appendix 7.2: inferential regression analysis table

Analysis	Outcome variable			Coefficient	Odds ratio	95% Confidence interval		p-value
						Lower	Upper	
<b>Analysis 3.0</b>	<b>Basic model – difference between slum and non-slum taking into account age and sex distribution. All analysis was controlled for age and sex</b>							
3-1	Dental caries disease	Setting	Non slum	-	1	-	-	-
			Slum	-	1.208714	.9364455	1.560144	0.145
3-2	Gingival bleeding	Setting	Non slum	-	1	-	-	-
			Slum	-	2.67315	2.111778	3.383751	<0.001
3-3	Periodontal pocket formation	Setting	Non slum	-	1	-	-	-
			Slum	-	1.495164	1.126372	1.984704	0.005
3-4	DMFT score (continuous variable)	Setting	Non slum	1	-	-	-	-
			Slum	-	-1.177907	-	-.4270935	.1915121
<b>Analysis 4.0</b>	<b>Investigation of potential effect of cariogenic diet on dental caries. All analysis was controlled for age and sex</b>							
4-1	Dental caries disease	Setting	Non slum	-	1	-	-	-
			Slum	-	1.209463	.9369326	1.561266	0.144
		Cariogenic diet intake	Less frequent	-	1	-	-	-
			More frequent	-	1.024352	.7937872	1.321887	0.853
4-2	Bleeding status	Setting	Non slum	-	1	-	-	-
			Slum	-	2.728908	2.152328	3.459947	0.000
		Cariogenic diet intake	Less frequent	-	1	-	-	-
			More frequent	-	1.527733	1.205734	1.935725	0.000
4-3	Periodontal pocket formation	Setting	Non slum	-	1	-	-	-
			Slum	-	1.485971	1.118108	1.974864	0.006
		Cariogenic diet intake	Less frequent	-	1	-	-	-
			More frequent	-	.5853538	.4382407	.7818513	0.000
4-4	DMFT score (continuous variable)	Setting	Non slum	1	-	-	-	-
			Slum	-	-1.193849	-	-.4288762	.1901064
		Cariogenic diet intake	Less frequent	1	-	-	-	-
			More frequent	-	-0.0650106	-	-.3744648	.2444435
<b>Analysis 5a</b>	<b>Investigation of potential effect of alcohol consumption on periodontal diseases. All analysis controlled for age and sex</b>							
5a-1	Gingival bleeding status	Setting	Non slum	-	1	-	-	-
			Slum	-	2.684222	2.119598	3.399252	0.000
		Alcohol use	Don't drink	-	1	-	-	-
			Moderate drink	-	.9428546	.6458307	1.376483	0.761
5a-2	Periodontal pocket formation	Setting	Non slum	-	1	-	-	-
			Slum	-	1.508932	1.135568	2.005055	0.005
		Alcohol use	Don't drink	-	1	-	-	-



			Moderate drink	-	.9644863	.6067496	1.533143	0.878	
			Excessive drink	-	2.121149	1.015829	4.429163	0.045	
<b>Analysis 5b</b>	<b>Investigation of potential effect of tobacco consumption on periodontal diseases. All analysis was controlled for age and sex</b>								
5b-1	Gingival bleeding status	Setting	Non slum	-	1	-	-	-	
			Slum	-	2.689455	2.123152	3.406808	0.000	
		Tobacco use	Never used	-	1	-	-	-	-
			Ever used	-	.8687974	.5939859	1.270752	0.468	
5b-2	Periodontal pocket formation	Setting	Non slum	-	1	-	-	-	
			Slum	-	1.490264	1.121668	1.979987	0.006	
		Tobacco use	Never used	-	1	-	-	-	-
			Ever used	-	1.066633	.6862157	1.657942	0.774	
<b>Analysis 5c</b>	<b>Investigation of potential effect of alcohol consumption on caries experience. All analysis was controlled for age and sex</b>								
5c-1	Dental caries disease	Setting	Non slum	-	1	-	-	-	
			Slum	-	1.207622	.9348576	1.559972	0.149	
		Alcohol use	Don't drink	-	1	-	-	-	-
			Moderate drink	-	.6682619	.4199826	1.063316	0.089	
5c-2	DMFT score (continuous variable)	Setting	Non slum	1	-	-	-	-	
			Slum	-1.199971	-	-.4294907	.1894964	0.447	
		Alcohol use	Don't drink	1	-	-	-	-	-
			Moderate drink	-0.3129752	-	-.8160212	.1900707	0.222	
5c-2	DMFT score (continuous variable)	Alcohol use	Excessive drink	.6004672	-	-.3328574	1.533792	0.207	
<b>Analysis 5d</b>	<b>Investigation of potential effect of tobacco consumption on caries experience. All analysis was controlled for age and sex</b>								
5d-1	Dental caries disease	Setting	Non slum	-	1	-	-	-	
			Slum	-	1.212204	.9385443	1.565657	0.140	
		Tobacco use	Never used	-	1	-	-	-	-
			Ever used	-	.934948	.6112698	1.43002	0.756	
5d-2	DMFT score (continuous variable)	Setting	Non slum	1	-	-	-	-	
			Slum	-1.1191251	-	-.4292555	.1910054	0.451	
		Tobacco use	Never used	1	-	-	-	-	-
			Ever used	.0317601	-	-.469023	.5325432	0.901	
<b>Analysis 6.0</b>	<b>Investigation of the potential effect of oral hygiene practices. All analysis was controlled for age and sex</b>								
6-1	Dental caries disease	Setting	Non slum	-	1	-	-	-	
			Slum	-	1.221969	.9460131	1.578421	0.125	
		Teeth cleaning freq.	< 2ce daily	-	1	-	-	-	-
			≥ twice daily	-	1.295977	.9808207	1.7124	0.068	
6-2	Gingival bleeding status	Setting	Non slum	-	1	-	-	-	
			Slum	-	2.675817	2.113364	3.387961	0.000	
		Teeth cleaning freq.	< 2ce daily	-	1	-	-	-	-

			≥ twice daily	-	1.024849	.7890582	1.3311	0.854	
6-3	Periodontal pocket formation	Setting	Non slum	-	1	-	-	-	
			Slum	-	1.511848	1.137988	2.00853	0.004	
		Teeth cleaning freq.	< 2ce daily	-	1	-	-	-	-
			≥ twice daily	-	1.307103	.9641742	1.772002	0.085	
6-4	DMFT score (continuous variable)	Setting	Non slum	1	-	-	-	-	
			Slum	-.1124444	-	-.4221062	.1972173	0.476	
		Teeth cleaning freq.	< 2ce daily	1	-	-	-	-	-
			≥ twice daily	.1339767	-	-.2130569	.4810103	0.449	
			Slum	.0471327	-	-.1839979	.2782632	0.689	
		Teeth cleaning freq.	< 2ce daily	1	-	-	-	-	-
			≥ twice daily	-.0908912	-	-.349916	.1681336	0.491	
<b>Analysis 7.0</b>	<b>Investigation of the potential effect of socioeconomic status. All analysis was controlled for age and sex</b>								
7-1	Dental caries disease	Setting	Non slum	-	1	-	-	-	
			Slum	-	1.387847	1.024889	1.879345	0.034	
		Teeth cleaning freq.	< 2ce daily	-	1	-	-	-	-
			≥ twice daily	-	1.239238	.9319069	1.647923	0.140	
		Wealth quintile/status (SES)	poorest	-	1	-	-	-	-
			poorer	-	.7017511	.4612894	1.067561	0.298	
			middle	-	1.278604	.867679	1.88414	0.214	
			richer	-	.8143507	.5277146	1.256677	0.354	
			richest	-	1.188668	.7489045	1.886666	0.463	
		Last dental visit	Within 12 mnths	-	1	-	-	-	-
			>1yr ≤ 2 yrs	-	1.973498	.6260168	6.221392	0.246	
			> 2years	-	1.031489	.5403736	1.968953	0.925	
			Never seen one	-	.5916234	.3260259	1.07359	0.084	
		Self- perceived overall dental health	Not good	-	1	-	-	-	-
Good	-		.8712251	.6660068	1.139678	0.314			
7-2	Gingival bleeding status	Setting	Non slum	-	1	-	-	-	
			Slum	-	2.99825	2.275884	3.949895	0.000	
		Teeth cleaning freq.	< 2ce daily	-	1	-	-	-	-
			≥ twice daily	-	1.01911	.7801657	1.331236	0.890	
		Wealth quintile/status (SES)	poorest	-	1	-	-	-	-
			poorer	-	1.14047	.780625	1.666194	0.497	
			middle	-	1.449429	.9844208	2.134091	0.060	
			richer	-	1.284191	.8631752	1.910559	0.217	
			richest	-	1.742259	1.135502	2.673239	0.011	
		Last dental visit	Within 12 mnths	-	1	-	-	-	-
			>1yr ≤ 2 yrs	-	1.307861	.4019892	4.255091	0.656	
			> 2years	-	.9616144	.5192708	1.780771	0.901	
			Never seen one	-	1.602629	.9133157	2.812194	0.100	
		Self- perceived overall dental health	Not good	-	1	-	-	-	-
Good	-		1.248514	.9786776	1.592748	0.074			
7-3	Periodontal pocket formation	Setting	Non slum	-	1	-	-	-	
			Slum	-	2.071425	1.469037	2.920825	0.000	

		Teeth cleaning freq.	< 2ce daily	-	1	-	-	-
			≥ twice daily	-	1.201463	.8801316	1.640111	0.248
		Wealth quintile/status (SES)	poorest	-	1	-	-	-
			poorer	-	1.327381	.8415668	2.093642	0.223
			middle	-	1.409951	.8985586	2.21239	0.135
			richer	-	1.464967	.9034	2.375612	0.122
			richest	-	2.47977	1.47319	4.17411	0.001
		Last dental visit	Within 12 mnths	-	1	-	-	-
			>1yr ≤ 2 yrs	-	.2491503	0290206	2.13903	0.205
			> 2years	-	.8330192	.383804	1.808009	0.644
			Never seen one	-	1.059221	.5260946	2.132598	0.872
		Self- perceived overall dental health	Not good	-	1	-	-	-
			Good	-	.7345096	.5482185	.9841045	0.039
		7-4	DMFT score (continuous variable)	Setting	Non slum	1	-	-
Slum	-.0785489				-	-.4186458	.2615479	0.651
Teeth cleaning freq.	< 2ce daily			1	-	-	-	-
	≥ twice daily			.1177653	-	-.2162729	.4518036	0.489
Wealth quintile/status (SES)	poorest			1	-	-	-	-
	poorer			-.6479834	-	-1.114288	.1816793	0.006
	middle			-.0095395	-	-.4754213	.4563423	0.968
	richer			-.4593049	-	-.9508881	.0322783	0.067
	richest			-.4126322	-	-.9484023	.1231379	0.131
Last dental visit	Within 12 mnths			1	-	-	-	-
	>1yr ≤ 2 yrs			1.740754	-	.240719	3.24079	0.023
	> 2years			.2796418	-	-.5203262	1.07961	0.493
	Never seen one			-1.792788	-	-2.520388	1.065188	0.000
Self- perceived overall dental health	Not good			1	-	-	-	-
	Good			.3201533	-	.0141744	.6261322	0.040
	richest			.5261084	-	.1198514	.9323655	0.011
Last dental visit	Within 12 mnths			1	-	-	-	-
	>1yr ≤ 2 yrs			-.7068068	-	-1.844235	.4306212	0.223
	> 2years			-.3689963	-	-.975586	.2375935	0.233
	Never seen one			-1.067338	-	-1.619053	.5156227	0.000
Self- perceived overall dental health	Not good			1	-	-	-	-
	Good			.9223033	-	.6902894	1.154317	0.000

## Appendix 8.1: Participant information leaflet (Qualitative)



### Participant Information Leaflet

#### Work package 3 (Qualitative research)

<b>Study Title:</b>	Determinants of Oral Diseases and Oral Health Care Needs in Slums: A comparative study with non-slum urban settings in Nigeria
<b>Investigator(s):</b>	Dr Mary E. Osuh; Dr Yen-Fu Chen and Professor R. Lilford (University of Warwick). Professor Emé T. Owoaje and Professor Gbemisola A. Oke (Public Health and Oral Health Experts respectively, University of Ibadan, Nigeria).

#### Introduction

You are invited to take part in a research study. Before you decide, you need to understand why the research is being done and what it would involve for you. Please take the time to read the following information carefully. Talk to others about the study if you wish.

Please ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

#### Who is organising and funding the study?

This research study is being undertaken in association with a larger international study titled National Institute for Health Research (NIHR) Global Health Research Unit on Improving Health in Slums. The study is being organised as a PhD research project for Mary Osuh in the University of Warwick, UK.

Funding for the project is provided by the NIHR Global Health Research Unit on Improving Health in Slums.

#### What is the study about?

This part of the study is a discussion session called the Focus Group Discussion (FGD) session. The purpose is to understand your own views about the challenges you may have in terms of accessing care for your oral health problems and your thoughts on how these challenges can be overcome.

The information you give will be helpful to health care planners in designing the appropriate type of oral health intervention programme and services that will improve your oral health and that of your entire community.

#### What would taking part involve?

Taking part in this aspect of the study will involve:

- Attendance at a one-hour meeting on an agreed date and venue.
- An audio recording of the discussions at the focus group meeting.

**Do I have to take part?**

No. Participation in this study is completely voluntary and choosing not to take part will not affect you in any way.

We will describe the study to you using the information leaflet which we will also give you to keep. If you choose to participate, we will ask you to sign a consent form to confirm that you have agreed to take part.

You can also choose to withdraw your participation at any time, without giving a reason by contacting one of the research team. Further details about withdrawing from the study are provided later on in this document.

**What are the possible benefits of taking part in this study?**

If you choose to take part in this research study, there will be no cost to you, nor will you receive any payments for participating.

Above all, information gathered from the study will help in the planning of context appropriate oral health care programmes and services for your people.

**What are the possible disadvantages, side effects or risks, of taking part in this study?**

There is no foreseeable side effect or risk that will be involved by virtue of participation in this study. It will be a discussion about your experience of oral health problems and the various decisions you make in its regard for yourself and members of your household/ family

**Expenses and payments**

If you choose to take part in this research study, you will not receive any payments for participating. But as a token of appreciation for your time in participating in the study, you will be given a tube of toothpaste and a toothbrush.

**Will my taking part be kept confidential?**

Yes, the information you give will be kept strictly confidential.

We will follow strict ethical and legal practice so that all information you give is handled in strict confidence. The information you provide will not be linked to you in any way. Anything you say to us directly and/or is recorded by the audio recorder will be kept confidential.

Your audio recording will be assigned a unique identification number to ensure confidentiality. Your specific quotes will be designated a study reference number in order to protect your identity. As such your statements will not be linked to you.

All recordings will be kept in a digital format to minimise the risk of theft of the physical recordings.

Additional procedures will be put in place to ensure that your data are safe at all times. Audio recordings will be encrypted and stored securely on a backed-up password protected server at the University of Ibadan.

Consent forms will be stored securely in a locked cabinet/office at the University of Ibadan. Only the researchers will have access to the data generated in this study.

**What will happen to the data collected about me?**

As a publicly-funded organisation, the University of Warwick have to ensure that it is in the public interest when we use personally-identifiable information from people who have agreed to take part in research. This means that when you agree to take part in a research study, such as this, we will only use your data (audio recordings) in the ways needed to conduct and analyse the research study.

Participants characteristics will not be required for the study. Therefore, during transcription, participants identities will be left out. Information collected will be without names. Rather, responses of participants will be assigned number identifiers

All audio recordings will be transcribed (listened to and typed up word by word), converted to special codes and stored securely, backed-up with password protection on the University of Warwick server, accessible only to the researchers. Once this is done securely, the recording files will be removed from the recorder. The recordings will be deleted after 3 years by the PhD student Dr, Mary Osuh. The transcribed copies, once created, will be kept for 10 years according to University of Warwick guidelines.

The identifiable information obtained about you such as your name, home addresses and telephone or mobile numbers will be collected separately and used only for contacting you for the FGD meeting. It will not be linked to the study data. Following the completion of the FGD meetings, you will be contacted again (if you will be happy to), for feeding of our findings from the FGDs to see if you agree with our interpretation of discussions during the meeting in order to validate our findings.

Following the validation exercises, the contacts will be destroyed.

Paper records such as consent form details will be stored securely in locked cabinet in an office at the University of Ibadan. Only the PhD student and the supervisors will have access to the data generated. It will be kept for no more than 10 years after which it will be destroyed.

### **Data Sharing**

There will be no data sharing from the University of Warwick.

Your information will be managed in specific ways in order for the research to be reliable and accurate. The University of Warwick has in place policies and procedures to keep your data safe.

This data may also be used for future research, including impact activities following review and approval by an independent Research Ethics Committee and subject to your consent at the outset of this research project.

For further information, please refer to the University of Warwick Research Privacy Notice which is available here: <https://warwick.ac.uk/services/idc/dataprotection/privacynotices/researchprivacynotice> or by contacting the Information and Data Compliance Team at [GDPR@warwick.ac.uk](mailto:GDPR@warwick.ac.uk).

### **What will happen if I don't want to carry on being part of the study?**

Participation in this study is entirely voluntary. Refusal to participate or withdrawal of your participation from the study at any time without giving a reason will not affect you in any way – your medical, social care, or legal rights will not be affected at all. If you decide to take part in the study, you will need to sign a consent form, which states that you have given your consent to participate.

If you agree to participate, you may nevertheless withdraw from the study at any time without it affecting you in any way.

You have the right to withdraw from the study completely and decline any further contact by study staff after you withdraw. In the event of this, you will be able to contact the research staff on the PIL to request withdrawal from the study

But, if you withdraw from the study, it will often not be possible to withdraw your data which have already been collected by audio recordings since no personal identifiable data will be collected. To safeguard your rights, we will keep your data secure in line with the University's Information and Data Compliance policies.

### **What will happen to the results of the study?**

The study results will help us to learn about your views and perspectives regarding your oral health problems and needs, issues with accessing care and what you will recommend as solutions. A thorough understanding

of the situation will go a long way to assist in the development of appropriate and focused interventions relevant to the oral health needs of this community.

We will send you a summary of the findings from the study.

The results may also be submitted to academic journals for publication and discussed at global conferences which aim to improve oral health of residents of slum and non-slum urban settings of low- and middle-income countries.

Data will also be used for the purposes of future research.

**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 37/18-19

**Who should I contact if I want further information?**

If you need any further information or have any questions about any aspect of the study, or your participation in it, not answered by this participant information leaflet, please contact:

Dr Mary E. Osuh on [Mary.Osuh@warwick.ac.uk](mailto:Mary.Osuh@warwick.ac.uk) and Dr Yen-Fu Chen on [Y-F.Chen@warwick.ac.uk](mailto:Y-F.Chen@warwick.ac.uk)

**Who should I contact if I wish to make a complaint?**

Any complaint about the way you have been dealt with during the study or any possible harm you might have suffered will be addressed. Please address your complaint to the person below, who is a senior University of Warwick official entirely independent of this study:

**Head of Research Governance**

Research & Impact Services

University House

University of Warwick

Coventry

CV4 8UW

Email: [researchgovernance@warwick.ac.uk](mailto:researchgovernance@warwick.ac.uk)

Tel: 024 76 522746

If you wish to raise a complaint on how we have handled your personal data, you can contact our Data Protection Officer, Anjeli Bajaj, Information and Data Director who will investigate the matter:

[DPO@warwick.ac.uk](mailto:DPO@warwick.ac.uk)

If you are not satisfied with our response or believe we are processing your personal data in a way that is not lawful you can complain to the Information Commissioner's Office (ICO).

**Thank you for taking the time to read this Participant Information Leaflet**



### FOCUS GROUP DISCUSSION (FGD) GUIDE- WP 3

**Study Title:** Determinants of Oral Diseases and Oral Health Care Needs in Slums: A comparative study of non-slum urban settings in Nigeria

**Investigator(s):** Dr Mary E. Osuh; Dr Yen-Fu Chen and Professor R. Lilford (University of Warwick). Professor Eme T. Owoaje and Professor Gbemisola A. Oke (Public Health and Oral Health Experts respectively, University of Ibadan, Nigeria).

**Location..... FGD Number. ....**

**Personal details questionnaire: Please answer the following questions in the spaces provided, circle or tick the most appropriate options.**

1. Name of Household .....
2. Name of Compound .....
3. Age as at last birthday.....
4. Gender: (please tick as necessary)?
  - a. Male
  - b. Female
5. Current marital status?
  6. Married
  7. Living together but not married
  8. Divorced or separated
  9. Widowed
  10. Never-married and never lived together
6. Do you take decisions regarding the general health and well-being of members of family or household members?
  - a. Yes
  - b. No

***Thank you for taking the time to complete this questionnaire***



## **FOCUS GROUP: DISCUSSION GUIDE**

### **Facilitator's welcome, introduction and instructions to participants**

**Welcome** and thank you for volunteering to take part in this focus group. You have been asked to participate because your views are important. I understand you are busy and I very much appreciate your time.

**Introduction:** This focus group discussion is designed to assess your current thoughts and feelings about your oral health needs, the barriers to access care and recommendations for intervention strategies. The information you give will assist in the development of appropriate and focused interventions relevant to the oral health needs of your community.

The focus group discussion will take no more than one hour.

May I tape the discussion to facilitate its recollection? (if yes, switch on the recorder)

**Anonymity:** Despite being taped, I would like to assure you that the discussion will be anonymous. The tapes will be kept safely in a locked facility until they are transcribed word for word, then they will be destroyed. The transcribed notes of this group talk will not contain any information that can link specific statements to individual persons. You should try to answer and comment as accurately and truthfully as possible. My Research Assistants and I would appreciate it if you would refrain from discussing the comments of other group members made here outside this meeting.

If there are any questions or discussions that you do not feel comfortable to respond to, you do not have to respond; however please try to participate as much as possible.

### **Ground rules**

- The most important rule is that only one person speaks at a time. There may be a temptation to jump in when someone is talking but please wait until they have finished.
- There are no right or wrong answers
- You do not have to speak in any particular order
- When you do have something to say, please say it. You are many in this group and it is important that I get the views of each of person.
- You do not have to agree with the views of other people in the group

Does anyone have any questions? (answers).

OK, let's begin

### **Warm up**

First, I'd like everyone to introduce themselves. Your name, HH, Compound and what you do?

### **Introductory question**

I am just going to give you some minutes to think about your experience of oral health problems and decision making for yourself and members of your household/ family.

Is anyone happy to share his or her experience?

### **Guiding questions**

1. What oral health problems/ diseases commonly affect the people in this community. Please give examples where you were affected personally, or any member of your household, or someone that lives within the community)?
2. How do you care for your mouth in general? What remedies are available for the common oral health problems you have mentioned. Could you give examples from your personal and or household experience or that of others residing in the community that you know?
3. Are there dental health care facilities (government owned or private practice) within the community or nearby and do you consider using them for your dental health problems? What has been your experience seeking dental care from the available care facilities? Either within or outside the community.
4. What motivates you to seek care from the dental health care facilities?
5. Are there reasons why you may not want to use the dental health care facilities for your dental health care problems? Discuss these?
6. Do you identify any specific need that can improve the dental health of your household members and the community as a whole?
7. What would be your suggestions or recommendations to improve timely access to dental health care in your household or the community?
8. Which of the actions/ strategies in Q7 do you think would make the greatest impact?

### **Concluding question**

Of all the things that has been said today, what would you say are the most important issues you would like to express about the oral health of your HH and of your community?

### **Conclusion**

- Thank you for participating. This has been a very successful discussion.
- Your opinions will be a valuable asset to the study.
- We hope you have found the discussion interesting.
- If there is anything you are unhappy with or wish to complain about, please contact the PI on the address in the PIL document given to you or speak to me later.
- I would like to remind you that any comments featuring in this report will be anonymous.
- Before you leave, please hand in your completed personal details questionnaire

**Thank you and thank you again for your time.**

Appendix 8.3: Consent form (Qualitative)



**CONSENT FORM**

**Study Number: Work Package 3 (Qualitative Research) STRICTLY CONFIDENTIAL**

**Participant Identification Number for this study:** \_\_\_\_\_

**Title of Project:** Determinants of Oral Diseases and Oral Health Care Needs in Slums: A comparative study with non-slum urban settings in Nigeria

**Name of Researcher(s):** Dr Mary Ebelechukwu OSUH (PhD Student).

**Supervisors:** Dr Yen-Fu CHEN and Professor Richard LILFORD (University of Warwick). Professor Eme T. OWOAJE and Professor Gbemisola A. OKE (Public Health and Oral Health Experts respectively, University of Ibadan, Nigeria).

Please initial all boxes

- 7. I confirm that I have read and understand the information sheet on Work Package 3, dated 8<sup>th</sup> of July 2019, V1.2 for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
- 8. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical, social care, education, or legal rights being affected. But that I will not be able to withdraw my data after it has been collected because it will be fully anonymised.
- 9. I understand that our discussions during the Focus Group Discussion session will be audio recorded. I consent to the use of my (anonymised) verbatim quotations in the session.
- 10. I understand that data collected during the study may be looked at by individuals from The University of Warwick or from regulatory authorities where it is relevant to my taking part in this study, I give permission for these individuals to have access to these data.
- 11. I am happy for my data to be used in future research.
- 12. I agree to take part in the above study.

\_\_\_\_\_  
Name of Participant giving consent

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature/ thumb print

\_\_\_\_\_  
Name of Person taking consent

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

## Appendix 8.4: Theme- code map

### Objectives of Study

1. To examine the slum dwellers views about their common dental ailments
2. To describe the practices of the slum dwellers towards oral health care.
3. To identify the slum dwellers barriers and enablers to seeking dental health care from care facilities
4. To explore their needs, and suggested measures and recommendations to improving timely access to dental health care.

