

**SOCIO-ECONOMIC POSITION, ORAL PAIN AND  
ORAL HEALTH-RELATED QUALITY OF LIFE  
AMONG SOUTH AFRICAN ADULTS**

by

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A thesis submitted in fulfilment of the requirements for the degree of  
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ORAL HEALTH-RELATED QUALITY OF LIFE  
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**KEYWORDS**

South Africa

Adults

Socio-economic position

Health inequality

Oral pain

Oral Health-Related Quality of Life

Oral Health Impact Profile

Validation

Prevalence

Cost

## ABSTRACT

### SOCIO-ECONOMIC POSITION, ORAL PAIN AND ORAL HEALTH-RELATED QUALITY OF LIFE AMONG SOUTH AFRICAN ADULTS

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**Background:** South Africa has one of the highest GINI coefficients in the world, yet little is known of oral health-related inequalities. Oral health-related inequality in South African adults was therefore studied using oral pain and oral health-related quality of life (OHRQoL) as oral health outcomes. The socio-economic position (SEP) was measured at both individual-level and area-level.

**Methodology:** This was a cross-sectional study involving a nationally representative sample of South African adults  $\geq 16$  year-old (n=2 651) surveyed during 2011. The primary data were obtained using an interviewer-administered questionnaire. The data included demographic data, dental service utilisation, self-reported oral health status, the oral health impact profile (OHIP) – short version, self-rated oral health, past six months oral pain experience and the individual-level SEP. The secondary data came from two nationally representative datasets, namely the 2010 General Household Survey (n=25 653 households) and the Quarterly Labour Force Survey of 2010/2011, which were used to determine the area/magisterial district-level SEP. Composite measures were used for individual-level SEP ( $\alpha = 0.74$ ) and area-level SEP ( $\alpha = 0.88$ ). The OHIP was validated by using confirmatory factor analysis (CFA) prior to further analysis. A multi-group

structural equation model was carried out to validate the structure of OHIP across socio-economic groups. Analysis included chi-square, ANOVA and multilevel Poisson and linear regressions. The level of significance was set at  $p < 0.05$ .

**Results:** Validation of the OHIP-14 for a South African adult population using CFA resulted in a 12-item scale (OHIP-12) with excellent reliability ( $\alpha = 0.94$ ), but the structural pathway varied across the socio-economic groups. The prevalence of oral pain was 19.4%, and varied significantly only across area-level SEP. Cost of care over the six months was estimated at about one billion Rand. Of those residing in the lowest SEP areas, 20.8% reported that they “did nothing” to relieve their last pain episode. Oral pain resulted in an average of two days lost per person from work/school over a six months period. The prevalence of OHIP was 16.2%. Those who had never visited a dental clinic had significantly better OHRQoL and less pain experience compared to those who previously visited a dental clinic. Both individual-level and area-level SEP were associated with OHRQoL in the bi-variate analysis, but these effects did not remain significant in multivariable-adjusted analysis. In particular, the respondents’ race completely attenuated the effect of individual-level SEP on OHRQoL, while the experience of oral pain in the past six months completely attenuated the effect of area-level SEP on OHRQoL. Both absolute and relative inequality in oral health among the South African adult population was greater in the highest SEP areas than in the areas of lowest SEP.

**Conclusion:** Inequality in oral health among the South African adult population was greater in the most affluent areas than in the areas of least affluence, therefore

highlighting the need for a “proportionate universal” approach when developing and implementing oral health policy in South Africa. Furthermore, when planning oral health services, consideration should be given to differences in pathways for poor oral health impact in the different socio-economic groups.



## DECLARATION

I declare that the thesis entitled *Socio-economic position, oral pain and oral health-related quality of life among South African adults* is my own work, that it has not been submitted before for any degree or examination at any other university, and that all the sources I have used or quoted have been indicated and acknowledged as complete references.



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Imade Joan Ayo-Yusuf

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WESTERN CAPE

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Date

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## LIST OF ABBREVIATIONS

<b><math>\alpha</math></b>	Crombach's alpha
<b>CFA</b>	Confirmatory Factor Analysis
<b>CFI</b>	Comparative Fit Index
<b>CI</b>	Confidence Interval
<b>DF</b>	Degree of Freedom
<b>EA</b>	Enumeration Area
<b>GFI</b>	Goodness of Fit Index
<b>GHS</b>	General Household Survey
<b>Ind</b>	Individual
<b>MSEM</b>	Multi-group Structural Equation Model
<b>n</b>	Number
<b>OH</b>	Oral Health
<b>OHIP</b>	Oral Health Impact Profile
<b>OHIP-12</b>	Oral Health Impact Profile – 12 items
<b>OHIP-14</b>	Oral Health Impact Profile – 14 items
<b>OHIP-ADD</b>	Oral Health Impact Profile – Additive method
<b>OHRQoL</b>	Oral Health Related Quality of Life
<b>Pclose</b>	P of Close Fit
<b>PRR</b>	Prevalence Rate Ratio
<b>PSU</b>	Primary Sampling Unit
<b>QLFS</b>	Quarterly Labour Force Survey
<b>R</b>	Rands
<b>RMSEA</b>	Root Mean Square Error of Approximation
<b>SA</b>	South Africa
<b>SASAS</b>	South African Social Attitudes Survey
<b>SE</b>	Standard Error
<b>SEM</b>	Structural Equation Model
<b>SEP</b>	Socio-Economic Position
<b>SII</b>	Slope Index of Inequality
<b>TLI</b>	Non-normed fit Index (Tucker-Lewis Index)
<b>UK</b>	United Kingdom
<b>USA</b>	United States of America
<b>WHO</b>	World Health Organisation

# CHAPTER 1

## INTRODUCTION

*“The quality of life, not the longevity of one’s life is what is important.”*

**Martin Luther King, clergyman and activist**

*“We want a world where life is preserved, and the quality of life is enriched for everybody and not only for the privileged.”*

**Isabel Allende, writer**

### 1.1 Context of the thesis

South Africa is a middle income country which had an estimated population of 51.8 million in 2011 (Statistics South Africa, 2012). The country has a history of social and economic inequalities resulting from 45 years of apartheid rule, a regime which was formally abolished in 1994 (Coovadia et al., 2009). The legacy of apartheid rule however, remains evident in the high levels of inequality that exist in the country. The Gini coefficient is a quantitative measure of inequality, based on the Lorenz curve (Deininger and Squire, 1996) and in 2009, the Gini coefficient for South Africa was 0.63, which was the highest in the world (World Bank, 2010); even with a modified technique used to measure the Gini coefficient, Bosch et al., (2010) still found South Africa to have one of the highest levels, at 0.59. This situation does not just make South Africa a useful case study for conducting inequality research, but also makes studies on socio-economic inequality in health imperative, so as to inform the design of appropriate interventions that can reduce such gross inequalities in health.



The apartheid regime required citizens to reside in demarcated areas, assigned according to the colour of their skin. The social and health amenities varied from place to place, depending on the population group residing in the area – the “White” areas had the best amenities and the “Black” areas the worst (Coovadia et al., 2009). However, in the post-apartheid era, since 1994, there has been much migration of people within South Africa. In particular, the migration of people from rural to urban areas that has occurred in a ‘stepwise’ manner, where people move from rural areas to urban areas, and then from urban areas (such as from informal peri-urban settlements) to more formal urban areas (Collinson, Tollman and Kahn, 2007).

The effects of the past social, political and economic discrimination have resulted in most of the patterns observed regarding health outcomes, poverty and race in South African society today (Myer, Ehrlich and Susser, 2004). These lasting effects, coupled with the current rate of urbanization, poses a challenge to the health of the population, especially because the majority of the people are dependent on very limited public resources (Collinson et al., 2007).

South Africa has a reasonably well-established public health system, which co-exists alongside a large private health sector. The private health sector has a history of over 100 years of support from private medical insurance, based largely on mutual insurers called medical schemes or medical aid societies (Booyesen, 2003). The main criterion for access to a medical aid fund is formal employment (Booyesen, 2003). In 2011, the medical aid coverage for the South African population was 16.1%. The 2013 South African Health Review found that the

majority of the population uses the public health sector (70.7%) compared to 24.3% who consult private medical practitioners (South African Health Review, 2013). The historically disadvantaged black Africans continue to be less likely to have medical insurance than those formerly classified as 'Whites' in South Africa (Gilson and McIntyre, 2007).

Widespread disparities continue to exist in health spending, professional staffing levels and accessibility between the public and private health sectors, amid escalating health care costs (Booyesen, 2003). The public health sector also includes the provision of dental services and the staffing level for dental professionals is also affected by these inequalities: in 2011, of the 5 409 dentists registered with Health Professional Council of South Africa, only 906 worked in the public sector, at a ratio of 2.19 dentists per 100 000 members of the population, and 176 of the 504 dental therapists registered worked in the public sector, as a ratio of 0.2 dental therapists per 100 000 members of the population (South African Health Review, 2013).

The public health sector provides health care to the majority of the South African population mainly for free, or at a highly subsidised rate. As a result of the combination of a high volume of people who seek care in the public dental sector clinics, and limited resources/funding a relatively lower level of care is provided in this public sector (Bhayat and Cleaton-Jones, 2003; Harkinson and Cleaton-Jones, 2004; Mickenautsch, Van't Hof and Frencken, 2007), compared to the level of care available in the private oral health sector, which often operates and is located in resource-rich areas. The reality for those living in resource-poor areas is

that they have to make use of over-burdened and under-resourced public dental services, and often live with oral/dental pain for some time before seeking care. Consequently, some people use various adaptive strategies, such as the use of home remedies to address their pain, prior to seeking dental care (Cohen et al., 2007). This may result in lower oral health-related quality of life in these disadvantaged populations.

## **1.2 Problem statement and rationale for the study**

In recognition of the psycho-social impact of oral pain, several socio-dental indicators, based mostly on Locker's conceptual model of oral health (Locker, 1988), and a number of subjective oral health measures have been developed (Brondani and MacEntee, 2007). It has been argued that several of these measures have overlooked differences in socio-cultural values and adaptive strategies used by different populations that may influence responses to these instruments or measures (Brondani and MacEntee, 2007). Moreover, people in a lower socio-economic position, living in deprived areas, may have more life challenges than those in less deprived areas with the effect that they may deem the impact of oral pain of less importance than other challenges (Jelma, Mkoka and Amosun, 2008; Wilson and Cleary, 1995).

The extent to which the level of social disadvantage affects individual oral health-related quality of life can be measured. However, the most widely used measure of oral health-related quality of life, namely the Oral Health Impact Profile (OHIP) (Slade and Spencer, 1994; Slade, 1997a), was developed and validated in

an elderly population in a resource-rich country, and has not been empirically tested or structurally validated in a national South African population, although the construct has previously been used in a South African HIV population (Yengopal and Naidoo, 2008). Given that such measures are used for the assessment of oral health service needs and for planning policy interventions (Sischo and Border, 2011), it is of public health importance to understand the relationship between the levels of socio-economic position and oral health-related quality of life in South Africa.

Considering that no national population data are available on the burden of oral pain in South Africa, the present study sought to determine the burden of oral pain across socio-economic groups in South Africa, and its impact on oral health-related quality of life, as measured by OHIP. Furthermore, the structural validity of the oral health-related quality of life instrument, OHIP, was also tested. In order to achieve these two broad aims, the research reported in this thesis employed a quantitative study design using three nationally representative datasets to obtain the individual-level and area-level measures used.

The following chapter in the thesis consists of an outline of the theoretical framework and review of the literature on the key concepts of socio-economic position, oral health-related quality of life and oral pain, and how these key concepts are associated with each other (Chapter 2). Chapter 3 describes the aims and objectives of the study, clarifying the main and sub-questions. Chapter 4 details the methodology used to achieve the aims of this study. The results are presented in Chapter 5, followed by a discussion of the research findings and the

limitations of the research in Chapter 6. Chapter 7 provides concluding remarks on the main research findings and makes recommendations together with suggestions for further research.



## **CHAPTER 2**

### **LITERATURE REVIEW AND THEORETICAL FRAMEWORK**

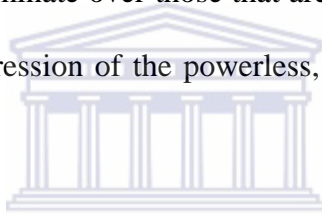
#### **2.1 Introduction**

This chapter is presented in four parts that describe the key concepts of the study. The first part, Section 2.2, provides a theoretical framework which is used in the present study and is based on a review of the literature. The second part, Section 2.3, reviews the literature on socio-economic position, including indicators of socio-economic position, the levels at which socio-economic position is measured, the use of and association of socio-economic position with health, the possible pathways through which socio-economic position influences health and the limitations of the use of socio-economic position. The third part, Section 2.4, focuses on the prevalence of oral pain and the factors that are associated with oral pain, as well as the association between oral pain and socio-economic position and oral health-related quality of life. The final two parts (Sections 2.5 and 2.6) explore oral health-related quality of life and the instrument used (oral health impact profile) particularly the origin, structure and the factors associated with oral health-related quality of life (OHIP).

## 2.2 Theoretical framework

### 2.2.1 *Social stratification*

Society is stratified based on power, privilege or prestige. This separation leads to the formation of different status groups. There are two schools of thought regarding the stratification of society, one based on functional theory and the other on conflict theory. The functional theory, which is based on Weber's view, relies on the premise that stratification of society is a result of functional necessity in the society (Davis and Moore, 1944). While the conflict theory assumes that a group of people with power dominate over those that are less powerful, which results in social inequality, by repression of the powerless, this theory originates from the view of Karl Marx.



Proponents of the functional theory believe that individuals are only transient occupants with comparatively stable social roles, where the individuals themselves are not significant. On the contrary, it is the role, status or position that an individual holds with regard to social relations, and the behaviour associated with that status that is significant (Davis and Moore, 1944). Consequently, people who find themselves in a particular role in society are likely to have a similar fate, as long as they fill to the same position in society (Lynch and Kaplan, 2000). Obviously, this is because they share common values and systems of exchange. In terms of this theory, it is argued that individuals who fit into similar positions in society, based on the common values and systems of exchange, belong to the

same social class (Bourdieu, 1987), and this also contributes to their socio-economic position.

The difference between the various positions in the society leads to inequality in society. This distinction in social position has traditionally been measured by income. However, there are other factors that influence these distinctions, which enable some individuals to be more likely to succeed in life than others. These factors include education, access to social networks, wealth, and cultural practices. Socio-economic position has been shown to influence various aspects of an individual's life, including health outcomes (Lynch and Kaplan, 2000; Van Lenthe et al., 2004).

Societies develop and maintain systems of social stratification along multiple dimensions, including socio-economic conditions. These systems determine, in part, which resources and goods are distributed to whom and what is accumulated over time by different groups. Unequal distribution of resources and social goods leads to different degrees of economic, political, social and cultural advantage among groups, which also translates to differences in health status (Galobardes, Lynch and Smith, 2007). Black provided some explanation that contributes to the observed inequality in health, which could be behavioural, material/structural (socio-economic positioning), psychosocial and the life course of the individual (Graham, 2011; Sisson, 2007).



### **2.2.2 Oral health-related quality of life**

Oral health-related quality of life is a multidimensional construct which attempts to incorporate different dimension of oral health (Slade, 1997b). These include the social, psychological and biological aspects in the definition of oral health or oral disease of an individual from the individual's perspective. Oral health-related quality of life is a subjective construct owned by the individual; it is dependent on the perception of the individual, on his or her state of oral health, which allows for a unique interpretation of each individual's state of oral health.

The construct of oral health-related quality of life emanates from a paradigm shift, from a biomedical perspective to a bio-psychosocial perspective of health and disease. This shift was initiated in 1948 by the World Health Organisation's (WHO) definition of health as "a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity" (WHO, online glossary). The shift consequently led to the WHO's international classification of functioning, disability and health (WHO, 1980), which suggests that the impact of disease progresses in a linear pattern through different stages until a state of handicap is reached, as depicted in the following sequence:

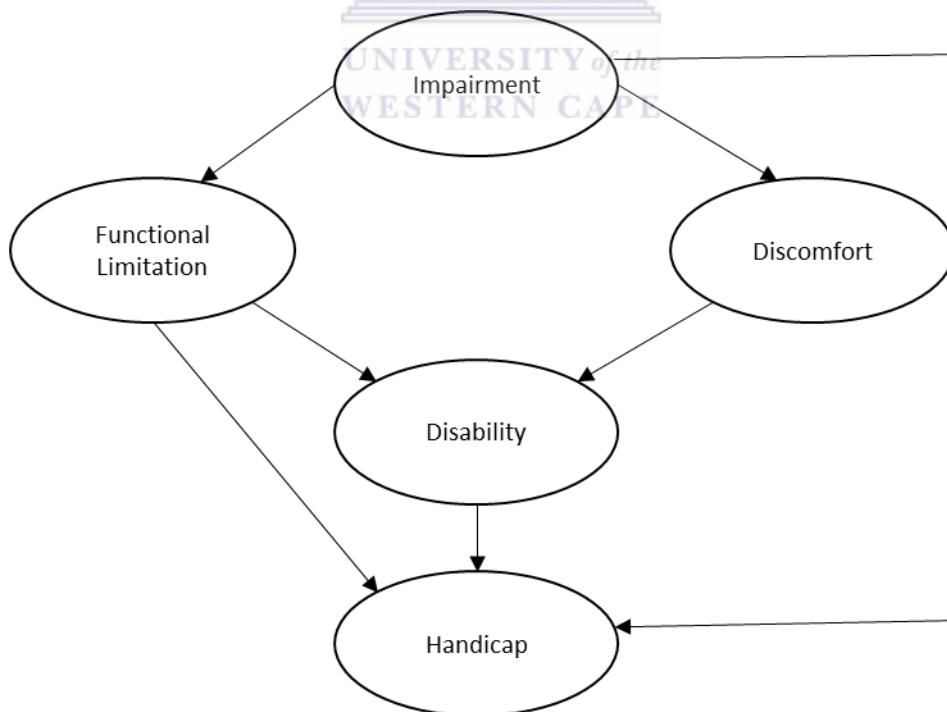
**Disease → Impairment → Disability → Handicap**

This classification was the basis for the development of Locker's conceptual oral health model (Locker, 1988). Unlike medical diseases, oral diseases, with only a few exceptions, progress slowly, and therefore progression through the different

stages of Locker's oral health model can be measured and monitored over time. It is a rare occurrence for an oral disease to progress directly to a handicap.

Locker's oral health model demonstrates the linear progression of oral disease, shown in Figure 1, from a biological level to a behavioural level, and then to the social level (Locker, 1988). The model identifies the different domains as consequences of oral disease to sequentially include functional limitation, discomfort (psychological or physical), disability (physical, psychological or social) and handicap (Figure 1). This conceptual model provided the basic structure for the development of several other oral health-related quality of life measures that are used today.

**Figure 1: Locker's oral health model**



**Source: Locker (1988:13)**

Wilson and Cleary (1995) also contributed to the development of the health-related quality of life model by pointing out that the course of any disease is a continuum, with the biological measures at the one end and the more complex social and psychological measures at the other end. Wilson and Cleary's model considers the two paradigms of health – the biomedical and the psychosocial paradigms. They also argue that the direction of disease progression is not necessarily unidirectional, but instead that the various domains may have reciprocal relationships.

The oral health impact profile (OHIP) was developed in 1994, based on Locker's conceptual model of oral health (Slade and Spencer, 1994). The OHIP was originally developed as a 49-item questionnaire, which is used as a socio-dental indicator to assess a person's oral health-related quality of life. Later, for practical reasons, a shorter version (OHIP-short version) comprised of 14 of the initial 49 items was validated (Slade 1997a). The conceptual domains which form the basis upon which OHIP and OHIP-short version (OHIP-14) models were designed, include seven conceptual dimensions of oral impact. These dimensions are functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap (Slade, 1997b). They make up five domains, namely functional limitation, pain, discomfort, disability and handicap. The disability domain has three different dimensions as indicated in Figure 2.

**Figure 2: The domains and dimensions of the OHIP**

<b>5 Domains</b>	<b>7 Dimensions</b>
Pain	Physical pain
Functional limitation	Functional limitation
Discomfort	Psychological discomfort
Disability	Physical disability
	Psychological disability
	Social disability
Handicap	Handicap

The OHIP has been widely used across the globe and has been shown to be the preferred measure of oral health-related quality of life (Nuttall et al., 2006; Robinson et al., 2003) and a better tool for cross-sectional studies (Nuttall et al., 2006) than other measures.

Recently, the theoretical basis upon which the structure of OHIP is based, Locker's conceptual oral health model, has come under scrutiny. Only a limited number of studies have empirically tested this model, and these report that the structure of OHIP varies from Locker's oral health model (Baker, Gibson and Locker, 2008; Nuttall et al., 2006). Consequently, a need has been identified to test the fit of OHIP to the Locker's oral health model (Baker et al., 2008), and more specifically, how it relates to different socio-economic groups.

### **2.3 Socio-economic position**

According to Krieger, Williams and Moss (1997:345) socio-economic position is an aggregate concept that includes both resource-based (include income, wealth, assets, educational credentials) and prestige-based (an individual's rank or status in a social hierarchy, e.g. people's access to consumption of goods, services and knowledge, as linked to their occupational prestige, income, and education level) measures, as linked to both childhood and adult social class position i.e. across the lifespan of an individual.

It is a multi-dimensional phenomenon that can be considered an umbrella term for a range of indicators and connected concepts (Galobardes et al., 2007). Various terms have been used for this phenomenon in the literature, such as social class, social stratification, social inequality, social status, and socio-economic status (Krieger et al., 1997). However, these terms differ historically and conceptually.

Socio-economic position relates to the social and economic factors that influence the position(s) that individuals and groups hold within the structures of society. These social and economic factors that identify an individual's position within the social structure are the best indicators to use to identify the influence of a person's socio-economic position on health.

The "resource-based measure" has sometimes been investigated in terms of deprivation, which describes a lack of adequate resources. Deprivation can be measured in various forms, for example, in terms of indicators of deprivation and the levels at which these have been constructed (Locker, 2000). These indicators

range from relatively simple single-item asset-based measures, asking about items such as income, car or house ownership, to complex measures which can consist of up to 40 different variables. Considering the fact that socio-economic position is a multi-dimensional phenomenon, a single item measure may be inadequate to capture the entirety of the position.

Furthermore, the multi-dimensional characteristics of socio-economic position make the use of different measurement methods possible. This is because these different measurement methods may tap into the different constructs of the multi-dimensional nature of a person's socio-economic position. These different measures may not be interchangeable, as each measure may tap into a particular construct within the multi-dimensional socio-economic position. This suggests that a composite measure of socio-economic position (where these different measures are combined into one single measure index) may be the preferred tool for use in health research, as the composite measures capture more of the context and differing constructs than a single item variable can (Oakes and Rossi, 2003).

Apart from measuring differences in constructs that the various measurements of socio-economic position tap into, some of these measures are time-sensitive, as some are more proximal measures, while others are distal measures of socio-economic position (Singh-Manoux, Clarke and Marmot, 2002). Therefore, the measures give an indication of the socio-economic position at particular points in time during the individual's lifespan, some are related to past positions as in the case of distal measures whereas others indicate a current position, which is a more proximal measure of socio-economic position. It is therefore important when

using socio-economic position measures in health research to pay attention to the underlying theoretical pathways or constructs that are involved, as this may give the researcher a better understanding of the health issues involved, and may thereby assist in finding an appropriate solution.

### ***2.3.1 Indicators of socio-economic position***

Socio-economic position can be measured using education, income (personal or household), occupation, a wealth index, asset index, past socio-economic position, and subjective socio-economic position (Braveman et al., 2005). These variables are discussed in more detail below.

#### ***2.3.1.1 Education***

Education is a commonly used indicator of socio-economic position. Formal educational attainment is often achieved by early adulthood, and this, to a large extent, is determined by a respondent's parents' socio-economic characteristics (Galobardes et al., 2006a). In turn, education is likely to determine a person's occupation and also income, which may result in an overlap of the influence of these different measures.

However, education has also been demonstrated to have an effect on inequalities in oral health (Geyer, Schneller and Micheelis, 2010) and oral health-related quality of life (Tsakos et al., 2009) independent of income.

There are disadvantages to using education as an indicator of socio-economic position in situations where education does not capture changes in socio-economic

position or the accumulated socio-economic position of the individual. This occurs because education is a distal measure of socio-economic position and therefore does not change with a change in the individual's circumstances (Singh-Manoux, et al., 2002). Education measures knowledge, and the ability to transform knowledge into action. It is also thought to reflect an ability to search for appropriate solutions to problems.

Education has been associated with health outcomes because, firstly, it is a strong determinant of future income. Secondly, it may affect a person's cognitive functioning and non-economic social characteristics, such as general health and health-related knowledge, literacy and problem-solving skills, prestige, and influence over others (Galobardes et al., 2006a). There is also the social selection explanation (which has since been discredited) of social inequality in health, which suggests that ill health in childhood may affect educational attainment and predispose a person to ill health later in life (MacIntyre, 1997).

#### *2.3.1.2 Income*

Income is one of the traditional indicators of socio-economic position, and has often been used to measure socio-economic position. However, income is also one of the most unstable variables, as it can change in the short term. Income measures the material resources of an individual directly. It differs from "wealth", as wealth has a cumulative effect over the life course of the individual (Braveman et al., 2005). Income can be measured at different levels, either at a personal level (the income received by the individual person) or at a household level (the income



received in the household) over a specific period, such as the past month (monthly income) or past year (annual income). Income can also be measured as the total household income in relation to the number of family dependents. Some studies measure income as a relative indicator of socio-economic position by using the levels of poverty (Galobardes et al., 2006a).

Ideally, when income is used as an indicator, it should include all sources of income, not only salary (wages), but also sources such as unemployment benefit, child support, retirement annuities, interest dividends, rental properties, in addition to the wages for employment (Galobardes et al., 2007). It is pertinent to note that income is a sensitive indicator, and participants may not be willing to disclose income information accurately, or even disclose their income at all, which may lead to inaccurate conclusions (Galobardes et al., 2007; Pikhart et al., 2003; Poleshuck and Green, 2008). Income and expenditure, whether measured at the individual or household level, may be used as somewhat inadequate proxy measures, due to the existence of extensive family- and community-based networks for sharing resources (Myer et al., 2004).

This is particularly relevant in Africa and developing countries. Income has a dose-response association with health through a causal pathway. The effect of income on health may accumulate over a period of time during the course of an individual's life (Galobardes et al., 2007). The construct of income measures the material resource of the individual. Thus, income determines material living conditions, which include opportunities for healthy lifestyles. Personal income is usually measured in adult life.

Income is interpreted in health service research as primarily influencing health through a direct effect on the material resources that influence more proximal factors in the causal chain, such as behaviours, for example, better food, shelter, services (direct effects) or education (an indirect effect) (Galobardes et al., 2007).

#### *2.3.1.3 Occupation*

The rationale underlying the use of a respondent's occupation relates to workplace hazards and variation of control that the individual has in the workplace. Occupation has been shown to modify personality, including the degree of mental flexibility, everyday habits, behaviour patterns and a sense of control (Geyer et al., 2010). The Whitehall study of British civil servants demonstrated the association between employment grades and ill-health as well as health risk behaviours (Marmot et al., 1991).

#### *2.3.1.4 Wealth index*

Wealth is a combined measure of total assets and income. This measure is important in health, as it has a more sustainable effect, since it can buffer the effects of temporary low income due to unemployment or illness. In addition it may vary across different social groups which appear to have a similar income (Braveman et al., 2005).

#### *2.3.1.5 Asset index*

The asset index has been found to be a valuable approach to measure socio-economic position across diverse urban and rural settings in South Africa (Myer et

al., 2004). Houweling, Kunst and Mackenbach (2003) concluded that because data on household income or expenditure are often unavailable or unreliable as a measure of economic status in developing countries, the use of an asset index is a good alternative to distinguish between the layers of wealth within a population. Nevertheless, they acknowledge that the choice of assets used influences the health outcomes observed, so care should be exercised in the selection of assets, and in comparing results with other studies using a different set of asset indices.

#### *2.3.1.6 Subjective socio-economic position*

Subjective socio-economic position (SEP) is an individual's self-perceived position within society. It reflects a person's relative social position as opposed to an absolute social position.

Subjective socio-economic position has been measured on a ten-point scale on which a person indicates where he or she belongs in society (Adler et al., 2000). At the top end (Point 10) are the people who are most well-off (those with the most money, the highest education level and the best jobs), while at the bottom, on the other end (Point 1 on the scale), are those that are least well-off (those with the least money, least education and worst paid jobs).

People's subjective socio-economic position has been demonstrated to be associated with health even after controlling for objective socio-economic position (Singh-Manoux, Adler and Marmot, 2003). However, Cohen et al. (2008), in a study on susceptibility to the common cold, demonstrated no association between subjective socio-economic position and objective measures of socio-economic

position. They suggested four main explanations as to why subjective socio-economic position differs from objective socio-economic position.

Firstly, subjective socio-economic position may reflect the success or failure to meet one's educational potential, while the objective measures do not. Secondly, subjective status allows a respondent to weigh income, education, and occupation in proportion to the importance of each marker in the respondent's own social context (for example, education may be a more important determinant of status for a college professor, while income is more important for an entrepreneur). Thirdly, objective measures of socio-economic position are crude, while the ladder in subjective socio-economic position may capture finer gradations of the objective indicators than objective markers. For example, asking about years of education does not distinguish between the quality and status of the school attended, but the respondents know that education scores have different meanings, depending on the school attended. Finally, subjective socio-economic position probably captures a broader range of socio-economic position markers, including wealth, living locations and conditions, and parental socio-economic position, that are not measured by the more limited range of objective markers.

Furthermore, Singh-Manoux, Marmot and Adler (2005) have demonstrated that subjective socio-economic position is a more precise measure of social position and a good predictor of health outcomes because subjective socio-economic position allows a nuanced judgement of objective indicators of social status and related life chances, as it measures hierarchical rank. The subjective socio-economic position also provides a better assessment of a person's future prospects

i.e. the opportunities and resources, which are a better predictor of decline in health over time than objective socio-economic position, as well as the socio-economic position and oral health of a person (Singh-Manoux, et al., 2005).

The underlying construct associated with the use of subjective socio-economic position is that both the social and economic phenomenon of the individual are measured from the individual's perspective. It represents a cognitive average of the standard markers of socio-economic position, including the assessment of the current and future prospects. The subjective socio-economic position measures the life course of an individual from childhood, as well as the person's wealth and financial security, which can inform the current and future prospects of the person's socio-economic position (Demakakos et al., 2008).

According to Singh-Manoux et al. (2005), the mechanism of action of subjective socio-economic position is mediated through a person's perception of his or her place in the social hierarchy, a reflection of the person's relative social position. This perception is believed to produce negative emotions in those of low subjective socio-economic position, which translate to poorer health. They suggest that this could occur in two ways. Firstly, there may be a direct effect on physiological processes and neuroanatomical structures, a process that leads to an increase in biological vulnerability to disease. Secondly, unhealthy behaviour by those lower in the hierarchy, the negative emotion has an indirect effect. Furthermore, the relative deprivation hypothesis suggests that a person's socio-economic position relative to that of others is important for his or her health and

that being lower down the social scale can have negative material and psychosocial consequences (Gianaros et al., 2007).

### ***2.3.2 Levels of socio-economic position***

Socio-economic position can be measured on different levels which include the individual-level, household-level and area-level (neighbourhood or community). Each level may independently contribute to the distributions of exposures and outcomes of health.

#### ***2.3.2.1 Individual-level socio-economic position***

Socio-economic position can be measured at different points in time during an individual's lifespan, and some measures can give information on the person's socio-economic position at specific periods during that individual's lifespan. The indicators that are used for the individual-level socio-economic position have already been discussed above (see Sections 2.3.1 above).

#### ***2.3.2.2 Household-level socio-economic position***

Household-level socio-economic position, measures the socio-economic position of the household in which the person resides and it's often used as a construct for childhood socio-economic position (Krieger et al., 1997). It is however often reflective of the gender of the most 'dominant' person or the household head who are often men (Krieger et al., 1997), and may therefore not adequately capture the socio-economic position of women. The total household income and asset index are indicators that can measure the household socio-economic position. Grundy

and Holt (2001) recommended that a combination of individual and household measures of socio-economic position is the best measure for health inequality studies in older adults.

### *2.3.2.3 Area-level socio-economic position*

Area-level socio-economic position is also known as neighbourhood, community-level or ecological measures of socio-economic position. This is measured by means of variables obtained from small areas such as census enumeration areas, census tracks, districts, electoral wards or other administrative databases (Krieger et al., 1997). This measure can be used to characterise areas on a continuum from deprived to affluent areas. The area-level socio-economic position measures the socio-economic conditions of an area which can have an effect on the lives of people residing in the area. Similar to the individual socio-economic position discussed above, the measure of area-level socio-economic position operates via multiple pathways, due to its multi-dimensional nature.

The area-level socio-economic position has sometimes been used as a proxy for the socio-economic position of the people living within a specific area, when individual-level socio-economic position measures are not available (Galobardes et al., 2006b; Galobardes et al., 2007; Locker, 2000).

Although some researchers purport that area-level socio-economic position only measures unmeasured individual-level socio-economic position, others have demonstrated the opposite. However, there appears to be some area-level socio-

economic position effects on some health outcomes, in some population groups, and in some types of areas (MacIntyre, Ellaway and Cummins, 2002).

MacIntyre et al. (2002) offer three possible explanations for geographical variations in health. The first is the composition explanation, which relates to the characteristics of individuals who live in particular areas. The second is the contextual explanation which relates to the opportunity structures in the physical and social environment. The third is the collective explanation, which involves the socio-cultural and historical features of the communities, which also includes shared norms, traditions, values and interests. Examples include psychosocial constructs such as social cohesion, social capital and perceived position in social and economic hierarchies; social functioning such as ethnic, regional or national identity, religious affiliations, political ideology and practices, legal and fiscal systems, shared histories, kinship systems, domestic division of labour, gender, age, caste appropriate roles, etc.

An advantage of using of area-level socio-economic position is that it supplements individual- or household-level data by improving the explanation of the models of health inequality (Watt and Sheiham, 1999). It can also be used as a surrogate indicator of the health care needs in small geographic areas (Locker, 2000). Area-level indicators can be measured by single variables, by aggregating individual-level measures of socio-economic position, for example, the proportion of unemployed people in an area, the proportion of formal employment in the area, the proportion of people with higher education ( $\geq$ high school). Another way to measure area-level indicators is by means of a composite measure, which



combines the aggregates of several different individual-level indicators or variables into a single index (Galobardes et al., 2007).

Some examples of composite indices which have been used include the following:

- *the Townsend deprivation index:*

The Townsend index uses four indicator variables, namely

- the percentage of households in the area with access to a car (percentage of households with no car);
- the percentage of owner occupied houses (percentage of households not owner-occupied);
- the percentage employed in the area (percentage of economically active persons who are unemployed);
- the percentage of overcrowded households;

- *the Carstairs deprivation index:*

Variables include:

- overcrowding;
- no car;
- male unemployment;
- the percentage of all persons in a household where the head is in a semi-skilled or unskilled occupation;

- *the Jarman underprivileged areas index/score (UPA):*

This index assesses deprivation, the level of need for primary care and general medical practitioner workload; it is a summation of 8 weighted variables.

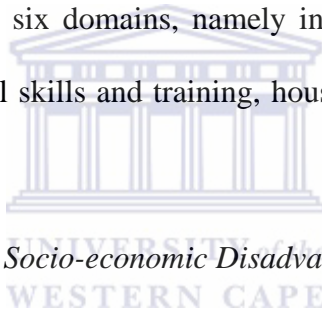
- *the Breadline British index:*

This index measures weighted counts of variables, including the following

- the percentage of the economically active population unemployed;
- the percentage of households without a car;
- the percentage of households not owner occupied;
- the percentage of single parents as a proportion of all households;
- the percentage of households with a person with limited long-term illness;
- the percentage of persons in social class IV or V.

- *the Index of Multiple deprivation:*

This index combines six domains, namely income, employment, health and disability, educational skills and training, housing and geographical access to services.



- *The Index of Relative Socio-economic Disadvantage (IRSD):*

This index is used by the Australian Bureau of Statistics (Sanders, Turrell and Slade, 2008). It measures

- income;
- education;
- occupation;
- living conditions;
- access to services.

Sloggett and Joshi (1998) found that the level of community deprivation was a better predictor of poor health than mortality, using the net individual and family socio-economic circumstances measured by employment status, occupational

class, housing tenure and car access. However, there are some limitations with area-level measures, including the fact that the composition of a neighbourhood can change over time, and is not factored in; there could be ecological fallacy in the case where both independent and dependent variables are based on group-level data, and confounding is introduced through the grouping variable; there could be under- or overestimation of socio-economic effects; and there is a possibility of individualist fallacy in the case when population patterns are presumed to be explained by individual-level characteristics which can be avoided by the use of multi-level model analysis (Krieger et al., 1997).

### ***2.3.3 Uses of socio-economic position measurement***

Socio-economic position measurement in research is used for different reasons (Galobardes et al., 2007):

- it describes and monitors the social distribution of disease in order to inform health policy, monitors change over time and evaluates if policy targets to diminish health inequality are achieved;
- it explains the causal mechanism through which socio-economic position generates health differences; and
- it statistically adjusts for socio-economic circumstances when another exposure is the main focus of interest.

### ***2.3.4 Social inequality in health***

Health status has been shown to be related to socio-economic position (Ataguba, Akazili and McIntyre, 2011; Feinstein, 1993; Smith, Bartley, and Blane, 1990; Van Lenthe et al., 2004). Similarly, oral health and oral health-related quality of life follow a socio-economic gradient (Chavers, Gilbert, and Shelton, 2002; Jung et al., 2011; Sabbah et al., 2007; Sanders et al., 2006; Tsakos et al., 2011; Watt and Sheiham, 1999). Hence, it has been suggested that reporting averages on the general population may conceal the inequalities in health that exist between sub-populations (Sanders and Spencer, 2005). Furthermore, it has been argued that variations in health between different sub-population groups are a combination of both the individuals' socio-economic position and the area-level or socio-environmental factors that individuals are exposed to (Ahern et al., 2008; Diez-Roux, 2007; MacIntyre et al., 2002). These variables may operate independently or in a complementary way (Krieger et al., 1997; Locker, 2000). Some suggest that area-based indicators are better predictors of oral health status as they contribute to the explanatory power when one is examining oral health inequalities (Watt and Sheiham, 1999). Others have maintained that area-level socioeconomic position may influence oral health (Locker, 2000) and general health (Krieger et al., 1997; Robert, 1999), independent of individual-level socio-economic position. By contrast, other studies have argued that after controlling for individual-level socio-economic position, the association between area-level socio-economic position and individual general health (Reijneveld, 1998) or oral health (Bower et al., 2007) is no longer statistically significant, implying that the

area effect is fully explained by individual socio-economic position. Robert (1999) noted that living in communities with low socio-economic profiles negatively affected a person's health promoting attitudes and behaviours by exposing the person to neighbours who are themselves less likely to practice health-promoting behaviours than neighbour in a high socio-economic position area. Stafford and Marmot (2003) found no evidence that personal poverty combined with an affluent neighbourhood had a negative health consequence.

Some inconsistencies reported on the role of area-level socio-economic position in health outcomes may be partly related to differences in study design. In particular, some studies investigating the role of individual- and area-level socio-economic position on health did not use a multi-level statistical modelling approach that allows influences to be partitioned (Merlo et al., 2005; Newton and Bower, 2005), and/or did not explore the potential effects of the interaction between area-level and individual-level socio-economic position (Sanders et al., 2008). Furthermore, differences in the nature of the socio-economic position measure used, for example, using single-variable factors instead of a combination of variables in the form of an index may also partly explain differences in findings – studies using only a single variable measure for individual-level socio-economic position may leave an unmeasured dimension of individual-level socio-economic position to be captured as part of area-level socio-economic position (Pickett and Pearl, 2001), and it is therefore recommended that multiple indicators be used (Poleshuck and Green, 2008).

### ***2.3.5 Pathways through which the socio-economic position affects health***

Socio-economic factors at an individual-level and area-level may act together or independently to influence health. Some of the pathways through which socio-economic position affects health include the following:

- the individual's socio-economic position affects the person's health and oral health directly (Chavers et al., 2002; Donaldson et al., 2008; Feinstein, 1993; Jung et al., 2011; Robert, 1999; Sabbah et al., 2007; Sanders et al., 2006; Smith et al., 1990; Van Lenthe et al., 2004; Watt and Sheiham, 1999);
- the area-level socio-economic position affects the characteristics of the community environment, which in turn affects the health of all its residents (Robert, 1999);
- the environment of the individual may shape the person's health behaviour (Adler and Ostrove, 1999);
- shaping the socio-economic position of the individual affects the individual's health;
- it may directly affect the collective resources in the area, which include the material or structural infrastructure of the area such as the social services, and physical environment of the community shared by its residents, which then affects the individual characteristics, conditions, and experiences of the individuals that more directly affect their health (MacIntyre et al., 2002; Stafford and Marmot, 2003); these include
  - physical features of the environment shared by all residents in a locality such as water sources, or air quality (which may affect all/most residents);

- the availability of healthy environments at home, work and play (which may affect some residents more than others);
- the services provided, publicly or privately, to support people in their daily lives, such as education, street cleaning and lighting, transport, policing, health and welfare services;
- socio-cultural (social and interpersonal) features of the environment or neighbourhood, both at work and home, such as political, economic, ethnic, religious history of the community, norms and values, levels of crime, networks of community support which may also have differential exposure to threats and stress (Adler and Ostrove, 1999; MacIntyre et al., 2002);
- the reputation of an area (how areas are perceived, by their residents, by services or amenity planners and providers, by banks and investors) may influence the infrastructure of the area, the self-esteem and morale of residents, and who moves in and out of the area (MacIntyre et al., 2002); and
- the local social inequality model – the disparity between an individual’s own socio-economic position and the socio-economic position of those living nearby negatively affects health (Stafford and Marmot, 2003).

The importance of the information on which of the above pathways is involved in the effect on a person’s or community’s health, would determine the most appropriate strategy and target for any health policy, and the interventions which are to be carried out, for example, whether to target low socio-economic position individuals or an entire community with a low socio-economic position.

## **2.4 Oral pain**

This section reviews the prevalence of oral pain, factors associated with oral pain and the impact of and responses to oral pain. It also looks at the association between oral pain and oral health-related quality of life and socio-economic position.

### **2.4.1 Pain**

The International Association for the Study of Pain (IASP) defines pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage”.

Oral pain refers to pain within the oral cavity, which for the purpose of the present study includes the teeth and the soft tissues within and around the mouth.

Oral pain has an impact on daily activity and affects the quality of life of the individual. The most common location of oral pain is from the teeth, in other words, toothache (Leung, McMillan and Wong, 2008; McGuire et al., 2008).

### **2.4.2 Prevalence of oral pain**

The prevalence of oral pain varies from place to place, country to country, and ranges from 7% to 66% in adults (Pau, Croucher and Marcenes, 2003). However, it should be noted that the time frame used to measure the prevalence of oral pain varies from study to study. Some researchers use a time frame of the past two weeks, or the past month, or the last six months, while others measure the past



year. This makes it difficult to compare the results of different studies. The most common time frame from the literature seems to be “the past six months” (and was the time frame used in the present study). A review of the various studies reporting on the prevalence of is summarised in Table 1, below.

**Table 1: Summary of oral pain prevalence from the literature**

Country	Author	Year	Population	Prevalence of pain
Brazil	Hafner et al.	2013	Adults aged 35 to 44 years	21% in the past six months. However, the prevalence varied by region between 15.7% and 36%
Canada	Ravaghi, Quiñonez and Allison	2013	Adults	11.7% in the past 12 months
Florianopolis, Santa Catarina, Brazil	Constante et al.	2012	Adults	14.8% in the past six months
Brazil	Silva de Pinho et al.	2012	35- to 44-year old adults	24.3% in past six months
Canada	Quiñonez	2011	Adults	5% in the past month in emergency room
Canada	Muirhead et al.	2009	Adults	14 % in past month
Brazil	Bastos, Gigante and Peres	2008	Adults	17.7% in past six months
UK	Steele	2007	Adults	28%
Florida, USA	Riley, Gilbert and Heft	2005	Adults $\geq$ 45 years	65% of the 23% who reported at least one urgent dental visit in 54

Country	Author	Year	Population	Prevalence of pain
				months longitudinal study
USA	Vargas, Macek and Marcus	2000	Adults	13.6% in past six months
Review	Pau et al.	2003	Adults	7-66%
São Paulo, Brazil	Peres et al.	2010	12 and 15 year olds	Nearly a quarter in the past six month. 32.8% from families with < ¼ Basic minimum wage and 8.7% were from private schools
USA	Lewis and Stout	2010	Children	10.7% in past six months
Belo Horizonte, MG, Brazil	Barrêto, Ferreira and Pordeus	2009	8-9 year old Children	15.6% in past one month
Peshawar, Pakistan	Pau et al.	2008	11-14 year old children	30.4% in past one month (45.9% life time)
Pelotas, Brazil	Bastos et al.,	2008	Longitudinal at 6 years and at 12 years	Lifetime prevalence for 6year olds 39% and 12 year olds 63%. Past month prevalence 11%
Belo Horizonte, Brazil	Moura-Leite et al.	2008	5-year olds	10.7% in past two months (25% lifetime)
Brazil	Goes et al.	2007	14-15 –year olds	33.6% in the past six months
A municipal area in Greece	Pau, Baxevanos	2007	10-14 year old children	37.4% in the past four weeks

Country	Author	Year	Population	Prevalence of pain
	& Croucher			
Sri Lanka	Ratnayake and Ekanayake	2005	Children	The children reported 25% past two months; while the parents reported 31%
Suphanburi Province, Thailand	Gherunpong Tsakos and Sheiham	2004	Children	65% of 89.8% in the past three months
Tabuk, Saudi Arabia	Stewart, Sabbah and Owusu-Agyakwa	2002	Children 8-year olds	40% prevalence in the past four weeks
Western Cape, South Africa	Naidoo, Chikte and Sheiham	2001	8- to 10 year olds	70% in the past two months (88% lifetime)
	Slade	2001	5-year olds	5% to 33%, an increase of 6% toothache prevalence for every unit increase in dmft (measure of caries prevalence) within a range of 0 to 10, but the effect is weaker in higher socio-economic groups and populations where most of the caries has been treated
Harrow, UK	Shepherd, Nadosky and Sheiham	1995	Children	7.6% past four weeks (47.5% lifetime)

### 2.4.3 Severity of oral pain

The severity of oral pain is associated with its social and psychological impact (Goes, Watt, Hardy and Sheiham, 2008; Locker and Grushka, 1986). It often

determines *when* care is sought (Cohen et al., 2007; McGuire et al., 2008; Vargas et al., 2000), as the majority of the people who suffer from oral pain seek emergency care (Anderson and Thomas, 2003; McGuire et al., 2008; Quiñonez, 2011; Riley, Gilbert and Heft, 2005). Delay in seeking care for oral pain can be attributed to different reasons; lack of finances is the reason most commonly cited (Leung et al., 2008; McGuire et al., 2008). Other reasons include a lack of time, anxiety/fear, and cultural beliefs (Cohen et al., 2007).

#### ***2.4.4 Factors associated with oral pain***

The literature has identified several factors associated with oral pain, which include demographic, socio-economic and service utilisation factors. The demographic factors include age, sex and race. Duncan, Gilbert and Peek (2003) found that age is associated with oral pain. Decreasing age and female gender contribute to inequality in the experience of oral pain (Constante et al., 2012), as does access to dental services and perceived treatment need (Steele, 2007).

The Black race group in Brazil experienced 30% higher toothache prevalence than the Whites, irrespective of indicator of socio-economic position (Bastos et al., 2008; Constante et al., 2012).

Socio-economic factors include education and income. Cohen et al. (2007) reported that although removing financial barriers alone may not lead to preventive dental visits, it would facilitate more timely visits to dentists to treat toothache. This is important, because Muirhead et al. (2009) observed that almost twice as many of the people who reported toothache compared to those who did

not, also reported relinquishing goods or services to obtain dental care. Other reasons cited for not visiting the dentist (in addition to financial barriers) include a lack of time availability (time off work), fear of the dentist, the attitude of the dentist, language barriers, transport problems (lack of access), and cultural reasons.

Smoking (> 21 cigarettes/day) and alcohol consumption were associated with a higher prevalence of pain (Bastos et al., 2008). People who visit the dental clinic regularly were less likely to report oral pain (Duncan et al., 2003).

#### ***2.4.5 Oral health-related quality of life and oral pain***

Oral pain impacts on the daily activity and affects the quality of life of the individual (Östberg and Hall-Lord, 2011). Oral health-related quality of life is poorest among those with a perceived need to relieve dental pain (Seirawan, Sundaresan and Mulligan, 2011) and among those with symptomatic (problem-oriented) dental visits, as compared to regular dental attendees (Chavers et al., 2002). Oral pain can result in an inability by a person to eat, drink, talk, sleep or socialize; and it can even result in emotional discomfort and difficulty in performing daily task (Cohen et al., 2007).

Oral pain is an integral part of oral health-related quality of life, and pain is one of the five domains in Locker's model of oral health (Locker, 1988). Slade and Spencer (1994) developed the oral health impact profile (OHIP) based on Locker's conceptual model of oral health, which was informed by the WHO's International Classification of Impairment Disability and Handicap (WHO, 1980).

Oral health-related quality of life has recently been demonstrated to be associated with an individual's socio-economic position (Turrell et al., 2007), but not with dental care attendance (Zini, Vered and Sgan-Cohen, 2011). However, the effect of area-level socio-economic position on the association between oral health-related quality of life and oral pain is yet to be fully understood.

Furthermore, the extent and psychosocial impact of oral pain, including the associated socio-economic factors contributing to the experience of oral pain and subsequent lowering oral health-related quality of life, have not been extensively explored in the South African adult population. Nor has the influence of oral pain on dental service utilisation and the intention to make preventive visits in future.

#### ***2.4.6 Service utilisation and oral pain***

Given that most oral diseases progress slowly, regular visits to the dentist should provide an opportunity for an early diagnosis of oral disease and treatment before the onset of oral pain. Oral pain has been associated with low levels of satisfaction with dental services received (Riley et al., 2005), and it is reported that people satisfied with their dentist are more likely to make use of dental services in future (Liddell and Locker, 1992). It is therefore not surprising that Kaylor et al. (2010) reported that those with a perceived unmet dental need were less likely to make a dental visit than their counterparts without a need. Unfortunately, this only perpetuates the vicious cycle of oral pain and symptomatic dental attendance patterns. Furthermore, symptomatic dental attendance has been associated with a higher prevalence of oral pain (Goes et al., 2007).

A study carried out on Canadian adults revealed factors that predicted a visit to the emergency room in a hospital for dental problems, namely pain or aching in the mouth in the past month, spending at least a day in bed because of dental pain, and being a person with a lower middle class income (Quiñonez, 2011).

Interestingly, in developing countries, some people use traditional healers to relieve their toothache. A study carried out in the Tanga region in Tanzania revealed that as many as 60% of those who experienced toothache within the past two years had sought treatment from traditional healers (Ngilisho, Mosha and Poulsen, 1994).

#### ***2.4.7 Cost of oral pain***

The cost of illness can be measured directly, as the direct financial impact, or indirectly, which includes the cost of lost wages due to days lost from work. A landmark study that highlighted the cost of dental problems was carried out by Gift, Reisine and Larach (1992) on the social impact of dental problems and visits to the dentist, which revealed that 148 000 hours of work were lost per 100 000 workers in the US in the year 1989. The authors concluded that the time lost from the impact of dental problems at an individual level may not account for much (1.48 hours), but when these hours are accumulated on a societal level, they have a much greater impact.

#### ***2.4.8 Oral pain and socio-economic position***

Vargas et al. (2000) reported that socio-economic differences remained after adjusting for other demographic characteristics among adults in the United States who experienced toothache. They found that people of low socio-economic position were more likely to report tooth pain but were also less likely to seek dental care for the pain they experienced. The presence of pain did not reduce the barrier that low socio-economic people experience to access a dental facility, but the severity of the pain was associated with the timing of seeking dental care.

Furthermore, Muirhead et al. (2009) reported that 20% of those who had pain in the mouth reported having to relinquish goods or services in order to afford dental care, compared to 11.7% of participants who did not report a toothache.

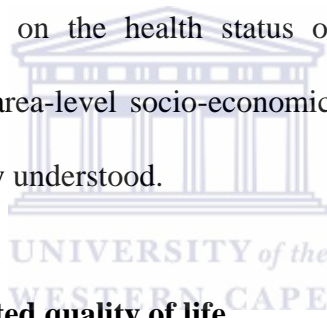
The literature suggests that those of low socio-economic position often suffer the most from oral pain (Bastos et al., 2008; Chavers et al., 2002; Constante et al., 2012; Gift et al., 1992; Goes et al., 2008; Pau, Croucher and Marcenes, 2007; Slade, 2001; Steele, 2007; Vargas et al., 2000). This occurs, firstly, as a result of higher oral disease prevalence among the poor (Wamala, Merlo and Boström, 2006) and, secondly, as a result of the delay to seek dental treatment (Vargas et al., 2000). Furthermore, this group of people cannot afford a loss of income on account of absenteeism resulting from the impact of oral pain, or from the time that may be required to make a dental visit.



This phenomenon is similar to the experiences of people with medical diseases (Dutton, 1978). It was found that three factors influenced poor (low socio-economic position) people, preventing them from utilizing services:

- financial coverage (medical aid coverage, free dental treatment – cost);
- a culture of poverty (time delay in seeking help for oral pain, disposable income); and
- system barriers (location of the closest clinic, satisfaction with previous dental visit).

It has been suggested that the socio-economic position of the area in which people reside has an influence on the health status of populations (Locker, 2000). However, the effect of area-level socio-economic position on the experience of oral pain is yet to be fully understood.



## **2.5 Oral health-related quality of life**

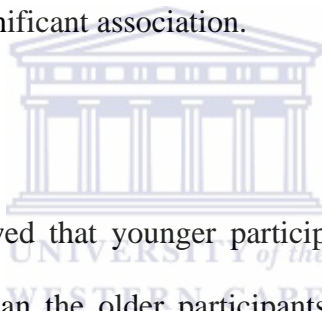
This part of Chapter 2 deals with the concept of oral health-related quality of life, the factors associated with oral health-related quality of life, how it is influenced by socio-economic status, and the short version of the OHIP (OHIP-short version).

### ***2.5.1 Factors associated with oral health-related quality of life***

Oral diseases and disorders impact on individuals by affecting their quality of life. Several factors have been associated with Oral health-related quality of life. These are discussed below.

### 2.5.1.1 *Sex*

There are mixed reports regarding the association between biological sex and oral health-related quality of life. While some authors claim that there is no association between sex and oral health-related quality of life (Robinson et al., 2003), others have demonstrated that females are more likely to have poorer oral health-related quality of life than males (Mason et al., 2006; Seirawan et al., 2011; Tsakos et al., 2009; Ulinski et al., 2013). A review of the literature by Cohen-Carneiro, Souza-Santos and Rebelo (2011) indicated that ten of the 39 articles reviewed showed a significant association between sex and oral health-related quality of life, while the others showed no significant association.



### 2.5.1.2 *Age*

At least one study showed that younger participants had a poorer oral health-related quality of life than the older participants, even in the presence of oral disease (Robinson et al., 2003). In a study carried out by Ulinski et al. (2013) on elderly Brazilians aged 60 years and above, the oral health-related quality of life significantly improved with age. They suggested an increase in tolerance to oral health problems in this group of older people may be responsible for their finding.

### 2.5.1.3 *Education*

An education gradient has been associated with oral health-related quality of life. Education has been shown to be independently and significantly associated with oral health-related quality of life (Tsakos et al., 2009).

#### *2.5.1.4 Natural teeth*

In a study carried out by Tsakos et al. (2009), denture wearers reported a significantly poorer oral health-related quality of life than those who have their natural teeth; and among people with natural teeth, the number of occluding pairs of teeth was significantly associated the oral health-related quality of life (Tsakos et al., 2006; Ulinski et al., 2013). Furthermore, Mason et al. (2006) reported a significant association between the number of retained teeth and oral health-related quality of life, which was especially prominent among female participants. While Ulinski et al. (2013) reported no significant association between number of remaining teeth and oral health-related quality of life in an elderly population, although the number of occluding pairs was significantly associated.

#### *2.5.1.5 Dental attendance*

Seeking dental attendance was not found to be associated with oral health-related quality of life (Crocombe, Brennan and Slade, 2012; Zini et al., 2011), but the association between dental attendance and oral health-related quality of life was found to be significantly influenced the area of residence of the individual (Crocombe et al., 2012).

#### ***2.5.2 Oral health-related quality of life and socio-economic position***

A limited number of studies using a multilevel modelling approach to delineate the role of people's socio-economic positions in oral health have been conducted mainly in developed countries, and/or focused only on specific population groups

(Bower et al., 2007; Turrell et al., 2007). There is also limited empirical evidence regarding the influence of social context on an index measure of oral health-related quality of life in a general adult population. Very few studies have been conducted in sub-Saharan Africa, and especially in South Africa, where the condition of absolute deprivation commonly co-exists with affluent conditions (Coovadia et al., 2009). This gap presents an opportunity to increase our understanding of the effects of people's social context on oral health-related quality of life. One recent study in South Africa focused on self-reported oral health, but did not use index measures of individual-level and area-level socio-economic position (Olutola and Ayo-Yusuf, 2012). The question remains then, to what extent individual-level socio-economic position accounts for the relationship between area-level socio-economic position and oral health-related quality of life, if at all?



### ***2.5.3 Self-rated oral health***

Self-rated oral health is one of the socio-dental indicators often used as a gold standard for global oral health ratings. The self-rated oral health measure is a Likert-like scale ranging from 1 to 5, where an individual rates his or her own oral health from his or her perception on a scale from being very satisfied on the one end, to being very dissatisfied with his or her oral health on the other end. Given that the results are based on individual perceptions, it is logical for the frame of reference to include the bio-psychosocial model of health. However, the frame of reference to give meaning to how people rate their oral health has recently been found to differ among people (Locker, Maggiriias and Wexler, 2009). Locker et

al. (2009) found that most of the frames of reference that people use originate from a bio-medical model of health, such as tooth loss or retention, past or present cavities, regular dental visits, previous dental treatment and oral health self-care behaviours (Locker et al., 2009). This may result in some discrepancy between self-rated oral health and oral health-related quality of life due to the underlying model used as reference.

Other factors influence self-rating, such as income and stress levels. People in the intermediate income bracket are associated with higher chronic stress than those of other income categories, and chronic stress significantly influences self-oral health ratings (Sanders and Spencer, 2005).

## **2.6 Summary**

This chapter discussed the theoretical framework upon which this present study is based. The literature was reviewed on the advantages and disadvantages of the different socio-economic position indicators. This chapter reviewed the suggested mechanisms through which individual- and area-level socio-economic position influence health.

The prevalence and associated factors influencing oral pain and oral health-related quality of life were discussed.

## CHAPTER 3

### AIMS AND OBJECTIVES

#### 3.1 Hypothesis

The distribution of oral pain and oral health-related quality of life among South African adults is inversely associated with socio-economic position.

#### 3.2 Central research question

Does oral pain and oral health-related quality of life among South African adults vary by socio-economic position?

#### 3.3 Research sub-questions

Five sub-questions were used to help address the central research question:

1. What factors are associated with oral pain in South African adults?
2. Does the prevalence, severity and response to oral pain among South African adults vary by socio-economic position?
3. What factors are associated with oral health-related quality of life among South African adults?
4. Does oral health-related quality of life among South African adults vary by socio-economic position?
5. Does the individual or area socio-economic position modify the structure of Locker's oral health model?

## CHAPTER 4

### RESEARCH DESIGN AND METHODOLOGY

#### 4.1 Introduction

This section describes the methodological aspects of this study – the study design and study population, sampling method, research instrument measures, data analysis and ethical considerations.

#### 4.2 Study design and study population

The present study was a cross-sectional multi-stage quantitative survey that comprised of three different datasets, namely a primary dataset, which was part of the South African Social Attitudes Survey (SASAS) and two secondary datasets, the General Household Survey (GHS) done in 2010 and the Quarterly Labour Force Survey (QLFS) of 2010/2011. The three datasets were nationally representative of the South African population. The sampling units of all the three datasets were based on the 2001 census enumeration areas (EAs), which allowed for the datasets to be merged.

##### *4.2.1 Primary dataset*

A quantitative interviewer-administrated household survey was carried out from September to November 2011 on a nationally representative sample of South African adults aged 16 years and older. The targeted sample size for the study population was 3500 participants. The primary survey was part of the Human

Sciences Research Council's annual South African Social Attitudes Survey (SASAS). The questionnaire was developed based on similarly fielded questions from past national surveys and was guided by the published literature. The questionnaire was piloted prior to its administration at a national level. The interviewers were trained and calibrated prior to field work.

#### *4.2.1.1 Sampling method and sample size*

The sample size for this study was based on the master sample design of the SASAS (n=3 500). A master sample is a sample which has been selected from a set frame for selecting samples. The frame is designed to be stable and to have an established systematic method for selecting the sub-samples used for the same survey repeated over a given period. The frame for the master sample can be used for multiple surveys in different fields of study or in different rounds of a periodic survey.

The 2011 SASAS annual survey used a multi-stage cluster sampling method to produce a representative sample of South African adults aged 16 years and older. The sampling method involved multiple stages. The first stage was a random selection of census enumeration areas (EAs) in the country. The EAs are the smallest geographical units that make up municipalities, which are the lowest level of government administration and service delivery (the EAs were established in preparation for the 2001 census, for which the country was divided into 80 787 EAs). The second stage involved the selection of visiting points, which are the



households within the EAs. The third stage involved a random selection of an eligible respondent within each selected household.

This primary dataset was used to obtain the socio-demographic data, the individual-level socio-economic position data and the oral health variables of the participants for this study. No clinical examination was carried out.

#### ***4.2.2 Secondary datasets***

The secondary data consisted of two datasets:

- the General Household Survey (GHS) 2010, which had a response rate of 93.4% and involved 25 653 household interviews;
- the Quarterly Labour Force Survey (QLFS) 2010/2011, which collects data on the labour market activities of South African adults within the economically active age group of 15 to 64 years of age and uses a sample size is about 30 000 households (dwellings) per quarter - in the current study, the data for the second, third and fourth quarters of 2010 and the first quarter of 2011 were used.

Both datasets were compiled by Statistics South Africa and were nationally representative, using the same master sample design as that for the SASAS (the primary dataset). All the surveys were cross-sectional household face-to-face interview surveys administrated by trained interviewers across South Africa.

### *4.2.3 Sampling method and sample size*

The master sample uses a two-staged, stratified design with probability-proportionate to size selection of primary sampling unit, which is comprised of EAs. These are in turn made up of dwelling units/households. These EAs formed the basis of the primary sampling units (PSUs). Where possible, PSU sizes were kept between 100 and 500 dwelling units. EAs with fewer than 25 dwelling units were excluded, while EAs between 26 and 99 dwelling units were pooled to form larger PSUs and the criterion used was “same settlement type”. Virtual splits were applied to large PSUs: 500 to 999 were split into two; 1 000 to 1 499 were split into three; and 1 500 plus were split into four PSUs; and Informal PSUs were segmented. For each of the surveys carried out, approximately 3 080 PSUs were selected.

The second stage involved the systematic selection of a varying number of dwelling units based on inverse sampling ratios of each PSU. The master sample design was the sampling method used for both the primary and secondary datasets.

These secondary datasets provided the area-level data, in other words, the socio-economic context of where the participants in the primary dataset live. This made it possible for the three datasets to be merged, since all three datasets used the EAs as the primary sampling units, and as such all the datasets were matched based on the EAs. Subsequently, each participant in the primary dataset was matched with the corresponding area-level socio-economic measures from the

secondary dataset, using the EA codes (n=179 municipal areas matched with an average of 20 participants from the primary survey matched to each area).

### **4.3 Measures / variables**

The data obtained included socio-demographic information, the individual-level socio-economic position, the area-level socio-economic position, and the oral health information. The oral health information focused on the experience of oral pain, self-rated oral health, oral health-related quality of life using the OHIP-14, and dental service utilisation patterns.

#### ***4.3.1 Socio-demographic information***

The respondents in the primary dataset were asked to give information on the socio-demographic characteristics listed below.

##### ***4.3.1.1 Age***

The respondent's age was requested in years as on the last birthday of the participant before the survey was conducted. The age of the participants was later categorised into groups and coded as follows:

1 – Age between 16-25 years

2 - Age between 26-35 years

3 – Age between 36-45 years

4 – Age between 46-55 years

5 – Age between 56-65 years

6 – Age > 65 years

#### *4.3.1.2 Sex*

The participants were asked to indicate if they were male or female. The sex was coded as

0 - Female

1 - Male

#### *4.3.1.3 Race / Ethnicity*

The population groupings (race) referred to in the present study were as follows: Indian/Asian, comprising 2.5 % of the population of South Africa (mainly people of Indian descent); Blacks, constituting 79% of the population of South Africa (descended from African people); Coloureds, who make up 8.9% of the population of South Africa (people of mixed parentage, mainly descendants of the indigenous Khoikhoi people, the Malaysian slaves and the White settlers); and Whites, comprising 9.5% of the population of South Africa (descendants of the European settlers, mainly Dutch, British, German, French, Portuguese, Greek, Italian and Jewish) (Department of National Health and Population Development, 1992).

Participants were asked to indicate which race group they belonged to. The options given were “black African”, “Coloured”, “Indian/Asian”, “White” or “Other”.

The respondent's race was coded as follows

1 – Black Africans

2 – Coloured

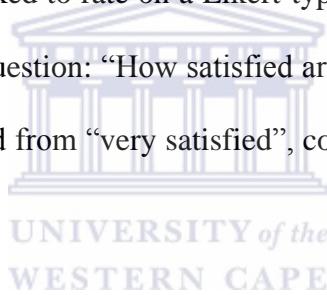
3 – Indian / Asians

4 – Whites

5 - Other

#### *4.3.1.4 Self-reported life satisfaction*

The participants were asked to rate on a Likert-type scale how satisfied they were with life by asking the question: “How satisfied are you with life as a whole these days?” The scores ranged from “very satisfied”, coded as 1, to “very dissatisfied”, coded as 5.



#### *4.3.2 Socio-economic measures*

##### *4.3.2.1 Medical aid (Private health insurance)*

The participants were asked if they belonged to a medical aid. The responses were coded as 0 for “Yes” and 1 for “No”.

##### *4.3.2.2 Payment method for last dental visit*

The participants were asked “How did you pay for your last visit to the dental clinic?” and were requested to mark only one answer. The options given were “I paid the complete cost through my medical aid”, “I paid part through my medical

aid and part from my pocket”, “I paid with cash to collect a refund from my medical aid later”, “I paid with cash”, “I paid with a credit card/loan”, “I did not pay, the treatment was free”, “I cannot remember”, and “I did not visit the dentist”. These options were categorised into “Free”, “Medical aid”, and ‘Cash’. These were then coded as follows:

0 - Free. (This included “I did not pay, the treatment was free”.)

1 - Medical aid. (This included the options “I paid the complete cost through my medical aid”, “I paid part through my medical aid and part from my pocket”, and “I paid with cash to collect a refund from my medical aid later”.)

2 - Cash. (This included those who indicated “I paid with cash”.)

Those who did not visit a dental clinic were regarded as missing values. Furthermore, analysis that involved the use of the variable “How did you pay for your last visit to the dental clinic” were restricted to only those who responded that they had been to a dental clinic.

#### 4.3.2.3 *Welfare grant*

The participants were asked if they or anyone in their household received any welfare grants. These grants include an old age grant, child support grant, disability grant, care dependency grant, foster care grant, and grant in aid. An affirmation of any the grants mentioned was regarded as “Yes”, while those who indicated “No-one in the household receiving any benefits” was regarded as a

“No”. Those who declined to answer and those who indicated “don’t know” were regarded as missing. The “No” was coded as 0 and “Yes” was coded as 1.

#### *4.3.2.4 Need to forego any basic need in order to pay for last dental visit*

The participants were asked if they had to forego any essential basic needs to enable them pay for their last dental visit (such as food or rent). The options given were “No” which was coded as 0 or “Yes” which was coded as 1. Those who indicated “Don’t know” were regarded as missing.

#### *4.3.2.5 Employment status*

The current employment status was sought by asking the question “What is your current employment status?” The options were coded as 1 for “Employed”, 2 for “Unemployed” and 3 for “Others” as follows:

1 – Employed. (This included the options “employed full-time”, “employed part-time”, and “employed less than part-time (casual work/piecework)”.

2 – Unemployed. (This included the options “unemployed, looking for work”, “unemployed not looking for work” and “housewife, looking for work”).

3 – Others. (This option was for the people who are not employed and are not seeking employment; it included the options “pensioner (aged/retired), permanently sick or disabled”, “temporarily sick”, “housewife, not looking for work”, and “student/learner”).

#### 4.3.2.6 *Education*

The participants were asked for the highest level of education they had completed. For the purposes of the present study, the educational attainment was categorized into three groups:

0 - Those with > 12 years of formal schooling (Grade 12)/high school

1 - Those with 12 years of formal schooling (Grade 12)/high school, also called Matric

2 - Those with < 12 years of formal schooling (Grade 12)/high school.

#### 4.3.2.7 *Income*

The income of the participants' was requested in South African Rands (ZAR). However, this measure was not used, because there was a lot of missing data, a finding similar to that of other researchers (Pikhart et al., 2003).

#### 4.3.2.8 *Asset index*

The asset index was used in the present study because data on household income or expenditure were difficult to obtain, and were likely be an unreliable measure.

It has been suggested that asset index is a good alternative to distinguish layers of wealth within a population (Houweling et al., 2003).

The asset index for this study was obtained by conducting a factor analysis of the different household assets to identify the assets that had the best fit, which were



then placed in a matrix. The reliability and internal consistency of the index were tested using the Cronbach's alpha test.

Participants were provided with a list of household assets, and they were asked which, if any, of the mentioned assets were available and in working order in their household. The assets included hot running water, a fridge/freezer combination, a microwave oven, a domestic worker, VCR, a vacuum cleaner/floor polisher, only one cell phone, two cell phones, three or more cell phones, a washing machine, a computer/laptop, a DVD player, an electric stove, a television (TV set), a tumble dryer, a Telkom home (fixed land line) telephone, no or only one radio, a home music centre (Hi-fi), a built-in kitchen sink, a home security service, a deep freezer, an M-Net and/or a DSTV subscription, a dishwashing machine, a motor vehicle (car), a home theatre system, and access to internet. The variables were factor analysed using the eigenvalue cut-off of  $> 1$  and the a priori set criterion that any factor retained will explain at least 10% of variance, with varimax rotation applied to display factor solutions for ease of interpretation. An extraction factor loading of 0.4 was the cut-off for item inclusion in the final model. The variance explained by the model was assessed for the final model. Fourteen of the above-mentioned assets that displayed one factor solution were eventually used to represent an underlying construct of wealth. The reliability of this construct was tested using the Cronbach's alpha internal consistency coefficient.

#### *4.3.2.9 Subjective socio-economic position*

The subjective socio-economic position is a participants' own perception of his or her socio-economic position. This reflects the psychological aspect of the participant. The participant was thus asked the question "In our society, there are groups which tend to be towards the top and groups which tend to be towards the bottom. Below is a scale that runs from the top to the bottom. Where would you put yourself on this scale?" A scale was provided with numbers from 1 to 10. The number 10 was at the top and 1 the bottom. Participants were asked to indicate which number they belonged to.

This variable was analysed as a continuous variable.

#### *4.3.3 Socio-economic position*

The socio-economic position was measured at both the individual-level and the area-level as indicated below.

##### *4.3.3.1 Individual-level socio-economic position*

The individual socio-economic position was measured as an index in the present study. This individual socio-economic position index was a combination of different socio-economic measures that assess different dimensions of the socio-economic position construct.

This index was determined following a principal component analysis (varimax rotation) on a set of selected individual socio-economic position measures. Since the variances within each measure were different, each measure was weighted

using the z-score to give equal weights first, before the principal component analysis was carried out. A factor loading cut-off of 0.4 was used. The employment status loaded  $< 0.4$  and was thus removed.

The measures finally retained were

- educational attainment;
- subjective socio-economic position; and
- the asset index

The results obtained from the principal component analysis were used as a measure of the individual-level socio-economic position index.

#### 4.3.3.2 *Area-level socio-economic position*

Suggestions have been made that area-level socio-economic position may reflect lifetime social circumstances and that lifetime circumstances are more strongly related to health than current circumstances (Pickett and Pearl, 2001).

The area-level socio-economic position information was combined so as to obtain an index to measure the area-level socio-economic position. This index was determined following a principal component analysis (varimax rotation) of a set of selected measures obtained from the secondary datasets as recommended by Vyas and Kumaranayake, (2006). The variances within each single measure were different, due to differences in prevalence, so each measure was weighted using the z-score to give standardised weights before factor analysis was carried out.

The measures included in the index are the following:

- *Educational attainment:*

The educational attainment in the area was measured as the percentage of people with a formal education of 12 years or more (“high school”/matriculation) in the area.

- *Economic activity:*

The economic activity in the area was measured as the percentage of people eligible for employment and who are employed; and the percentage of people who are employed in the formal sector in the area.

- *Infrastructure:*

The physical infrastructure in the area was measured by the percentage of homes in the area with flushing toilets and with piped water, and the percentage of people in the area reporting access to electricity for lighting.

- *Access to private health facilities:*

The access to private health facilities in the area was measured by the percentage of people in the area who use private facilities when they are ill.

This information was obtained from the secondary dataset base on the local municipality (an aggregation of EAs), which was the basis for matching this information, with that of the primary dataset. The variables used for the area-level socio-economic position were obtained from the different datasets as indicated below.

- *From the General Household Survey (GHS) 2010*

- the percentage of people with highest educational attainment greater than a matriculation certificate in the area;

- the percentage of people with piped water in the area;
  - the percentage homes with a flushing toilet in the area;
  - the percentage of people who use private health facilities when ill; and
  - the percentage of people in the area reporting access to electricity for lighting.
- *From the Quarterly Labour Force Survey (QLFS)*
    - the percentage of people of employment age who are unemployed in the area; and
    - the percentage of people employed in the formal sector in the area.

The internal consistency and reliability of the socio-economic position indexes were assessed using the Cronbach's alpha.

Both individual-level and area-level socio-economic position index scores were auto-ranked, and the total study population was divided into tertiles, namely the lowest-third, middle-third and highest-third socio-economic position.

#### **4.3.4. Oral health and general health status**

##### *4.3.4.1 Self-rated oral health*

This was a single item Likert-type scale. The participants were asked to rate the response to the question “how would you rate your oral health?” on a scale of 1 to 5, with 1 as very good, 2 as good, 3 as neither good nor poor, 4 as poor, and 5 as very poor, as suggested by Locker, Clarke and Payne (2000). The options were

later recoded such that those who indicated “very good” or “good” were categorised as “good” and others as “poor”. This measure was coded as

0 – Good oral health (Codes 1-2)

1 – Poor oral health (Codes 3-5)

#### *4.3.4.2 Self-rated general health*

This was a single item Likert-type scale. The participants were asked to rate the response to the question “How would you rate your general health?” on a scale of 1 to 5, with 1 as “very good”, 2 as “good”, 3 as “neither good nor poor”, 4 as “poor”, and 5 as “very poor”. Similar to the self-rated oral health, those who indicated “very good” or “good” were categorised as “good” and others as “poor”.

0 – Good general health (Codes 1-2)

1 – Poor general health (Codes 3-5)

#### *4.3.4.3 Past dental visit pattern*

The participants were asked “How often do you visit the dentist or dental clinic?”. The options given were “Only when in pain”, “At least every 6 months”, “At least once a year”, “At least every 2 years”, “Whenever needed”, “Never visited a dentist or dental clinic” and “Don’t know”. The past dental visit pattern categorized and coded as

0 – Never visited a dental clinic

1 – Symptomatic attendees. This category included participants who visited the dental clinic only “when in pain” or “when needed”

2 – Regular/routine attendees. This category included only participants who visited the dental clinic at least once every six months, every year, or every two years.

#### *4.3.4.4 Self-reported number of natural teeth present in the mouth*

The self-reported number of teeth present in the mouth a subjective self-report method that has been utilised in the literature (Sander and Spencer, 2005) was used. This was obtained from the response to the question “How many of your natural teeth do you have in your mouth?” the options available were “All my teeth”, “Most of my teeth (more than half)”, “About half of my teeth”, “Few teeth (less than half)” and “None of my teeth”. The participants were then categorized as “None”, “Some” and “All”. The categories were coded as follows:

0 – None. This represents the option “None of my teeth”.

1 - Half / less. This represents the options “About half of my teeth” and “Few teeth (less than half)”.

2 - Most / all. This represents the options “All my teeth” and “Most of my teeth (more than half)”.

#### *4.3.5 Oral health-related quality of life*

The oral health-related quality of life was measured using the OHIP-14.

#### 4.3.5.1 Oral health impact profile – short version (OHIP-14)

The OHIP-14 has been found to be suitable for questionnaire-based research, and more specifically for research related to the presence of a dental problem, pain and self-reported oral health status, and a global oral health rating, than other measures for oral health-related quality (Robinson et al., 2003).

The OHIP-14 is made up of 14 questions with two questions on each of the seven dimensions of oral health-related quality of life measures. The response to each question was scored as

0 – Never

1 – Occasional

2 – Hardly ever

3 – Fairly often

4 – Very often



The OHIP-short version was used as a discriminant measure.

#### 4.3.5.2 Internal consistency

The internal consistency and reliability was measured by Cronbach's alpha (Kirshner and Guyatt, 1985; Papagiannopoulou et al., 2012; Ravaghi et al., 2010; Saub, Locker and Allison, 2005; Wong, Lo and McMillan, 2002). A score of 0.70 or more was considered desirable to validate the OHIP-14 for this sample (Guyatt, Kirshner and Jaeschke, 1992; Kirshner and Guyatt, 1985).



#### 4.3.5.3 Validity

The structure of OHIP was validated using the structural equation model.

Criterion validity for OHIP was measured against self-rated oral health, a “gold standard” (Ebrahim, 1995).

Convergent validity for OHIP was measured against the self-rated oral health reported (Ravaghi et al., 2010; Saub et al., 2005).

Discriminant validity was measured by comparing the OHIP scores of the participants who experienced pain and those who did not experience oral pain (Ravaghi et al., 2010).

#### 4.3.5.4 Prevalence of OHIP

The prevalence for the total population, areas of high and low socio-economic position were calculated as the proportion of participants who experienced one or more items “fairly often” or “very often” to the total participants of the study population (Sanders et al., 2009) and the different areas respectively.

#### 4.3.5.5 Severity of OHIP

The severity of oral impacts was measured with the additive method (OHIP-ADD). The score for each individual question was added to give the OHIP-ADD score, which gives a maximum of 56 (14x4) (Locker and Quiñonez, 2011; Tsakos et al., 2012). Therefore, higher scores for OHIP-ADD imply greater impacts on oral health. This method has been found in a previous study to be simple to use and did not compromise the validity (Robinson et al., 2003).

#### *4.3.5.6 Extent of OHIP*

The extent of OHIP was measured as the number of items experienced “fairly often” or “very often”.

#### *4.3.6 Oral pain*

The past six months experience of oral pain for the participants was collected. Also collected was the intensity of the pain, location of the pain and duration of the pain, as well as the response to oral pain by the participants who experienced pain in the past six months.

- *Past six months experience of oral pain*

The past six months experience of oral pain was obtained by asking the question “In the past 6 months have you had any pain from the following in your mouth/jaw – teeth, gums, denture, sores around the mouth, jaw joint?”

The response options were “No” or “Yes” and were coded as follows:

0 – No

1 – Yes

- *Location of pain*

The participants were asked “In the past 6 months have you had any pain from the following in your mouth/jaw?” Options included “teeth”, “gums”, “dentures”, “sores around the mouth” and “jaw joint (in front of the ears)”.

The participants were allowed multiple responses, in other words, to indicate all that applied in the past six months prior to the date of the interview.

Participants were also asked to indicate the number of episodes within the six-month period.

- *Intensity of oral pain*

Participants were asked to rate the intensity of their last episode of oral pain on a Likert-type scale scored from 1 to 5, with 1 being “very mild” and 5 “very intense”.

- *Duration of oral pain*

Participants were asked to indicate the duration of their last pain episode in days and weeks.

- *Cost*

The direct financial cost and the indirect cost in terms of the number of days lost from work or school were obtained for the last dental visit. The participants were asked to indicate the financial cost to them for the last pain episode in Rands (R). For the indirect cost, the participants were asked the open-ended question “How many days in total did you miss from work, college or school in the past six months due to oral pain and / or a visit to the dental clinic?”

- *Treatment seeking pattern in response to oral pain*

The participants were asked the question “What did you do/where did you go for your last pain episode with your teeth, dentures or mouth?” Participants

were allowed multiple responses. The response options to this question included “Never had a painful dental episode before”, “Visited a private dental clinic”, “Visited a government dental clinic”, “Visited a nurse/GP/Hospital”, “Used self-medication/Pharmacist”, “Used home remedies”, and “Did nothing”.

#### **4.4 Outcome variables**

The main outcomes or dependent measure(s) were

- experience of oral pain in past six months; and
- OHIP-short version.



The main explanatory/independent measure(s) were

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- the participants’ socio-demographic characteristics (sex, age, race/ethnicity, residential location (with the EAs), highest educational attainment, current employment status, subjective socio-economic position, payment method for the last dental care received); and
- experience related to oral pain in the past six months – duration, intensity and severity of oral pain, measures taken regarding relief of oral pain, any lost work/school days, and cost of treatment.

#### 4.5 Data analysis

All data analyses were conducted in SPSS version 21 and STATA version 12 (STATA Corp., College Station, TX). Multi-level analyses used STATA's "survey design" features to account for the cluster-sampling design and to incorporate the SASAS sampling weights, which account for population oversampling and non-response patterns in the data set.

Bivariate data analysis included cross tabulations, followed by the use of Rao Scott test an adjusted chi-square statistics for complex samples, the t-test for unequal variances an equivalent for non-parametric test for independent samples and analysis of variance (ANOVA) to compare group differences among categorical measures, continuous measures with two comparison groups and continuous measures with more than two comparison groups respectively. All statistical analyses were two-tailed and the threshold for statistical significance was set at  $p < 0.05$ .

Moreover, all measures significantly associated with various outcome measures at the 20% significance level in the bivariate analysis were entered into a multi-variable adjusted regression model to assess their independent association with the outcome variables that is, after controlling for potential confounders. Regression models were built starting with the full model, followed by the backward deletion method. The criterion for retention in the final model was set at  $p < 0.10$ .

Multi-level Poisson regression was carried out for binary outcome (pain), while multi-level linear regression was carried out for the continuous outcomes of OHIP

following transformation of the skewed OHIP score distribution to approach normal distribution of the OHIP scores. Specifically, because several participants scored zero on the OHIP scale, the data were highly skewed.

This was normalised by using the square root of OHIP and adding 2 ( $\sqrt{\text{OHIP} + 2}$ ), as recommended by Baker, Gibson and Locker (2008). The slope of the inequality index (SII) was also explored in line with the WHO's suggested complex measures of absolute inequality. The SII is the difference in the regression predicted parameter estimates between the most socio-economic advantaged (ranked 1) and the most disadvantaged (ranked 0) at the individual level; a negative value indicates greater inequity, to the disadvantage of those in the lowest socio-economic position (WHO, 2013). The SII among those living in the lowest area socio-economic position were compared to that among those in the highest area socio-economic position to explore the role of area socio-economic position as a moderator of inequality. Furthermore, the relative concentration index of inequality was also determined which measures the relative inequality among groups. The concentration index was measured by the same predicted values used for the SII except that the values are divided instead of subtracted (WHO, 2013).

The analysis on the cost of oral pain was restricted only to those who indicated that they are in employment or schooling.

#### *4.5.1 Confirmatory factor analysis and structural equation modelling*

The structural equation model (SEM) is a statistical technique that is mainly cross-sectional for testing and estimating causal relationships. Confirmatory modelling enables the testing of a theory by a priori specifying a hypothesis to represent the causal model and then testing the relationships between the concepts used in the model.

Confirmatory factor analysis (CFA) is a special type of SEM. CFA is a confirmatory technique that is theory driven (Schreiber et al., 2006). It tests the specific hypothetical structure of a model and is used when a number of underlying factors are hypothesized a priori. The CFA gives information on how scale items measure the underlying (latent) construct. This is necessary because these latent constructs are not directly measurable, since they cannot be observed directly, but are inferred from responses to the observable and measurable items which are used to represent the constructs. CFA can provide a test of validity of the selected items.

The theoretical framework for the structure model of OHIP is based on Locker's model. The CFA was carried out for the OHIP-14 in this South African adult population in order to validate OHIP in this population. Other validation tests were carried out prior to this, which include the convergent and discriminant validity tests.

Following the confirmatory validation of OHIP in South African adults, the structural validity of OHIP (Baker et al., 2008) in the different socio-economic

groups was investigated to assess the structural relationships between the domains in the OHIP model. Multi-group structural equation modelling (MSEM) was used to compare the different socio-economic groups using the same theoretical model. This was done to determine whether there is any group that moderates the relations specified. The CFA and MSEM were carried out using AMOS version 21.0 with maximum likelihood estimation and bootstrapping in order to account for the fact that OHIP may not be normally distributed, after OHIP was normalised by using the square root of OHIP and adding 2 ( $\sqrt{\text{OHIP}} + 2$ ) (Baker et al., 2008). The adequacy of model fit was assessed by the chi-square test statistics, the Goodness of fit index (GFI), the Normed Fit Index (NFI), the Non-Normed Fit Index (TLI), the Comparative Fit Index (CFI), and the root mean square error of approximation (RMSEA) with a 90% confidence Interval (90% CI). Acceptable results with a significant fit for continuous data are the following values –  $P_{\text{close}} > 0.05$ ;  $\text{RMSEA} < 0.06$ ;  $\text{TLI} > 0.95$ ;  $\text{CFI} > 0.95$ ;  $\text{GFI} > 0.95$  (Hu and Bentler, 1999).

#### **4.6 Ethical considerations**

Participation in this study was voluntary. Study participants were only included in the study after informed consent was obtained. The study protocol was subject to ethical review and approval by the Senate Research Ethics Committee at the University of the Western Cape (Ref No.11/1/48) and the Human Sciences Research Council.



## 4.7 Summary

In this chapter, the study design and study population was discussed. The measure variables and the outcome variables to be used in this study were outlined. This chapter also explained the analytical methods to be used and noted the ethical considerations that were observed.



## CHAPTER 5

### RESULTS

#### 5.1 Introduction

This chapter is divided into three main parts.

The first part deals with the response rate (Section 5.2), the exclusion of criteria due to missing data and the analysis of the excluded data due to missing data on main measures. The socio-demographics (Section 5.3) are presented. The reliability of the asset index and socio-economic position indices used in this study are also discussed in this part (Section 5.4). The validation of the OHIP is examined in Section 5.5.

The second part of the chapter (Sections 5.6) reports of the results of the analysis carried out on oral pain which includes the prevalence, the bivariate analysis on the factors associated with oral pain followed by a multi-level analysis. This part also deals with the economic impact of oral pain and the type of services sought in response to oral pain.

The third part of the chapter looks at the reliability and validity including CFA carried out on the OHIP-short version, for the South African adult population, followed by the bivariate and multi-level analysis on OHIP. Finally, it explores the structure of OHIP in the South African adult population and the different subpopulations based on individual-level and area-level socio-economic position. A summary of the main findings is presented at the end of the chapter.

## 5.2 Response rate

The response rate for the primary dataset was 85.8% (3 003 of the targeted 3 500 participants identified for the survey). However, there was some missing data for the main dependent measure (pain; n=2 878 and OHIP-14; n=2 902) and the independent measure (individual-level socio-economic position; n=2 845 and area-level socio-economic position; n=2 971).

**Table 2: Socio-demographic measures of missing data excluded from final dataset used for analysis**

Measure		Missing data % (SE)	95% Confidence Interval	p- value
Race n= 3 002	Black African	11.3 (SE 1.2)	9.2 – 13.8	0.101
	Coloured	17.0 (SE 3.7)	10.9 – 25.5	
	Indian/ Asian	11.3 (SE 2.0)	7.9 – 15.7	
	White	8.8 (SE 1.9)	5.6 – 13.4	
Sex n=3 003	Male	10.9 (SE1.3)	8.5 – 13.7	0.386
	Female	12.2 (SE 1.2)	10.0 – 14.7	
Self-rated oral health n=2 962	Poor	11.8 (SE 1.9)	8.6 – 16.0	0.544
	Good	10.6 (SE 1.0)	8.8 – 12.8	
Age n=3 000	16 -25 years	10.7 (SE 1.9)	7.6 – 15.0	0.449
	26 – 35 years	10.0 (SE 1.4)	7.6 – 13.2	
	36 -45 years	13.6 (SE 2.2)	9.8 – 18.5	
	46 – 55 years	11.6 (SE 1.9)	8.4 – 15.8	
	56 -65 years	15.0 (SE 2.9)	10.1 – 21.7	
	>65 years	10.1 (SE 2.5)	6.1 – 16.3	
Education n=2 972	< 12 years	12.3 (SE 1.4)	9.8 – 15.2	0.075
	12 years	9.1 (SE 1.2)	7.0 – 11.7	
	> 12 years	8.2 (SE 2.2)	4.8 – 13.7	
Employment status n=2 943	Employed	10.6 (SE 1.6)	7.9 – 14.2	0.971
	Unemployed	10.9 (SE1.3)	8.7 – 13.7	
	Others	11.1 (SE 1.6)	8.3 – 14.7	

Because there were no significant socio-demographic differences between those with complete data on all main dependent and independent measures (Table 2), the final analytical sample was restricted to those with complete data on all four main dependent and independent measures (n=2 651).

### **5.3 Socio-demographic characteristics of the study population**

The age of the study population ranged from 16 years to 95 years, with a mean age of 36.8 years (95% CI: 36.0 – 37.7; n=2 651).

There were slightly more females (52.2%; n=1 548) than males (47.8%; n=1 103).

The race distribution was similar to that of the country (South Africa), with “Black African” being the majority at 76.9%, followed by the “Whites” at 11.3%, then the “Coloured” people at 8.9%, and the “Indian/Asian” people at 2.9%.

Most of the participants had an educational level lower than Grade 12 (55%; n=1 500), with only a much smaller number who attained more than Grade 12 (10.2%; n=303).

Only 22.7% (n=697) of the study participants were in possession of a medical aid.

About a third of the study population were employed (33.4%; n=966), while 38.9% (n=866) were unemployed.

More than half of the participants had never been to a dentist (58.8%; n=1 488), and only 13.2% (n=357) visit a dentist regularly, between every six months to every two years. Of the study population 5.4% (95% CI: 4.3 – 6.8; n=191) were edentulous.

## 5.4 Reliability of indices

### 5.4.1 Asset index

The variables were factor analysed using an eigenvalue cut-off of 1, with varimax rotation. An extraction factor loading of 0.40 was the cut-off for inclusion in the final construct, as recommended by Costello and Osborne (2005). Of the mentioned assets 14 were eventually used. The asset items loaded as two components, suggesting that the different components measure different constructs (Table 3, overleaf). The internal consistency of the asset index was measured, which gave an excellent result of 0.91 (Table 4, overleaf below).

**Table 3: Factor analysis for asset index measure**

Asset Variables	Component 1 Factor loading	Component 2 Factor loading	Total
Fridge		0.803	
Microwave		0.587	
DVD player		0.675	
Electric stove		0.783	
TV set		0.812	
Hot water	0.743		
Vacuum cleaner	0.756		
Washing machine	0.707		
Computer	0.754		
Telkom (telephone land line)	0.676		
Freezer	0.686		
DSTV	0.710		
Car	0.780		
Home theatre system	0.520		
<b>Variance (%)</b>	<b>35.21</b>	<b>22.73</b>	<b>57.94</b>

**Table 4: Reliability test for asset index measure**

Asset Variables	Corrected item- Total correlation	Cronbach's alpha if item is deleted	Cronbach's alpha
Fridge	0.559	0.905	
Microwave	0.690	0.900	
DVD player	0.561	0.905	
Electric stove	0.522	0.906	
TV set	0.491	0.907	
Hot water	0.713	0.899	
Vacuum cleaner	0.622	0.903	
Washing machine	0.713	0.899	
Computer	0.665	0.901	
Telkom (telephone land line)	0.538	0.906	
Freezer	0.627	0.903	
DSTV	0.660	0.901	
Car	0.717	0.899	
Home theatre system	0.496	0.907	
Total			0.909

#### 5.4.2 Individual-level socio-economic position index

The individual-level socio-economic position index was determined following principal component analysis (varimax rotation) of a set of socio-economic measures that have been theoretically and/or empirically associated with level of health and were obtainable from the primary dataset. However, considering that the variances for the different measure items were very different, each item had to be weighted equally by obtaining a Z-score before factor analysis could be conducted. Three items extracted as one component, explaining 65.6% of the total variance in the sampled population (Table 5). The employment status measure had a low factor loading, so it was not included the index. A final individual socio-economic position index score was computed with three factors, namely

education, the asset index and subjective socio-economic position. This individual socio-economic position index produced excellent internal consistency or reliability as determined by a Cronbach’s alpha of 0.74 (Table 5).

**Table 5: Factor analysis and reliability for individual-level socio-economic position index measure**

Measure	Factor loading (varimax rotation)	% variance explained	Cronbach’s alpha if item is deleted	Cronbach’s alpha
Education	0.730		0.758	
Asset index	0.877		0.516	
Subjective-SEP	0.816		0.651	
Total		65.61%		0.735

SEP – Socio-Economic Position

The individual-level socio-economic position index was ranked into three (tertiles) to represent those in the lowest third individual socio-economic position (coded as 1), the middle third individual socio-economic position (coded as 2) and the highest third individual socio-economic position (coded as 3).

#### 5.4.3 Area-level socio-economic position index

Area-level socio-economic position was determined following principal component analysis (varimax rotation) of a set of variables that has been theoretically and/or empirically associated with level of health, economic and physical infrastructure and were obtainable from publicly available very large

scale annual surveys in South Africa; specifically, the various area-level measure items were obtained from two sources, namely the 2010 General Household Survey (GHS) and the quarterly labour force survey for the second to the fourth quarters of 2010 and the first quarter of 2011. However, considering that the variances for the different items were very different, each factor had to be weighted equally by obtaining a Z-score before factor analysis could be conducted.

The seven items originally included for data reduction extracted as one component, which explained 57.4% of total variance in the sampled population. The percentage of people in an area who reported having access to electricity for lighting was removed, as it produced an initial extraction loading of 0.24, which was considered below the acceptable benchmark of 0.40, in line with Costello and Osborne (2005) and Gorsuch (1997). The remaining six factors listed in Table 6 extracted as one component, but now explained a total of 63.8% of the variance observed in the study population. A final area-level socio-economic position index score was computed with the six factors and produced excellent internal consistency or reliability as determined by a Cronbach's alpha of 0.88.



**Table 6: Factor analysis and reliability for the area-level socio-economic position index measure**

Data source	Measure	Factor loading (varimax rotation)	% variance explained	Cronbach's alpha if item is deleted	Cronbach's alpha
GHS 2010	% in an area with $\geq$ 12 years of schooling	0.63		0.888	
	% in an area with piped water	0.92		0.832	
	% with flush toilets	0.89		0.840	
	% using private facility when ill	0.87		0.843	
QLFS 2010/2011	% in an area employed	0.69		0.880	
	% in an area in formal sector	0.74		0.872	
Total			63.8%		0.88

The area-level socio-economic position index scale was then divided into three levels (tertiles) to represent the lowest third area (coded as 1), the middle third area (coded as 2) and the highest third area (coded as 3).

## 5.5 Validation of Oral health impact profile – short version

### 5.5.1 Confirmatory factor analysis

The confirmatory factor analysis (CFA) showed that two of the fourteen items of OHIP-14 were not a good fit for the model. These were the questions “Have you had to interrupt meals because of a problem with your teeth, mouth or dentures?” and “Have you had difficulty doing your usual job because of problems with your teeth, mouth or dentures?” This resulted in a 12-item OHIP (OHIP-12) which then was used for the rest of the analysis, as only twelve of the items were validated for the South African adult population (Table 7).

**Table 7: The fit of the model of OHIP for the original and the modified CFA of Figure 3**

Model	GFI	CFI	TLI	RMSEA (95% CI)	PCLOSE	CMIN/DF	p-value
1	0.962	0.974	0.963	0.064 (0.060– 0.068)	0.000	12.281	<0.001
2	0.983	0.989	0.983	0.045 (0.040– 0.050)	0.942	6.585	<0.001

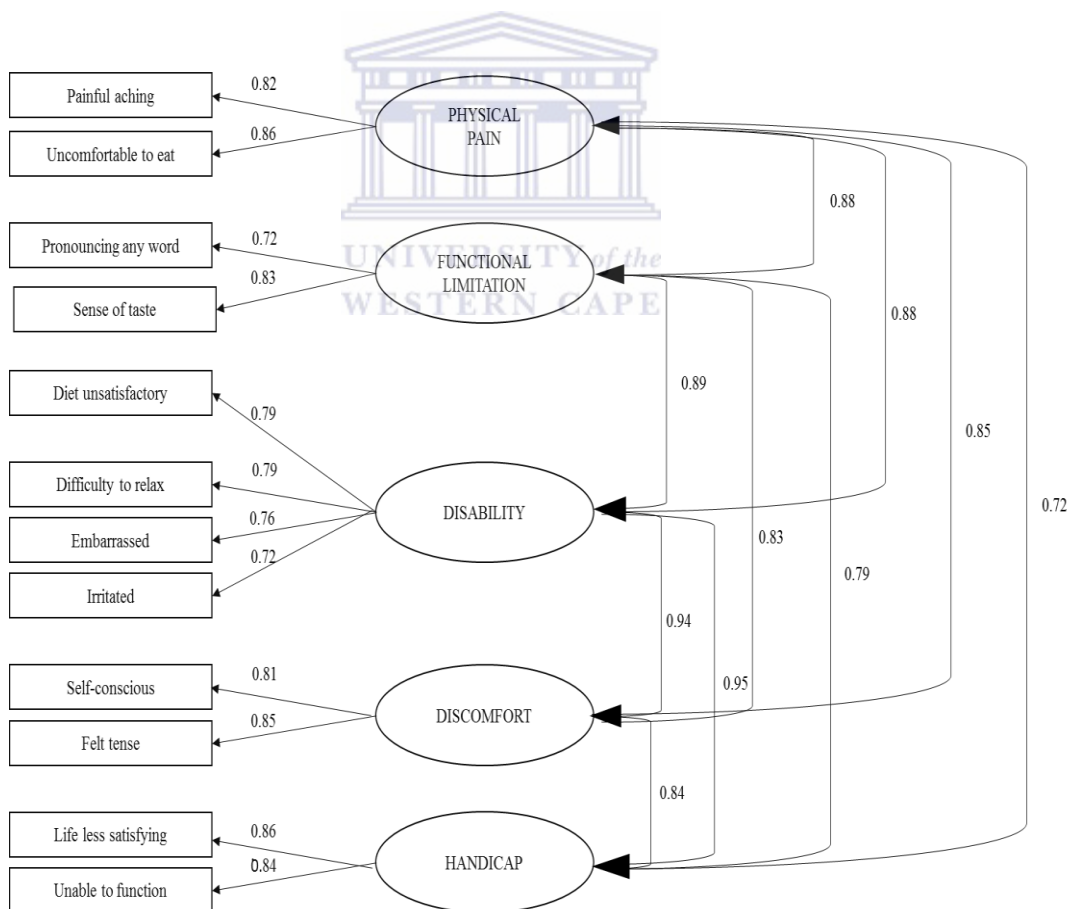
Model 1: The original model the OHIP-14 item.

Model 2: The final modified model (best fit for the data) OHIP 12 item (see Figure 3).

The original model with all 14 items showed a fair fit with Goodness-of-fit (GFI), comparative fit index (CFI) and the non-normed fit index (TLI) all higher than 0.95, except for the root mean square error of approximation (RMSEA) which was higher than the 0.06 cut-off recommended by Hu and Bentler (1999). Two items had large residual co-variances (> 2.00). The two items belonging to the disability domain were “Have you had to interrupt meals because of a problem with your teeth, mouth or dentures?” and “Have you had difficulty doing your

usual job because of problems with teeth, mouth or denture?” which were removed from the OHIP-14 to modify the model resulting in a 12-item OHIP scale which had a better fit (Table 7), as the RMSEA reduced to acceptable levels of 0.045 (95% CI: 0.040 – 0.050). The GFI, TLI and CFI were all over 0.95 and acceptable residual covariance was lower than 1.0, therefore Model 2 was considered a good fit, and was thus validated for this study population by the CFA (Figure 3).

**Figure 3: Confirmatory Factor Analysis of OHIP-12**



### 5.5.2 Reliability of OHIP-12

The reliability of the OHIP-12 scale is excellent, as indicated in Table 8 (overleaf), with a good Cronbach's alpha score. Interclass correlation for OHIP-12 was 0.94 (95% CI: 0.937 – 0.944) with a variance of 63.69 (Standard Deviation 7.98).

**Table 8: Reliability test for OHIP-12**

Items	Corrected item- Total correlation	Cronbach's alpha if item is deleted	Cronbach's alpha
Pronouncing any word	0.640	0.938	
Sense of taste	0.743	0.935	
Painful aching	0.717	0.936	
Uncomfortable to eat	0.754	0.935	
Self-conscious	0.744	0.935	
Felt tense	0.774	0.934	
Diet unsatisfactory	0.754	0.935	
Difficult to relax	0.764	0.934	
A bit embarrassed	0.743	0.935	
A bit irritated	0.699	0.936	
Life in general was less satisfying	0.753	0.935	
Totally unable to function	0.732	0.936	
Total			0.94

### 5.6 Oral pain

The prevalence of oral pain in the past six months for the present study population was 19.4% (95% CI= 17.2 – 21.9). This translates to a weighted count of 5 796 012 people (95% CI= 5 025 065 – 6 566 959). Since for the purpose of this study oral pain included self-reported pain from the teeth, gums, dentures, sores around the mouth and pain from the jaw joint, both dentate and edentulous participants

were included. The edentulous participants made up 5.4% (n=191) of the study population.

### ***5.6.1 Factors associated with oral pain***

The age of the person was the most significant demographic factor associated with experience of oral pain in the past six months. The area-level socio-economic position, employment status, receiving a government grant in the household and having had to forego basic needs to pay for a dental visit were the socio-economic factors associated with experience of oral pain in the past six months (Table 9).



**Table 9: Demographic and socio-economic characteristics of the respondents who experienced oral pain in the past six months**

Characteristics		Oral pain % (95% CI)	n =
Age	16 - 25 years	15.6 (12.0 – 19.9) <sup>a</sup>	77
	26 - 35 years	18.2 (14.4 – 22.7) <sup>a</sup>	114
	36 - 45 years	19.0 (15.0 – 23.7) <sup>a</sup>	97
	46 - 55 years	18.2 (14.0 – 23.3) <sup>a</sup>	83
	56 – 65 years	33.4 (26.5 – 41.1) <sup>b</sup>	86
	> 65 years	25.2 (18.3 – 33.5) <sup>b</sup>	59
Sex	Male	17.6 (14.7 – 20.8)	190
	Female	21.1 (18.2 - 24.4)	326
Race	Black	19.7 (17.0 – 22.6)	329
	Coloured	14.4 (10.2 – 19.9)	62
	Indian	20.7 (14.9 – 28.0)	49
	White	21.5 (15.9 – 28.4)	76
Medical aid	Yes	18.0 (14.3 – 22.3)	122
	No	19.7 (17.2 – 22.6)	391
Receiving a grant in the household	Yes	22.1 (18.9 – 25.8) <sup>a</sup>	290
	No	16.2 (13.6 – 19.2) <sup>b</sup>	226
Having to forego basic needs to pay for dental visit	Yes	56.5 (41.9 – 70.0) <sup>a</sup>	49
	No	35.4 (30.9 – 40.1) <sup>b</sup>	367
Employment status	Employed	22.2 (18.7 – 26.0) <sup>a</sup>	203
	Unemployed	15.9 (12.7 – 19.7) <sup>b</sup>	140
	Other	20.3 (16.8 – 24.3) <sup>a</sup>	163
Individual socio-economic position index	Low	21.7 (18.0 – 25.9)	191
	Middle	19.1 (15.7 – 23.2)	167
	High	16.9 (13.7 – 20.7)	158
Area socio-economic position index	Low	20.2 (16.5 – 24.3) <sup>a</sup>	185
	Middle	23.9 (19.6 – 28.9) <sup>a</sup>	209
	High	14.4 (11.3 – 18.0) <sup>b</sup>	122

<sup>a,b</sup> significantly different from each other

<sup>†</sup>Relative Standard Error >30%, thus estimate here may be unreliable

There was a significant difference between the mean scores of the subjective socio-economic position of those who experienced oral pain in the past and those who did not, with scores of 4.33 (95% CI: 4.07 – 4.59) and 4.77 (95% CI: 4.62 – 4.91) respectively (p=0.002).

**Table 10: Health and oral health characteristics of the respondents who experienced oral pain in the past six months**

Characteristics		Oral pain % (95% CI)	n=
Satisfied with life	Very dissatisfied	18.5 (11.4 – 28.6)	28
	Dissatisfied	24.5 (19.4 – 30.4)	120
	Neither	20.2 (15.8 – 25.5)	94
	Satisfied	17.7 (14.8 – 21.0)	219
	Very satisfied	15.3 (10.2 – 22.3)	51
Self-reported general health*	Good	17.6 (15.3 – 20.2)	376
	Poor	26.9 (21.9 – 32.6)	138
Self-rated oral health*	Good	14.7 (12.5 – 17.1)	318
	Poor	41.6 (35.3 – 48.2)	198
Dental status (Self-reported number of teeth present)*	Most / all	17.4 (15.1 – 19.9)	376
	Half / less	46.3 (38.3 – 54.5)	122
	None	8.7 (3.9 – 18.2) <sup>†</sup>	16
Past dental visit*	Never	6.9 (5.4 – 8.9) <sup>a</sup>	97
	Symptomatic	39.7 (34.7 – 45.1) <sup>b</sup>	289
	At least every 6 months – 2 years	32.2 (25.5 – 39.8) <sup>b</sup>	129
Method of payment for last dental visit*	Free	46.1 (38.3 – 54.1) <sup>a</sup>	139
	Medical aid	28.9 (23.0 – 35.6) <sup>b</sup>	110
	Cash	39.5 (32.2 – 47.3) <sup>a</sup>	160
Medical aid	Yes	18.0 (14.3 – 22.3)	122
	No	19.7 (17.2 – 22.6)	391

<sup>a,b</sup>, significantly different from each other

<sup>†</sup>Relative Standard Error >30%, thus estimate here may be unreliable

\*p-value <0.005

But there was no significant difference between the mean asset index score of the participants who experienced oral pain (mean index = 6.10; 95% CI: 5.57 - 6.64) and those who did not (mean index = 6.18; 95% CI: 5.86 – 6.49) (p=0.799). The past dental visit pattern, dental status, self-rated oral health and general health were associated with experiencing oral pain in the past six months (Table 10).

### 5.6.2 Prevalence and intensity of oral pain by socio-economic position

Prevalence of oral pain in the past six months for this study population was 19.4%. The prevalence of oral pain varied significantly across the different area-level socio-economic position (Table 11).

**Table 11: The prevalence of oral pain location and severity by area-level socio-economic position**

Variable	Low area-SEP % (95%CI) (n)	Middle area-SEP % (95%CI) (n)	High area-SEP % (95%CI) (n)	Total % (95%CI) (n)
Pain (Total)*	20.2 (16.5 – 24.3) 185	23.9 (19.6 – 28.9) 209	14.4 (11.3 – 18.0) 122	19.4 (17.2 – 21.9) 516
Teeth*	15.8 (12.7 – 19.6) 148	18.5 (14.9 – 22.9) 156	11.8 (9.1 – 15.1) 97	15.3 (13.4 – 17.5) 401
Gum*	9.8 (7.1 – 13.4) 87	9.1 (6.6 – 12.3) 73	4.3 (2.7 – 6.7) 39	7.8 (6.4 – 9.6) 199
Others*	5.2 (3.6 – 7.4) 49	7.1 (5.2 – 9.6) 65	3.5 (2.1 – 5.7) 29	5.2 (4.2 – 6.5) 143
Severity / Intensity of pain	3.23 (2.99 – 3.47) 183	2.82 (2.63 – 3.02) 206	3.17 (2.93 – 3.41) 122	3.16 (2.92 – 3.16) 508

\*p-value <0.05; SEP – socio-economic position



The teeth were the most commonly reported location for oral pain in the participants. In view of the possibility that the participants could have had more than one episode of pain in the past six months, the respondents were allowed to select more than one location of oral pain during the period. Hence, the sum of the prevalence of the different locations of oral pain is different from that of the total pain experienced (Table 11 and 12). The numbers of positive responses from the pain location of dentures, sores in and around the mouth and jaw joint were very small; therefore, the three were combined into one variable labelled “other” (Table 11 and 12).

**Table 12: The prevalence of oral pain location and severity by individual-level socio-economic position**

Variable	Low individual-SEP % (95%CI) (n)	Middle individual-SEP % (95%CI) (n)	High individual-SEP % (95%CI) (n)	Total % (95%CI) (n)
Pain (Total)	21.7 (18.0 – 25.9) 191	19.1 (15.7 – 23.2) 167	16.9 (13.7 – 20.7) 158	19.4 (17.2–21.9) 516
Teeth	17.0 (13.7 – 20.8) 153	14.7 (11.9 – 18.1) 127	14.0 (11.1 – 17.6) 121	15.3 (13.4–17.5) 401
Gum	10.1 (7.3 – 13.8) 82	6.6 (4.7 – 9.2) 61	6.4 (4.5 – 8.9) 56	7.8 (6.4 – 9.6) 199
Other	5.4 (3.7 – 7.6) 47	6.6 (4.6 – 9.2) 58	3.5 (2.3 – 5.3) 38	5.2 (4.2 – 6.5) 143
Severity / Intensity of pain	3.14 (2.87 – 3.38) 190	3.13 (2.95 – 3.31) 165	2.87 (2.67 – 3.07) 156	3.05 (2.92–3.17) 511

SEP – socio-economic position

On an individual level, there was no significant difference in the prevalence of oral pain across the different socio-economic groups (Table 12).

**Figure 4: Pain prevalence by individual-level socio-economic position**

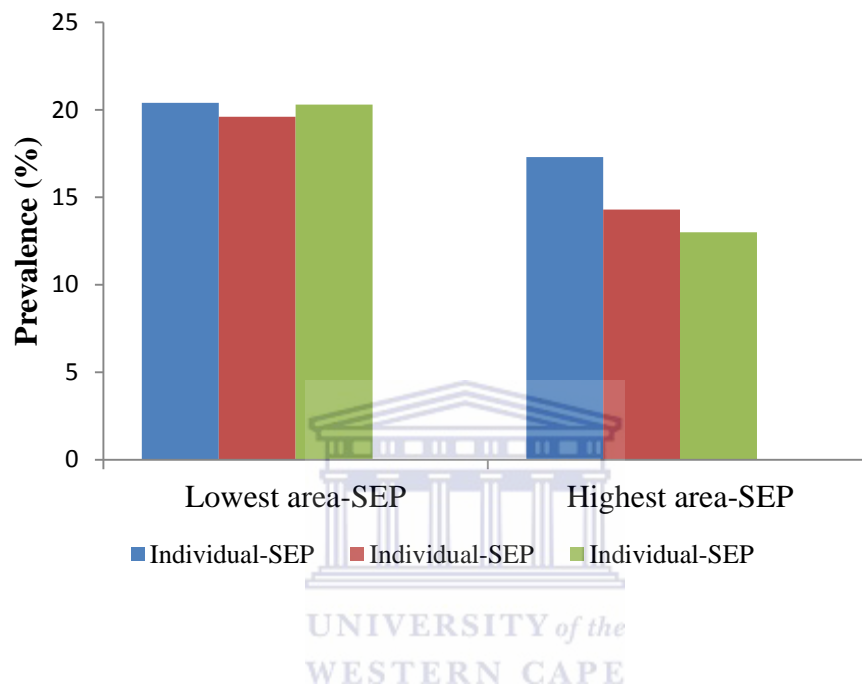


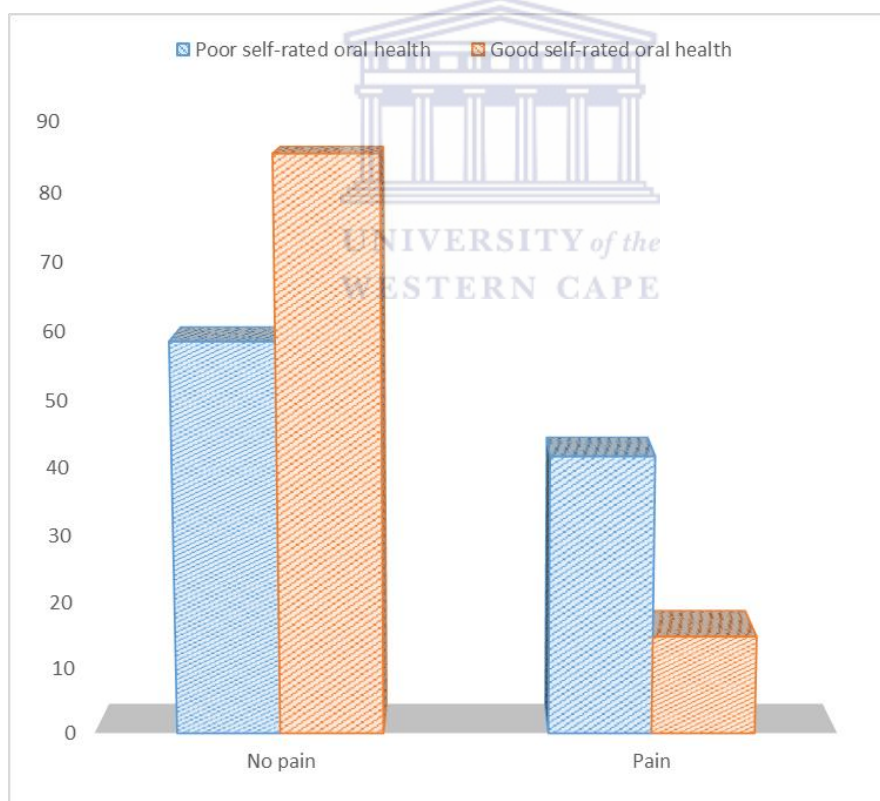
Figure 4 shows the individual-level socio-economic position gradient in the experience of oral pain in the past six months, which highlights a steep gradient in the areas of highest socio-economic position, compared to the gradient in the areas of lowest socio-economic position.

The mean intensity of oral pain was 3.04, of which 26.3% and 9.6% were intense and very intense respectively. However, the mean intensity of oral pain did not significantly differ across socio-economic groups (Table 11 and 12).

### 5.6.3 Self-rated oral health and oral pain

Figure 5 demonstrates that a significant amount of those who rated their oral health as “good” did not experience oral pain in the past six months (about 85%). Just over 40% of those who rated their oral health as “poor” did experience oral pain, but close to 60% of those who rated their oral health as “poor” did not experience any pain in the past six months.

**Figure 5: Self-rated oral health and experience of oral pain in the past six months**



The mean score of the self-rated oral health was higher in those participants who experienced oral pain in the past six months (Table 13).

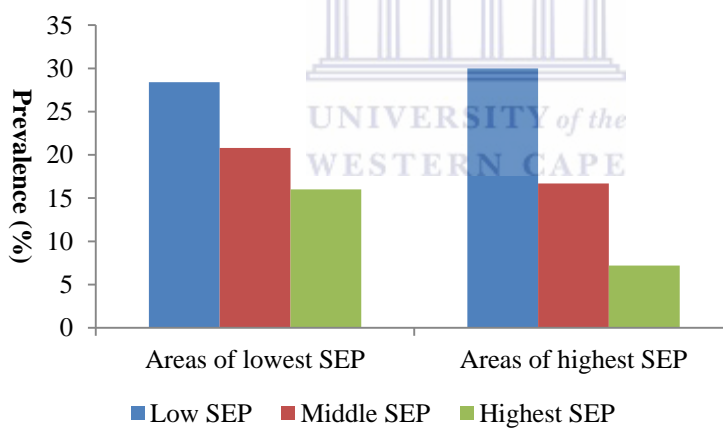
**Table 13: Mean self-rated oral health score and the experience of oral pain**

Oral pain	Mean self-rated oral health score* (95% CI)	n
No	1.86 (1.80 – 1.89)	2,119
Yes	2.50 (2.38 – 2.63)	516
Total population	1.99 (1.93 – 2.02)	2,635

\*The higher the score on a likert-type scale of 1 to 5, the worse the self-rated health

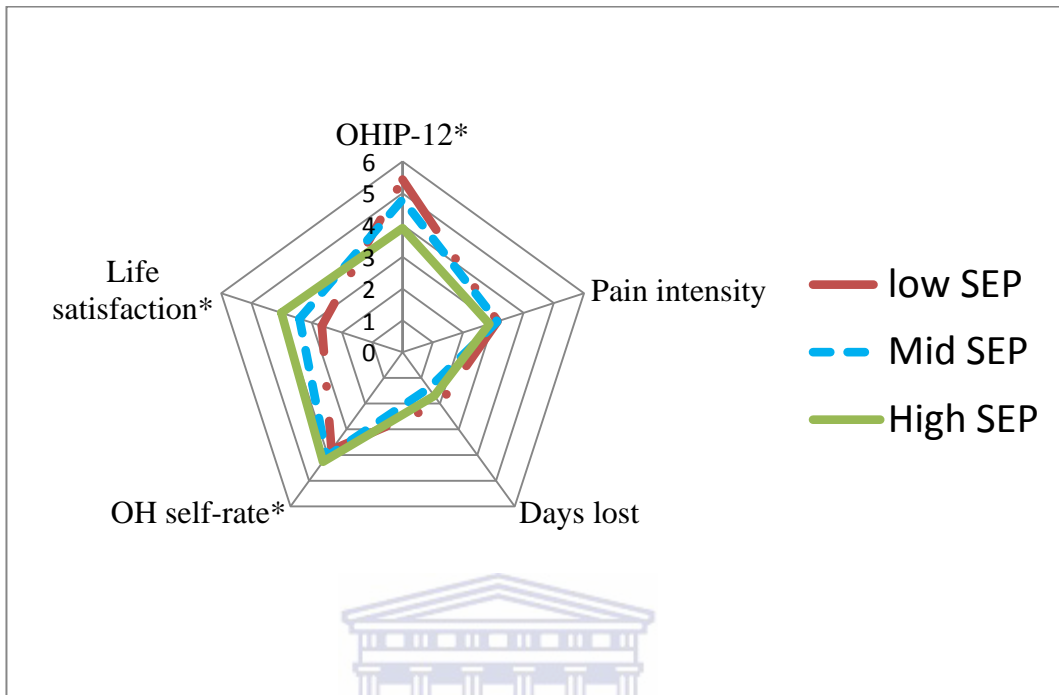
The percentage by individual-level socio-economic position of those who rated their oral health as “poor” in the area of the highest area-level socio-economic position showed a steep gradient, compared to the gradient in the areas of the lowest socio-economic position (Figure 6).

**Figure 6: Self-rated poor oral health by individual-level socio-economic position**



In the OHIP-12, life satisfaction and self-rated oral health were significantly affected in those who suffered from oral pain across the different individual-level socio-economic position groups. However, the number of days lost from work or school and the pain intensity did not significantly vary across the individual-level socio-economic position groups (Figure 7).

**Figure 7: Individual-level socio-economic position distribution of impacts of pain**

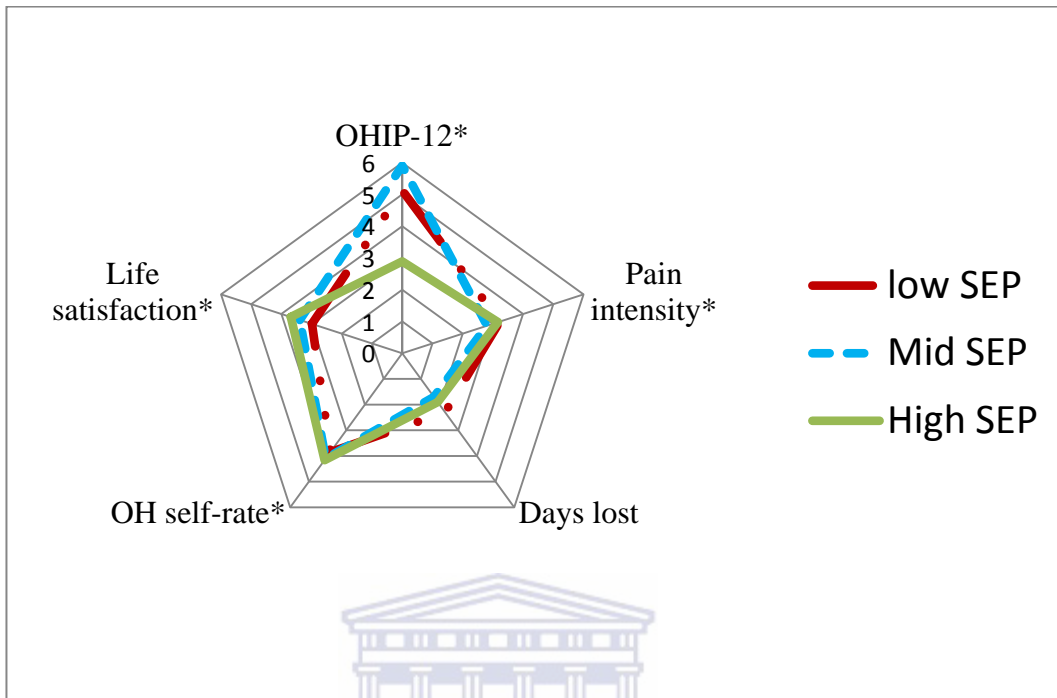


\*Indicates a statistically significant difference



On an area-level, the pain intensity was significantly associated with oral pain across the different socio-economic groups (Figure 8). This finding contrasts with that on the individual-level socio-economic position, where the pain intensity was not significantly impacted (Figure 7).

**Figure 8: Area-level socio-economic position distribution of impacts of pain**



\*Indicates a statistically significant difference



#### 5.6.4 *Economic burden of oral pain*

The main method of payment for the last dental visit was significantly different across both the individual-level and area-level socio-economic position groups; the cash payment for the last dental visit was mostly in the areas of low socio-economic position. The individuals of low socio-economic position received mainly free treatment, while those individuals of highest socio-economic position paid mainly with the use of medical aids (Table 14).

**Table 14: The payment method for the last dental visit by socio-economic position**

Measure		Free % (95%CI) (n)	Medical aid % (95%CI) (n)	Cash % (95%CI) (n)
Individual SEP*	Low	53.7 (44.5 – 62.6) (n=164)	11.0 (5.3 – 21.4)* (n=25)	35.3 (27.1 – 44.5) (n=91)
	Middle	30.9 (24.7 – 38.0) (n=126)	22.4 (16.5 – 29.6) (n=71)	46.7 (39.0 – 54.6) (n=149)
	High	6.8 (4.5 – 10.1) (n=34)	61.2 (54.6 – 67.3) (n=287)	32.1 (26.5 – 38.2) (n=172)
Area SEP*	Low	32.5 (25.1 – 40.8) (n=102)	21.9 (15.5 – 30.0) (n=71)	45.7 (36.7 – 54.9) (n=112)
	Middle	28.1 (21.6 – 35.8) (n=117)	34.5 (26.5 – 43.6) (n=155)	37.5 (30.1 – 45.2) (n=165)
	High	22.9 (17.2 – 29.8) (n=105)	46.5 (39.2 – 53.9) (n=157)	30.7 (24.4 – 37.8) (n=135)

\* Relative Standard Error >30%, thus estimate here may be unreliable

\*p-value 0.001

### 5.6.5 Financial cost

Most of the variation in cost to the individual for the last pain episode was across the individual-level socio-economic position, and not the area-level socio-economic position (Table 15). This is represented graphically in Figure 9. When the average amount spent on the last oral pain episode is multiplied by total count

of those people who experienced oral pain, the cost will translate to an estimated total amount spend over the six month of R 991 118 052 (95% CI: 532 656 996 – 1 549 802 324).

**Table 15: Financial cost for the last oral pain episode by socio-economic position**

		Mean cost in Rands (ZAR)	Standard Error	95% Confidence Interval
Individual socio-economic position*	Low (n=170)	61.44 <sup>a</sup>	9.02	43.68 – 79.20
	Middle (n=163)	108.70 <sup>b</sup>	14.46	80.23 – 137.16
	High (n=152)	433.83 <sup>c</sup>	128.92	180.04 – 687.63
Area socio-economic position	Low (n=172)	121.58	24.65	73.04 – 170.11
	Middle (n=198)	138.91	16.49	106.45 – 171.38
	High (n=115)	297.34 <sup>†</sup>	126.33	48.63 – 546.04
South Africa	National	170.92	33.14	105.67 – 236.17

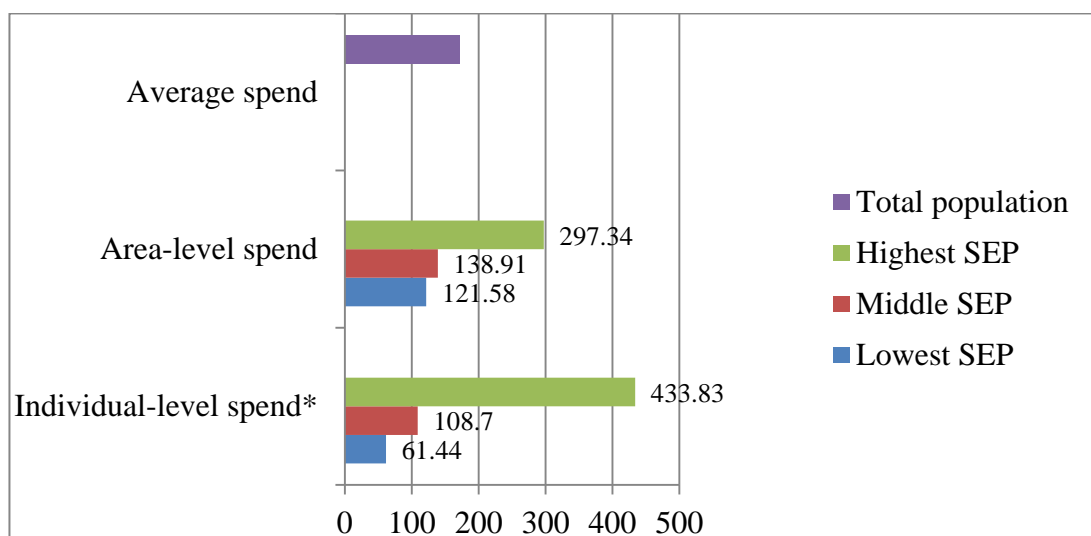
<sup>a,b,c</sup> significantly different from each other

<sup>†</sup>Relative Standard Error >30%, thus estimate here may be unreliable

\*p-value <0.001

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**Figure 9: Estimated cost of last oral pain episode (in South African Rand ZAR)**



\*Indicates a statistically significant difference



### ***5.6.6 Cost in days lost from work or school***

The mean number of days lost from work and school at a national level was 2.04 days (95%CI: 1.00 – 3.09; SE 0.53). The number of days lost from work and school by socio-economic position were unreliable (Standard error > 30%).

### ***5.6.7 Type of health service sought in response to oral pain***

The individuals of low socio-economic position made significantly more use of government dental clinics and nurses/general practitioner/hospital than others, while those of high individual socio-economic position used significantly more private dental clinics than the other groups (Table 16, overleaf).



**Table 16: Type of health service sought in response to the last pain experience by individual-level socio-economic position**

<b>Response</b>	<b>Low Individual-SEP % (95%CI) n</b>	<b>Middle individual-SEP % (95%CI) n</b>	<b>High individual-SEP % (95%CI) n</b>
Private dental clinic*	11.9 (7.5 – 18.5) (n=23)	28.3 (19.3 – 39.3) (n=45)	64.7 (53.4 – 74.5) (n=103)
Government dental clinic*	45.0 (36.0 – 54.4) (n=90)	42.6 (32.5 – 53.4) (n=72)	19.7 (12.0 – 30.6) (n=31)
Nurse / GP / hospital*	17.4 (10.3 – 27.8) (n=31)	6.7 (3.5 – 12.4) (n=15)	6.2 (2.9 – 12.5) (n=10)
Self-medication	10.0 (5.0 – 19.0) (n=14)	8.1 (4.2 – 15.0) (n=14)	5.1 (2.9 – 9.0) (n=16)
Home remedy	11.1 (6.7 – 18.0) (n=28)	12.9 (8.1 – 19.9) (n=27)	7.0 (3.4 – 13.9) (n=12)
Did nothing	13.3 (8.0 – 21.3) (n=21)	9.8 (4.4 – 20.4) (n=10)	6.4 (2.4 – 15.6) (n=6)

\*p-value ≤0.005

There were significantly more people in the low area-level socio-economic position who did not do anything in response their last episode of oral pain than in the other groups (Table 17).

**Table 17: Type of health service sought in response to the last pain experience by area-level socio-economic position**

Response	Low Area-SEP %	Middle Area-SEP	High Area-SEP %
	(95%CI) n	% (95%CI) n	(95%CI) n
Private dental clinic*	20.8 (12.7 – 32.2) (n=44)	35.0 (27.0 – 43.9) (n=81)	42.0 (30.0 – 55.0) (n=46)
Government dental clinic	36.4 (27.0 – 47.0) (n=70)	43.6 (33.8 – 53.9) (n=78)	30.7 (21.3 – 42.1) (n=45)
Nurse / GP / Hospital	11.9 (6.4 – 21.2) (n=23)	14.7 (8.0 – 25.7) (n=25)	3.4 (1.5 – 7.7) (n=8)
Self-medication	7.8 (4.4 – 13.5) (n=14)	5.7 (3.2 – 10.2) (n=20)	12.3 (4.9 – 27.4) (n=10)
Home remedy	11.3 (6.8 – 18.1) (n=24)	10.0 (6.1 – 15.9) (n=28)	10.7 (6.0 – 18.2) (n=15)
Did nothing*	20.8 (13.2 – 31.2) (n=26)	2.5 (0.7 – 8.3)* (n=3)	4.7 (1.9 – 10.9)† (n=8)

† Unreliable estimates due to small numbers

\*p-value <0.005

### 5.6.8 Multi-level model of oral pain

Measures that were significantly associated with oral pain in the South African population included poor self-rated oral health, and having made a dental visit. The people with no teeth in their mouths and those of high individual socio-economic position were associated with having reported less prevalence of oral pain (Table 18).

**Table 18: Final multi-level Poisson regression model on oral pain in the general South African adult population**

Measures		Prevalence rate ratio	95% Confidence Interval
Employment	Employed	Referent	
	Unemployed	0.81	0.65 – 1.02
	Other	0.82	0.66 – 1.02
Self-rated oral health	Poor	Referent	
	Good**	0.50	0.41 – 0.62
Past dental visit pattern	Never	Referent	
	Symptomatic**	5.34	4.19 – 6.80
	Regular (6 monthly – 2 yearly)**	5.54	4.18 – 7.35
Natural teeth present in mouth	All / most	Referent	
	>half / few	1.22	0.96 – 1.54
	None*	0.48	0.29 – 0.80
Area socio-economic position	Low	Referent	
	Middle	0.89	0.68 – 1.16
	High*	0.72	0.53 – 0.99
Individual socio-economic position	Low	Referent	
	Middle	0.92	0.73 – 1.15
	High*	0.71	0.55 – 0.91

\*p-value <0.05; \*\*P-value<0.001

In the multivariable adjusted model above (Table 18), factors associated with oral pain include poor self-rated oral health, past dental visit, half/few natural teeth present in mouth, low/middle area-level and low/middle individual-level socio-economic position.

The individual-level socio-economic position of the people in areas of low socio-economic position did not significantly influence prevalence of oral pain compared to those in the middle and high socio-economic areas (Table 19).

**Table 19: Final multi-level Poisson regression model on oral pain by area-level socio-economic position**

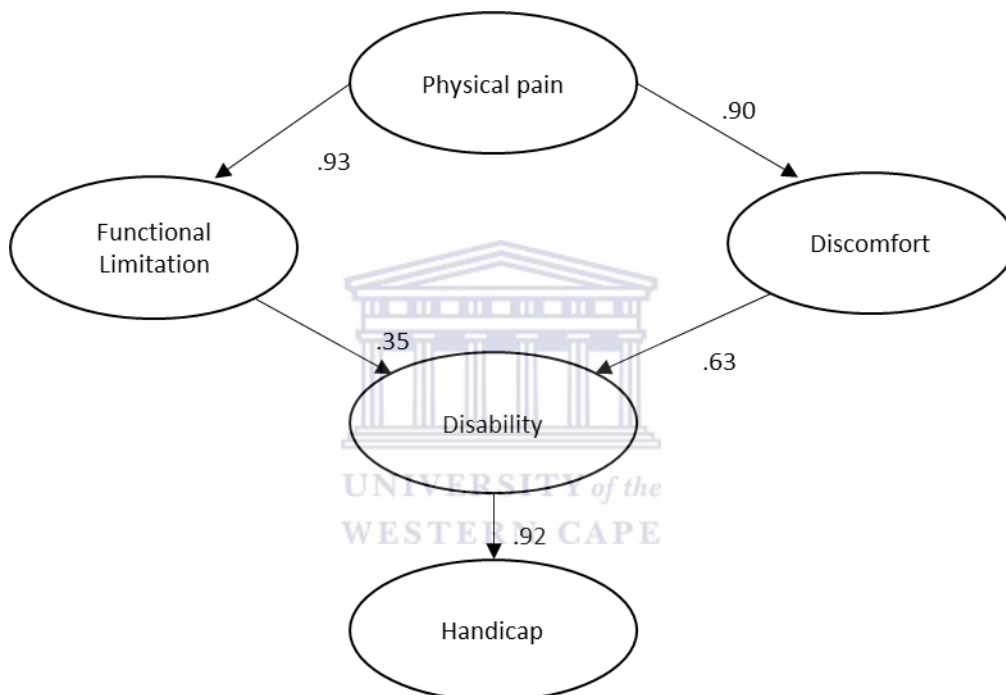
Measures		Low area-SEP PRR (95%CI)	Middle area-SEP PRR (95%CI)	High area-SEP PRR (95%CI)
Employment	Employed	Referent		
	Unemployed	0.88 (0.60-1.29)	0.84 (0.59-1.21)	0.66 (0.40-1.07)
	Other	0.87 (0.60-1.27)	0.86 (0.61-1.21)	0.71 (0.45-1.11)
Self-rated oral health	Poor	Referent		
	Good	0.43* (0.31-0.59)	0.71 (0.49-1.02)	0.41* (0.26-0.64)
Past dental visit pattern	Never	Referent		
	Symptomatic	5.19* (3.56-7.56)	5.15* (3.40-7.79)	5.52* (3.39-8.98)
	Regular (6 monthly – 2 yearly)	5.92* (3.72-9.45)	5.85* (3.77-9.08)	4.52* (2.40-8.51)
Natural teeth present in mouth	All / most >half / few	Referent 1.17 (0.81-1.69)	1.23 (0.83-1.82)	1.41 (0.86-2.31)
	None	0.57 (0.23-1.40)	0.65 (0.28-1.52)	0.32* (0.13-0.82)
Individual socio- economic position	Low	Referent		
	Middle	1.07 (0.75-1.51)	0.87 (0.61-1.25)	0.75 (0.47-1.21)
	High	0.91 (0.59-1.40)	0.68* (0.47-0.99)	0.56* (0.33-0.94)

\*p-value <0.05; PRR Prevalence Rate Ratio

## 5.7 Oral health-related quality of life

The SEM structure of OHIP for the general South African population is presented below (Figure 10) with the general model statistics (Table 20).

**Figure 10: Structural validity of the OHIP-12 for South African adults**



The Goodness of fit index (GFI) was 0.98, comparative fit index 0.99, non-normed fit index (TLI) 0.98, root mean square error of approximation (RMSEA) 0.05 and the Pclose was 0.23 all the values show a significant fit (p-value <0.001) and fall within the acceptable range.

**Table 20: The general model statistics from the structural equation model**

	$\beta$	Bootstrap	Bias-corrected 95%	p-value	%Total effect
<u>Pain</u>					
Functional limitation	0.93	0.02	0.89-0.97	0.015	100
Discomfort	0.90	0.02	0.86-0.93	0.007	100
<u>Functional limitation</u>					
Disability	0.35	0.07	0.21-0.47	0.013	100
<u>Discomfort</u>					
Disability	0.63	0.07	0.50-0.76	0.01	100
<u>Disability</u>					
Handicap	0.92	0.01	0.89-0.95	0.011	100

**5.7.1 Factors associated with the OHIP-12**

Oral health-related quality of life was significantly better in those aged 55 years and less, the “Whites”, and those belonging to both high individual-level and high area-level socio-economic position (Table 21). Table 21 shows the demographic and socio-economic characteristics associated with OHIP-12 in this study.

**Table 21: Bivariate analysis of demographic and socio-economic characteristics of the OHIP-12 in the South African adult population**

Characteristics		Mean OHIP12 score (95% CI)	n
Age	16 - 25 years	3.95 (3.00 – 4.90) <sup>a</sup>	507
	26 - 35 years	3.94 (3.19 – 4.69) <sup>a</sup>	627
	36 - 45 years	4.52 (3.68 – 5.36) <sup>a</sup>	496
	46 - 55 years	4.39 (3.60 – 5.18) <sup>a</sup>	443
	56 - 65 years	7.48 (6.03 – 8.93) <sup>b</sup>	314
	> 65 years	7.24 (5.53 – 8.90) <sup>b</sup>	263
Sex	Male	4.23 (3.53 – 4.92)	1103
	Female	5.03 (4.44 – 5.63)	1548
Race	Black	4.99 (4.35 – 5.63) <sup>a</sup>	1672
	Coloured	3.91 (2.96 – 4.85) <sup>a</sup>	402
	Indian	4.78 (3.39 – 6.17) <sup>a</sup>	227
	White	2.89 (1.99 – 3.79) <sup>b</sup>	349
Medical aid	Yes	3.84 (3.04 – 4.64)	697
	No	4.85 (4.25 – 5.46)	1941
Receiving a grant in household	Yes	5.48 (4.72 – 6.24)	1313
	No	3.65 (3.15 – 4.16)	1338
Having to forego basic need to pay for dental visit	Yes	13.86 (10.10 – 17.63) <sup>a</sup>	79
	No	7.05 (6.19 – 7.92) <sup>b</sup>	1081
Employment status	Employed	4.42 (3.76 – 5.08)	966
	Other	5.19 (4.35 – 6.04)	866
	Unemployed	4.40 (3.61 – 5.20)	789
Individual socio-economic position index	Low	5.43 (4.61 – 6.26) <sup>a</sup>	880
	Middle	4.81 (3.98 – 5.63) <sup>a</sup>	869
	High	3.49 (2.87 – 4.10) <sup>b</sup>	902
Area socio-economic position index	Low	5.13 (4.13 – 6.13) <sup>a</sup>	883
	Middle	5.91 (5.01 – 6.81) <sup>a</sup>	905
	High	2.89 (2.36 – 3.42) <sup>b</sup>	863

Among those who had reported making a dental visit

<sup>a,b</sup> Superscript of these different letters within the same variable category indicate significant difference at <0.001



**Table 22: Bivariate analysis of health and oral health-related characteristics of OHIP-12 for the South African adult population**

Characteristics		Mean OHIP-12 score (95% CI)	n
Satisfied with life	Very dissatisfied	6.69 (4.16 – 9.22) <sup>a</sup>	139
	Dissatisfied	5.75 (4.53 – 6.97) <sup>a</sup>	471
	Neither	5.50 (4.60 – 6.40) <sup>a</sup>	457
	Satisfied	4.09 (3.46 – 4.72) <sup>c</sup>	1281
	Very satisfied	1.90 (1.22 – 2.57) <sup>b</sup>	294
Self-reported general health	Good	3.98 (3.49 – 4.46)	2122
	Poor	7.58 (6.20 – 8.95)	520
Self-rated oral health	Good	3.31 (2.85 – 3.77)	2142
	Poor	10.75 (9.31 – 12.19)	493
Dental status (Self-reported number of teeth present)	Most / all	4.00 (3.50 – 4.51) <sup>a</sup>	2155
	Half / less	11.75 (9.84 – 13.66) <sup>b</sup>	296
	None	3.31 (2.08 – 4.55) <sup>a</sup>	191
Pain	No	2.84 (2.43 – 3.25)	1872
	Yes	12.16 (10.87 – 13.45)	516
Past dental visit pattern	Never	2.59 (2.15 – 3.03) <sup>a</sup>	1488
	Symptomatic	7.67 (6.71 – 8.63) <sup>b</sup>	794
	At least every 6 months – 2 years	7.47 (5.94 – 9.01) <sup>b</sup>	357
Method of payment for last dental visit*	Free	9.81 (8.18 – 11.44) <sup>a</sup>	324
	Medical aid	4.47 (3.41 – 5.52) <sup>b</sup>	383
	Cash	9.21 (7.73 – 10.69) <sup>a</sup>	412

\*Among those who had reported making a dental visit

<sup>a,b</sup> Superscript of these different letters within the same variable category indicate significant difference at <0.001

<sup>a,c</sup> Superscript of these different letters within the same variable category indicate significant difference at <0.05

The more satisfied a participant is with life, the better his or her oral health-related quality of life. Other health related factors associated with better oral health-related quality of life include good self-rated health and oral health, never having

been to a dental clinic, not having experienced oral pain in the past six month, paying for the last dental visit with a medical aid and those having most, all or none of their natural teeth (Table 22).

## **5.8 Validity of the OHIP-12**

Convergent validity was tested by evaluating the association between OHIP and the global rating of self-perceived oral health (a gold standard) which showed that there was a highly significant association between OHIP-12 and self-rated oral health ( $p < 0.001$ ). Furthermore, those with poor self-rated oral health had a mean OHIP score of 10.75, while those who rated their oral health as good only had a mean score of 3.31 (Table 22).

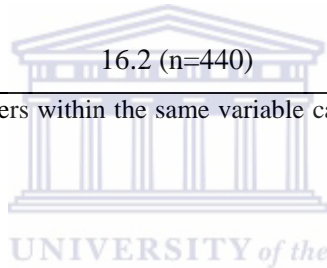
The discriminant validity for OHIP-12 was further demonstrated by evaluating the association between the OHIP-12 and experiencing oral pain in the past six months, which showed a significant association between OHIP-12 and the experience of oral pain ( $p < 0.001$ ). The participants who experienced oral pain in the past six months had a mean OHIP score of 12.16, compared to the mean OHIP score of 2.84 of those who did not experience oral pain (Table 22).

The OHIP-12 prevalence for the South African population was 16.2 (Table 23).

**Table 23: OHIP-12 prevalence by individual-level and area-levels socio-economic position**

<b>Socio-economic position</b>	<b>Prevalence (%) (n)</b>	<b>95% Confidence Interval</b>	<b>Standard Error</b>
<b>Individual socio-economic position</b>			
Low	18.6 (n=181) <sup>a</sup>	15.4 – 22.3	1.7
Middle	17.6 (n= 145) <sup>a</sup>	14.2 – 21.8	1.9
High	11.6 (n=114) <sup>b</sup>	9.1 – 14.8	1.4
<b>Area socio-economic position</b>			
Low	18.2 (n=168) <sup>a</sup>	14.4 – 22.6	2.1
Middle	19.7 (n=166) <sup>a</sup>	15.9 – 24.2	2.1
High	10.6 (n=106) <sup>b</sup>	7.8 – 14.2	1.6
<b>South Africa</b>	16.2 (n=440)	14.1 – 18.6	1.2

<sup>a,b</sup> Superscript of different letters within the same variable category indicate significant difference at <0.001

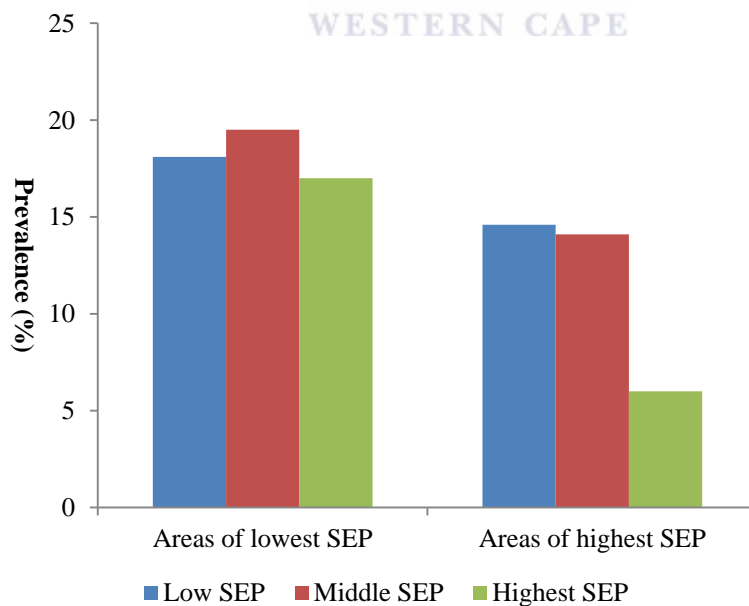


Those in the high individual-level and high area-level socio-economic position had OHIP-12 prevalence less than that of the national average and also significantly different from the other socio-economic groups. These groups also had less severity of OHIP-12 compared to the national average (Table 24).

**Table 24: OHIP-12 severity by individual-level and area-level socio-economic position**

Socio-economic position	Severity	95% Confidence Interval	Standard Error
<b>Individual SEP</b>			
Low (n=880)	5.43	4.61 – 6.26	0.42
Middle (n=869)	4.81	3.98 – 5.63	0.42
High (n=902)	3.49	2.87 – 4.10	0.31
<b>Area SEP</b>			
Low (n=883)	5.13	4.13 – 6.13	0.51
Middle (n=905)	5.91	5.01 – 6.81	0.46
High (n=863)	2.89	2.36 – 3.42	0.27
<b>South Africa (n=2651)</b>	4.65	4.13 – 5.17	0.26

**Figure 11: OHIP-12 Impact prevalence of  $\geq 1$  by individual-level socio-economic position**



The prevalence of OHIP-12, that is the presence of one or more impact on an individual, is displayed on Figure 11, while Table 25 gives the values of the OHIP-12 prevalence and the confidence intervals for the different socio-economic groups.

**Table 25: OHIP-12 12 prevalence ( $\geq 1$  impact) by individual-level socio-economic position**

		<b>Lowest area SEP % (95% CI)</b>	<b>Highest area SEP % (95% CI)</b>
<b>Individual SEP</b>	Low	18.3 (14.2 – 23.1)	14.6 (9.2 – 22.3)
	Middle	18.8 (13.0 – 26.4)	14.1 (8.4 – 22.5)
	High	16.4 (10.0 – 25.6)	6.0 (4.0 – 8.9)



### 5.8.1 Multi-level model for OHIP

At the start of the mixed-effect linear regression model building for OHIP-12, the model consisted of only individual-level socio-economic position and area-level socio-economic position. Both individual-level and area-level socio-economic position were significantly associated with OHIP. As other measures were included in the model, the significance was lost. Specifically, when oral pain was included in the model, the high area-level socio-economic position and middle individual-level socio-economic position lost significance. When race was included in the model, significance was lost in the high individual-level socio-economic position. This suggests that the individual-level socio-economic position may be mediated by race and oral pain to some extent, while the area-

level socio-economic position is mediated by oral pain. The final model is depicted in Table 26.

**Table 26: Final mixed effect linear regression model for OHIP-12**

Measure		$\beta$	95% Confidence Interval
Pain	No	Referent	
	Yes**	1.26	1.01 – 1.51
Age	Continuous**	0.01	0.00 – 0.01
Life satisfaction	Continuous*	-0.10	-0.18 - -0.02
Race	Black African	Referent	
	Coloured	-0.04	-0.45 – 0.37
	Indian / Asian	-0.30	-1.27 – 0.67
	White**	-0.62	-0.96 - -0.27
Self-rated oral health	Poor	Referent	
	Good**	-0.87	-1.07 - -0.66
Natural teeth present in mouth	All / Most	Referent	
	<Half / Few**	0.59	0.35 – 0.84
	None	-0.01	-0.32 – 0.31
Past visit pattern	Never	Referent	
	Symptomatic**	0.58	0.38 – 0.78
	At least every 6 months – 2 years**	0.71	0.44 – 0.98
Individual socio-economic position	Low	Referent	
	Middle	0.06	-0.08 – 0.21
	High	-0.03	-0.21 – 0.14
Area socio-economic position	Low	Referent	
	Middle	-0.10	-0.36 – 0.17
	High	-0.27	-0.56 – 0.30

\*p-value <0.05; \*\*p-value <0.001

The slope inequality index (SII) is the predicted value of the difference in the value for the highest and the lowest socio-economic group. It measures the absolute inequality in the study population. While the concentration index measures the relative inequality in the study population and is represented by a ratio of highest to the lowest socio-economic group. The SII for “poor” self-rated oral health, the prevalence of oral pain and the prevalence of oral impact measured by OHIP-12 in the lowest and the highest area-level socio-economic position areas is presented in Table 27. The SII is negative in both the lowest and highest socio-economic position areas for all the oral health outcomes, this demonstrates an absolute inequality. But the SII value in the highest socio-economic position areas is much higher than that in the lowest socio-economic position areas, suggesting a greater inequality in oral health outcomes in the areas of highest socio-economic position. The concentration index in the areas of lowest socio-economic position for all the oral health outcomes were larger than the values for each corresponding oral health outcome in the highest socio-economic position areas (Table 27). This suggests that the relative inequality is greater in the highest areas compared to the lowest areas.

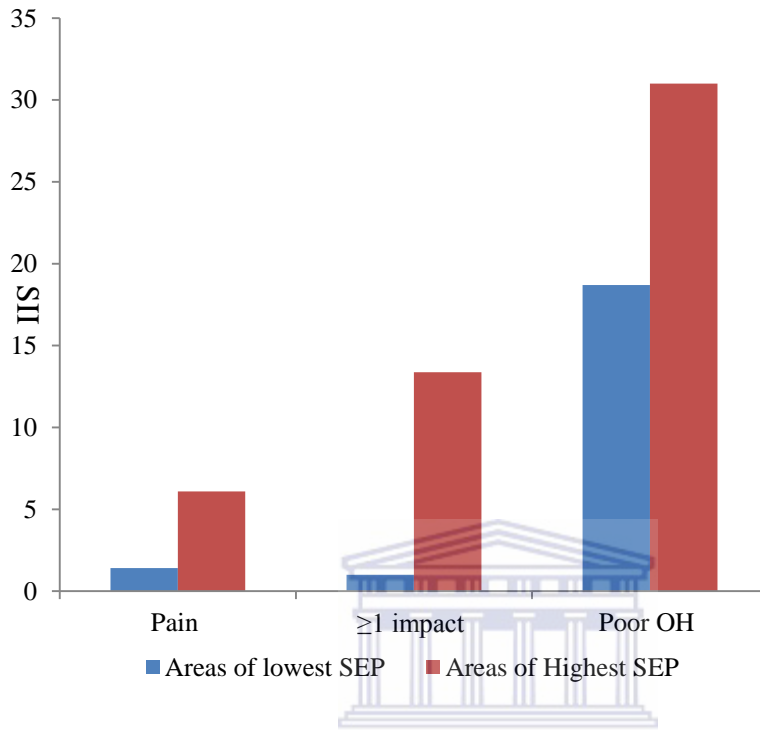
**Table 27: Computing the Slope Index of inequality (SII) and concentration index for the two extreme socio-economic positions areas**

Individual-level SEP ranking	Proportional distribution in the population	Cumulative range of population	Midpoint of cumulative range of population	Prevalence of poor OH self-rating (%)	Prevalence of pain (%)	Prevalence of $\geq 1$ impact in OHIP (%)
<b>In Lowest area SEP</b>						
Lowest	0.554	0.000-0.554	0.277	28.4	20.3	18.1
Middle	0.311	0.554-0.865	0.710	20.8	19.6	19.5
Highest	0.135	0.865-1.000	0.933	16.0	19.4	17.0
<b>SII</b> (predicted value for highest – lowest)				<b>-18.7</b> (15.7 – 33.7)	<b>-1.4</b> (19.3 – 20.7)	<b>-1</b> (17.8 – 18.8)
<b>Concentration Index</b>				<b>0.466</b> (15.7 / 33.7)	<b>0.932</b> (19.3 / 20.7)	<b>0.947</b> (17.8 / 18.8)
<b>In Highest area SEP</b>						
Lowest	0.217	0.000-0.217	0.109	30.0	17.3	14.6
Middle	0.339	0.217-0.556	0.387	16.7	14.4	14.1
Highest	0.444	0.556-1.000	0.778	7.2	13.1	6.0
<b>SII</b> (predicted value for highest – lowest)				<b>-31</b> (1.2 – 32.2)	<b>-6.1</b> (11.4 – 17.5)	<b>-13.3</b> (3.9 – 17.2)
<b>Concentration Index</b>				<b>0.037</b> (1.2 / 32.2)	<b>0.651</b> (11.4 / 17.5)	<b>0.227</b> (3.9 / 17.2)

The information on the SII for the oral health outcomes presented in Table 27 is illustrated graphically in Figure 12.



**Figure 12: Slope inequality index (SII) for various oral health outcomes comparing areas of lowest socio-economic position with areas of highest socio-economic position**



### 5.8.2 Structural validity of OHIP-12 in different socio-economic groups

The structure of OHIP at the area and individual socio-economic position showed a good fit as demonstrated in Table 28.

**Table 28: The statistics for the OHIP-12 model fit for the general adult South African population, the area-level and individual-level socio-economic position**

Model	GFI	CFI	TLI	RMSEA	PCLOSE	DF	CMIN/DF	p-value
General SA model	0.98	0.99	0.98	0.05	0.23	46	8.20	<0.001
Area SEP	0.95	0.97	0.95	0.04	1.00	138	5.93	<0.001
Individual SEP	0.96	0.98	0.98	0.04	1.00	138	4.46	<0.001

The critical ratios are displayed in Table 29.

**Table 29: Critical ratios of the significant differences in pathways between the socio-economic groups**

<b>Path</b>	<b>Pair wise comparison critical ratio for difference (significance of &gt; 1.96)</b>	
<b>Area socio-economic position</b>		
Functional limitation → Disability	Low vs High	2.66
Physical pain → discomfort	Low vs High	-4.03
	High vs Middle	2.77
Disability → Handicap	Low vs High	5.47
	High vs Middle	3.58
<b>Individual socio-economic position</b>		
Functional limitation → Disability	Low vs High	2.62
	High vs Middle	-2.55
Physical pain → Discomfort	Low vs High	-2.11
	High vs Middle	3.71
Disability → Handicap	Low vs High	-4.08
	High vs Middle	3.96

The structure of the OHIP-12 for the South African adult population (see Figure 3) as it relates to the structure of the Locker's oral health model was tested in the different socio-economic groups in the South African population, using both the individual-level and area-level socio-economic position (Figures 13 to 18).

**Figure 13: Lowest area socio-economic position model**

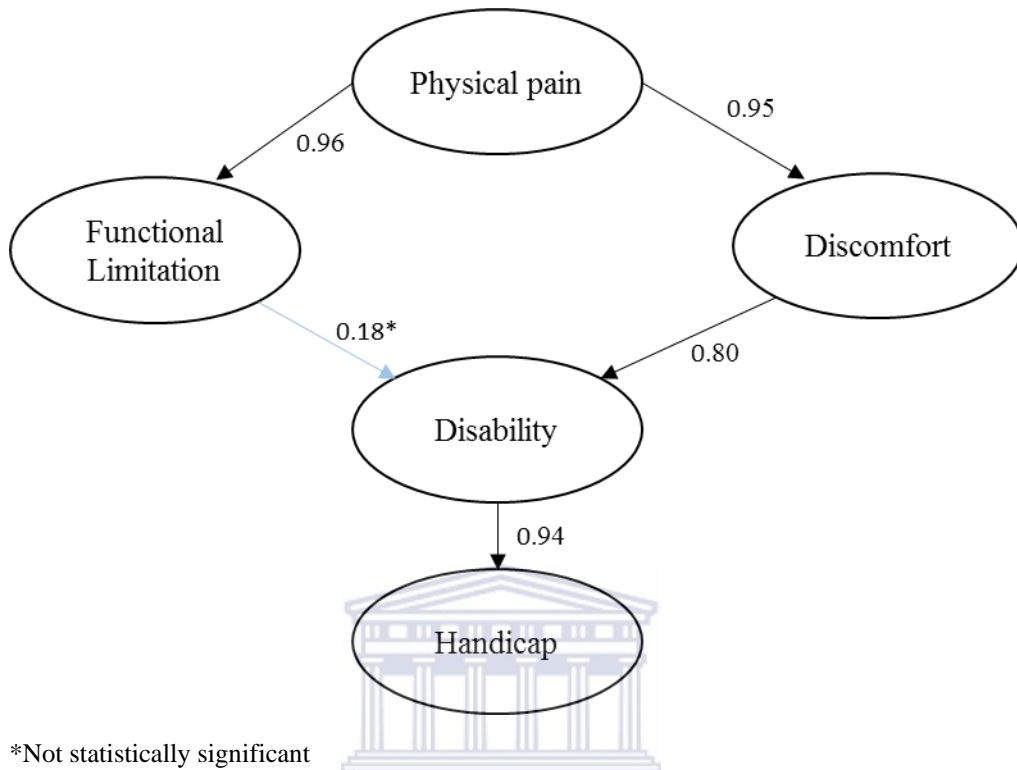
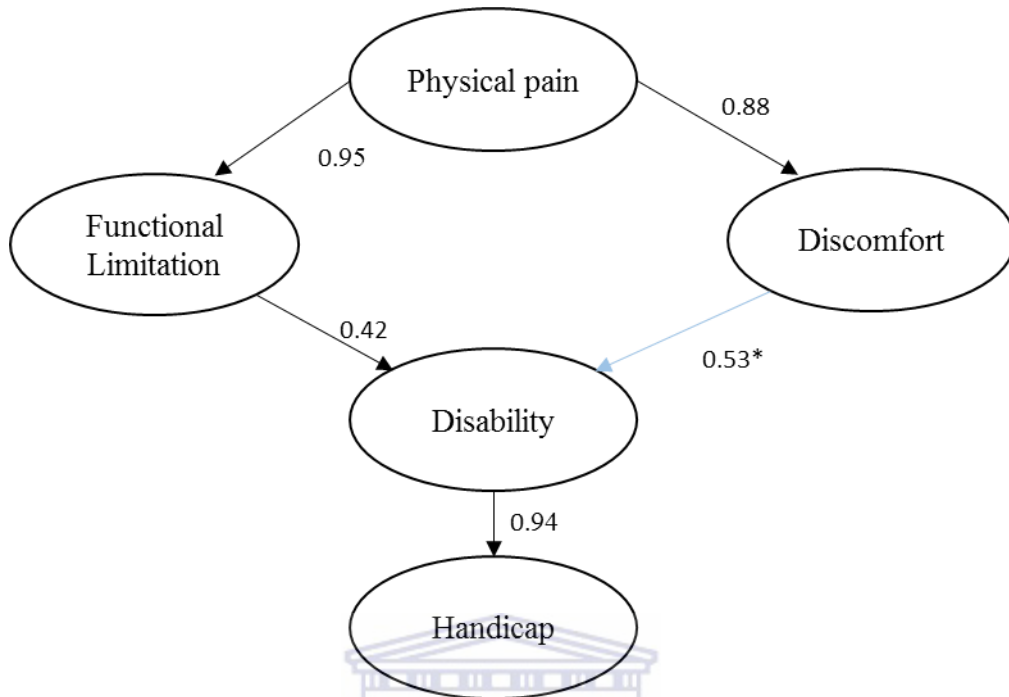


Figure 13 shows the SEM diagram for OHIP-12 in the lowest socio-economic position areas, which demonstrates that the connection between functional limitation and disability was not statistically significant.

In the middle area-level socio-economic position, the insignificant pathway to disability is through discomfort (Figure 14).

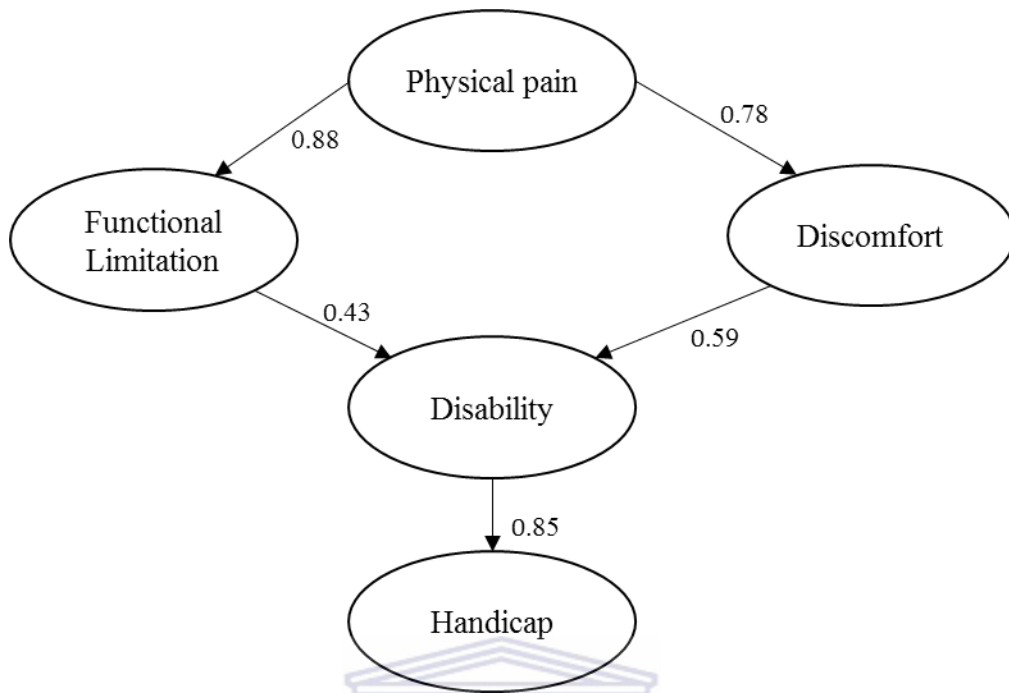
**Figure 14: Middle area-level socio-economic position model**



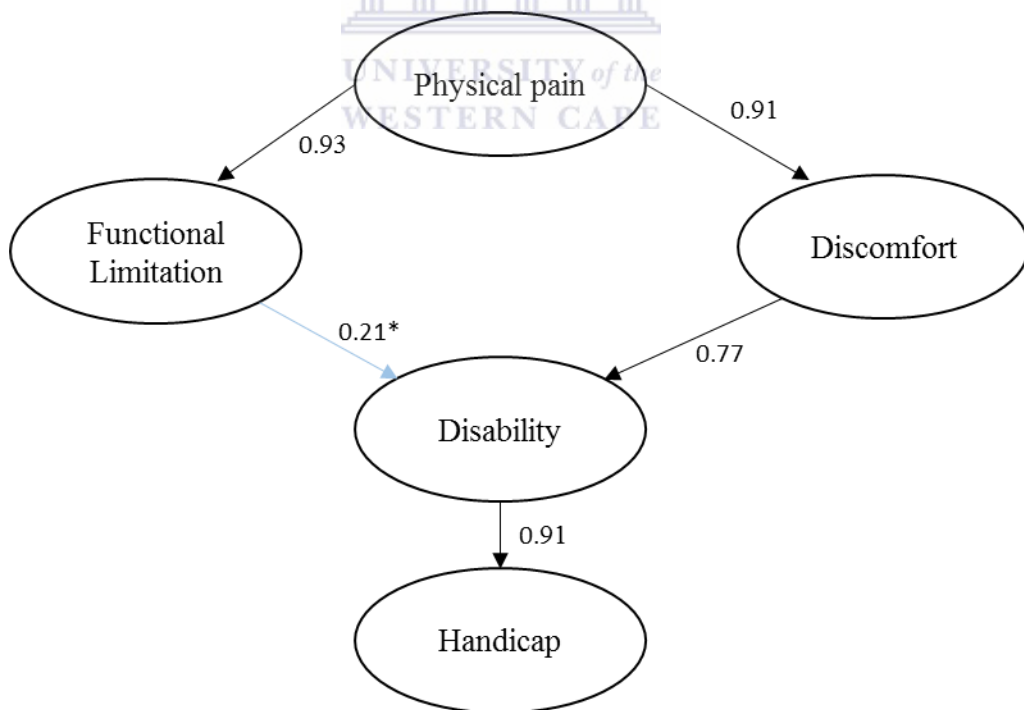
\*Not significant  $p=0.065$

For the highest area-level socio-economic position, all the pathways are significant, making it similar to Locker's oral health model (Figure 15).

**Figure 15: Highest area-level socio-economic model**



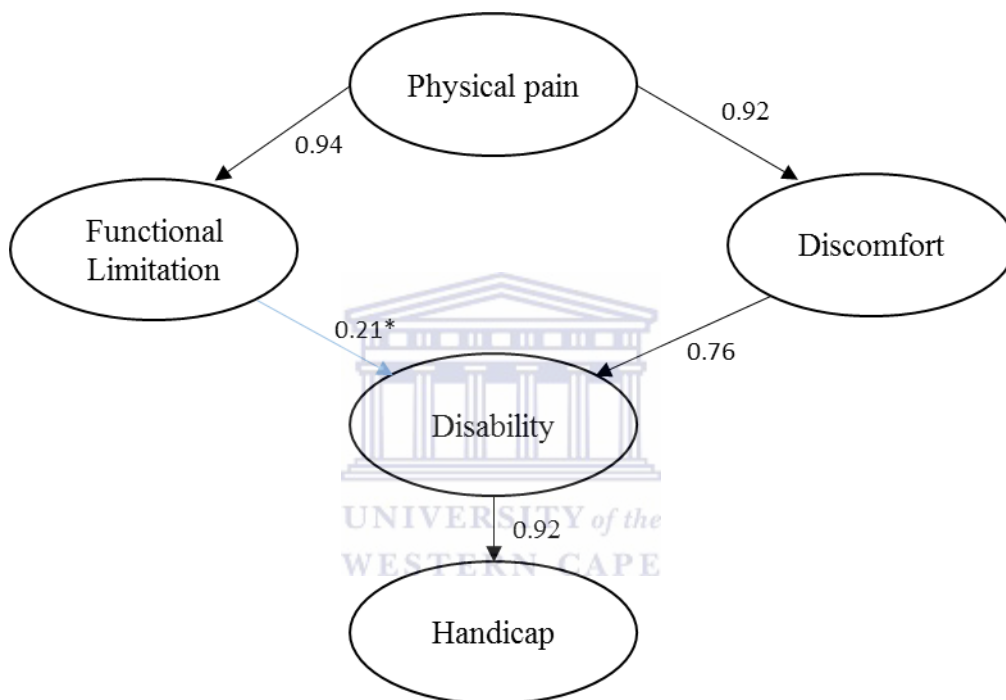
**Figure 16: Lowest individual-level socio-economic position model**



\*Not significant

The individuals with the lowest socio-economic position have an insignificant path between functional limitation and disability (Figure 16). This value was similar to that obtained in the individual of middle-level socio-economic position (Figure 17).

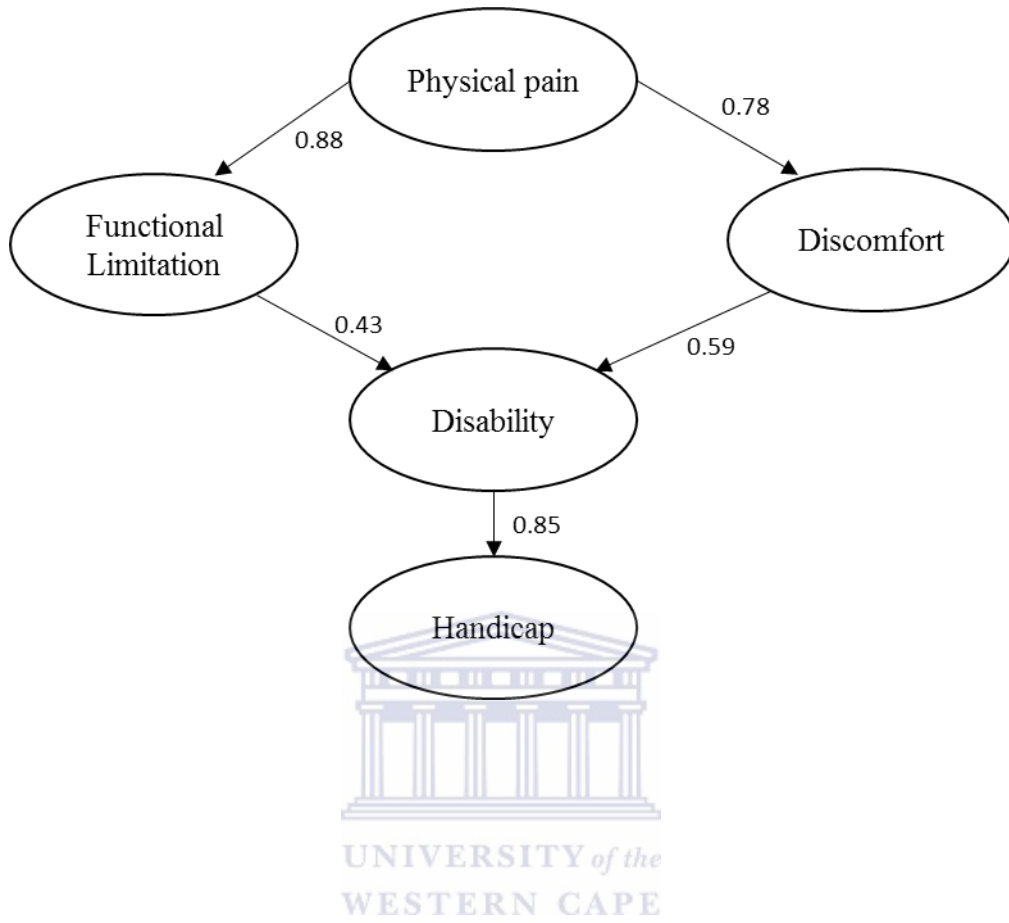
**Figure 17: Middle individual-level socio-economic position model**



\*Not significant

The highest individual-level socio-economic position is similar to that of Locker's oral health model (Figure 18).

**Figure 18: Highest individual-level socio-economic position model**



# CHAPTER 6

## DISCUSSION

### 6.1 Introduction

This chapter discusses the findings of the present study. It is divided into three parts. The first part contains a discussion of the results on oral pain (sections 6.2 and 6.3), followed by a discussion on oral health-related quality of life (section 6.3), which includes a validation of the OHIP for the South African adult population, a discussion on the structural equation model of OHIP-12 for the South African adult population for the different socio-economic position groups (both the individual-level and area-level groupings). The final part discusses the limitations of the study (section 6.5) and the chapter concludes with a summary of the key findings and a reflection on the limitations of this study.

### 6.2 Oral pain

About one out of five South African adult was found to have experienced oral pain in the past six months suggesting that poor oral health is a significant public health problem in South Africa. However, the prevalence varied significantly across the different socio-economic areas, which supports the argument that using only a national average prevalence rate may mask inequalities in the burden of oral pain prevalence in South African society. In particular oral pain was significantly lower among those residing in areas of the highest socio-economic position than among those residing in areas of the low socio-economic position.



The most common location for oral pain in the present study was the teeth (toothache), which is consistent with the literature (Leung et al., 2008; McGuire et al., 2008), followed by pain from the gums. Furthermore, the prevalence of oral pain in the past six months, involving the different oro-facial locations, varied significantly not only at the individual-level, but also at the area-level socio-economic position. This suggests the importance of where people live in determining disease burden and provides further evidence in support of the current South African policy position that different priority interventions may be required for promoting oral health of different communities, depending on the level of resources and disease burden. For instance, while tooth-related pain (likely related to tooth decay) did not differ across areas, the burden of gum-related pain was significantly higher in areas of low socio-economic position. The implication for service planning is that while, the need to prevent and treat tooth decay might be universal across all areas there is need for more oral health promotion interventions and a disproportionately higher number of oral hygiene services in the less affluent areas as compared to the more affluent areas.

Bivariate analysis revealed a significant positive association between the experience of oral pain in the past six months and age, with oral pain particularly high among those in the age group from 56 years to 65 years of age. The present study showed that those older than 55 years were more likely to report an experience of oral pain in the past six month. However, age lost its significance in the adjusted multi-variable adjusted model and therefore age by itself was not independently associated with the frequency of experience of oral pain and may

just be a confounder for the effect of number of natural teeth, considering that the number of natural teeth is associated with age.

Past dental visit had an inverse and significant association with the experience of oral pain in the past six months, which suggests that those who made a past dental visit were significantly more likely to have experienced oral pain in the past six months. It is worth noting that this association was significant in both those who reported being regular dental attendee and those who were symptomatic dental attendees, compared to those who have never been to a dental clinic previously. This finding is of concern, as it is expected that people who attend a dental clinic regularly should have a low prevalence of oral pain compared to those who are symptomatic attendees. However, respondents were not asked when the regular attendance to the clinic started and the reason for their regular attendance. It could be that those who reported to be regular attendees actually only started attending the clinic more regularly after realising that they had dental problems and thus had a perceived need for regular dental attendance. In addition only 13.2% of the total study population claimed to make regular dental visits, and more than half of the population (58.8%) have never been to a dentist. This figure is much higher than the 7.1% of Brazilians aged 35 to 44 years who have never been to a dentist (Silva de Pinho et al., 2012).

Surprisingly, the experience of oral pain in the past six months did not differ among those in employment when compared to those who were unemployed. Although there is no unemployment benefit in South Africa, it is still conceivable that many of those unemployed in South Africa are also likely to be recipients of

one form of social grant or the other. It is therefore possible that even those unemployed are still able to access cheap sugars, particularly those who live in more urban settings and thus have moved from traditional diet to cariogenic diets that could be associated with significant caries risk with the long-term outcome of oral pain at a frequency similar to that experienced by those employed. In support of this view was the fact that the oral pain prevalence of 22.1% among those who receive grants or have a member of the household receiving grant was comparable to oral pain prevalence of 22.2% among those employed (see Table 9). This potential access to social grants due to the large spends on the social welfare system in South Africa, may partly explain why employment status, which did not load favourably when factor analysing the composite measure of individuals' socio-economic position, had to be removed.

Both those in the highest individual-level and the highest area-level socio-economic position experienced significantly less oral pain in the past six months (Tables 17 and 18). This finding is consistent with the literature (Bastos et al., 2008; Constante et al., 2012; Pau et al., 2007). The high socio-economic position individuals who reside in the areas of low socio-economic position did not have any advantage compared to their counterparts in other areas. Areas of low socio-economic position conceivably have poorer infrastructure, which may result in limited choices for all individuals to maintain and/or improve the state of their oral health, irrespective of their individual-level socio-economic position.

There appears to be a distinct pattern in the payment method for the last dental visit based on the individual-level socio-economic position. People of low

individual-level socio-economic position tend to make more free visits, such as visits to the government dental clinics, those of middle individual-level socio-economic position were more likely to pay cash (out-of-pocket), while the majority belonging to the highest tertile individual-level socio-economic position paid for their last dental visit via a medical aid (Table 14), which may imply better access to private dental clinics. This is confirmed by the findings shown in Table 16, where 65% of those belonging to the highest tertile individual-level socio-economic position attended private dental clinics in response to their last oral pain episode, compared to those in low and middle individual socio-economic position groups, who attended mostly government clinics for their last pain experience.

It is pertinent to note that when the method of payment for last dental visit was assessed by area-level socio-economic position, those of low and middle area-level socio-economic position tended to pay with cash for their last visit (Table 14). This may indicate a lack of sufficient free dental clinics in these areas. Furthermore, this likely limited financial access to dental care may also be the reason for almost 21% for those residing in low socio-economic position areas to “do nothing” in response to their pain (Table 16). Similarly, Vargas et al. (2000) reported that people of low socio-economic status were more likely to experience pain and were also more likely to endure their pain without the benefit of professional dental care support. The reason for not doing anything in these low socio-economic position areas may be due to a lack of access to dental clinics. On the other hand, those in the low socio-economic position areas were also more

likely to report gum-related pain which may be self-limiting in nature and these people may wait for the pain to subside on its own.

The possibility that those in areas of low socio-economic position may be experiencing limited access to dental facilities supports the argument that a well-managed universal health insurance may be important to address oral health inequality in a country like South Africa (Ayo-Yusuf, Ayo-Yusuf and Olutola, 2013). Such a position is in line with the findings of Wang, Norton and Rozier (2007), who have demonstrated that the implementation of health insurance coverage for eligible children in a US population significantly lowered the chances of low-income families experiencing a financial barrier to needed dental care for children. Similarly, in a South African study by Bhayat and Cleaton-Jones (2003) the introduction of free primary dental health care service in Soweto clinics resulted in a significant six-fold increase in the patient attendance for the relief of pain and sepsis. Other studies, mainly from developed countries, have also suggested that providing universal insurance coverage increases health service utilization (Pizarro et al., 2009; Veugelers and Yip, 2003). Furthermore, Villalobos-Rodelo et al. (2010) observed that in Mexican children not having health insurance was associated with dental service utilization for dental pain in the preceding 12-months.

Only 10% of those in the low individual socio-economic position indicated that they self-medicated for their last pain episode, which is lower than the percentages reported by Cohen et al. (2003), who indicated that 25% of their study participants consulted a pharmacist to alleviate their toothache, and these were also mainly

individuals of low income. The differences in findings may be related to differences in the study population.

It is possible that those in well-resourced settings, even when of low income, are still able to afford to consult a pharmacist for self-medication, while those in resource-poor settings like most parts of South Africa would be more likely to endure the pain as is the case in this study where about 20% reportedly did nothing about their oral pain experience.

### **6.3 Cost of oral pain**

On average, the cost to the individual to treat the last oral pain episode was R170.92 (SE 33.14). There was a clear significant cost gradient, showing an increase from the lowest individual-level socio-economic position to the highest individual-level socio-economic position. This difference could be reflective of the type of service that was sought and/or provided. The richer people attending private clinics paid via medical aid. The use of medical aid is likely to remove the financial burden for the treatment cost from them if they opt for a more conservative treatment for their problem, as a conservative treatment option is usually expensive. Poor people who attend government clinics for free treatment may not have much choice, as most of these clinics are over-crowded and overburdened, resulting in a very high possibility of extraction as the treatment offered instead of a conservative treatment option. Those who attend private clinics and pay out-of-pocket with cash are also likely to opt for a treatment option that is affordable to them, which would therefore differ from individual to

individual, depending on their individual economic position. This view is consistent with the observation that while the cost of care did not vary significantly by area socio-economic position, there was significant variation by individual socio-economic position. Furthermore, considering that about one-third of those of low socio-economic position might have paid out-of-pocket for their dental care, this group of less affluent people must have disproportionately borne a part of the total estimated spend of about R1 billion on oral pain over the six month period or of a possible R2 billion over a year.

This significant financial burden for caring for only oral pain episodes among South African adults older than 15 years, it even excludes indirect costs such as lost wages and the cost to the economy.

The mean number of days lost from work or school as a result of oral pain in the past six months was two days (95% CI: 1.00 – 3.09), and could translate to about four days lost per person per annum. This estimated figure of four days lost per person per year is much greater than the figure of 1.48 hours lost per person per year reported by Gift et al. (1992), and therefore has a greater implication for the individual, the economy (in the case of work days lost) and academic achievements (in the case of school days lost). A possible explanation for the greater number of days lost in the present study compared to that reported by Gift et al. (1992) could be related to the fact that in South Africa as in similarly lower resourced settings, it could take up to a whole day to get through the queues to access public health services and the treatment recovery may also take a longer time as treatment are more likely to be extraction i.e. an invasive or surgical

intervention (Lesolang, Motloba and Lalloo, 2009). The reason that extraction is the more likely treatment option for most people may be that people report late for treatment (i.e. delay seeking treatment till a more advanced level of the oral disease is experienced) and due to the large number of people seeking care in the public clinics with limited staffing levels, treatment options may be limited. Furthermore, those of lower socio-economic position who pay with cash for treatment perhaps, in private clinics are likely to opt for the cheapest treatment - extraction.

## **6.4 Oral health-related quality of life**

### **6.4.1 Validation of the OHIP structure for the South African adult population**

To the best of the author's knowledge, this is the first time the short version of OHIP has been validated in a South African population using CFA. A 12-item OHIP short version was validated by CFA, a convergent validity test and a discriminant validity test. The two items removed from the original OHIP-14 due to high residual co-variances were "Have you had to interrupt meals because of a problem with your teeth, mouth or dentures?" and "Have you had difficulty doing your usual job because of problems with your teeth, mouth or dentures?" This could suggest that these two items from the disability domain were both perhaps not well-understood or were irrelevant for varying number of participants and thus may need to be reworded if they are to be used in future studies.



The validated OHIP-12 scale derived had excellent internal consistency (0.94), which was higher or comparable to that obtained in most of the other published OHIP validation studies – 0.88 (Kushnir, Zusman and Robinson, 2004; Ravaghi et al., 2010; Slade, 1997a), 0.89 (Saub et al., 2005) and 0.93 (Bae et al., 2007; Ekanayake and Perera, 2003).

This 12-item OHIP scale was therefore used for further analysis in the present study to analyse and interpret the results to achieve the stated objectives of this study. Self-rated oral health was significantly associated with oral pain, which remained significant even in the multivariable-adjusted models. This finding validates the construct of self-rated oral health as used in the present study. Similarly, oral pain, self-rated oral health and self-rated general health were all significantly associated with poorer oral health-related quality of life, which also validates the construct of oral health-related quality of life as operationalized in this study. Furthermore, those with poorer oral health-related quality of life were also significantly more likely to be dissatisfied with life as expected.

#### **6.4.2 *The OHIP***

The prevalence of 16.2% of oral health impacts in the South African adult population is comparable to the 16.5% prevalence obtained in a national population survey of Australians using the OHIP-14 (Sanders et al., 2009), and similar to the 15.3% prevalence reported in a US population survey using the NHANES-OHIP (Sanders et al., 2009), although the mean age of the participants

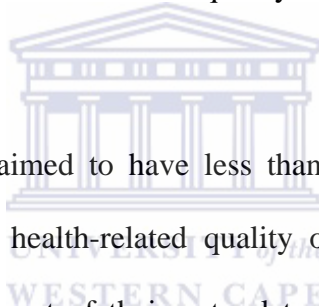
in the current study (36.8 years) was lower than that in the other studies (43 years in the US study and 44 years in the Australian study).

Socio-demographic factors found to be significantly associated with OHIP-12 in the South African population were age, sex and race. Oral health-related quality of life decreased significantly with increasing age in years. Females had poorer oral health-related quality of life than males, which is consistent with the findings of Tsakos et al. (2009).

Race was significantly associated with oral health-related quality of life in this study. In particular the “White” race had significantly better oral health-related quality of life than other race groups. This finding may be due a lifelong exposure to better health care (Charasse-Pouélé and Fournier, 2006), perhaps higher dental IQ, higher value placed on oral health and the fact that the proportion of “Whites” with a medical aid is much higher than that of other races (Gilson and McIntyre, 2007), as the use of a medical aid was also significantly associated with better oral health-related quality of life in the bivariate analysis (Table 22). Furthermore, race was observed to mediate to a large extent the effect of the individual-level socio-economic position on oral health-related quality of life as when the race variable was loaded into the multivariable-adjusted model, the effect of individual-level socio-economic position became non-significant.

The dental-related factors that were found to be associated with oral health-related quality of life in the present study were dental attendance and the number of natural teeth present in the mouth, as well as possession of a medical aid. The

participants who had never been to a dentist were significantly better off than those who had been to a dentist, irrespective of whether they claimed to have been regular attendees or symptomatic attendees at the dental clinic. Perhaps those who reported to be regular attendees visited regularly as a result of a need to visit, due to poorer oral health, or may be visiting because they perceive their oral health as poor. This observed association between dental attendance and oral health-related quality of life suggests that those who have never been to a dental clinic may not have attended because of a lack of a perceived need to attend. This may be a possible explanation as to why they had a significantly lower prevalence of oral pain, and rated their oral health-related quality of life better than those who did attend a dental clinic.



The participants who claimed to have less than half or few natural teeth had significantly worse oral health-related quality of life (OHIP scores) than the participants with all or most of their natural teeth, or those with none of their natural teeth in the bi-variate analysis. This association remained significant in the multivariable-adjusted models. This may be because the loss of teeth is associated with cumulated oral disease that may have had impacts that influence participants' perceptions of their oral health-related quality of life. Having less than half or fewer natural teeth was also significantly associated with the experience of oral pain in the past six months, which could suggest that those with less than half of their teeth may still have some degree of untreated oral disease present that could be compromising their oral health-related quality of life. This finding of poorer OHIP scores associated with a decrease in the number of natural teeth is

consistent with the finding of Steele et al. (2004) in their study on two national samples from the UK and Australia. Furthermore, it is conceivable that those with less than half or few natural teeth are also more likely to have fewer occluding pairs of teeth, which has been demonstrated to be associated with poorer oral health-related quality of life, as few occluding pairs of teeth can result in functional impairment (Tsakos et al., 2006; Ulinski et al., 2013).

It is worth noting that those participants with no natural teeth had similar OHIP scores to those with all or most of their natural teeth in their mouth. Respondents who were completely edentulous were not asked whether they wore dentures, so it is not possible to compare this finding with that of Tsakos et al. (2006), who found that even denture wearers had significantly poorer oral health-related quality of life. Furthermore, the fact that those with no natural teeth in the present study had similar OHIP scores as those with all or most of their natural teeth may be related to the perception by some people that the absence of teeth in the mouth may not be a source of problems. This perception may be of a cultural nature resulting from cultural norms of the community the person belongs to, particularly relevant if being edentulous is relatively common or where removing teeth is considered 'fashionable' as is the case in the so called 'Coloured communities' in South Africa (Friedling & Morris, 2005).

The possession of a medical aid was significantly associated with better OHIP scores. Similarly those who claimed to have paid for their last dental visit via a medical aid (private health insurance) were significantly better off than those who either paid with cash or those who attended free dental care services. This

observation of better perceived oral health outcomes for those with pre-paid dental visits supports the current plan to institute universal health insurance in South Africa, especially if it can be efficiently administered.

As observed with the prevalence of oral pain, employment status was not found to significantly influence the oral health-related quality of life of the individual. However, those participants who receive or have a family member receiving a government welfare grant tended to have poorer oral health-related quality of life than those not receiving a welfare grant. It may imply that it is not so much a fact of whether a person is employed that improves the oral health-related quality of life in this setting, but rather the quality of the employment. It is conceivable that the large number of South Africans who earn relatively low salaries may still not be able to access dental care, particularly if such a low-salaried employed person lives in an area of middle or high socio-economic position where private facilities are more likely to be main source of dental care. Consistent with this view is the observed greater disparity in oral health-related quality of life by area socio-economic position than by individual socio-economic position (Figures 7 and 8).

#### ***6.4.3 Structural equation model of OHIP***

The structure of OHIP was tested in the South African adult population with the assumption that OHIP has a structure based on Locker's oral health model (Locker, 1988), which presumes that disease progresses linearly through impairment (discomfort and functional limitation) to disability and ultimately to a handicap.

The structural equation model analysis demonstrated that the structural path of the five domains in the OHIP model was similar to that of Locker's oral health model for the general adult South African population. However, in the different socio-economic groups this path varied. The structure in the highest area-level and highest individual-level socio-economic position was similar to the original model, which evolved in developed countries, and is therefore likely to share similar socio-economic positions. The pathway from functional limitation to disability was insignificant in the lowest area-level socio-economic position, the lowest individual-level socio-economic position and in the middle individual-level socio-economic position groups, implying that the main pathway to handicap in this group of people is through discomfort, as opposed to functional limitation. It could suggest that people of this less affluent group develop adaptive behaviours in response to functional limitations, and therefore the disease path mainly progresses when significant psychological discomfort is experienced.

The similarity between the OHIP structure in this population and that of the Locker's oral health model is contrary to results reported in recently published studies (Baker et al., 2008; Nuttall et al., 2006). However, the pathway for oral disease in the different socio-economic groups within the population differs, suggesting that some domains provide a more significant path than others in the different groups. This may provide valuable information to be used in oral health service planning in these groups, as the pathway may highlight appropriate service needs within a sub-population. This finding has implications for oral health service planning in the different socio-economic groups.

As previously noted, the path from functional limitation to disability in the lowest socio-economic areas, as well as those of the lowest and middle individual-level socio-economic position is not significant when compared to that in other socio-economic position groups, which may particularly suggest that this group are likely to adapt to the conditions that limit function, and may thus not consider limitation in oral function a significant problem. Therefore only when there is psychological discomfort that the disease in these individuals progresses to cause disability. For this reason, merely addressing presenting physical symptoms that limit function may not be enough for those of low socio-economic position, but the service provider may also need to ensure any intervention eliminates any possible residual psychological discomfort related to the presenting problem. The presentation of the most common oral manifestation of HIV would be most relevant example of this service planning implication, particularly in South Africa that has the highest burden of HIV infection in the world. By contrast, the path from functional limitation to disability in the areas of middle and high socio-economic position, as well as in people with the highest individual-level socio-economic position is significant. This suggests that functional limitation is an important pathway in the progression of oral diseases in these individuals. Therefore intervention at this stage is likely to prevent further serious consequences in these individuals and they are therefore more likely to require curative treatment to restore normal function in order to improve their oral health-related quality of life.

Similarly, the path analysis suggest that those with the highest individual-level socio-economic position and in the highest area-level socio-economic position were also less likely to have oral conditions progressing to handicap than their counterparts with lower socio-economic position levels. It is conceivable that these people are more likely to seek timely help, particularly for preventive treatment, but also for curative treatment of their oral health problems, before the end stage of handicap is reached.

In summary, the present study has shown differences in the structural pattern of OHIP based on individual-level and area-level socio-economic position. The structural patterns observed for the aggregate population and the highest individual-level and area-level socio-economic position are consistent with those found in more resource-rich, developed countries, such as in the UK and Canada, but the structural patterns observed for those of lowest individual-level and area-level socio-economic position differ from those reported in developed countries.

Considering that quality of life is an innately personal assessment that can be influenced by ethnicity/race or culture, it is not surprising that the introduction of race as a variable completely attenuated the influence of individual-level socio-economic position on oral health-related quality of life. It is pertinent to note that the social construct of race in South Africa, in addition to representing underlying differences in cultural beliefs, is strongly related to individuals' socio-economic position and where people live. It is therefore conceivable that, as opposed to other race/ethnic groups, the White population, who are considered to be more than likely in the highest tertile socio-economic position and live in the more



affluent areas, are more likely to prioritize self-actualization (a non-materialistic value orientation) over economic security (materialistic values) in their frame of reference in assessing their quality of life and are perhaps also more conscious of how oral disease influences their quality of life (Inglehart and Bagramian, 2002).

The implications of this argument are two-fold. Firstly, it implies that the impact of pain is likely to be more easily felt by Whites as a functional limitation and/or discomfort, and subsequently as disability and as a handicap.

This may partly explain the observed differences in the structural pattern of OHIP, such that those of the high individual-level and/or area-level socio-economic position had multiple pathways to handicap, but those in the low and middle socio-economic position had a single pathway to handicap. It is indeed possible that those of lower socio-economic position with competing needs may have a different appraisal of the same disease state and may find strategies to cope and adapt to their disease state in such a way that any compromise in normal function is not seen as limiting, except when it becomes so frequent and/or intense that it leads to noticeable discomfort (for instance, facial swelling) and disability (Cimprich and Paterson, 2002). Secondly, it is also more likely that those classified as White and thus those of high socio-economic position, have enough financial resources and greater access to quality dental facilities which enables them to experience pain less often, and consequently report a lower impact on quality of life.

## 6.5 Limitations of this study

This study has a number of limitations that should be taken into account when reading this thesis:

- Study design: The study was a cross sectional study, and therefore may not be able to show causal relationships. For example, oral health-related quality of life may well have influenced the rating of life satisfaction, rather than the reverse, as reported here. Nevertheless, it has been acknowledged that people's psychosocial state (as reflected by their rating of satisfaction with life in general) may influence ratings of oral health impact (Locker et al., 2000).
- Non-sampling error: The study is based on self-report and is therefore dependent on the participants' ability to recall events, which may not be accurate, and may lead to recall bias. In particular, the question on the dental visit pattern may be subject to recall bias if it has been a long time since the participant last made a visit, as the participants may not remember and may therefore claim that they have never been to a dentist/dental clinic before and therefore lead to misclassification. Similarly, the experience of oral pain was self-reported, but to limit the recall bias, the recall period was limited to six months, which gives enough time to have a reasonable positive response and is not too long to compromise on the recall.
- This study did not include any clinical examination of the participants, and thus the oral health self-reported measures are subject to reporting bias.

However, considering that this is likely to occur at random, we do not expect this to significantly influence the conclusions reached in this study.

- The options provided for the frequency / pattern of past dental visit may not have been mutually exclusive, such that a participant may have attended a dental clinic every year as a result of pain or a perceived need to attend and not necessarily for a routine check-up and prophylaxis.
- Lastly, we did not ask for what reason or how far back participants initiated regular visits. “Regular” attendees who rated oral impacts as high as symptomatic attendees did, but rated them lower than “never” visitors, may have been prompted to make regular visits only by oral impacts experienced during the 12-month frame of reference for self-rating oral health impacts in this study. However, regular dental attendance may indeed not actually be associated with reporting fewer oral problems, as previously noted (Crocombe et al., 2012). Consistent with the findings of Crocombe et al. (2012), the apparent negative impact of dental attendance and having lost all/most natural teeth was stronger in the most deprived areas, which may reflect poorer infrastructure (and thus the quality of dental services available) in more deprived areas than in more affluent areas.

## CHAPTER 7

### CONCLUSION AND RECOMMENDATIONS

In this chapter, the key findings are highlighted, and their implications are discussed as they relate to the recommendations made, and suggestions for further research are outlined.

About one out of every five South African adults had experienced oral pain in the past six months, with over a third of them reporting intense or very intense pain. This, taken together with the large estimated direct financial cost of treatment for oral pain episodes alone and the indirect costs in terms of an average of two days lost from work and/or school makes poor oral health a matter that should be seen by policy makers to be of public health importance in South Africa.

The present study is the first known study to validate the OHIP instrument in a South African population using confirmatory factor analysis. It is also the first study to validate the structure of the OHIP using the five domains in different socio-economic groups in a sub-Saharan African country (as an example of a developing country). The findings on the structure validity in the different socio-economic groups suggest that the highest socio-economic groups have a similar structure to that of people in developed countries. In particular, they have multiple pathways that may result in handicap. By contrast, in the lower socio-economic groups, the pathway to handicap mainly manifests through psychological discomfort (and not via functional limitation). This suggests that among the

poorer people and in the less affluent areas, there may be some adaptive capacity which may need further investigation.

The OHIP provided interesting results regarding the association between socio-economic position and oral health-related quality of life. The effect of individual socio-economic position on oral health-related quality of life seems to have to a large extent been mediated by race/ethnicity. This highlights the need for improved access to oral health services for people of all races, possibly through universal health insurance that may provide the historically disadvantaged population greater access to oral health care. Similarly, the differences in reported oral health-related quality of life across areas of different socio-economic position appear to be mainly mediated by differences observed in the burden of oral pain. This finding highlights the need for improved dental care infrastructure particularly in the less affluent areas, not only so as to prevent oral pain, but also to reduce its impact by ensuring quick access to care. Such improved access is likely to reduce the number of poor people who “do nothing” in response to their oral pain experience, and having to endure such pain for long periods, especially if the pain is not self-limiting.

Furthermore, the fact that the inequality gradient was steeper in the areas of highest socio-economic position suggests that there is a need for South Africa’s health policy to be based on “proportionate universalism” and not to focus solely on the low socio-economic areas. This implies that oral health policies should be applied across the country with a scale and intensity proportional to the level of disadvantage, rather than focus only on disadvantaged areas.

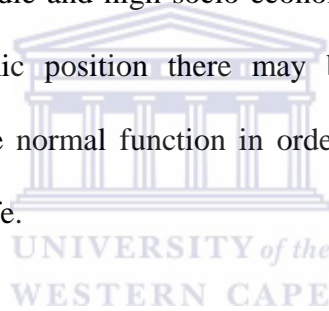
The majority of the South African population (more than half) have never been to a dental clinic. Most people visited the public dental clinic for the relief of oral pain, particularly those of low and middle socio-economic position. Almost half of those who paid in cash for their last dental visit were from the least affluent areas. Of concern, is that those who reported to have made a past dental visit (whether regular and symptomatic attendees) also reported poorer oral health-related quality of life and were more likely to have experienced oral pain than those people who have not visited the dental clinic. This finding needs to be explored further using a longitudinal study to help understand the reason for this association, and also to identify the mechanism through which dental service utilisation may negatively impacts on oral health-related quality of life and the experience of oral pain.



### **7.1 Recommendations**

- The disease burden in a specific area and the level of available resources should be used to determine the appropriate oral health strategy for the specific area.
- There is a need for improved dental care infrastructure particularly in the less affluent areas.
- Oral health policies should be applied across the country with a scale and intensity proportional to the level of disadvantage, rather than focus only on disadvantaged areas. A well-managed universal health insurance may be important to address oral health inequality in a country like South Africa.

- While the need to prevent and treat tooth decay might be universal across all areas there is need for more oral health promotion interventions and a higher number of oral hygiene services in the less affluent areas as compared to the more affluent areas.
- In the areas of low socio-economic position, and individuals of low and middle socio-economic position addressing the presenting physical symptoms that limits function may not be enough, the service provider may also need to ensure that interventions eliminates any possible residual psychological discomfort related to the presenting problem.
- In the areas of middle and high socio-economic position and individuals of high socio-economic position there may be a need for more curative treatment to restore normal function in order to improve their oral health-related quality of life.



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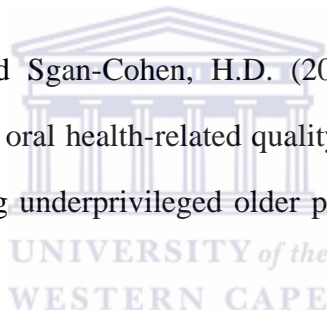
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World Bank 2010

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## APPENDIX A: SASAS 2011 QUESTIONNAIRE

### SOUTH AFRICAN SOCIAL ATTITUDES SURVEY Questionnaire 2: September/October 2011



**RESPONDENTS AGED 16 YEARS +**

Good (morning/afternoon/evening), I'm \_\_\_\_\_ and we are conducting a survey for the Human Sciences Research Council (HSRC). The HSRC regularly conducts surveys of opinion amongst the South African population. Topics include a wide range of social matters such as communications, politics, education, unemployment, the problems of the aged and inter-group relations. As a follow-up to this earlier work, we would like to ask you questions on a variety of subjects that are of national importance. To obtain reliable, scientific information we request that you answer the questions that follow as honestly as possible. Your opinion is important in this research. The area in which you live and you yourself have been selected randomly for the purpose of this survey. The fact that you have been chosen is thus quite coincidental. The information you give to us will be kept confidential. You and your household members will not be identified by name or address in any of the reports we plan to write.

**PARTICULARS OF VISITS**

**DAY  
STARTED**

**MONTH**

**TIME**

**TIME**

**COMPLETED**

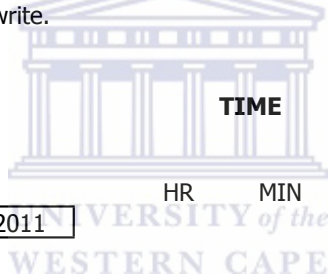
**\*\*RESPONSE**

First visit

/	/	2011
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HR MIN

HR MIN



Second visit	/	/	2011				
Third visit	/	/	2011				

**\*\*RESPONSE CODES**

- Completed questionnaire = 01
- Partially completed questionnaire (specify reason) = 02
- Revisit
- Appointment made = 03
- Selected respondent not at home = 04
- No one home = 05
- Do not qualify
- Vacant house/flat/stand/not a house or flat/demolished = 06
- No person qualifies according to the survey specifications = 07
- Respondent cannot communicate with interviewer because of language = 08
- Respondent is physically/mentally not fit to be interviewed = 09
- Refusals
- Contact person refused = 10
- Interview refused by selected respondent = 11
- Interview refused by parent = 12
- Interview refused by other household member = 13
- OFFICE USE = 14

**STRICTLY CONFIDENTIAL**



UNIVERSITY of the  
WESTERN CAPE



Name of Interviewer .....

Number of interviewer


Checked by

Signature of supervisor \_\_\_\_\_

**FIELDWORK CONTROL**

CONTROL	YES	NO	REMARKS
Personal	1	2	
Telephonic	1	2	
Name	SIGNATURE		
.....	DATE ...../...../.....2011		

**RESPONDENT SELECTION PROCEDURE**

Number of households at visiting point

--	--

Number of persons 16 years and older at visiting point

--	--

Please list all persons at the visiting point/on the stand who are 16 years and older and were resident 15 out of the past 30 days. Once this is completed, use the Kish grid on next page to determine which person is to be interviewed.

Names of Persons Aged 16 and Older	
	01
	02
	03
	04
	05
	06
	07
	08
	09
	10
	11
	12
	13
	14
	15
	16
	17
	18
	19
	20
	21
	22
	23
	24
	25

NAME OF RESPONDENT:
ADDRESS OF RESPONDENT:
.....
.....
TEL NO.:

**GRID TO SELECT RESPONDENT**

NUMBER OF QUESTION-NAIRE				NUMBER OF PERSONS FROM WHICH RESPONDENT MUST BE DRAWN																								
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	26	51	76	1	1	1	3	2	4	1	3	5	8	6	5	12	10	1	6	8	7	19	19	13	21	13	24	25
2	27	52	77	1	2	3	4	3	1	2	2	3	4	8	3	7	2	5	14	4	15	4	8	6	16	14	22	19
3	28	53	78	1	1	2	1	4	2	7	6	9	3	5	11	2	1	3	11	7	10	16	16	10	5	2	2	3
4	29	54	79	1	2	3	2	1	3	5	8	6	2	4	2	4	8	11	10	16	6	9	10	15	11	12	11	18
5	30	55	80	1	1	1	4	5	6	3	5	7	5	9	8	1	3	2	13	5	18	1	4	1	20	11	5	24
6	31	56	81	1	2	2	2	3	5	7	7	8	7	1	4	9	14	8	2	17	17	14	12	14	22	10	3	14
7	32	57	82	1	2	1	1	4	1	4	1	4	6	3	6	5	7	13	9	2	3	13	14	8	2	7	20	4
8	33	58	83	1	1	2	3	2	5	1	4	2	1	7	10	6	5	4	15	10	5	2	13	4	17	5	17	8
9	34	59	84	1	1	3	2	5	6	2	2	1	9	10	1	10	4	6	6	1	9	10	1	5	6	9	1	12
10	35	60	85	1	2	2	4	1	3	3	6	9	10	11	12	3	9	15	7	8	11	6	3	9	4	3	10	1
11	36	61	86	1	1	1	3	1	4	5	3	1	6	2	9	13	11	14	4	11	4	15	15	17	1	1	23	2
12	37	62	87	1	2	3	1	3	2	7	5	6	5	7	7	8	6	10	3	3	1	12	20	7	13	22	12	16
13	38	63	88	1	1	2	1	5	3	6	4	3	4	6	2	11	13	12	1	15	8	7	2	12	15	21	13	7
14	39	64	89	1	2	3	2	4	1	4	7	8	2	5	6	11	12	9	16	13	16	11	18	18	14	16	18	23
15	40	65	90	1	2	1	4	2	4	3	8	7	7	11	1	3	5	7	12	14	13	8	17	20	19	20	19	11
16	41	66	91	1	1	3	3	1	6	5	1	5	9	10	3	2	11	13	8	12	12	5	6	21	8	8	4	15
17	42	67	92	1	1	2	2	3	4	2	6	2	3	2	12	5	2	10	13	5	8	18	9	16	10	17	16	20
18	43	68	93	1	2	1	4	2	6	4	1	4	8	9	10	7	9	3	12	12	9	7	20	19	9	19	21	13
19	44	69	94	1	2	2	1	3	5	2	8	9	10	4	9	8	13	1	1	14	10	19	10	11	18	15	7	6
20	45	70	95	1	1	3	2	5	4	1	3	8	1	3	8	6	6	9	5	7	13	4	15	1	7	22	15	21
21	46	71	96	1	1	1	2	5	1	7	2	3	2	1	11	4	7	5	3	2	1	3	12	18	5	19	14	9
22	47	72	97	1	2	1	3	1	3	2	6	2	1	8	7	1	4	2	11	8	2	17	4	17	21	16	3	5
23	48	73	98	1	2	3	4	2	2	6	7	7	8	3	4	9	3	6	2	11	11	16	2	8	11	23	6	22
24	49	74	99	1	1	2	1	4	6	3	5	5	3	1	5	13	1	14	8	14	6	15	9	14	3	6	9	17
25	50	75	100	1	1	2	3	3	2	4	6	4	7	5	3	12	12	12	4	6	2	17	11	2	12	4	8	10

**SASAS QUESTIONNAIRE 1: 2011**

Number of persons in this household

Number of persons 16 years and older in this household


**INTERVIEWER: PLEASE CIRCLE APPROPRIATE CODES**

<b>Household schedule</b>					

<b>Population Group</b>
1 = Black African
2 = Coloured
3 = Indian or Asian
4 = White
5 = Other (specify)

<b>Relationship to respondent codes</b>
1 = Respondent
2 = Wife or husband or partner
3 = Son/daughter/stepchild/adopted child
4 = Father/mother/ step father/step mother
5 = Brother/sister/step brother/step sister
6 = Grandchild/great grandchild
7 = Grandparent/great grandparent
8 = Mother- or father-in-law
9 = Son- or daughter-in-law
10 = Brother- or sister-in-law
11 = Other relation (e.g. aunt/uncle)
12 = Non-relation

## HEALTH (ISSP 2011)

I would now like to ask you some questions about your health and health care in South Africa in general.

**170. In general, would you say your health is ... [This refers to both physical and mental health]**

Excellent	Very good	Good	Fair	Poor	(Can't choose)
1	2	3	4	5	8

**174. Are you covered by a medical aid or medical benefit scheme or other private health insurance?**

Yes	1
No	2

→ Skip to Q. 176

## ORAL HEALTH

**184. How would you rate your Oral health?**

Very Good	Good	Neither nor	Poor	Very Poor
1	2	3	4	5

**185. In the past, have you had to delay dental care or treatment because of the cost?**

Yes	1
No	2

**186. How many of your natural teeth do you have in your mouth?**

All my teeth	Most of my teeth (more than Half)	About half of my teeth	Few teeth (less than half)	None of my teeth
1	2	3	4	5

**In the past 12 months how often have you experienced the following? [Showcard 29]**

192.						
193.						
194.						
195.						
196.						
197.						
198.						
199.						
200.						
201.						
202.						
203.						
204.						
205.						



**206. How often do you visit a dentist or dental clinic?**

Only when in pain	1
At least every 6 months	2
At least once a year	3
At least once every 2 years	4
Whenever needed	5
Never visited a dentist or dental clinic	6
(Don't know)	8

→ Skip to Q.211

**207. What was the main reason for your last dental visit? (Mark only one)**

Emotional discomfort (moody, irritable)	1
Unable to socialize as usual	2
Unable to perform normal daily tasks	3
Unable to open my mouth	4
Unable to eat	5
Unable to sleep	6
Unable to talk	7
Unable to drink cold or sweet things	8
Unable to drink both cold and hot things	9

**208. If you were not satisfied with your last dental services, why not? (Select the most appropriate)**

I was actually very satisfied / satisfied	01
I had to wait for a long time to see the dentist	02
I had to wait for a long time to get an appointment date	03
The staff were rude/ unfriendly	04
The staff did not look professional	05
The treatment was too expensive	06
I was not involved with the treatment decisions	07
The treatment was too painful	08
The clinic was dirty and/or untidy	09
None of the above (specify reason)	10
(Do not know / Can't choose)	11

**209. How did you pay for your last visit to the dental clinic? (Mark only one answer)**

I paid the complete cost through my medical aid	1
I paid part through my medical aid and part from my pocket	2
I paid with cash to collect a refund from my medical aid later	3
I paid with cash	4
I paid with credit card / loan	5
I did not pay, the treatment was free	6
I cannot remember	7
I did not visit the dentist	8

**210. Did you have to do without any essential basic needs to enable you pay for your last dental visit (such as food, rent)?**

Yes	1
No	2
(Don't know)	8

**211. In the past 6 months have you had any pain from the following in your mouth/jaw? (all that is applicable to you) (Number of pain episodes)**

	Yes	No	How many episodes did you experience in the past 6 months?
a) Teeth	1	2	
b) Gums	1	2	
c) Denture (False teeth)	1	2	
d) Sores around the mouth	1	2	
e) Jaw joint (In front of the ears)	1	2	

**FIELDWORKER: IF NO TO ALL OPTIONS IN Q.212, PLEASE SKIP TO QUESTION 218.**

**212. What problems did you have from the last dental (oral) pain episode you had with your teeth, mouth or denture? (Mark all that is applicable to you)**

a) Unable to eat / bite / chew	1
b) Unable to sleep	2
c) Unable to drink cold or sweet things	3
d) Unable to perform normal daily tasks (unable to carry out your major work / role)	4
e) Unable to talk /speak	5
f) Unable to socialize as usual (e.g. go out, visit family or friends or shop)	6
g) Emotional discomfort (moody, irritable, easily upset)	7

**213. How would you rate the intensity of your last oral pain episode?**

Very mild	Mild	Moderate	Intense	Very Intense
1	2	3	4	5

**214. What did you do / where did you go to for your last pain episode with your teeth, dentures or mouth? [FIELDWORKER: MULTIPLE RESPONSE]**

a)	Never had a painful dental episode before	1
b)	Visited a Private dental clinic	2
c)	Visited a Government dental clinic	3
d)	Visited a Nurse / GP / Hospital	4
e)	Visited a traditional healer	5
f)	Used self medication / pharmacist	6
g)	Used home remedies	7
h)	Did not do anything	8

**215. For how long did you experience your last pain episode for each of the following?**

	Weeks	Days
a) Teeth		
b) Gums		
c) Denture (False teeth)		
d) Sores around the mouth		
e) Jaw joint (In front of the ears)		
f) Other		

**216. How much did the last pain episode with your teeth, gums, or mouth cost you?**

**Cost (R)**


**217. How many days in total did you miss from work, college or school in the past 6 months due to oral pain and / or a visit to the dental clinic?**

Number of days I had to miss work/school/college/university	.....days
I did not have to miss work/school/college/university	997
(Can't answer)	998
(Not applicable: I do not work or go to school/college/university)	999

**FIELDWORKER: PLEASE ASK QUESTION 218 FOR ALL RESPONDENTS**

**218. Do you intend to visit the dental clinic within the next 12 months for a preventive oral health visit, check up and/or cleaning?**

Yes	1	→	Skip to Q.220
No	2		
(Not sure)	8	→	Skip to Q.220

**219. If not, why not? What is the most important thing stopping you? (Mark only the most applicable one)**

No need to go to the dentist / nothing wrong with my teeth, I do not see the point in going to the dentist	01
I cannot afford to pay the fees	02
Only private dentist available	03
No dentist near by	04
I cannot get the time to go	05
I am afraid of going to the dentists	06
I keep forgetting	07
It's difficult to get to / from the dentist	08
I've had a bad experience with a dentist	09
I'm too embarrassed to go to the dentist	10
None of these reasons	11
Other reason (specify)	12



**VOTING**

**220. Some people don't vote nowadays for one reason or another. Did you vote in the last national election in 2009?**

Yes, I did vote	1	Answer Q.221
No, I did not vote	2	→ Skip to Q.222
I was not eligible to vote in the last election	3	→ Skip to Q.222

**221. For which party did you vote in the last national election, which was held in 2009?**

**FIELDWORKER: DO NOT READ OUT OPTIONS. PLEASE CIRCLE ONE OPTION ONLY**

African Christian Democratic Party (ACDP)	01
African National Congress (ANC)	02
Azania People's Organisation (AZAPO)	03
Democratic Party / Alliance (DA/DP)	04
Freedom Front Plus / Vryheidsfront Plus (FF+/VF+)	05
Independent Democrats (ID)	06
Inkatha Freedom Party (IFP)	07
Minority Front (MF)	08
Pan-Africanist Congress (PAC)	09
United Christian Democratic Party (UCDP)	10
United Democratic Movement (UDM)	11
Congress of the People (COPE)	12
Other (specify) .....	13
Did not vote	14
Uncertain	15
(Refuse to answer)	97
(Do not know)	98

**RESPONDENT CHARACTERISTICS**

**222. Sex of respondent [copy from contact sheet]**

Male	1
Female	2

**223. Race of respondent [copy from contact sheet]**

Black African	1
Coloured	2
Indian/Asian	3
White	4
Other	5

**224. Age of respondent in completed years [copy from contact sheet]**

Years (Don't know) = 998

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**225. Do you have a spouse/partner and if yes, do you share the same household?**

Yes, I have a spouse/partner and we live in the same household	1
Yes, I have a spouse/partner but we don't live in the same household	2
No spouse/partner	3
(Refused)	9

**226. What is your current marital status?**

Married (customary only)	1
Married (civil only)	2
Married (both customary and civil)	3
Separated from spouse/civil partner	4
Divorced from spouse/civil partner	5
Widowed/civil partner died	6
Never married/never in civil partnership	7
(Refused to answer)	8
(Don't know)	9

**227. What is the highest level of education that you have ever completed?**

No schooling	00
Grade 0/Grade R	01
Sub A/Grade 1	02
Sub B/Grade 2	03
Grade 3/Standard 1	04
Grade 4/Standard 2	05
Grade 5/Standard 3	06
Grade 6/Standard 4	07
Grade 7/Standard 5	08
Grade 8/Standard 6/Form 1	09
Grade 9/Standard 7/Form 2	10
Grade 10/Standard 8/Form 3	11
Grade 11/Standard 9/Form 4	12
Grade 12/Standard 10/Form 5/Matric	13
NTC I	14
NTC II	15
NTC III	16
Diploma/certificate with less than Grade 12/Std 10	17
Diploma/certificate with Grade 12/Std 10	18
Degree	19
Postgraduate degree or diploma	20
Other, specify	21
(Do not know)	98

**228. How many years of full time education have you completed?**

**FIELDWORKER: INCLUDE ALL PRIMARY AND SECONDARY SCHOOLING, UNIVERSITY AND OTHER POST-SECONDARY EDUCATION, AND FULL-TIME VOCATIONAL TRAINING, BUT DO NOT INCLUDE REPEATED YEARS. IF RESPONDENT IS CURRENTLY IN EDUCATION, COUNT THE NUMBER OF YEARS COMPLETED SO FAR.**

--	--

years

(No formal schooling) = 00 (Don't know) = 98

**229. Are you a citizen of South Africa?**

Yes	1
No	2
(Do not know)	8

**230. What language do you speak mostly at home?**

Sesotho	01
Setswana	02
Sepedi	03
Siswati	04
IsiNdebele	05
IsiXhosa	06
IsiZulu	07
Xitsonga	08
Tshivenda/Lemba	09
Afrikaans	10
English	11
Other African language	12
European language	13
Indian language	14
Other (specify) .....	15

**231. Are you currently working for pay, did you work for pay in the past, or have you never been in paid work?**

I am currently in paid work	01	→ Ask Q.232
I am currently not in paid work but I had paid work in the past	02	→ Skip to Q.233
I never had paid work	03	→ Skip to Q.242
No answer	08	

**232. How many hours, on average, do you usually work for pay in a normal week, including overtime?**

			Hours
--	--	--	-------

96 hours or more	96
(Do not know)	98

**233. Are/were you an employee, self-employed or working for your own family's business? (Refer to your main job)**

An employee	1	→ Skip to Q.237
Self-employed without employees	2	→ Skip to Q.237
Self-employed with employees	3	
Working for your own family's business	4	→ Skip to Q.237
(No answer)	9	
NAP (Never had a work)	0	

**234. How many employees do/did you have, not including yourself?**

			employees
--	--	--	-----------

9995 employees or more	9995
(No answer)	9999
(Not applicable)	0000

**235. Do/did you supervise other employees?**

**FIELDWORKER: IF NOT CURRENTLY EMPLOYED, ASK FOR MOST RECENT JOB**

Yes	1
No	2
(Don't know)	8
(No answer)	9
(Not applicable - never had a job)	0

→ Skip to Q.237

**236. How many other employees do/did you supervise?**

			employees
--	--	--	-----------

9995 employees or more	9995
(No answer)	9999
(Not applicable)	0000

**237. Do/did you work for a for profit organisation or for a non-profit organisation?**

**FIELDWORKER: CIRCLE ONE RESPONSE. IF NOT CURRENTLY EMPLOYED, ASK FOR MOST RECENT JOB**

For-profit organisation	1
Non-profit organisation	2
(Don't know)	8
(No answer)	9
(Not applicable – never had a job)	0

**238. Do/did you work for a public or private employer?**

**FIELDWORKER: CIRCLE ONE RESPONSE. IF NOT CURRENTLY EMPLOYED, ASK FOR MOST RECENT JOB**

Public employer	1
Private employer	2
(Don't know)	8
(No answer)	9
(Not applicable – never had a job)	0

**239. What is your current occupation (the name or title of your main job)?**

**FIELDWORKER: WRITE DOWN RESPONSE IF NOT CURRENTLY EMPLOYED, ASK FOR MOST RECENT JOB**

(Refused to answer)	97	
(Don't know, inadequately described)	98	
(Not applicable – never had a job)	99	

**240. What kind of activities do you do most of the time (In your main job)?**

**FIELDWORKER: WRITE DOWN RESPONSE IF NOT CURRENTLY EMPLOYED, ASK FOR MOST RECENT JOB**

_____		
(Refused to answer)		97
(Don't know, inadequately described)		98
(Not applicable – never had a job)		99

**241. What does the firm/organisation you work for mainly make or do – what kind of production/function is performed at your workplace?**

**FIELDWORKER: IF RESPONDENT WORKED FOR MORE THAN ONE EMPLOYER, OR IF HE/SHE IS BOTH EMPLOYED AND SELF-EMPLOYED, PLEASE REFER TO THE MAIN JOB. IF HE/SHE IS RETIRED OR NOT CURRENTLY EMPLOYED, ASK FOR MOST RECENT JOB**

_____		
(Refused to answer)		97
(Don't know, inadequately described)		98
(Not applicable – never had a job)		99

**242. What is your current employment status? (Which of the following best describes your present work situation?)**

Employed full time	01
Employed part time	02
Employed less than part time (casual work/piecework)	03
Temporarily sick	04
Unemployed, not looking for work	05
Unemployed, looking for work	06
Pensioner (aged/retired)	07
Permanently sick or disabled	08
Housewife, not working at all, not looking for work	09
Housewife, looking for work	10
Student/learner	11
Other (specify) .....	12

**243. If you are married or have a partner, is he or she currently working for pay, did he/she work for pay in the past, or has he/she never been in paid work?**

Currently in paid work	1	→ Ask Q.244
Currently not in paid work, paid work in the past	2	→ Skip to Q.245
Never had paid work	3	→ Skip to Q.250
Not applicable (No partner)	0	→ Skip to Q.251

**244. How many hours, on average, does your spouse /partner usually work for pay in a normal week, including overtime?**

			Hours
--	--	--	-------

96 hours or more	96
(Do not know)	98
(No answer)	99
(Not applicable - not currently working)	00

**245. Is/was your spouse/partner an employee, self-employed, or working for his/her own family's business?**

An employee	1
Self-employed without employees	2
Self-employed with employees	3
Working for your own family's business	4
(No answer)	9
(Not applicable - Never had a job)	0

**246. Does/did your spouse/partner supervise other employees?**

**FIELDWORKER: IF NOT CURRENTLY EMPLOYED, ASK FOR MOST RECENT JOB**

Yes	1
No	2
(Don't know)	8
(No answer)	9
(Not applicable - never had a job)	0

**247. What is /was your spouse's/partner's occupation (the name or title of your main job)?**

**FIELDWORKER: WRITE DOWN RESPONSE IF NOT CURRENTLY EMPLOYED, ASK FOR MOST RECENT JOB**

(Refused to answer)	97	
(Don't know, inadequately described)	98	
(Not applicable – never had a job)	99	

**248. In his/her main job, what kind of activities does/did he/she do most of the time (in the main job)?**

**FIELDWORKER: WRITE DOWN RESPONSE IF NOT CURRENTLY EMPLOYED, ASK FOR MOST RECENT JOB**

(Refused to answer)	97	
(Don't know, inadequately described)	98	
(Not applicable – never had a job)	99	

**249. What does/did the firm/organisation he/she work/worked for mainly make or do – what kind of production/function is /was performed at his/her workplace?**

**FIELDWORKER: IF SPOUSE/PARTNER WORKED FOR MORE THAN ONE EMPLOYER, OR IF HE/SHE IS BOTH EMPLOYED AND SELF-EMPLOYED, PLEASE REFER TO THE MAIN JOB. IF HE/SHE IS RETIRED OR NOT CURRENTLY EMPLOYED, ASK FOR MOST RECENT MAIN JOB**

(Refused to answer)		97
(Don't know, inadequately described)		98
(Not applicable – never had a job)		99

**250. Which of the following best describes your spouse's / partner's current situation?**

In paid employment	1
Unemployed and looking for a job	2
In education (student / learner)	3
Apprentice or trainee	4
Permanently sick or disabled	5
Pensioner / retired	6
Domestic work (looking after the household)	7
In community service	8
Other (specify) .....	9

**251. Are you or have you ever been a paid-up member of a Trade Union?**

Yes, I am currently a member	1
Yes, previously but not currently	2
No, never a member	3
(Refused)	7

**252. Do you consider yourself as belonging to any religion?**

Yes	1
No	2

→ Skip to Q.255

**253. If answer is yes, which one? Please specify denomination**

Christian (without specification)	01
African Evangelical Church	02
Anglican	03
Assembles of God	04
Apostle Twelve	05
Baptist	06
Dutch Reformed	07
Full Gospel Church of God	08
Faith Mission	09
Church of God and Saints of Christ	10
Jehovah's Witness	11
Lutheran	12
Methodist	13
Pentecostal Holiness Church	14
Roman Catholic	15
Salvation Army	16
Seventh Day Adventist	17
St John's Apostolic	18
United Congregation Church	19
Universal Church of God	20
Nazareth	21
Zionist Christian Church	22
Other Christian	23
Islam / Muslim	24
Judaism / Jewish	25
Hinduism / Hindu	26
Buddhism / Buddhist	27
Other (specify)	28
(Refused)	97
(Don't know)	98
(Not answered)	99

**254. Apart from special occasions such as weddings, funerals and baptisms, how often do you attend religious services or meetings?**

Several times a week or more often	01
Once a week	02
2 or 3 times a month	03
Once a month	04
Several times a year	05
Once a year	06
Less frequently than once a year	07
Never	08
(Refused)	97
(Do not know)	98
(No answer)	99



**255. Do you or anyone in this household receive any of the following Welfare grants?**

Old Age Grant	1
Child Support Grant	2
Disability Grant	3
Care dependency grant	4
Foster care grant	5
Grant in aid	6
No-one in household receiving any benefits	9
(Refused to answer)	97
(Don't know)	98

**256. How satisfied are you with your life as a whole these days? [Showcard 2]**

Very satisfied	1
Satisfied	2
Neither nor	3
Dissatisfied	4
Very dissatisfied	5
(Do not know)	8

**257. Would you say that you and your family are...**

Wealthy	1
Very comfortable	2
Reasonably comfortable	3
Just getting along	4
Poor	5
Very poor	6

**258. People sometimes describe themselves as belonging to the working class, the middle class, or the upper or lower class. Would you describe yourself as belonging to the...?**

Lower class	1
Working class	2
Middle class	3
Upper middle class	4
Upper class	5
(Don't know)	8

**259. In our society, there are groups which tend to be towards the top and groups which tend to be towards the bottom. Below is a scale that runs from the top to the bottom. Where would you put yourself on this scale?**

TOP .....	10
	9
	8
	7
	6
	5
	4
	3
	2
BOTTOM ....	1

## HOUSEHOLD CHARACTERISTICS

### 260. Indicate the type of main dwelling that the household occupies?

Dwelling/House or brick structure on a separate stand or yard or on farm	01
Traditional dwelling/ Hut/ Structure made of traditional materials	02
Flat or apartment in a block of flats	03
Town/cluster/semi-detached house (simplex, duplex or triplex)	04
Unit in retirement village	05
Dwelling/House/Flat/room in backyard	06
Informal dwelling/Shack in backyard	07
Informal dwelling/Shack not in backyard, e.g. in an informal/squatter settlement or on farm	08
Room/Flatlet	09
Caravan/Tent	10
Other, specify	11

### 261. How satisfied are you with your accommodation? [Showcard 2]

Very satisfied	1
Fairly satisfied	2
Neither satisfied nor dissatisfied	3
Slightly dissatisfied	4
Very dissatisfied	5
(Do not know)	8

### 262. Would you describe the state of repair of your home as good, adequate or poor?

Good	1
Adequate	2
Poor	3
(Do not know)	8

### 263. Do you have any of the following problems with your accommodation?

[FIELDWORKER: MULTIPLE RESPONSES]

Shortage of space	1
Too dark, not enough light	2
Lack of adequate heating	3
Leaky roof	4
Damp walls, floors, foundations, etc.	5
Damaged or broken windows or doors	6
Other (specify)	7
None of these problems with accommodation	8

### 264. Has your health or the health of anyone in your household been made worse by your housing situation?

Yes	01
No	02

**265. What is the most often used source of drinking water by this household?**

**FIELDWORKER: PLEASE CIRCLE ONE NUMBER ONLY**

Piped tap water in dwelling-metered	01
Piped tap water in dwelling-pre-paid meter	02
Piped tap water on site/yard-meter	03
Piped tap water on site/yard-pre-paid meter	04
Piped tap water on site/yard-no meter	05
Public/communal tap – Free	06
Public/communal tap – Paid	07
Neighbour – Free	08
Neighbour – Paid for	09
Water carrier/tanker	10
Water carrier/tanker on site / communal	11
Borehole on site	12
Borehole off site/communal	13
Rainwater tank on site	14
Flowing river/stream	15
Dam/pool	16
Stagnant pond	17
Well	18
Spring	19
Other, specify	20

**266. What type of toilet facility is available for this household?**

**FIELDWORKER: PLEASE CIRCLE ONE NUMBER ONLY**

Flush toilet connected to a municipal sewage system	01
Flush toilet connected to a septic tank	02
Chemical toilet	03
Pit latrine with ventilation pipe (long drop)	04
Pit latrine without ventilation pipe (long drop)	05
Bucket toilet	06
Other, specify .....	07
None	08
(Do not know)	98

**→ Skip to Q.268**

**267. Where is this toilet facility located?**

In dwelling	1
On site (In yard)	2
Off site (out side yard)	3



**PERSONAL AND HOUSEHOLD INCOME**

**294. Please consider the income of all household members and any income which may be received by the household as a whole. What is the main source of income in your household?**

Salaries and/or wages	1
Remittances	2
Pensions and/or grants	3
Sale of farm products and services	4
Other non-farm income	5
No income	6
(Refused to answer)	7
(Don't know)	8

**SHOWCARD G2**

**295. Please give me the letter that best describes the TOTAL MONTHLY HOUSEHOLD INCOME of all the people in your household before tax and other deductions. Please include all sources of income i.e. salaries, pensions, income from investment, etc.**

**296. Please give me the letter that best describes your PERSONAL TOTAL MONTHLY INCOME before tax and other deductions. Please include all sources of income i.e. salaries, pensions, income from investment, etc.**

		<b>295. Household</b>	<b>296. Personal</b>
	No income	01	01
<b>K</b>	R1 – R500	02	02
<b>L</b>	R501 –R750	03	03
<b>M</b>	R751 – R1 000	04	04
<b>N</b>	R1 001-R1 500	05	05
<b>O</b>	R1 501 – R2 000	06	06
<b>P</b>	R2 001 – R3 000	07	07
<b>Q</b>	R3 001 – R5 000	08	08
<b>R</b>	R5 001 – R7 500	09	09
<b>S</b>	R7 501 – R10 000	10	10
<b>T</b>	R10 001 – R15 000	11	11
<b>U</b>	R15 001 – R20 000	12	12
<b>V</b>	R20 001 – R30 000	13	13
<b>W</b>	R30 001 – R50 000	14	14
<b>X</b>	R 50 001 +	15	15
	(Refuse to answer)	97	97
	(Uncertain/Don't know)	98	98

**297. What was your household's total expenditure in the past month? This would include expenses on all items.**

**FIELDWORKER: IF 'DO NOT KNOW' OR 'REFUSE', SHOW THE HOUSEHOLD EXPENDITURE CATEGORIES, AND FILL IN THE CORRECT CODE IN THE SPACE PROVIDED**

Amount (In Rands)	(Don't Know)	(Refuse)
<b>R</b>	<b>8</b>	<b>9</b>


**THANK YOU FOR YOUR COOPERATION**

## APPENDIX B: ETHICAL CLEARANCE



### Office of the Deputy Dean Postgraduate Studies and Research

Faculty of Dentistry & WHO Collaborating Centre for Oral Health

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UNIVERSITY OF THE WESTERN CAPE

Private Bag X1, Tygerberg 7505

Cape Town

Date: 04<sup>th</sup> March 2011

Dear Dr I Ayo-Yusuf ,

**STUDY PROJECT:** Socio-economic burden of oral pain in South African adults: implications for service planning

**PROJECT REGISTRATION NUMBER:** 11/1/48

**ETHICS:** Approved

At a meeting of the Senate Research Committee held on Friday 4<sup>th</sup> February 2011 the above project was approved. This project is therefore now registered and you can proceed with the work. Please quote the above-mentioned project title and registration number in all further correspondence. Please carefully read the Standards and Guidance for Researchers below before carrying out your study.

Patients participating in a research project at the Tygerberg and Mitchells Plain Oral Health Centres will not be treated free of charge as the Provincial Administration of the Western Cape does not support research financially.

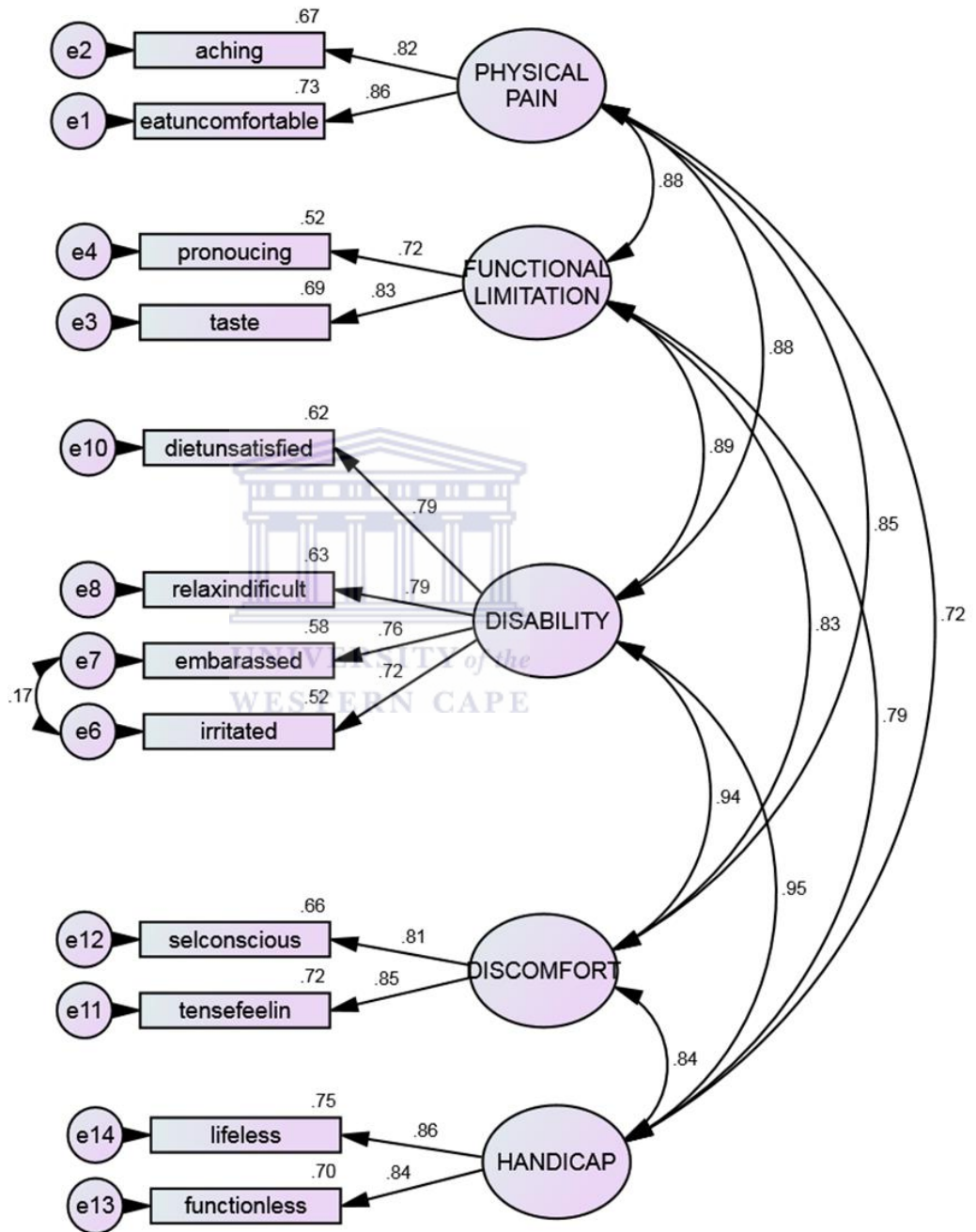
Due to the heavy workload auxiliary staff of the Oral Health Centres cannot offer assistance with research projects.

Yours sincerely

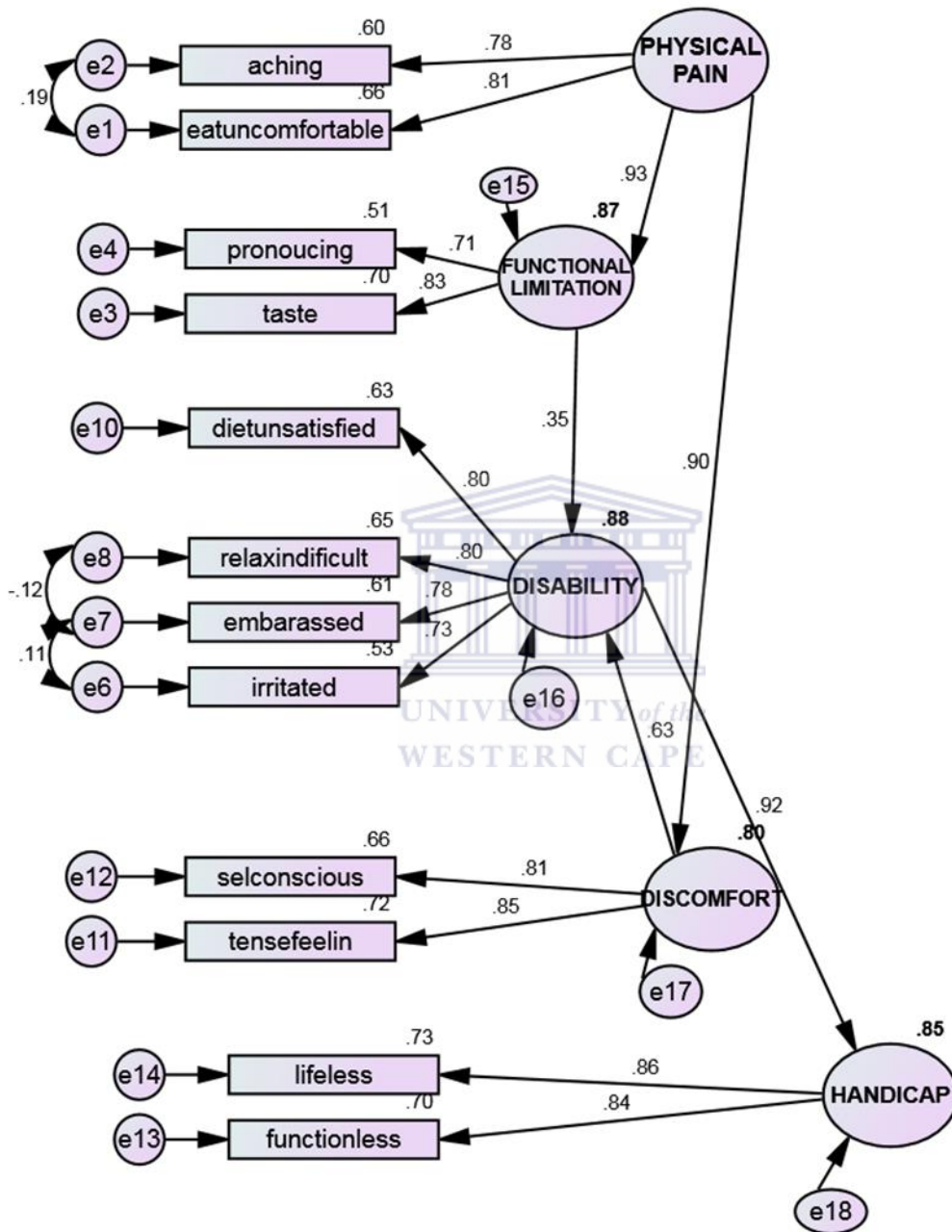
Professor Sudeshni Naidoo

## APPENDIX C: SEM OUTPUT

### Confirmatory factor analysis of OHIP-12

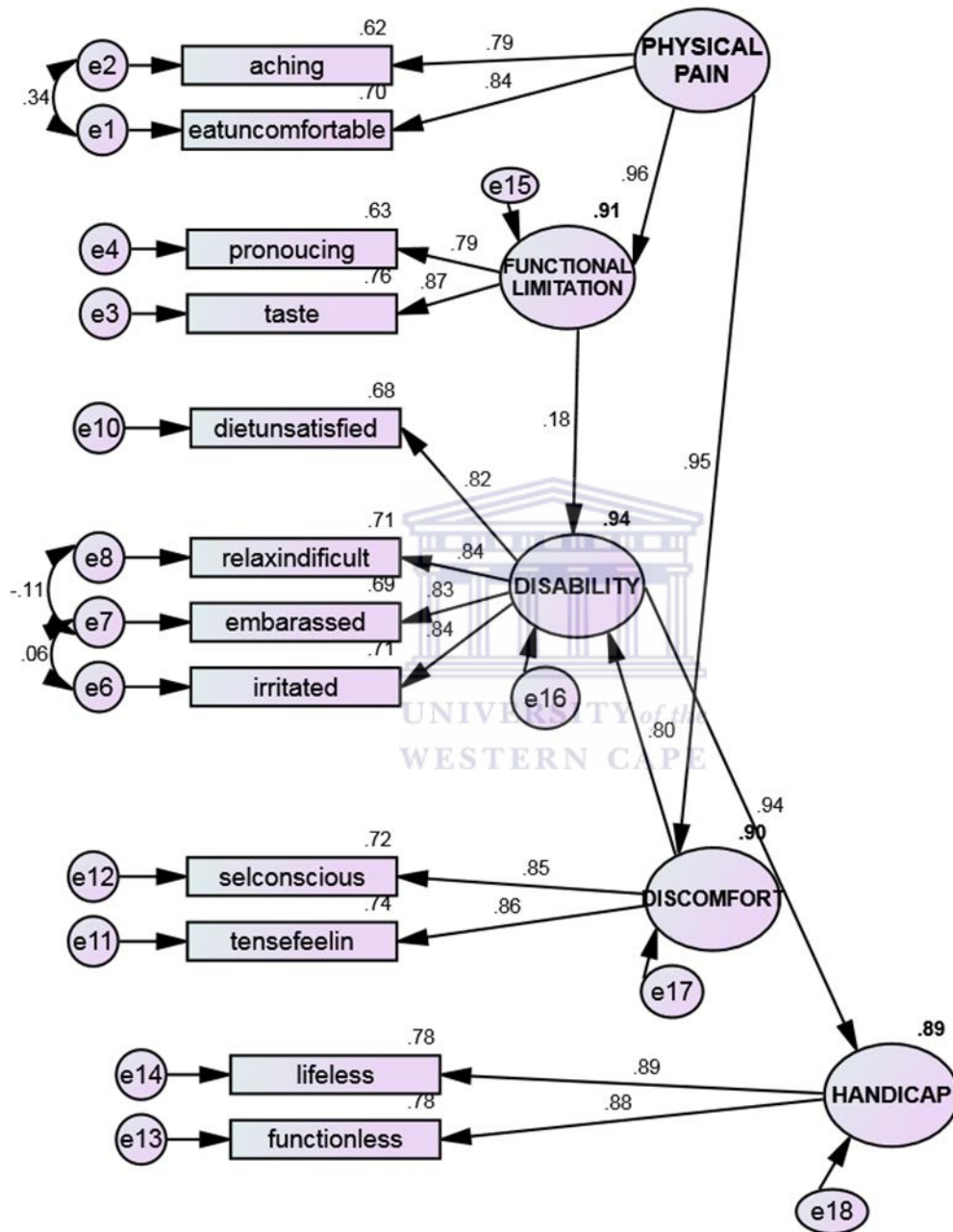


## Structural validity of OHIP12 in South African adults

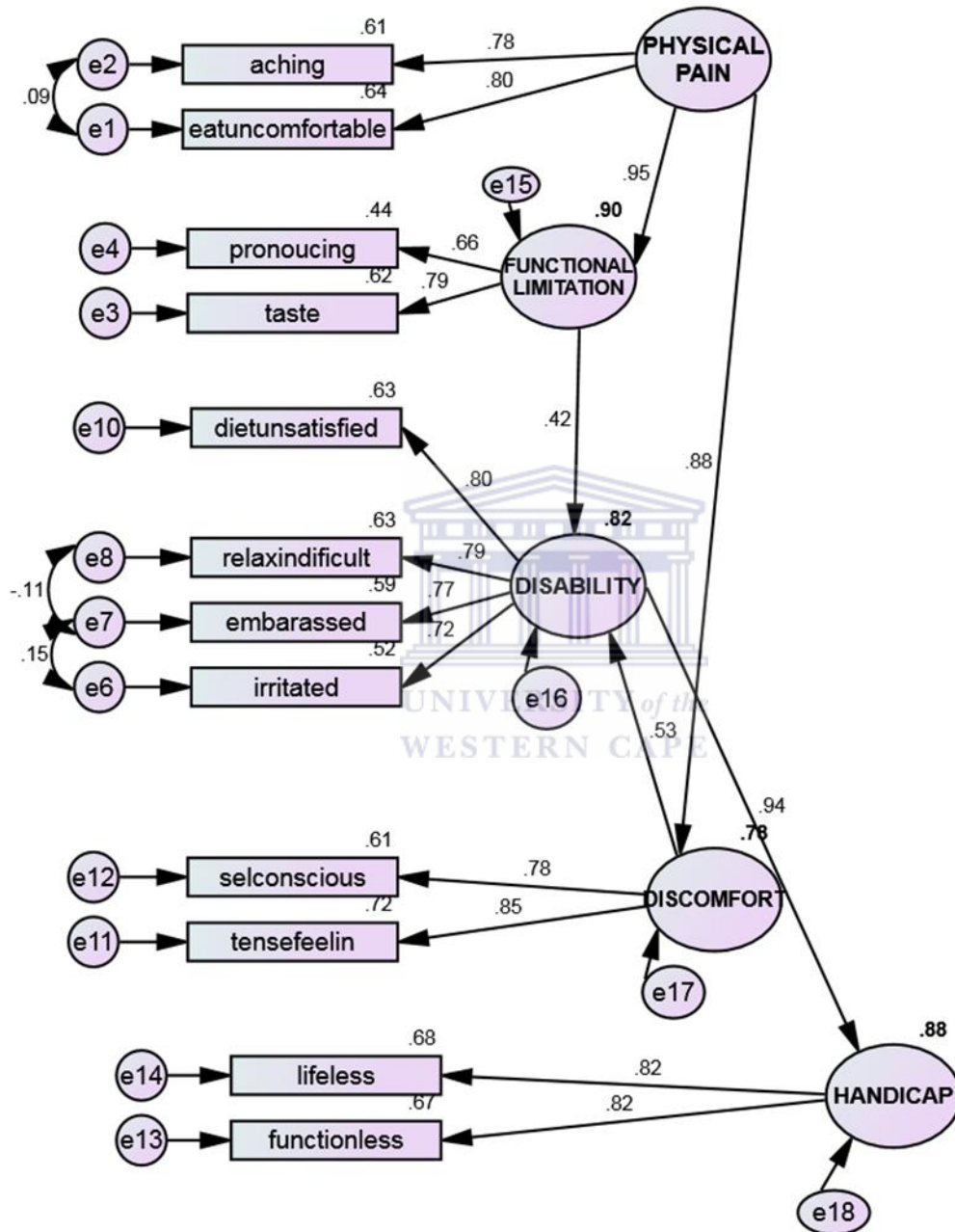




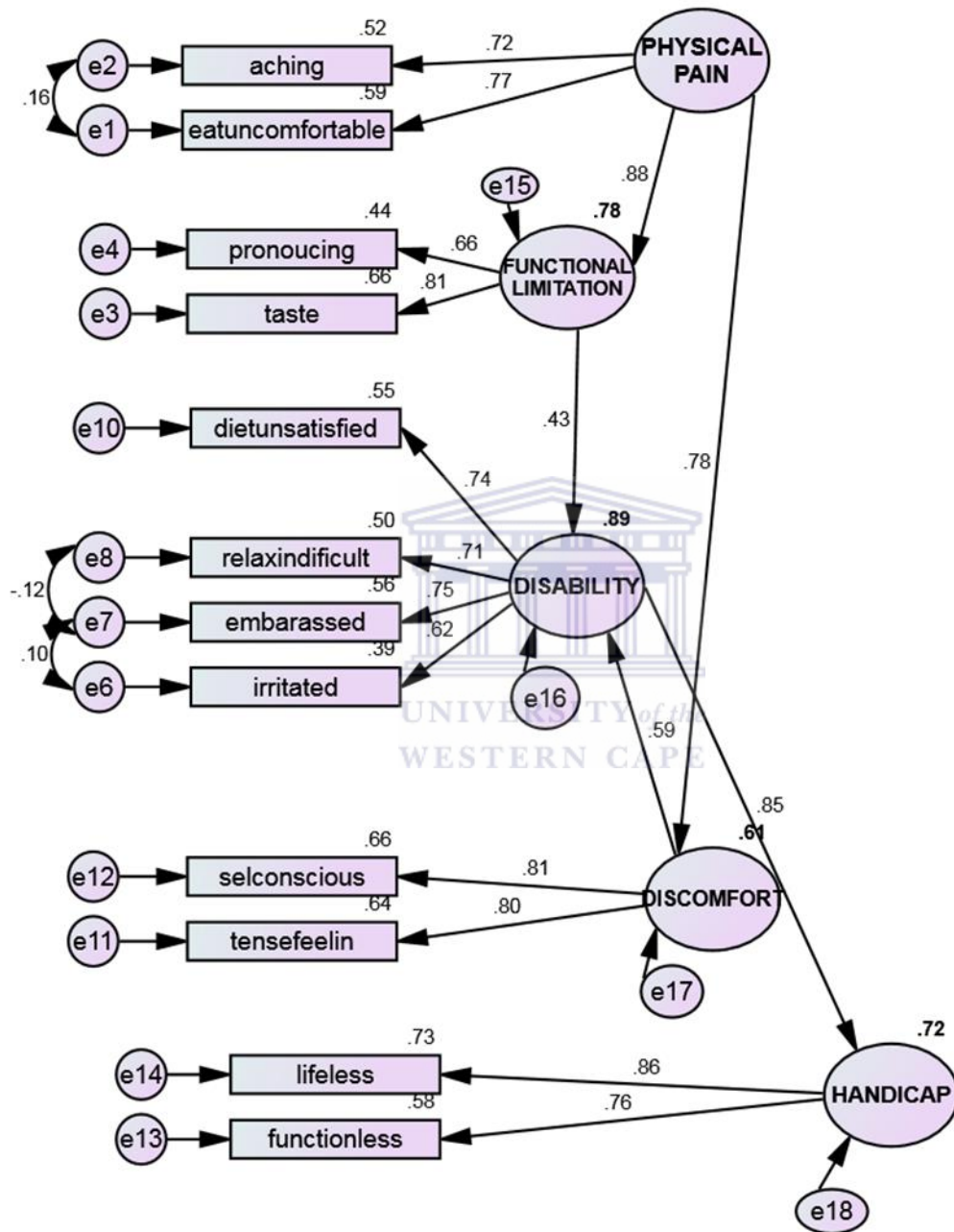
## Lowest area-level socio-economic position model



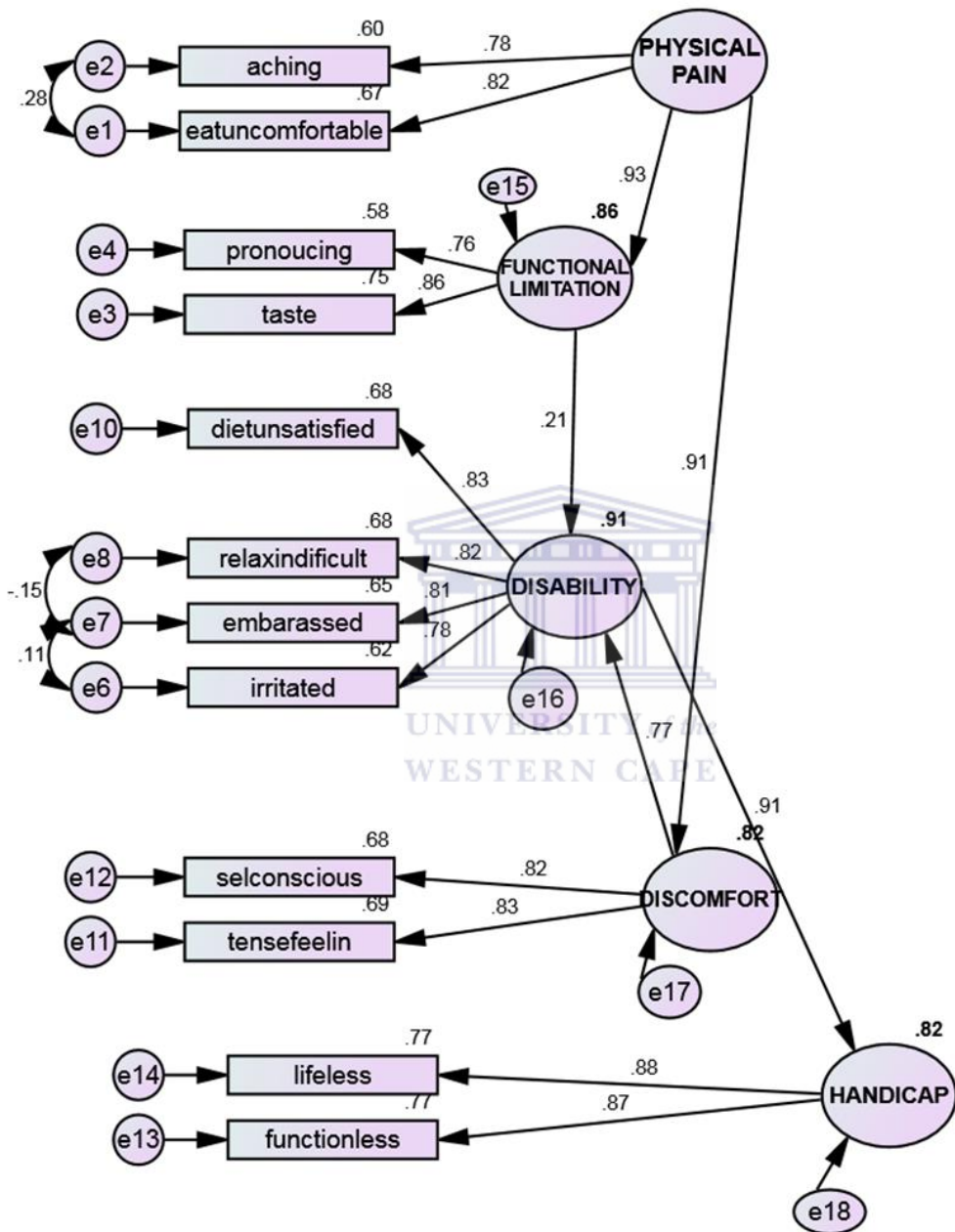
## Middle area-level socio-economic position model



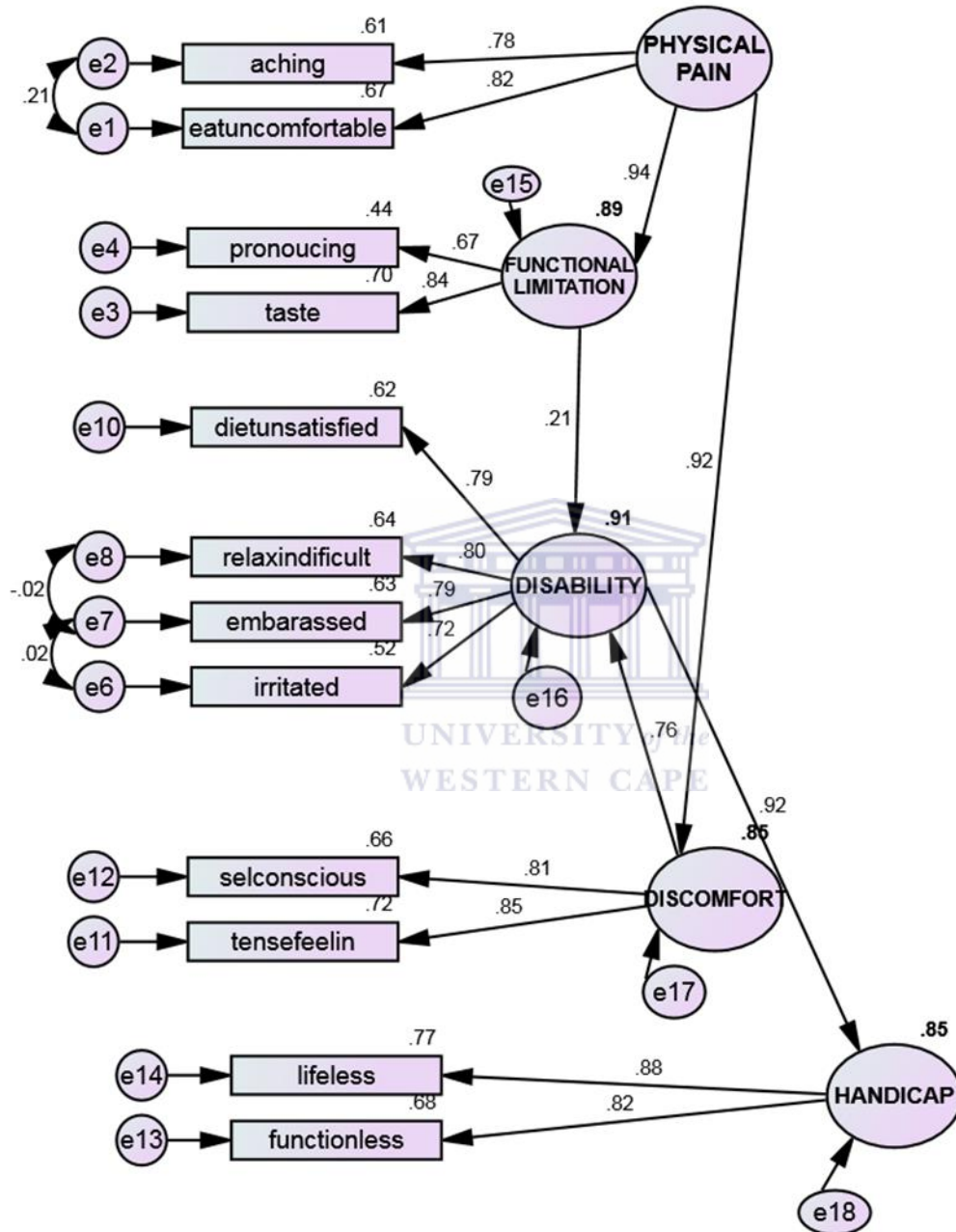
## Highest area-level socio-economic position model



### Lowest individual-level socio-economic position model



## Middle individual-level socio-economic position model



## Highest individual-level socio-economic position model

