

Family functioning and chronic periodontitis in Outer North East
London

by

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In fulfilment of the requirements for the degree of

Doctor of Philosophy in Epidemiology and Dental Public Health

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Abstract

Background: This study assumes that while all families are unique, families share common tasks that must be fulfilled as part of their functioning and the definition of whether the family process is functional or not is specific and may be unique to the family and is dependent upon what the family perceives as being normal, while considering cycle demands, resources and socio cultural influences.

Objectives: To explore the role of family functioning in chronic periodontitis.

Methods: The Outer North East London (ONEL) Oral Health Needs Assessments collected data in a representative sample of 2,343 adults aged 16-65 and 1,174 children 3-4 years old in 2009-10. Data were collected through home visits by trained dentists and interviewers, and included dental clinical examinations and answers to questionnaires. Family function in the domains general functioning, problem solving, communication, roles, affective responsiveness, affective involvement and behaviour control was assessed using the Family Assessment Device (FAD) Epstein et al., 1983). Chronic periodontitis was defined as having at least one interproximal site with pocket depth of 4 mm or more.

Results: Chronic periodontitis was associated with family functioning in the domains general functioning (odds ratio:0.45; 95%CI: 0.25-0.84), communication (odds ratio: 0.55 95%CI: 0.30-0.98), affective involvement (odds ratio:0.56; 95%CI: 0.34-0.94), affective responsiveness (odds ratio:0.47; 95%CI: 0.26-0.81) and behaviour control (odds ratio:0.40 95%CI: 0.22-0.74) after adjustment for ethnicity and socioeconomic position (NS-SEC). However, after adjusting for oral health related behaviour (tobacco consumption and plaque score) only the domain of general functioning (odds ratio: 0.51

95%CI: 0.27-0.97) affective responsiveness (odds ratio 0.52; 95%CI: 0.29-0.92) and behaviour control (odds ratio 0.46; 95 CI: 0.25-0.83) remained significantly associated with chronic periodontitis.

Family functioning domains general functioning, communication, affective involvement, affective responsiveness and behaviour control also potentially partially mediates the relationship between socioeconomic position and chronic periodontitis experience.

Conclusion:

Efficient family functioning in the domains of general functioning, affective responsiveness and behaviour control may act as protective factors against chronic periodontitis.

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1. Introduction

Periodontitis can be defined as “an inflammatory disease of the supporting tissues of the teeth caused by microorganisms or groups of specific microorganisms resulting in progressive destruction of the periodontal ligament and alveolar bone with pocket formation, recession or both” (Carranza, 2006).

There have been many classifications of the different clinical manifestations of periodontitis in the past 20 years; however, the 1999 International Workshop for Classification of Periodontal Disease, concluded that forms of periodontitis are divided into three main groups based on specific aetiological formulation. The three groups are: chronic periodontitis, aggressive periodontitis and periodontitis as a manifestation of systemic disease (Armitage, 2004). This study will focus on chronic periodontitis as it is one of the most common forms of periodontitis and one of the most prevalent diseases throughout the world (Armitage, 2004). Chronic periodontitis has also been found to have an impact on an individual in terms of perceived oral health, functional limitation, physical pain, psychological discomfort, physical and psychological disabilities (Ng and Leung, 2006).

Data on the prevalence of chronic periodontitis are dependent on how the disease is defined and the age group from which they were taken. General population studies have shown that some 5% to 20% of any population is said to suffer from severe, generalized chronic periodontitis, while mild to moderate chronic periodontitis affects a majority of adults (Burt, 2005b). The 2009 United Kingdom Adult Dental Health Survey (ADHS) defined chronic periodontitis in terms of pocket depth (White et al., 2011). The ADHS reported that 45 per cent of adults had periodontal pocketing exceeding 4mm,

although for the majority (37%) disease was moderate with pocketing not exceeding 6mm (White et al., 2011). In the United States 30% to 50% of all adults were reported to have the mild and moderate forms of chronic periodontitis, while the severe generalized form was found to affect 5% to 15% of all adults (Burt, 2005a). Chronic periodontitis is also said to have even higher prevalence in developing countries, with considerable global variation (Pihlstrom et al., 2005).

Chronic periodontitis is a common form of destructive periodontal disease in adults. While its epidemiology, biological and behavioural risk factors have been extensively investigated (Albandar 2002, Albandar & Rams 2002, Burt 2005), a significant proportion of the variation in the occurrence of chronic periodontitis cannot be explained by taking only these factors into account (Marcenes and Sheiham, 1992). The host response is now seen as a key factor in the clinical expression of chronic periodontitis, with only some 20% of periodontal diseases now attributed to bacterial variance (Page et al., 1997). Chronic periodontitis, viewed for years as primarily the outcome of infection, is now seen as resulting from a complex interplay between bacterial infection and host response, often modified by behavioural factors.

In exploring the role of host response in chronic periodontitis, it is important first to look at the potential effect of the social environment on disease aetiology so as to elucidate whether there are any particular classes of or patterns in environmental factors that are capable of modifying host response, thus making certain individuals more or less susceptible to chronic periodontitis (Cassel, 1995). In this context, epidemiological studies looking at distal determinants have postulated that periodontal disease in general (and chronic periodontitis in particular), like other chronic disease, is socially patterned: health in populations follows a social gradient, being better at the top of the

social gradient, and getting worse as one goes down the social scale (Sheiham and Nicolau, 2005).

Psychosocial factors such as stress, marital conflict or lack of social support (Merchant et al., 2003) have also been known not only to affect the behavioural responses of the host, such as hygiene behaviour and smoking (Sheiham & Nicolau, 2000) but also to modulate the host's susceptibility to chronic periodontitis via neural and endocrine systems (Genco et al., 1998). Therefore, factors within the social environment which may provoke changes in the host's defences and modify health behaviour should be investigated.

However, to stop at that would be to assume that factors such as social class or stress are invariant and affect the host response of all individuals in the same manner, rather than idiosyncratic, affecting each individual differently depending on his personality, resource availability, interpretation of the situation and coping abilities (Cassel, 1995).

This concept can be further explained by Antanovsky's salutogenic theory which answers why people stay well in spite of stressful situations and hardship (Lindstram and Eriksson, 2005). Salutogenesis, meaning the origin of health, is a stress-resource orientated concept, which focuses on resources, and movement towards health. Antanovsky observed that, while stress is ubiquitous, not all individuals have negative health outcomes in response to stress. Instead, some people achieve health despite their exposure to potentially disabling stress factors. The salutogenic model proposes that the goal of health research should be to identify, define, and describe pathways, factors, and causes of this positive health, in addition to increasing our understanding of health risks (Becker et al., 2009). One core salutogenic concept is that which refers to the generalised resistance resources (GRRs). GRRs are biological, material or

psychosocial factors which make it easier for people to understand and structure their lives. When people have resources available to them, there is a better chance they will be able to deal with the challenges of life (Lindstram & Errikson, 2005). The family is recognised as an important resource for health: ideally a family should provide an environment that allows for the social, psychological and biological development and maintenance of its individual members (Epstein et al., 2003).

The family, the locus of a person's social activity and one of the most basic social institutions which forms an individual's social environment, has been postulated as an important explanatory component of the psychosocial pathway, by producing profound effects on host susceptibility to disease (Cassel, 1976). Family functioning, which is the manner in which members communicate with each other, solve problems, and fulfil their roles and responsibilities, shapes this environment and in turn impacts on emotional and physical health (Epstein et al., 2003).

The major pathways by which family and family functioning can influence health are through direct biological pathways (i.e infectious disease, shared genes); behavioural pathways (i.e shared lifestyle); and psycho-physiological pathways (i.e cognition and emotions resulting in physiological responses) (Campbell, 2003).

Previous studies looking at families and chronic periodontitis utilizing family indicators such as marital status and marital quality found that, while being married may afford a degree of protection against chronic periodontitis, it is not marriage *per se* but the quality or functioning of the marriage that affects the outcome of chronic periodontitis (Marcenes and Sheiham, 1996). Therefore, the next logical step is to explore families in a more comprehensive manner by investigating the role of the different dimensions of family functioning in the psychosocial pathway of chronic periodontitis experience.

To date, no study explicitly investigating the association between the different dimensions of family functioning and chronic periodontitis has been undertaken. However, related studies looking at marital quality (Marcenes and Sheiham, 1996) exist to support the assumption that processes within the family are associated with chronic periodontitis experience.

This study adopts a positive approach to chronic periodontitis, by assessing the different domains within family functioning which may act as protective factors in the psychosocial pathway of chronic periodontitis experience, by comparison with previous studies which have concentrated on finding risk factors for periodontitis or isolated associations such as the effects of marital status on periodontitis.

2. Literature Review

2.1 Introduction

First, the literature review will discuss the current classification and case definition of chronic periodontitis used in population-based studies of risk factors. Second, there will be a brief review of the physiological process of chronic periodontitis. Third, there will be a review of the aetiological factors associated with chronic periodontitis. The review will include demographic, socio-economic, behavioural and psychosocial factors affecting chronic periodontitis, with an emphasis on families and family functioning.

2.2 Classification of chronic periodontitis

The International Workshop for a Classification of Periodontal Diseases and Conditions 1999 agreed upon a classification system for periodontitis. The classification divided periodontitis into three main groups, based on specific aetiological reasons, chronic periodontitis, periodontitis as a manifestation of systemic disease and aggressive periodontitis (Armitage, 2000). The term 'chronic periodontitis' was to replace the term 'adult periodontitis' used in the 1989 classification because, while chronic periodontitis is recognized as the most frequently occurring form of periodontitis in adults, it was also present in adolescents and children. The American Academy of Periodontology (AAP) defined chronic periodontitis as an infectious disease resulting in inflammation within the supporting tissues of the teeth, progressive attachment and bone loss, characterized by pocket formation or recession of the gingivae. The rate of disease progression for chronic periodontitis can be modified by local factors, systemic diseases and extrinsic factors such as smoking (Armitage, 2000)

Definition of chronic periodontitis is a fundamental requirement for population-based research into periodontitis. However until now, proper case definitions have been a challenge, hitherto without a satisfying solution (Meisel and Kocher, 2009). The absence of consensus on how best to define periodontitis continues to hamper clinical and epidemiological research (Burt, 2005b). Heterogeneity of case definitions affects comparison of the results of other studies and leads to overestimation or underestimation of disease prevalence (Costa et al., 2009).

A systematic review of definitions of periodontitis and methods used to identify periodontitis found that only 15 out of 104 relevant publications actually gave a quantitative definition of periodontitis; and amongst these 15 there was heterogeneity in terms of indices used and areas of mouth surveyed (Savage et al., 2009). The systematic review also concluded that the studies reviewed utilized a minimum diagnostic threshold, at a given site in terms of clinical loss of attachment of 2mm and periodontal pocket depth of 3mm (Savage et al., 2009). This lack of uniformity is due to the use of different diagnostic criteria with different threshold points for definition of periodontitis.

The Group C consensus of the 5th European workshop in Periodontology (Tonetti and Claffey, 2005) reported that one of the most important issues that impacted on data interpretation was the definition of periodontitis. The report not only suggests that attachment loss should be the primary outcome used in risk factor based periodontitis studies but also that additional measurements such as periodontal pocket depth measurement must be included. Although clinical attachment loss is considered the gold standard measurement for disease severity and progression the use of clinical attachment loss alone would result in an overestimation of disease as

some attachment loss could be due to non inflammatory causes (Page and Eke, 2007a) or past disease.

Meanwhile, the Periodontal Disease Surveillance Workgroup of the Division of Oral Health at the Centre for Disease Control proposed criteria for definition of severe periodontitis where severe periodontitis is defined as having 2 or more interproximal sites with clinical attachment loss of 6mm or more and at least one interproximal site with a pocket depth of 5mm or more. Moderate periodontitis is defined as having at least 2 or more interproximal sites with clinical attachment loss of 4mm or more or 2 or more interproximal sites with pocket depth of 5mm or more. The rationale behind clinical attachment loss and pocket depth combinations is that clinical attachment loss represents a cumulative measure of periodontal tissue destruction throughout life, whereas pocket depth indicates the presence of active disease.

While it is recommended that a uniform case definition is used for prevalence surveys to allow for comparability of data between populations, a population or hypothesis specific case definition will be more suitable for association or hypothesis testing studies (Dhingra and Vandana, 2011). Some studies have utilized combinations of pocket depth and clinical attachment level, with the rationale being that this combination represents cumulative tissue destruction (clinical attachment level) and a measure of current disease (pocket depth) (Dhingra and Vandana, 2011). This is valid for clinical prospective studies. By contrast, studies adopting a cross-sectional design must focus only on current disease otherwise a spurious association may be identified.

From a public health point of view, it is important to include mild and incipient cases of periodontitis in a definition of periodontitis as this category of disease is more responsive to routine clinical preventive care and personal oral hygiene practices to

prevent and control periodontitis, and is critical to predicting populations at risk for developing mild, moderate to severe disease (Eke et al., 2012). As such a risk association or hypothesis testing study of periodontitis should utilize a case definition that includes the whole spectrum of severity of the disease from mild to moderate to severe rather than utilizing a definition that only captures certain severity levels.

Pocket depth measurement represents a measure of current chronic periodontitis as opposed to clinical loss of attachment which is a better measure of accumulative periodontal destruction over a lifetime (National Health Service, 2011). Past disease cannot be correlated to current exposure to a risk or protective factor. In addition, pocket depth measurements are clinically important since they provide a useful overall assessment of the depth of periodontal pockets, which are the principal habitats of periodontal pathogens. Also, pocket depth measurements can be rapidly recorded and give a good assessment of the distribution of periodontal problems within a given patient and, as such, are considered to be an essential component of a complete periodontal examination (AAP Position Paper, 2003)

Hujoel, et al. (2005) in their paper 'Abnormal pocket depth and gingival recession as distinct phenotypes' outlined that there are two distinct clinical conditions of alveolar bone loss: periodontal atrophy, where the gums retain a healthy aspect and are quite free of pain and inflammation, and yet will gradually recede; and destructive periodontal disease, with the presence of deepened periodontal pockets and underlying bone loss. Currently, both conditions are often labeled as chronic periodontitis, as defined by attachment loss, and are therefore considered as a disease. Hujoel, et al. (2005) not only raise the question of the merit of classifying both clinical conditions, which have distinct aetiologies and different prognoses, as one disease but also of the validity of periodontal atrophy as a disease altogether. Given that attachment loss is almost

universal after the age of 30 (based on a national representative sample of the United States population) and that attachment loss increases with ageing (Albandar et al., 1999) it may be logical to assume the possibility that periodontal atrophy is a normal age-related process (Hujuel et al., 2005b). As such, clinical probing depth, or pocketing, may be the most obvious marker for diagnosis of destructive periodontal disease or chronic periodontitis: it is simple to determine, it is a clinical measure used worldwide, it is predictive of tooth loss and deepened pockets have been considered the cardinal measure of destructive periodontal disease or chronic periodontitis for centuries (Page and Schroeder, 1982).

Furthermore, the issue of comparability of data must be addressed. The latest UK Adult Dental Health Survey (ADHS) undertaken in 2009 recorded pocket depths. The presence of pocketing up to 3.5mm was regarded as generally healthy; pockets deeper than this were recorded to give an indication of disease and were reported starting at the threshold of 4mm. Any attachment loss was only recorded in adults over the age of 55.

Taking all these factors into consideration, the case definition of chronic periodontitis in this study utilizes the pocket depth measurement as a diagnostic marker and is characterized by the presence of at least one site with periodontal pocket depth of \geq 4mm. Measures of interproximal sites were used because the disease usually begins and is most severe at interproximal sites and also minimizes the effects of gingival recession on the accuracy of pocket depth measurement (Page and Eke, 2007b).

2.3 Pathogenesis of chronic periodontitis

Chronic periodontitis is a complex disease in which disease expression involves interactions between biofilms with the host immune-inflammatory response and

subsequent alterations in bone and connective tissue homeostasis (Tatakis and Kumar, 2005). Chronic periodontitis is a bacterially induced chronic inflammatory disease that destroys the connective tissue and bone that supports teeth (Kornman, 2008). A critical development in the understanding of periodontal microbiology was the concept of biofilms, which are matrix-enclosed complex bacterial communities that form in aqueous environments where there is a regular nutrient source. The biofilm acts as a protection to the individual bacterium, making it highly resistant to killing by phagocytosis (or also by antimicrobial drugs) (Preshaw et al., 2004).

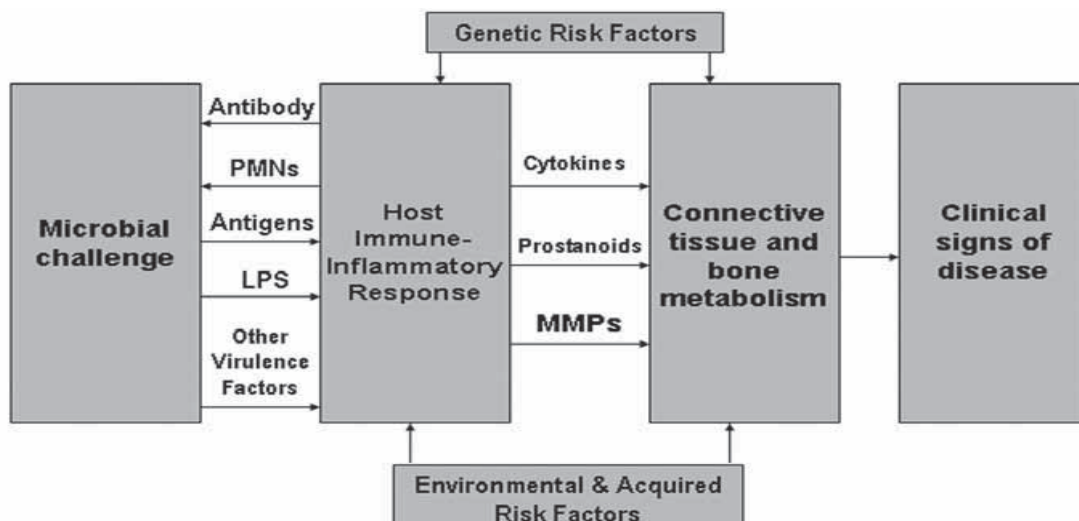
Realization of the importance of plaque biofilms led to the Environmental Plaque Hypothesis which suggests that the entire subgingival microbial environment is the important determinant of the role of bacteria in the development of disease (Haffajee et al., 1991). More than 500 bacterial species have been identified as being able to colonize a periodontal pocket but, of these, only 20–30 are considered to be pathogenic, suggesting that a susceptible host is an essential prerequisite for periodontitis to develop and pathogenic species must develop in sufficiently high quantities within the subgingival plaque biofilm (Preshaw et al., 2004).

The accumulation of plaque with bacteria in the gingival sulcus results in the release of microbial substances (such as lipopolysaccharide – LPS, microbial peptides) which cross the junctional epithelium and enter the gingival connective tissues (Preshaw et al., 2004) stimulating cells to produce inflammatory mediators resulting in an inflammatory response which causes vasodilation. This then leads to accumulation of fluid and cells in the tissues, and the gingiva become erythematous and oedematous (Preshaw et al., 2004). In the early stages of the gingival inflammation, neutrophils predominate and initiate the disease, and bacterial antigens that cross the junctional epithelium drive the inflammatory process.

In those individuals who are susceptible to periodontitis, the microbial challenge is not contained by the primary host defences, leading to proliferation of the junctional epithelium which becomes increasingly permeable and ulcerates, accelerating the ingress of bacterial products, accumulation of matrix metalloproteinases (MMPs), including collagenases, which break down collagen fibres in the gingival and periodontal tissues, disrupting the normal anatomy of the gingival tissues, resulting in destruction of the periodontal ligament (PDL). As the inflammation extends apically, osteoclasts are stimulated to resorb alveolar bone to create yet more space for the continuing inflammatory cell infiltrate (Preshaw et al., 2004).

Therefore, while bacteria are essential for chronic periodontitis to occur, they are insufficient to cause disease without a susceptible host. The majority of periodontal breakdown (bone loss, attachment loss) is caused by host-derived destructive enzymes and inflammatory mediators (prostaglandins, interleukins) that are released during the inflammatory response (Preshaw et al., 2004). In other words, bacteria initiate disease, but the key destructive events in periodontitis are caused by host derived mediators and enzymes released by inflammatory cells (Preshaw et al., 2004).

Figure 2. 1 The pathogenesis of chronic periodontitis (Page et al., 1997)



2.4 Demographic factors

2.4.1 Age

Chronic periodontitis manifested by the prevalence and severity of clinical loss of periodontal attachment is invariably related to age, where greater clinical loss of attachment is seen in the elderly (Morris et al., 2001, Burt, 2005b). However, given the accumulative and non-reversible nature of clinical loss of attachment, this association has to be interpreted with caution. Current knowledge proposes that this association reflects the accumulation of lifetime disease rather than being an age-specific condition (Page, 1984, Burt, 1994, Machtie et al., 1994) because, while there may be a pronounced effect of increasing attachment loss with age, the effect on pocket depth appears to be minimal (Albandar, 2002). In addition, the association between age and prevalence and severity of chronic periodontitis appears to be influenced by oral hygiene condition. The estimated incidence of chronic periodontitis throughout all age groups, is much higher among subjects with poor oral hygiene than among those with good oral hygiene, thus leading to the conclusion that the effect of age on the progression of periodontitis could therefore be considered negligible when good oral hygiene is maintained (Abdellatif and Burt, 1987). Further evidence which also takes into consideration the effects of confounding factors to ageing such as socio-economic condition, oral health behaviour and capacity is needed to elucidate the true association between ageing and chronic periodontitis.

2.4.2 Gender

Gender is significantly associated with chronic periodontitis, where chronic periodontitis is more prevalent in males than in females (Paper, 2005, Burt, 2005b, Shiau and Reynolds, 2010a). Gender differences in the development of chronic periodontitis can

be attributed to different exposures to modifiable environmental risk factors (Burt, 2005b) (such as oral hygiene habits, and smoking) and to a gender dimorphism in susceptibility to chronic periodontitis (Shiau and Reynolds, 2010b). A systematic review exploring the biological basis of the gender differences concluded that differential gene regulation, particularly in sex steroid responsive genes, may contribute to this dimorphism (Shiau and Reynolds, 2010b). This suggests that being male represents an immutable risk factor for chronic periodontitis, rather than just reflecting the presence of associated modifiable risk factors. A systematic review found that gender accounted for a 9% difference in chronic periodontitis prevalence between males and females. A meta-analysis undertaken within the same review also showed males to have a higher prevalence than females ($d=0.19$; 95%CI, 0.16-0.22; $P\text{-value}=,0.0001$) (Shiau and Reynolds, 2010a). However, differences in prevalence of chronic periodontitis between males and females are similar regardless of disease severity thresholds, contrary to the hypothesis that males are at greater risk of rapid periodontal destruction than females (Shiau and Reynolds, 2010a).

2.4.3 Ethnicity

Ethnicity has been found to be related to chronic periodontitis (Borrell et al., 2005). No national study looking at ethnicity and periodontal disease in the UK population was found, however smaller studies (Newton et al., 1999) looking at ethnicity and oral health in general suggest that adults from minority ethnic groups may have better oral health than the wider UK population. By contrast, evidence from studies done in the USA shows a general trend for people from ethnic minorities to have poorer oral health as compared to the predominant White population (Sabbah et al., 2009). In the United States, Blacks exhibited the highest prevalence of periodontitis followed by Mexican-Americans and Whites (Borrell et al., 2005). Subjects of African ethnicity seem to have

the highest prevalence of periodontitis, followed by Hispanics and Asians (Albandar and Rams, 2002). Mixed ethnicity groups of African-Americans were suggested to have a higher prevalence of chronic periodontitis as compared to Asian-American or Hispanics. However, it was suggested that the ethnic differences in chronic periodontitis experience may not be a representation of true genetic differences, but rather that this association may be confounded by socio-economic factors which influence cultural and ethnic practices and traits (Craig et al., 2001, Burt, 2005b).

2.5 The Socio-economic factor

2.5.1 Individual-based Socio-economic deprivation

Social gradients exist in most common chronic diseases (Marmot, 2003) including chronic periodontitis (Sheiham and Nicolau, 2005). People with lower socio-economic status, regardless of their race or ethnicity, are more likely to have chronic periodontitis than those of their peers who have higher socio-economic status (Borrell et al., 2002).

Low income is associated with higher odds of having chronic periodontitis, independent of area-based socio-economic circumstances (Borrell et al., 2006). However, it is important also to note that inequality in the prevalence and severity of periodontal disease according to social class may be related mainly to health behaviour, such as oral cleanliness and smoking. Belonging to a high social class was associated with cleaning the teeth more effectively and frequently, and with using more oral hygiene aids than those of low social class (Watt and Sheiham, 1999). This was evidenced from a systematic review which concluded that, while lower socio-economic status was associated with chronic periodontitis, the association appeared to be less important when smoking was included in the analysis (Klinge and Norlund, 2005).

2.6 Psychosocial factors

2.6.1 Marital status

The association between marital status and chronic periodontitis is unclear. Studies looking at this association have produced conflicting results: some studies have suggested that marital status may have limited impact on chronic periodontitis experience (Persson et al., 2004, Sabbah et al., 2011) while others have concluded otherwise and marital status is seen as significantly associated with outcomes for chronic periodontitis (Croucher et al., 1997). Married couples have also been shown to exhibit a similar distribution of chronic periodontitis (Persson et al., 2004). The explanatory pathway by which marital status affects chronic periodontitis experience may be related to the clustering effect whereby married couples have been found to exhibit similar social habits and similar perceptions of oral health and thus to experience similar patterns of periodontitis (Persson, 2006). The biological plausibility of this association can also be supported by the theory of transmission of infection, whereby the transmission of *Actinobacillus actinomycetemcomitans* and *P. gingivalis* between spouses is possible (Asikainen et al., 1996).

Further, the relationship between differing marital status and chronic periodontitis experience may be explained by two major hypotheses: the 'selection hypothesis', where healthier individuals may be more likely to be married and stay married; and the 'protection hypothesis,' where married people may be more likely to be economically stable (Brown, 2000), experience less stress and exhibit less risky health behaviour as compared to unmarried individuals (Umberson, 1992). On the other hand, it has also been suggested that being married or being in a relationship may not necessarily be protective, as being in a troubled relationship may in itself be a prime source of stress, while simultaneously limiting the partner's ability to seek support from other

relationships. However, amidst these conflicting findings, it has been postulated that, among those who are married, marital quality is the strongest correlate of wellbeing: people who have low quality marriages experience lower levels of wellbeing as compared to their unmarried counterparts (Brown, 2000).

Thus, it can be concluded that while being married may or may not afford a degree of protection from chronic periodontitis experience for an individual, it is not marriage *per se* but the quality or functioning of the marriage that affects the outcome of chronic periodontitis. Individuals reporting low levels of marital quality were more likely to have periodontitis than those reporting high marital quality (Marcenes and Sheiham, 1996).

2.6.2 Family functioning

Family functioning describes the evaluative, operational and behavioural characteristics that typify family life (McCubbin and McCubbin, 1987). Family functioning can be defined as the process of continual change as information and energy are exchanged between the family and the environment. It describes the different ways in which family members interact with each other, includes rules that govern behaviour, roles that are fulfilled by members and the level of emotional involvement and interest family members invest in each other's welfare (Miller et al., 1985). Families function in various ways to influence health. Aldefer et al., (2008) described the functioning of the family system as follows:

'At a basic level, families are conceptualised as organised systems that aim to keep balance and order through communication and assigned roles (Kazak et al., 2003). When families are functioning well, roles are clear, communication is open and straightforward, and affect is well regulated. In contrast, when a family is functioning poorly, it may, for example, respond to stress by becoming disorganized and chaotic with unfocused communication patterns and emotional

dysregulation. Alternatively it may be over controlled, with increased rigidity of roles, inadequate communication, and a restricted range of affect' (Alderfer et al., 2008)'.

A strategic search of the literature did not find any study explicitly considering the association between family functioning and chronic periodontitis. However, related studies looking at marital quality (Marcenes and Sheiham, 1996) exist to support the assumption that processes within the family are associated with chronic periodontitis experience.

Applying the common risk factor approach to chronic periodontitis allows us to hypothesise the association between family functioning and chronic periodontitis by looking at how family functioning has affected general health. Solid evidence has also been found to link interpersonal social relationships and health (House et al., 1988). Studies have shown that social relationships not only have a correlation with health but also have causal impacts: prospective studies show greater mortality among people with fewer relationships (House et al., 1988). Further reviews confirm that social support offers two types of effect on health outcomes: namely, 'indirect/buffering' whereby it is postulated that support protects individuals from the potentially harmful effects of stressors and enhances their coping abilities; and what is known as the 'direct/main effect' where social support is said to improve wellbeing directly (House et al., 1988). The family, which is the most basic form of social support, is a logical unit to explore in terms of health because families have a primary responsibility for developing self-care and dependent care competencies within the family, fostering resilience among family members, providing resources and promoting healthy individuation while providing resources. The task of fostering health and healthy behaviours should be an integral part of a functional family process.

The relevance of the family to the health of individuals is supported by the following claims (Turk et al., 1985):

- A persons' definition of his illness is largely derived from consultation with family members.
- Agreement among family members' conceptions of illness has been related to successful treatment outcome. Family attitudes are a major factor in patient compliance with recommended treatment regimes.
- Chronic illness in a family member affects other family members as well.
- Maladaptive family interaction patterns can affect the course of both acute and chronic illness and family interaction patterns have also been implicated as a causal or precipitating factor in illness.

2.6.2.1 Theoretical perspectives in family studies

An important consideration in the study of families is the theoretical perspective that explains different dynamics of families. The five theoretical perspectives that are commonly used to examine family life are as listed in the table below (table 2.1) (Newman and Grauerholz, 2002)

Table 2. 1 Five theoretical perspectives on family dynamics

Theoretical Perspective	Key Assumptions About Families
Socio-biology	Individual, couple, and family patterns are determined by biology
Structural Functionalism	Families' purpose is to fulfil certain roles in order to keep society as a whole functioning smoothly
Conflict Perspective	Inequality is an inherent part of families. Some family

	members benefit more than others from these arrangements.
Social Exchange Theory	Enduring family relationships and interactions are those that offer greatest rewards and fewer costs
Symbolic Interactionism	Families are created through day to day interactions. Communication is central to the creation and maintenance of family bonds.

The socio-biology perspective looks at family structure in terms of the interaction between biology and culture. The fundamental assertion of this perspective is that, by nature, people desire to ensure the survival of their genetic material and consequently human families reflect the biological characteristics of their reproductive patterns (Newman and Grauerholz, 2002)

According to the structural functionalism perspective, families are seen as essential for survival not in terms of genetic fitness but because they serve as an individual's primary source of emotional and practical training in society(Newman and Grauerholz, 2002).

The conflict perspective theory looks at families in terms of conflict and struggle. It postulates that family units are borne from dominance and coercion, which promotes division and inequalities between family units(Newman and Grauerholz, 2002). The key question this theory asks is, who benefits and who is disadvantaged by certain family arrangements?

The basic concept of social exchange theory is that family relationships are in essence an exchange, particularly of needs, or rewards, or resources of, primarily, material value and, secondarily, of symbolic attributes (Newman and Grauerholz, 2002).

The Symbolic Interactionism perspective denotes that the key to understanding family is to look at the interactions between family members and the meanings family members assign to these interactions (Newman and Grauerholz, 2002). Each of these five perspectives makes different assumptions about human behaviour and interaction but these may not necessarily be mutually exclusive. Some definitions of family may be coined specifically according to one particular theoretical perspective, while other definitions may be the result of a combination of theoretical perspectives (Newman and Grauerholz, 2002)

More recently, Koerner and Fitzpatrick (2004) suggested defining 'family' according to three perspectives. The first of these looks at structural definitions, which are 'based on the presence or absence of certain family members' (including parents, children, and other relatives) as a household unit (Koerner and Fitzpatrick, 2004). The second perspective is based on psychosocial functions and tasks and looks at institutional aspects of family in the performance of societal functions (such as maintaining a household, socializing children, providing emotional and material support and fulfilling roles). The third definitional perspective focuses on transactional definitions where 'groups of intimates through their behaviour generate a sense of family identity with emotional ties and an experience of a history and a future'. Definitions based on this perspective emphasize the degree of emotional connection and feeling of belonging within different types of family.

Akin to the five perspectives listed by Newman (2002) these three perspectives are not necessarily mutually exclusive as definitions of family may consist of elements from more than one perspective.

2.6.2.2 Definition of family

As the term 'family' is in such common usage this suggests that it carries with it a definite referent. However, the vast diversity in everyday understanding and sociological ideas and the lack of a universally agreed definition of what is meant by the term 'family' suggests that its definition is more complex. The question of what constitutes a 'family' is controversial but it requires clarification as 'families' and their functioning are the basis of the conceptualization in this study.

Families can be viewed as the smallest and most intimate form of social relationships. Traditionally, families are considered to be social units created by blood, marriage or adoption. Today, the definition of 'family' has evolved to include not only biological parents and their children (commonly known as the 'nuclear family'), the single-parent family, the couple and extended family, but also other family types such as cohabiting couples and same sex couples. Some family researchers define 'family' as people who are committed to each other and share intimacy, resources, and decision-making responsibilities (Olson and DeFrain, 2000). Some sociologists have proposed that the definition of what constitutes a family should be considered to be an empirical question answered by the individuals who are being studied, rather than by reference to a set of pre-defined criteria relating to household membership or family roles, however inclusive those may be (Bernades, 1993, Levin, 1993).

Census definitions adopt the structural perspective when defining a census family by linking related individuals residing within the same household. For example, the UK census defines family as 'a co-resident group of close relatives' or 'a married or cohabiting couple with or without child(ren)'. Children are defined either as dependent children who live with their parents, aged under 16 (under 18 if attending full-time education) or non-dependent children; children aged 16 and over living with their

parents (excluding those aged 16 to 18 in full time education) excluding all children who have a spouse, partner or child living in the household in both instances. The US census defines 'family' as 'a group of two or more people related by birth, marriage or adoption and residing together' (US Census Bureau, 2010); while Statistics Canada defines the census family as a 'married or common law couple living together with or without never married children or a lone parent of any marital status with at least one child living in the same dwelling' (Statistics Canada, 2011).

An argument against using household composition when defining families is that complex and changing household structures mean that individuals do not have permanent family relationships. In order to understand family dynamics, it is necessary to look beyond household composition to the relationships within which families are perceived to live, because looking only at household composition obscures the importance of actual relationships and gives rise to the misperception that certain family types might be dysfunctional (McRae, 1999). 'Family', as defined demographically or by household composition, may be too restrictive and may not include the definition of the type of family within which people actually live. Further, research has shown that family members who are psychologically present in the mind of an individual, while being physically absent, can have an important influence on individual and family functioning (Acock et al., 2005)

The Vanier Institute of the Family in Canada defines a family as 'any combination of two or more persons who are bound together over time by ties of mutual consent, birth and/or adoption or placement and who, together, assume responsibilities for variant combinations of some of the following; physical maintenance and care of group members, addition of new members through procreation or adoption, socialization of children, social control of members, production, consumption, distribution of goods and

services, and affective nurturance or love' (Luxton, 2011). This definition, unlike the others, is less restrictive in the sense that it omits any reference to marriage, and it is more conceptual in the sense that it outlines the core functions within a family and includes a notion of temporality conferring a degree of stability (Muirhead, 2007).

In this study 'family' is defined according to the conceptual basis of the sociobiological perspective, the structural functionalism perspective and the symbolic interactionism perspective of families, in which people form intimate partnerships, maintain households, pool and share resources, have and raise children, and provide emotional and social support to one another. This study has adopted the definition by The Vanier Institute of the Family in Canada (Luxton, 2011) where the term 'family' refers to 'any combination of two or more persons who are bound together over time by ties of mutual consent, birth and/or adoption or placement and who, together, assume responsibilities for variant combinations of some of the following: physical maintenance and care of group members, addition of new members through procreation or adoption, socialization of children, social control of members, production, consumption, distribution of goods and services, and affective nurturance or love'. This study defines a family as a combination of two or more persons that includes one or more dyadic subsystems, such as a parent-child subsystem, a spousal subsystem or a sibling-sibling subsystem. These dyadic subsystems are limited to the parent-child, spousal and the sibling-sibling dyad as these dyadic subsystems are considered to be the most important socio-environmental influence on many aspects of an individual's development, behaviour, lifestyle, physical and psychological health. They act as agents for socialization through modelling, delivery of reinforcement/punishment contingencies, reminding one another of rules, and shaping one another's physical and social environments.

2.6.2.3 Diversity of family structure

The family is not a closed and static unit, rather it is a complex and dynamic system which both affects and is affected by social, cultural and historical development and by individual cycles and transitions. Family structure refers to 'the number of members of the family and to the designation of familial positions such as parent, spouse, child and or other kin' (Vijver et al., 2011).

The different types of family structures vary across cultures: in the United Kingdom, United States, Canada and most of the countries of northern Europe, the nuclear family structure of a father, mother and children appears to predominate, while in almost all of the rest of the world, the extended families, grandparents, parents, children, aunts and uncles and cousins are considered to be 'family' (Georges, 2003).

In 2010, the Office for National statistics identified 17.9 million families in the UK. Of these, the number of married couple families (12.1 million) had decreased by 100,000 between 2001 and 2010. This is consistent with both the increase in opposite sex cohabiting couple families over the same period (from 2.1 million to 2.8 million) and with a general decrease in the number of marriages since 1970 (Office of National Statistics, 2011) There were an estimated 51,000 families of same sex cohabiting couples and 45,000 civil partnered couples, the latter steadily increasing since the introduction of civil partnerships in the UK in December 2005 (Office of National Statistics, 2011). The number of single parent families had increased by 12 per cent over the 10 year period to 2 million in 2010. The Labour Force Survey (Office of National Statistics, 2011), which published these figures defined a family as a married, civil partnered or cohabiting couple with or without children, or a lone parent with at least one child. While this survey did not report on extended families, it did report that the percentage of

multiple families in one household in the UK was only 1% (Office of National Statistics, 2011). However this is not necessarily reflective of extended families.

Some factors that have been studied that influence the decline or increase of certain types of family structure are cultural and societal attitudes and socio-economic influences.

The most significant change affecting types of family structures over the last fifty years has been the gradual uncoupling of sexuality, marriage, parenting and cohabitation (Luxton, 2011). A relaxation of societal attitudes towards marriage has led to the increase of 'complicated' family structure as opposed to the traditional 'married parents with children' family (Jenkins et al., 2009).

The type of family structure that exists is also influenced by ethnic minorities. Families within ethnic minorities are influenced by the 'traditional' relationships they brought with them from their country of origin, their adaptation to their changed environment and relationship patterns within the dominant 'White' community (Goodwin, 2003). In Britain, ethnic minority groups exhibit very different family structures, with those of Caribbean origin being more likely to cohabit and have a number of children, while South Asians are more likely to be married and live in semi-extended arrangements or extended families (Goodwin, 2003).

Ecology and subsistence also influence family structure. Historically agricultural families are characterized by large extended families, as agricultural societies tend to have a permanent base, live near kin, and required the help of many people (children and kin) to cultivate the crop before the mechanization of farming (Georges, 2003). This is in contrast to hunting families, which are generally smaller nuclear families which are more mobile and adaptable to their non-permanent surroundings (Georges, 2003). In

today's world, the means of subsistence is to work in industry, commerce, or the service industry which requires leaving the traditional extended family structure to move to urban areas where housing constraints and diversity in work opportunities has created a trend toward more families becoming structurally nuclear (Georges, 2003).

In classifying types of families, it is also important to consider the measure of family functioning used. In the ONEL Family Study, the measure of family functioning is based on the McMaster Model of Family Functioning, which is based on the Family Systems Theory. According to this theory, a family is a system which is composed of groups of individuals which function as subsystems. The family systems theory views each family member as part of an interdependent, interactional system in which the behaviour and presence or absence of each individual or subsystem (such as a spousal subsystem, parent child subsystem, or sibling subsystem) modifies that of other subsystems. Using the family systems theory, six main types of families can be defined as listed: nuclear families, reconstituted families, single parent families, childless couple families, other families of related adults (siblings) and extended families. The descriptions of each of these family types are as shown in table 2.2.4.2.1.1. Each of these family types is composed of their own combination of subsystems unique to their family type, making each family type distinct from other family types, or mutually exclusive. While the definition of types of family is also somewhat consistent with the definitions in the UK, US and Canadian censuses, this study will not be adopting the census definition of family based on residence or household as separate residences does not indicate isolation from family relationships. Geographical proximity and psychological distance are not the same. Separate residence of family members may indicate geographical separation but does not imply psychological separation (Georges, 2003). This study assumes that family members who are psychologically present in the mind of an

individual, while being physically absent, can have an important influence on the individual and family functioning (Acock et al., 2005). The definition of 'children' within this study also differs from census definitions as this study does not differentiate between biological, adoptive, step, dependent or non-dependent children.

Schlesinger (1979) defined the nuclear family as consisting of husband, wife and children, while other definitions include a group of people united by ties of partnership and parenthood and consisting of a pair of adults and their socially recognized children. The adults may or may not be married and while, typically, such couples are a man and a woman, the definition of 'nuclear family' has expanded with the advent of same sex marriage. There are two types of nuclear families, one a family of orientation, which refers to a domestic group into which a person was born, adopted or in which they were reared (Nett, 1991); and second, a family of procreation, which is created when a person marries, enters a relationship and adopts or bears a child (Nett, 1991). This study adopts the definition of 'nuclear family' as defined by the Vanier Institute of the Family (1994) where 'nuclear' families are composed of two parents and their one or more biological or adopted children. This definition of nuclear family, while consistent with earlier definitions (Schlesinger 1979) which includes a spousal and parent-child relationship, is also in keeping with more contemporary definitions as it does not necessitate a marital relationship or differentiate between same sex or opposite sex partnerships. However, the UK 2006 Labour Force Survey and General Household Survey of the demographics of families in the UK did not utilize a single 'nuclear family' definition. Instead, families with a spousal subsystem and a parent-child subsystem were divided into 2 categories: 'cohabiting couple family' and 'married couple family'.

A reconstituted family has been defined as a situation in which one or both of the spouses has or have been previously married and has or have a child or children from

that marriage living in the new household (Nett, 1991). Other definitions define reconstituted families as families formed when remarriages occur or when children living in a household share one or no parents (Kreider and Ellis, 2009). The presence of a step-parent, step-sibling, or half-sibling designates a family as reconstituted. This study defines reconstituted families as families composed of parents who have divorced their first spouses, remarried someone else and formed a new family that includes children from one or both first marriages, and/or from the re-marriage (Schlesinger, 1998). This definition is consistent with other definitions in the literature whereby it necessitates the merger of two separate families into one new unit. However, as with the nuclear family definition, the UK 2006 Labour Force Survey and General Household Survey of the demographics of families in the UK did not utilize a single 'reconstituted family' definition. Instead reconstituted families were divided into 2 categories: 'cohabiting couple stepfamily' and 'married couple stepfamily'.

An early definition of 'childless family' refers to a childless couple, consisting of a husband and wife (Schlesinger, 1979), with a emphasis on the marital dyad in the spousal relationship. A more contemporary definition of the 'childless couple family' refers to a family that has never had children (Schlesinger, 1998) with no reference to the marital status of the spousal relationship but with an emphasis on never having children. This study defines a 'childless family' as a family consisting of a couple (Schlesinger, 1998). This definition is in keeping with more contemporary definitions of families which do not necessitate a marital relationship or differentiate between same sex or opposite sex partnerships. However, the UK 2006 Labour Force Survey and General Household Survey of the demographics of families in the UK did not utilize a single 'childless couple' definition. Rather, families with a spousal subsystem were

divided into 2 categories: 'cohabiting couple family with no children' and 'married couple family with no children' (McConnell and Wilson, 2007).

A 'single parent' family has been defined as one composed of a parent, (whether a mother or a father) with a child or children (Schlesinger, 1998). Other definitions define single parent families as composed of one parent and one or more minor children for whom the adult is responsible (Steinmetz and Stein, 1988). This study defines a single parent family as 'families composed of a parent, with a child or children' (Schlesinger, 1998). This definition is consistent with other definitions of single parent families found in the literature and in the 2001 UK Census, the Labour Force Survey (LFS) and the General Household Survey (GHS), with one exception (McConnell and Wilson, 2007). This definition omits any reference to the marital status or dependency of the child in the family unlike that in the aforementioned surveys where a single parent family is defined as a father or mother together with his or her child or children, providing that the children do not have a spouse, partner or child in the household according to the 2011 UK census. The LFS definition is a lone parent, living with his or her never-married children, providing that these children have no children of their own living with them (McConnell and Wilson, 2007). The GHS definition is one parent, irrespective of sex, living with his or her never-married dependent children, provided these children have no children of their own (McConnell and Wilson, 2007).

Other families of related adults refer to families where no couple or parent-child relationship exists, but consists of relationships between an individual and a brother or sister (Limited, 2009).

Extended family refers to 'social relationships among those related by blood, marriage, or self-ascribed associations that extend beyond the marital dyad or committed partner

couple and the immediate family of parenting adult(s) and dependent children' (Vangelisti, 2008). Within this study the 'extended family' refers to an extension of a basic family unit, where a mother, father, step parents, brother, sister, step-sibling, grandparents or grandchildren, aunts, uncles, nephews and/or nieces are considered to be family in addition to a basic family unit. A basic family unit in both these instances refers to any of the first four types of families identified in this study: the nuclear family, the reconstituted family, the single parent family, and the childless couple family. The extended family unit is further sub-categorized into an extended nuclear family, extended reconstituted family, extended single parent family and extended childless couple family. This definition differs slightly from the UK census definition where such extended families are categorized as a multigenerational household where the household type is identified through identification of the number of generations of direct descent in a household.

Table 2.2 Description of family characteristics by family type.

Family Type	Description
Nuclear family	A family group composed of two parents and their one or more biological or adopted children.
Reconstituted family	A family group composed of parents who have divorced their first spouses, remarried someone else and formed a new family that includes children from one or both first marriages, and/or from the re-marriage
Single parent family	A family group composed of a parent, either a

	mother or father with a child or children
Childless family	A family consisting of a couple
Other families of related adults	Consists of those within a sibling relationship
<u>Extended family</u> Extended nuclear family Extended reconstituted family Extended single parent family Extended childless couple family	Consists of relationships among those related by blood, marriage, or self ascribed associations that extend beyond the marital dyad or committed partner couple and the immediate family of parenting adult(s) and children

2.6.2.4 Validity of a single family member's perception of family life

The family systems theory is based on the General Systems Theory where a family is viewed as a hierarchical, open and organized system composed of smaller interactive subsystems embedded in a larger macro system. Subsystems are made up of individuals and their relationships (spousal subsystem, sibling subsystem, parent-child subsystem). An individual may belong to more than one subsystem but each subsystem has a specific role.

The issue of unit of analysis is critical in studying family functioning. A major criticism of many studies of family life is their reliance on single informant reporting. Historically, the justification for using single informants in understanding family processes was, typically, financial restraints, accessibility, or the assumption of basic agreement among family

members (Larson, 1974). While the first two justifications are somewhat acceptable, there is little evidence of interpersonal family agreement (Larson, 1974). This is because family members may each 'live in rather different worlds' (Olson, 1983) and hold somewhat different perceptions of their family processes (Sweeting and West, 1995). Studies that used multiple informants report family discordance and a low correlation between family members' perceptions, suggesting that conclusions about family relationships or functioning should not be drawn based on data collected at the individual level.

Thomson and Walker (1982) argued that while collecting data from multiple family members results in a richer and more intricate description of what is going on within a family, as compared to single informants, the meaning and usefulness of these reports must be established at the theoretical rather than methodological level (Thompson and Walker, 1982).

There is no reason for assuming that an individual's perception of his or her family functioning is not an aspect of that individual's family reality, as it is reasonable to suggest that perceptions of reality are 'reality' to the perceiver (Larson, 1974, Foxcroft and Lowe, 1995).

Each person's perceived reality is significant as it is that perceived reality which affects his psychological wellbeing (Burt et al., 1988), behaviour, style and the quality of his interpersonal relationships (Safilios-Rothschild, 1970).

Data collected from individuals or single informants qualifies as research about families if the intention is to use an individual's report as either a) an objective reality, implying that the report is independent of the individual's view, (such as a report about the number of family members, length of time a marriage has existed); or b) a subjective

individual reality that is interpreted as one family member's perception of himself, her family, or other family members (Pruchno et al., 1994). From this perspective, the report is accepted as an individual's construction or perception of the family.

Hence, within this study, the usage of a single informant, the participant's report on family functioning is valid when it is interpreted in the context of the participant's perception of their family functioning.

2.6.2.5 Model of family functioning

Various models and theories have been proposed to describe family functioning.

This study uses the Family Assessment Device (FAD) which is based on the McMaster Model of Family Functioning (Epstein et al., 1978). The McMaster model describes the primary function of the family as providing a setting for the development and maintenance of family members on social, psychological and biological levels as families confront basic, instrumental issues such as the provision of food, transportation and shelter, and developmental issues as well as crises such as illness or losing a job. The McMaster Model covers aspects of family functioning that are seen as having the most impact on the emotional and physical health or problems of family members.

The Family Assessment Device (FAD) which is based on the McMaster Model of family functioning was chosen to be used in this study because it is a clinically oriented conceptualization of families which identifies the six dimensions of family functioning which are deemed to be relevant to periodontitis experience: Problem Solving, Communication, Roles, Affective Responsiveness, Affective Involvement and Behaviour Control as well as a General Functioning Scale which is an overall scale that measures family functioning. The FAD has also been used in many peer reviewed

studies (Aldefer et al. 2008). A detailed explanation of each of these domains and its relevance to chronic periodontitis can be found below.

2.6.2.5.1 Problem solving

The problem solving dimension is defined as: a family's ability to resolve problems to a level that maintains effective family functioning. A family's problem can be defined as issues that threaten the integrity and functional capacity of the family. Family problems can be subdivided for clinical utility into instrumental and affective types. Instrumental problems are the mechanical problems of everyday life and relate to issues that are basic in nature such as financing, provision of shelter, food and so forth. Affective problems are those related to feelings or emotions, such as anger, depression, and sadness. While families may have problems restricted to affective areas, instrumental problems are usually almost always coupled with problems in the affective area. It is also possible that problems present an overlap of both affective and instrumental areas (Epstein et al., 1978).

Epstein et al. 1978 postulated that families who have difficulty in resolving both instrumental and affective problems function least effectively; those who have difficulty solving only affective problems function more effectively; and families who resolve both types are most effective in their problem solving functions.

Effective problem solving can be conceptualized as a sequence of seven steps (Epstein et al. 1976):

- Identification of the problem.

This involves consideration of who identifies the problem, whether it presents a consistent or inconsistent pattern and judgement as to

whether the family has correctly identified the problem, as opposed to displacing the problem onto less conflicted areas which are then identified as the problem.

- Communication of the problem to appropriate resources within or outside of the family.

This considers to whom the identified difficulty is communicated and whether that resource is an appropriate one.

- Development of alternative action plans.

This considers the types of alternative action plans developed and how they vary with the nature of the problem.

- Decision regarding a suitable action.

This embodies the decision-making process and the consideration given to alternatives, considers whether those who will ultimately be involved in the action are informed of the decision.

- Action.

This embodies consideration of the degree to which the family carries out the alternative they have decided on. There is a range of possibilities: the family may not act at all, may act in a limited way, or may carry out all aspects of the action.

- Monitoring the action which is taken.

This considers whether or not the family built in an accountability mechanism to check that the decision they have taken is, in fact, acted on and carried out.

- Evaluation of the success of the action.

This considers whether the family has reviewed what happened in an attempt to learn from the situation and evaluate which mechanisms are proving most successful. It also considers whether they are able to recognize inappropriate problem-solving behaviour when it has occurred.

It is hypothesized that the more effective a family's functioning the more stages of this process they can negotiate. As family functioning becomes less effective, family problem solving behaviour becomes less systematic, and fewer problem solving steps are accomplished (Epstein et al. 1978). It is postulated that efficient family functioning in the problem solving domain allows individuals to tackle challenges that are present in life. This leads appropriately to resolution which moderates and balances for the effect of the social environment on oral health behavioural choices. Conflict resolution as a result of efficient problem solving would save the individual from heading down a detrimental oral health behavioural pathway (such as alcohol or tobacco indulgence) as a consequence of the resolution not having been achieved.

2.6.2.5.2. Communication

Communication can be defined as the exchange of verbal communication within a family. While all behaviour can be construed as one form of communication or another, the focus here is solely on verbal exchange. Non-verbal aspects of family

communication are excluded because of the methodological difficulties of collecting and measuring such data for research purposes, while verbal communication is manifest and measurable (Epstein et al. 1978).

Communication is also subdivided into instrumental and affective areas with the same ramifications for each as discussed for the problem solving dimension. In addition, communication is also assessed along two other vectors, the 'clear vs. masked continuum' and the 'direct vs. indirect continuum' (Epstein et al. 1978). The clear vs. masked continuum focuses on the clarity with which the content of the information is exchanged. It answers the question of whether the message is clear, camouflaged, muddled, argued or vague. The direct vs. indirect continuum focuses on whether the messages go to the appropriate individual, namely the person for whom it was intended.

It is hypothesized that the more masked and indirect the form of communication the more ineffective the family's functioning will be, while the clearer and more direct the communication the more effective it will be. It is further hypothesized that masked or indirect communication invites a similar response from the recipient of the message (Epstein et al. 1978). This study postulates that effective family function in the communication domain moderates the effect of the social environment on oral health-related behaviour where effective communication may allow individuals within family to help one another make healthier choices. For example, effective communication may allow one individual to help another family member to quit smoking or to adopt a healthy habit such as making a regular dental visit.

2.6.2.5.3 Role functioning

Family roles are the repetitive patterns of behaviour by which individuals fulfil family functions. In order to maintain an effective and healthy system, there are some functions that all families have to deal with repeatedly. These functions can be grouped into five necessary family roles (Epstein et al. 1978):

- Provision of resources - this embodies tasks associated with the provision of food, clothing, and money for the family.
- Nurturance and support - this embodies the need for the family to make provision for comfort, reassurance and support of the family members.
- Adult sexual gratification - this considers the need for sexual fulfilment between husband and wife/ partners.
- Personal development - this includes those tasks and functions necessary to support family members in developing skills for personal achievement including physical, emotional, social, professional and educational development.
- Maintenance and management of the family system - this involves several functions: decision making; boundary and membership functions; implementation of and adherence to behavioural control; household finance; and health related functions.

Two other additional and integral aspects of role functioning include role allocation and role accountability.

Role allocation incorporates the concepts of the assignment of responsibilities for family functions, whether such allocations are appropriate, and whether the allocation process is carried out implicitly or explicitly, by dictum or by open, free discussion. It also

considers whether reassignments can take place easily and whether tasks are distributed and allocated to the satisfaction of family members (Epstein et al. 1978).

Role accountability looks at the procedures in the family for making sure that functions are fulfilled. It involves the process of a family member being made accountable for the responsibilities which he or she has been allocated. This includes the presence of a sense of responsibility in family members and the existence of monitoring and a corrective mechanism (Epstein et al. 1978).

It is hypothesized that the more functions are adequately fulfilled and the clearer the allocation and accountability processes, the healthier the family (Epstein et al. 1978).

Role accountability affects oral health behaviour where with efficient role accountability, often roles can be well defined, such as when one member in the family is the care giver or 'health expert', this person may determine how and when dental attendance should happen. Efficient role accountability may also help in monitoring personal oral hygiene habits, making sure oral hygiene products such as toothbrushes are available and monitoring tobacco and alcohol habits which may result in improved oral hygiene or tobacco cessation and drinking alcohol in moderation.

2.6.2.5.4 Affective responsiveness

Affective responsiveness refers to the ability to respond to a range of stimuli with appropriate quality and quantity of feeling. Two aspects that are being considered in terms of quality of response are whether family members demonstrate an ability to respond with the full spectrum of feelings experienced in human emotional life and whether the emotion experienced at times is consistent with the stimulus and situational context (Epstein et al. 1978). Quantitatively, the degree of affective responses is

assessed along a continuum, from 'absence of response' through 'reasonable or expected responsiveness' to 'over responsiveness' (Epstein et al. 1978).

Affective responsiveness can be divided into two classes: 'welfare feelings' and 'emergency feelings' (Rado, 1961). 'Welfare feelings' consists of affection, warmth, tenderness, support, love, consolation, happiness and joy; while 'emergency feelings' include responses such as anger, fear, sadness, disappointment and depression (Epstein et al. 1978). Affective responsiveness may be influenced by cultural variability and thus this must be considered.

It is hypothesized that, at the healthy end of the dimension, a family is able to experience and express a full range of emotion within the appropriate context, with reasonable intensity and for a reasonable duration (Epstein et al. 1978). When affective responsiveness is efficient, individuals are postulated to be able to handle life stressors better and to have better coping skills which can help them make better health choices.

2.6.2.5.5 Affective involvement

Affective involvement is defined as the degree to which the family shows interest in and values the activities and interests of family members (Epstein et al. 1978). It considers the extent to which and in what way family members can show an interest and invest themselves in each other. There is a range of styles from total lack of involvement at one end to extreme involvement at the other. The six styles of involvement are as follows (Epstein et al. 1978):

- Lack of involvement: no interest or investment in one another.
- Involvement devoid of feeling: some interest, primarily intellectual in nature.

- Narcissistic involvement: interest in others only to the degree that the behaviour it reflects on oneself.
- Empathic involvement: interest in one another for the sake of others
- Over involvement: excessive involvement in one another.
- Symbiotic involvement: an extreme and pathological investment in others seen only in very disturbed relationships.

'Empathic involvement' is viewed as the most effective form of involvement, with involvement designations moving to either end of the range, implying increasingly ineffective forms of functioning (Epstein et al. 1978). Efficient affective involvement may regulate oral health behaviour where empathic involvement makes people invest in each other's action, and this can help the adoption of good oral health behaviours among family members, where empathic involvement suggest that individuals in the family would be inclined to motivate each other to adopt healthy behaviours for the betterment of all.

2.6.2.5.6 Behaviour control

Behaviour control can be defined as the pattern the family adopts for handling behaviour in three specific situations: physically dangerous situations, situations involving the meeting and expressing of psychobiological needs and drives, and situations involving socializing behaviour both inside and outside the family (Epstein et al. 1978).

For each of these previously mentioned areas, families develop a standard of acceptable behaviour and of how much latitude they will allow in relationship to that standard. Four styles of behaviour control based on the variation in standard and latitude are as follows (Epstein et al. 1978):

- Rigid behaviour control: standards are narrow and specific for the culture, and there is minimal negotiation or variation across situations.
- Flexible behaviour control: standards are reasonable, and there is opportunity for negotiation and change, depending on context.
- Laissez-faire behaviour control: at the extreme, no standards are held, and total latitude is allowed regardless of context.
- Chaotic behaviour control: there is unpredictable and random shifting among styles 1, 2, 3, so that family members do not know what standards apply at any one time or how much negotiation is possible.

It is hypothesized that flexible behaviour control is the most effective form while the chaotic behaviour control is least effective. Effective behaviour control may regulate oral health behaviour. Where individuals form families with effective behaviour control they may be less likely to indulge in detrimental oral health behaviours, as these families will set reasonable standards by socializing behaviour both inside and outside the family which may act as guidelines for the individual. For example, excessive alcohol drinking could be avoided when behaviour control is efficient.

Efficient family functioning in all these domains may also serve as a coping mechanism in dealing with stressors which may, in turn, act on the psycho-physiological pathway of chronic periodontitis leading to decreased disease susceptibility.

2.7 Behavioural factors

2.7.1 Personal oral hygiene

There is currently limited evidence about the association between personal oral hygiene and chronic periodontitis experience. A systematic review linking personal oral hygiene and chronic periodontitis found no evidence to suggest that improved oral hygiene prevents or controls chronic periodontitis (Hujoel et al., 2005a). Specifically, the systematic review considered whether the frequency or extent of personal oral hygiene was related to the incidence or progression of chronic periodontitis (Hujoel et al., 2005a). It is imperative to note that the systematic review only included three studies, two of which included age ranges that were not ideal for the study of chronic periodontitis. This limitation also goes on to highlight the lack of trials looking at the association between personal oral hygiene and chronic periodontitis. The studies included in the systematic review used personal oral hygiene training and motivation as an intervention. This does not measure the outcome of interest, which is whether the frequency or efficacy of oral hygiene practice is associated with chronic periodontitis experience. Given these limitations, more definitive trials looking at the association between the efficacy of oral hygiene practices (measured by plaque scores or index) and chronic periodontitis experience are needed before a conclusive association can be made regarding the role of oral hygiene in the prevention or control of chronic periodontitis.

2.7.2 Dental attendance

The association between dental attendance and chronic periodontitis has not been substantiated. Evidence from a systematic review showed no consistency in the direction of effect of differing dental attendance frequency in permanent dentition

between studies for: bleeding, probing depth/pockets, presence of plaque/calculus, bone score, chronic periodontitis experience (Davenport et al., 2003).

In contrast, evidence from a recent epidemiological study shows an association between dental attendance and chronic periodontitis experience. Individuals with unfavourable attendance were 1.5 times more likely to have chronic periodontitis, than adults with favourable attendance. The presence of periodontal pockets of 4 mm or more was also more prevalent among those with unfavourable attendance (Ellershaw and Spencer, 2011). The conflicting findings and lack of high quality evidence (ie. a systematic review) to elucidate the association clearly suggests that more definitive studies are needed before the association between dental attendance pattern and chronic periodontitis experience can be confirmed.

2.7.3 Tobacco related behaviour

Tobacco use is a significant risk factor for the development of periodontal disease. Tobacco use poses a risk for periodontitis by altering the host response by interfering with vascular and immunologic reactions and by undermining the supportive functions of the periodontal tissues (Bergström, 2004). The prevalence and severity of periodontal diseases in their various forms are found to be higher among smokers than among non-smokers (Sham et al., 2003). A smoker is said to be 5 to 20 times more at risk of developing periodontal disease as compared to a non-smoker depending on the length of exposure to smoking and disease severity (Bergström, 2004). Disease severity characterized by an increased risk of periodontal attachment loss, formation of periodontal pockets and alveolar bone loss is correlated with quantity, frequency and duration of exposure to tobacco (Martinez-Canut et al., 1995). Smokers are also 2.5 to 3.5 times greater at risk of having severe periodontal attachment loss as compared to

non-smokers (Bergstrom, 1989). Rate of bone loss in smokers was four times greater than non-smokers (Bergström, 2004).

3. Theoretical framework

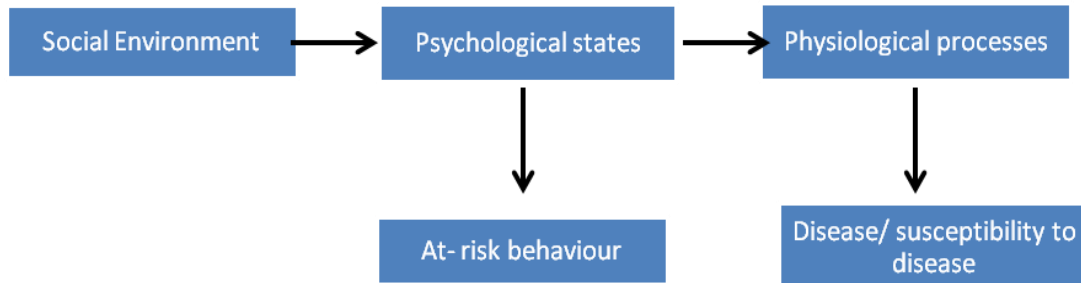
3.1 Introduction

John Cassel in his 'The contribution of the social environment to host resistance' lecture quoted: "Epidemiology at any given time is something more than the totality of its established facts. It includes their orderly arrangement into chains of inference which extends beyond the bounds of direct observation." It is this "orderly arrangement into chains of inference" which distinguishes creative epidemiologic studies from studies which may display considerable rigour in their methods but which are essentially pedestrian (Cassel, 1995).

The "Socio-ecologic model for periodontal diseases" (Hansen et al., 1993) proposes that the balance between plaque and host defences is influenced by biological factors, health care organization, behavioural and environmental parameters. While this model takes into consideration the multi-factorial factors influencing periodontitis, it only considers these factors as independent entities and fails to consider that these factors are interlinked and the mechanism whereby these factors act on periodontal disease.

The most important concept which underlies all attempts to understand the influence of social and psychological factors on health is that of stress. Locker (1989) proposed a model (figure 3.1) to explain the relationship between the social environment and disease or disease susceptibility using stress (which is represented as the psychological component of the model) as a link. Locker (1989) has also postulated that the stress disease model presented below needs to be modified to take into account mediating or moderating factors that influences the pathway between psychological states and disease outcome/susceptibility (Locker, 1989).

Figure 3.1 The Stress Disease Model (Locker, 1989).

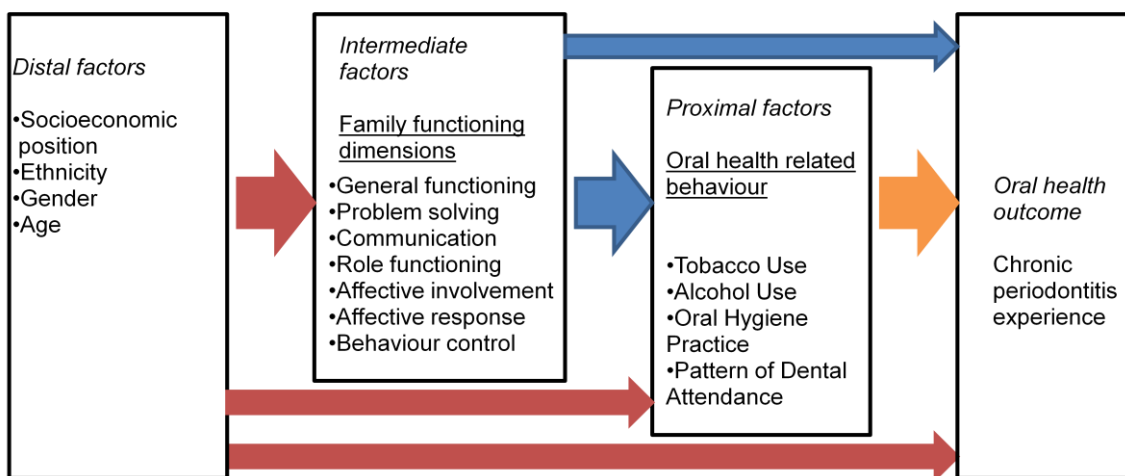


The relationship between stress and periodontal disease has been established (Genco et.al, 1998). Based on this finding, Genco and his colleagues proposed two models through which stress can affect the risk of periodontitis.

In the first model, it is said that stress is associated with activation of the hypothalamic-pituitary adrenal axis where stress stimulates the hypothalamus to release corticotrophic-releasing hormone, which acts on the pituitary gland to secrete adrenotropic hormone which, in turn, stimulates the adrenal cortex to release glucocorticoids which is reflected in an increased concentration of salivary cortisol (Genco et.al, 1998). Glucocorticoid increases the risk of periodontitis by depressing the immune function through inhibition of macrophage antigen in neutrophils (Lamas et.al 1991), lymphocyte differentiation (Miyaura et.al, 2002) and eicosanoid production (De Caterina et.al 1986). Glucocorticoids increase blood glucose levels and induce insulin resistance which are associated with the accumulation of advanced glycation end products in periodontitis. This condition exacerbates periodontal inflammation resulting in periodontitis.

In the second model, Genco suggested that stress is associated with behavioural changes such as ineffective oral hygiene, increased smoking and poor diet which lead to an increased risk of developing periodontitis (Genco et.al, 1998). Genco and colleagues postulated that psychosocial stress, without the ability to cope, may be more detrimental than similar stresses experienced by individuals with good coping mechanisms (Genco et al., 1998)

Figure 3.2 Study proposed theoretical framework



The theoretical framework for this study is based on the Stress Disease Model (Locker, 1989). Figure 3.2 depicts the association between the social environment and chronic periodontitis experience in adults. Here, the social environment acts as a distal determinant of disease outcome and is made up of the individual's socio-economic position as measured by NS-SEC, and ethnicity. In this study, it is postulated that the social environment in which an individual lives, can influence chronic periodontitis experience directly or by modifying an individual's oral health-related behaviour. This study theorizes that efficient family functioning may act as a mediating factor between the social environment and oral health behaviour where efficient family

functioning (in the problem solving, communication, role functioning, affective involvement, affective response and behaviour control domains) mediates for the effect of risk factors (e.g. low socio-economic ethnic minority), on oral health related behaviour which, in turn, influences chronic periodontitis experience. This study also theorizes that efficient family functioning may act as a mediating factor between the social environment and chronic periodontitis outcome directly where efficient family functioning (in the problem solving, communication, role functioning, affective involvement, affective response and behaviour control domains) mediates for the effect of risk factors (e.g. low social economic background, being black, and being from a deprived neighbourhood) on chronic periodontitis.

Various models have been proposed to describe family functioning but this study has used the McMaster Model of family functioning which is based on a systems approach and refers to a group of individual units acting as one. The family is seen as an open system consisting of systems within systems (spousal dyad, parent-child dyad) and relating to other systems (extended family, schools, industry, religions). The unique aspect of the dynamic family group cannot be reduced to the characteristics of the individuals or interactions between pairs of members. Instead there are explicit and implicit rules, plus action by members, which govern and monitor each individual's behaviour. The five assumptions of systems theory that make up the basis of the McMaster Model can be summarized as follows (Epstein et al. 1978):

- The parts of the family are interrelated.
- One part of the family cannot be understood in isolation from the rest of the system.
- Family functioning cannot be fully understood by simply understanding each of the parts.

- A family's structure and organization are important factors determining the behaviour of family members.
- Transactional patterns of the family system are among the most important variables that shape the behaviour of family members.

This study theorizes that family function acts upon chronic periodontitis through two main pathways, namely the direct pathway and the indirect pathway:

3.2.1 The direct pathway

The study proposes that efficient family functioning (in the problem solving, communication, role functioning, affective involvement, affective response and behaviour control domains) mediates the effect of risk factors (e.g. socio-economic deprivation, and ethnic minority background) on chronic periodontitis experience by reducing the expected relationship between the risk factor and the outcome, without actually eliminating the relationship. The direct pathway involves the psychophysiological pathway whereby it is postulated that family function reduces the effect of the risk factors (social environment) on chronic periodontitis by modifying the host response of the individual.

3.2.2 The indirect pathway

In the indirect pathway, it is hypothesized that efficient family functioning (in the problem solving, communication, role functioning, affective involvement, affective response and behaviour control domains) mediates the effect of risk factors (e.g. socio-economic deprivation, ethnic minority background) on chronic periodontitis through the behavioural pathway. It is postulated that oral health behaviour is influenced by the different domains of family functioning, namely problem solving, communication, role

functioning, affective involvement, affective response and behaviour control. Efficient functioning in these domains ensures good oral health-related behaviour which is expected to lead to good periodontal health. Thus, individuals who are at a higher risk of experiencing chronic periodontitis because of their social environment (i.e socio-economic deprivation, or ethnic minority background) but who experience efficient family functioning would be less likely to have chronic periodontitis as compared to individuals with the same social environment who have inefficient family functioning. Here, efficient family functioning is postulated to mediate the influence of the social environments by promoting good oral health related behaviour, (such as not consuming tobacco, practising efficient oral hygiene and making regular dental visits).

3.3 Summary

In this study we postulate that efficient family functioning (in the problem solving, communication, role functioning, affective involvement and affective response and behaviour control domains) mediates the effect of risk factors (e.g.socio-economic deprivation, ethnic minority background) on chronic periodontitis outcome directly through psycho-physiologic pathways and indirectly through behaviour modification. While this study does not propose to infer causality, it is meant to explore the role of host response in chronic periodontitis experience by looking at the potential effect of family functioning to elucidate whether there are any particular dimensions within family functioning that are capable of modifying host response, thus making certain individuals more or less susceptible to chronic periodontitis.

4. Aims and Hypotheses

4.1 Aims

This study aims to explore the role of socio-economic position and family functioning (in the general functioning, problem solving, communication, role functioning, affective involvement, affective responsiveness and behaviour control domains) in chronic periodontitis. We aim to identify general functioning and the domains of efficient family functioning (problem solving, communication, role functioning, affective involvement, affective response and behaviour control) which may have a protective effect.

4.2 Hypotheses

1. Adults from lower socio-economic backgrounds are more likely to develop chronic periodontitis as opposed to their more affluent counterparts.
2. Adults who perceive that they experience more effective family functioning (in the general functioning scale) are more likely to be free of chronic periodontitis as compared to adults from families who perceive that they experience less effective family functioning.
3. Adults who perceive that they experience more effective family functioning (in the problem solving abilities, effective role functioning, affective responsiveness, affective Involvement, behaviour control and effective communication domains) are more likely to be free of chronic periodontitis as compared to adults from families who perceive that they experience less effective family functioning.
4. Adults reporting periodontal risk-related behaviour (such as tobacco consumption, irregular dental attendance pattern, poor oral hygiene practices and high levels of plaque) would be more likely to have chronic periodontitis as

compared to adults presenting with more healthy periodontal health-related behaviour.

5. Effective general family functioning (in the problem solving abilities, effective role functioning, affective responsiveness, affective involvement, behaviour control and effective communication domains) mediates the negative effects of low socio-economic position on oral health-related behaviour and the development of chronic periodontitis.

5. Methodology

5.1 Introduction

This study is part of a major cross-sectional survey, the Outer North East London Oral Health Needs Assessment (OHNA) that collected data in a representative sample of 2,343 adults aged 16- 65 and 1,122 children aged 3-4 years old in 2009-10. The researcher (BS) was involved in the planning of the survey by assisting in the process of obtaining ethical approval, editing the adult and child questionnaire, consent forms, information letters and training interviewers. The researcher was also involved in conducting the survey by applying the questionnaire as an interviewer and collecting clinical data as a recorder during clinical examinations.

The first part of this chapter will describe the OHNA protocol and will then explain the methodology specific to this study.

This cross-sectional survey obtained ethical approval from the Outer North East London Research Ethics Committee (REC Reference Number: 08/H0701/93) and the joint R&D office of Barts and The London NHS Trust and Queen Mary, University of London (ReDA Reference: 006190).

Written consent was obtained from all participants prior to any clinical examination or interview. Participants were allowed to withdraw from the study at any point without any consequences. All the information collected in the course of this study was treated in the utmost confidence in accordance with the Data Protection Act 1998. Clinical and questionnaire data were assigned codes and names were removed prior to any data analysis to maintain anonymity. In addition, all the data sheets and files were stored in

the research supervisor's locked office or on a password protected computer located in an area of limited access within the college.

5.2 Study design

This study has adopted the cross-sectional study design. Cross-sectional surveys assess the presence or absence of disease and other health-related information in groups of individuals at one point in time.

5.3 Setting of the study

The Outer North East London Oral Health Needs Assessment (OHNA) was carried out in 2009-2010 in the Outer North East London boroughs of Waltham Forest, Redbridge and Barking & Dagenham. In terms of average deprivation ranking, out of 354 local authorities in England, (where 1 is the most deprived) Barking & Dagenham is the most deprived of the 3 boroughs being ranked 22nd, followed by Waltham Forest which is ranked 25th and Redbridge which is ranked 143rd. The population in Barking & Dagenham is mainly White (87%); while Waltham Forest has the second largest population of Pakistanis in London; and Redbridge has a mixed population consisting of 37% ethnic minorities (English Indices of Deprivation, Communities and Local Government 2007).

5.4 Selection of participants

The Outer North East London Oral Health Needs Assessment (OHNA) included 2,343 adults aged 16-65 years, living in Waltham Forest, Redbridge, and Barking and Dagenham. A stratified two-stage random sampling was used to select a representative sample of the general non-institutionalised population. The sampling frame comprised all addresses in Waltham Forest, Redbridge and Barking & Dagenham, excluding business, institution, and empty addresses. A list of home addresses grouped by

postcode and then by ward was compiled, with each ward representing a stratum. A stratified random probability sampling procedure was then adopted to select a representative sample of adults aged 16 to 65. Representativeness of the population was assured by replacing non-respondents with an address in the same postcode area. An average of 1.7 adults living in each selected address was invited to answer a screening questionnaire and a 132 item self-completion questionnaire and to undergo an oral clinical examination.

5.5 Contact with potential participants

Potential participants were contacted in advance. Invitation letters (Appendix 1), a pre-paid envelope, an opt-in card (Appendix 2), and information sheet (Appendix 3) were sent to all sampled addresses. The invitation letter also stated “if we do not hear from you within two weeks from the date of this letter then an appointment will be sent by default”. The information sheet explained that participation was voluntary, the purpose of the survey, asked for their co-operation, and their telephone number. Potential participants could opt-in by returning the opt-in card by post. An appointment was arranged for those that replied in accordance with their preferences of time, venue, and gender of the dentist and interviewer. Also, a research assistant visited non-respondent addresses to check if they were empty or to determine a reason for non-response. A dentist and an interviewer then visited addresses that accepted the appointment. Once they have agreed to participate, written consent was obtained (Appendix 4). They were informed that they could interrupt or stop the interview at any time and that this would not have any consequences whatsoever.

5.6 Training and calibration exercise

The data collection team consisted of qualified dentists (dental examiners) who conducted the clinical examination and interviewers who recorded the information from

the clinical examinations and administered the survey questionnaires. All the dentists and interviewers were formally trained. The training exercise was set to assure intra- and inter-examiner agreement during the data collection, and comparability with data collected in other National Adult Dental Health Surveys in the UK. The data collection teams were trained regarding procedures and criteria to be used in the clinical examinations and interviews prior to the starting of data collection. They were also calibrated against one another and also against a gold standard examiner. The criteria and examination forms were distributed to dental examiners and interviewers prior to the first training session, and all members of the data collection team were asked to study the criteria and memorise the codes. The interviewer acted as a recorder during the clinical examination. In addition, the questionnaire was distributed to interviewers and they underwent a formal training in obtaining general and personal details of participants and applying the questionnaire.

5.7 Data Collection

5.7.1 Cross infection control

Each data collection team carried sufficient sets of sterile disposable instruments to be used in one day of screening. Examiners wore a clean pair of disposable vinyl gloves for the examination of each participant. Alcohol hand-rub was used before and after putting the gloves on. All used instruments and gloves were disposed of into a standardised clinical waste bag which was returned to the Institute of Dentistry for incineration.

5.7.2 Equipment Set-Up and Seating Arrangements

The participants were seated in a comfortable chair which had a good support, and to which the examiner could get access. A 'Daray' lamp set at high power setting was used as a standardised source of lighting for the clinical examination.

The clinical examination instrumentation included the 'Pinnacle Sterile Single Use Oral Health Examination Kit 8400' produced by Kerr which includes a mouth mirror, a sickle/ perio 3,5,7,9,11,13 probe, tweezers, a bib, a tissue/wipe, 2 masks, 2 cotton rolls and a tray.

5.7.3 Conduct of the clinical examination

The clinical examination used a standardized protocol adapted from the UK Adult Dental Health Survey in 1998. Before the clinical examination the dentist asked the person a set of questions about their medical history, specifically relating to any risk that the examination may pose. They were asked about a history of rheumatic fever, endocarditis, valvular heart disease, and the presence of any artificial joints. Despite the extremely low risk of the examination, we believed that no risk should be seen as acceptable in a survey of this sort, and those who responded positively to these questions did not undergo the periodontal examination.

Dentists examined participants seated in a comfortable chair, easily accessible to the dental examiner with good head support. Participants did not clean their teeth prior to the examination, but sometimes rinsed their mouths. Debris and/or moisture were removed gently from individual sites with gauze, cotton wool rolls or cotton wool buds if visibility was obscured. Probes were used for cleaning debris from the tooth surfaces to enable satisfactory visual examination. Dental examiners did not use compressed air so as to ensure comparability and maintain infection control. The clinical examination did not include radiographs or fibre-optic trans illumination. The convention throughout all clinical examinations was to score low (i.e., record the lowest level of disease) if in doubt.

5.7.4 Clinical examination

The clinical examination included a full mouth assessment for presence of plaque, presence of calculus, periodontal pocket depth and clinical loss of attachment. Adult Dental Health Survey criteria for periodontal status are comparable, pocket depths and loss of attachment were measured at two sites (mesial and distal) on each tooth (buccally for upper teeth and lingually for lower teeth) and the worst score for each tooth was coded. The pocket depth and loss of attachment was measured using a disposable periodontal probe which had a coloured-coded area. These were defined as first probe band= Up to 3mm, green band = 4-5mm, first area above green band = 6-7mm, purple band = 8-9mm, first area above the purple band = 10-11mm, red band = 12-13mm and all areas above red band = 13mm or more. Pocketing was recorded from the gingival crest to the base of the pocket. Loss of attachment was recorded from the base of the pocket to the cemento enamel junction (CEJ), or the margin of a restoration in the event the CEJ was restored.

5.7.5 Referral for treatment

The data collection team had referral forms (Appendix 8) for participants to complete if found necessary by the dentist. The forms would then be passed to the project coordinator who would organise an appointment with an NHS dentist for further assessment and dental treatment.

5.7.6 Conducting the interview

After the clinical examination, each participant was asked to answer an oral health risk assessment form (Appendix 6) and an adult questionnaire (Appendix 7). Part one of the adult questionnaire included validated questions on demographic, socio-economic factors, oral health related behaviour, experience of dental pain and oral health-related impact on quality of life. The second part of the questionnaire included validated

questions regarding perception of family functioning and partner's current socio-economic characteristics. Participants were allowed to ask for clarification from the interviewer at any time if in doubt and to withdraw from the study at any point.

5.7.6.1 Data collection instruments used in interviews

All data were collected using validated questionnaires. Socio-economic classification and ethnic group information was collected according to the questions included in the census (National Statistics, 2005), and used in the Adult Dental Health Survey (1998). Information on oral health-related behaviours such as dental attendance and oral hygiene habits were assessed using questions adapted from the Adult Dental Health Survey in the UK (1998). Questions about diet were adapted from the Diet and Nutrition Survey (1992-1993). The impact of oral health on the quality of life was assessed using the validated inventory Oral Health Impact Profile (Slade, 1997).

Family functioning data were collected using the validated Family Assessment Device (Ryan et al 2005). The FAD is based on the McMaster Model of Family Functioning (MMFF), a clinically oriented conceptualization of families which identifies six dimensions of family functioning. These six dimensions make up six of the seven scales in the FAD. The seventh scale, General Functioning assesses the overall health/pathology of the family (Epstein et al. 1983). The scale is made up of 60 items which are statements a person could make about his or her family by selecting a response from a four point Likert scale (strongly agree/agree/disagree/strongly disagree). The FAD takes 15 to 20 minutes to complete, requiring a reading age of around 12 years.

The FAD is a self-report questionnaire as it takes into consideration that a family may not be perceived in the same way by observers with different points of view. Family members are likely to perceive things differently from participant observers, who will

also have a different view from non-participant observers or researchers (Epstein et al., 1983). The instrument is also designed so that participants are not asked directly how the family functions but are led to reveal this indirectly resulting in a low social-desirability response bias. This was assessed by correlating the FAD with the Marlowe-Crowne Social desirability Scale (Miller et al., 1985).

The seven scales are intercorrelates, which conflicts with the traditional psychometric practice which dictates that subscales of an instrument should be independent of each other. This has also been reported as a limitation by Ridenour et al.(1999).The assumption is that if a set of scales intercorrelates very highly then using a single scale provides almost as much information as all the scales used together and thus it is more efficient to use only the single scale. However the authors of the instrument argue that there is no reason to think that different aspects of family functioning will be totally independent of each other, as problems in one area of family functioning may have ramifications in other areas. Thus total independence of scales may seem an illogical demand to place on a family assessment device (Epstein et al. 1983) It has also been used in many peer reviewed studies (Aldefer et al. 2008), has cross cultural applicability and has been applied across cultures (Ryan et al., 2005).

5.7.7 Duplicate clinical examinations

The reliability of the clinical data was assessed through duplicated clinical examinations. It was considered advisable to perform duplicate examinations for ten per cent of the sample (or a smaller percentage in large samples) and in at least 30 subjects in small surveys. For reliability of assessment of clinical examinations, parallel measurements on 133 adults (including 4,256 teeth) were carried out by 11 examiners and the 2 gold standard examiners in this study. Percentage agreement and Kappa statistics were used to evaluate the level of intra-examiner reliability.

5.8 Sample size

The minimum required sample size to test association in this study was estimated to be 672. This sample size was calculated to have a 90% power of demonstrating a statistically significant difference in chronic periodontitis experience between those who experienced effective family functioning and those who did not experience effective family functioning at the 5% level, if an odds ratio of 2 or more was observed. The calculation of the size of the sample adopted the 95% confidence interval, 40% of prevalence of chronic periodontitis experience and 20% prevalence of inefficient family functioning (exposure).

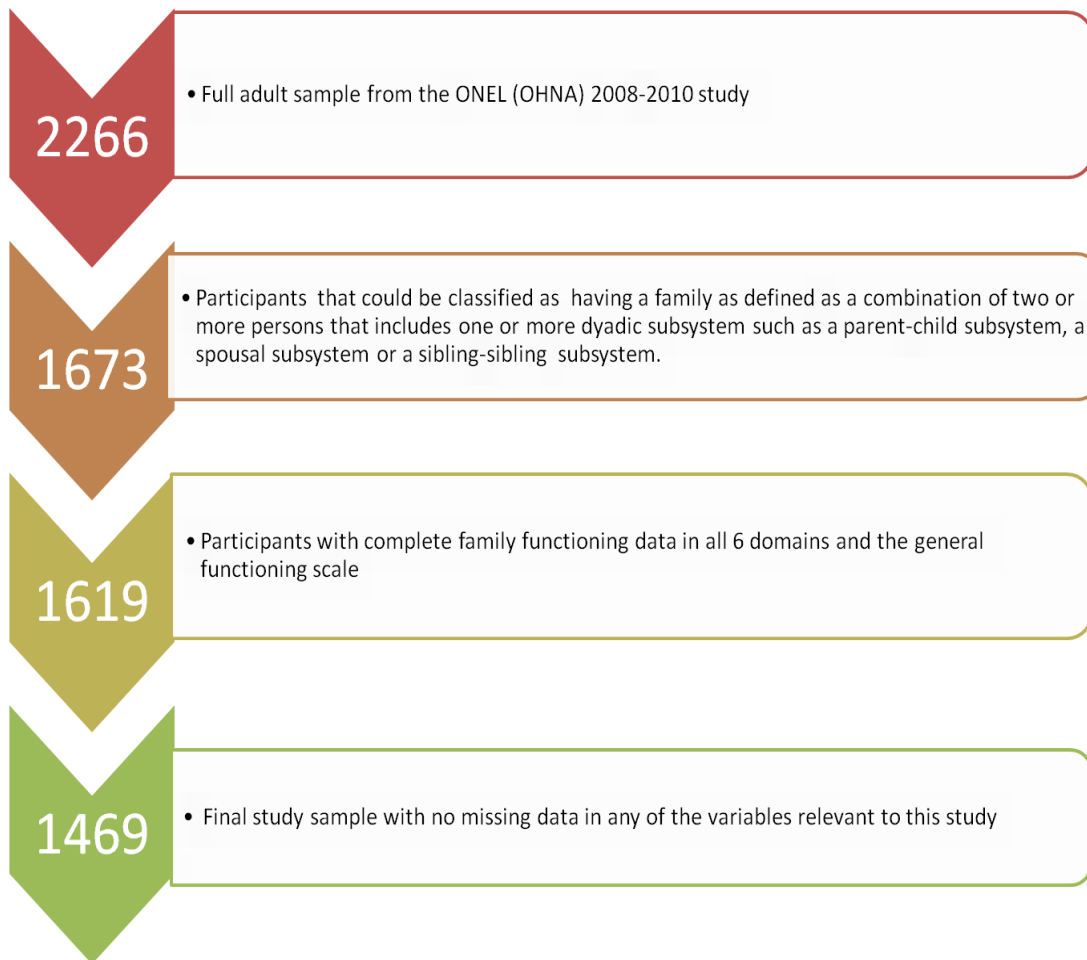
5.9 Data analysis

5.9.1 Data entry

Data processing includes entering, error checking and reliability testing. Data from the questionnaire and the clinical examination were entered manually into a spread sheet developed using the Statistical Package for Social Sciences (SPSS 16) software. Data were coded and anonymised by assigning a family and patient number to each participant to replace names. Data entry was followed by checking for errors, outliers and missing data. The data were entered twice into separate SPSS files and then compared. The differences between the two files were highlighted and any error identified was corrected by checking the participants' records. Numbers of valid and missing cases were also checked. SPSS was used for data entry, to check for entry mistakes, to select the subsample and for doing univariate analysis. STATA 12 was used for modelling of data and mediation analysis.

5.9.2 Sample selection

Figure 5. 1 Flowchart of sample selection for the study



The full adult sample of the ONEL Oral Health Needs Assessment 2009-2010 comprised 2,266 subjects. Of these, 1,673 participants were identified to have family as defined in this study. Participants were identified as having family, as defined in this study, based on methods discussed in section 5.10.3.3. This study defines a family as a combination of two or more persons which includes one or more dyadic subsystem such as a parent-child subsystem, a spousal subsystem or a sibling-sibling subsystem. From this group, 62 were excluded for missing information on any family functioning domain bringing the sample down to 1,619. A further 52 participants were excluded for

missing information on socio-economic status information. 82 participants were excluded, either for not having participated in the clinical examination (periodontal section) due to medical history, or due to incomplete clinical periodontal status data. 6 participants were excluded for missing tobacco consumption data, 8 were excluded for missing tooth brushing information and 7 were excluded for missing dental attendance data, bringing the final sample down to 1,469. This was the sample that was used for data analysis in this study.

5.9.3 Data manipulation

Data manipulation included construction of variables by recoding relevant variables based on conceptual grounds and to facilitate analysis. The analysis included variables assessing demographic characteristics, socio-economic position, oral health-related behaviour, periodontitis status and family functioning domains.

5.9.3.1 Demographic characteristics.

The demographic variables included in the analysis were gender, age and ethnicity.

5.9.3.1.1 Age

Age in years was analysed as a continuous variable.

5.9.3.1.2 Ethnicity

The data on ethnicity was collected using an adaptation of the self-assigned 2001 UK Census categories, which included 26 possible categories under five main ethnic groups: White, Black, Asian and mixed or other. White adults were those who classified themselves as White British, West European, East European, Mediterranean, North American, Latin American or White Other. Black adults were those who classified

themselves as Black British, European, African, Caribbean, American or Black Other. Asians were those who classified themselves as Asian British, Indian, Bangladeshi, Pakistani, Middle East/ Arabic, Chinese, Japanese or Asian Other. Those who classified themselves as Mixed Asian/Black, Mixed Asian/White or Mixed Black/White were categorized as Mixed. For analysis purposes, ethnicity was categorized as being White, Black, Asian or Mixed and the Other category was collapsed into the Mixed/Other category as the size of the sample did not allow for assessment of individual ethnic category.

5.9.3.2 Socio-economic position indicator

5.9.3.2.1 Individual based socio-economic indicator National Statistics

Socio Economic Classification (NS-SEC)

Socio-economic position was analysed according to an individual based socio-economic indicator, as measured by the National Statistics Socio Economic Classification (NS-SEC) using the self-coded method of deprivation. The NS-SEC has been constructed to measure employment relations and conditions of occupations which, conceptually, are central to showing the structure of socio-economic positions in modern societies and helping to explain variations in social behaviour and other social phenomena. The NS-SEC is based on occupation, employment status, supervisory status and size of organisation. There are numerous methods to derive the NS-SEC classes depending on the level of detail of occupation and employment status available (full, reduced, simplified and self-coded methods). Occupation is ideally coded to the most detailed level of SOC2000 for the full, reduced and simplified methods, however as there are 353 unit groups this can be time consuming and costly. In this study NS-

SEC classes were derived using the self-coded method based on current or last main job or occupation, employment status, size of organisation and supervisory status. Participants were categorized into 5 NS-SEC classes; managerial and professional occupations, intermediate occupations, small employers and own account workers, lower supervisory and technical occupations, semi-routine and routine occupations and two additional classes of never worked and long term unemployment and full time students. These classes were collapsed into three classes, namely the managerial and professional occupations class, the intermediate occupations class and the routine and manual occupations class. A fourth class, made up of the never worked, long time unemployed and full time students were also included in the analysis for statistical power but were not reported in the results due to the heterogenous nature of this class which would have rendered the results invalid.

5.9.3.3 Types of families

In operationalizing the types of families included in this study, we have taken into consideration three theoretically relevant distinctions involved in defining the composition of a family: The first is that the individual family members' definition of who they consider to be their family may differ from the definition of observers (Acock et al., 2005). These are called subjective and objective definitions. Secondly, the term 'household' needs to be distinguished from the term 'family' (Acock et al., 2005). The third distinction is between individual level and family level definitions. Definitions of family at the individual level may differ between members in the family, as individuals within the same unit might have contrasting views of who they consider to be family (Acock et al., 2005).

Based on these distinctions, we proposed that the operationalization of family is based on marital status as an objective measure and on the participants' definition of who they consider to be family as the subjective measure. The following subjective measure was used: 'Different people have different definitions of what a family is. When answering questions in this section, please consider all the people in your family who have played a role, either positive or negative, in your life during the past year. Please tick, from the list provided, those you will consider as family when answering the following section.' Meanwhile the objective definition selected was participants' self-reported marital status. The subjective definition was used together with the objective definition to allow families to be defined in the broadest possible way, based on the individuals' perception of family, yet have easily identifiable, objective definitional boundaries for research purposes. A family is not defined based on household definitions which refer to a residential unit and the people who live in it. This is because defining a family by household may not accurately represent who is actually considered to be family (McRae, 1999).

Participants who indicated that they did not consider anyone to be their family and participants whose responses were missing information on the variables used to categorize them into the various family types in this study (question: 'Please tick, from the list provided, those you will consider as family when answering the following section') were automatically excluded from this study.

Nuclear families, as defined in this study, are a group of people united by ties of partnership through marriage or cohabitation and parenthood and consisting of a pair of adults and their socially recognized children. There are 2 types of nuclear families: the nuclear family of orientation and the nuclear family of procreation. Participants who indicated that they were either married, remarried or cohabiting in their marital status

response and answered that they considered only their partner and child(ren) as family when answering the 'who do you consider as family' question were grouped into the 'nuclear family of procreation' type. Participants who indicated that they were single, divorced, separated or widowed in their marital status response and answered that they considered only their mother, father and/or siblings as family when answering 'who do you consider as family' question were grouped into the 'nuclear family of orientation' type.

Reconstituted families are families formed when remarriages occur and when children living in a household share one or no parents (Kreider and Ellis, 2009). The presence of a step-parent, stepsibling, stepchild or half sibling designates a family as reconstituted. The options available for the question 'who do you consider family' did not differentiate between a step child and a participant's own child, making it impossible to operationalize the reconstituted family of procreation type. Participants who indicated that they were single, divorced, separated or widowed in their marital status response and answered that they considered either a stepmother, step father, step siblings and/or siblings as family when answering 'who do you consider as family' question were categorized into the 'reconstituted family of orientation' type.

Single parent families are defined as families composed of a parent, either a mother or father, with a child or children (Schlesinger, 1998). Participants who indicated that they were either single, divorced, widowed or separated in their marital status response and answered that they considered only their child(ren) as family when answering the 'who do you consider as family' question were grouped into the 'single parent family of procreation' type. Participants who indicated that were either divorced, widowed or separated and answered that they considered only a single parent, either mother or father (with or without siblings) when answering the 'who do you consider as family'

question were grouped into the 'single parent family of orientation' type. Within this study, both types of single parent families were merged as one group, the 'single parent family' group.

Childless couple families are families that have never had children (Schlesinger, 1998). Participants who indicated that they were married, remarried or cohabiting in their marital status response and answered that they considered only their partner as family when answering the 'who do you consider as family' question were grouped into the 'childless couple family' type.

Sibling dyads refer to families where no couple or parent-child relationship exists but consists of sibling relationships such as between an individual with a brother or sister. Participants who indicated that they were either single, divorced, separated or widowed in their marital status response and answered that they considered either a brother or a sister and/or, aunt, uncle, cousin or grandparents as family when answering the 'who do you consider as family' question were grouped into the 'sibling dyad' family type.

'Extended family' refers to 'social relationships among those related by blood, marriage, or self-ascribed associations that extend beyond the marital dyad or committed partner couple and the immediate family of parenting adult(s) and dependent children' (Vangelisti, 2008). Within this study, the extended family takes into account both, the same generation extended family and the cross-generation extended family in the operationalization process. The same generation extended families refer to a horizontal extension of a basic family unit, where a brother, sister, stepsibling, or cousin is considered to be family, in addition to a basic family unit. The cross-generation extended families refer to a vertical extension of a basic family unit, where a mother, a father, stepparents, grandparents or grandchildren, aunts, uncles, nephews and/or

nieces are considered to be family, in addition to a basic family unit. However, this study does not differentiate between the cross-generation extended family and the same generation extended family during analysis. A basic family unit in both these instances refers to any of the five types of family identified in this study: the nuclear family of procreation, the nuclear family of orientation, the reconstituted family, the single parent family of procreation, the single parent family of orientation, the childless couple family and the sibling dyad family. The extended families are subcategorized according to their basic family units, such as extended nuclear family of orientation or extended single parent family of procreation.

Participants who indicated that they were either married, cohabiting or remarried but did not identify that they considered their partner to be family were excluded as the subjective and objective measures used to define the type of family to which participants belong could not be operationalized to classify these participants into any of the family types included in this study. Participants who indicated that they were married, cohabiting or remarried but indicated that they did not consider their partner to be family may have done so for various reasons. Some of these participants could have done so by accident, thinking that it was a foregone conclusion that partners are automatically family members. At the same time, there might be some people whose answers reflect their true perception of their family, and thus that their partner is excluded, either due to physical distance or psychological distance. The data available in this study makes it impossible to distinguish and ascertain to which orientation these participants belong. Including these participants would introduce bias in the study sample as their definition of family would not have complied with the same theoretically relevant distinctions involved in defining the composition of a family adopted in this

study. Categorizing these participants into a separate family type would have created an ambiguous, uncertain and non-homogenous family type.

Participants who indicated that they were single, divorced, separated or widowed but identified that they considered their partner to be family have also been excluded from the study sample as the subjective and objective measures used to define the type of family to which participants belong could not be operationalized to classify these participants into any of the family types included in this study. Categorizing these participants into any of the types of families included in this study would have introduced bias into the study sample as their definition of family would not have complied with the same theoretically relevant distinctions involved in defining the composition of a family adopted in this study.

5.9.3.4 Oral health related behaviour

5.9.3.4.1 Dental attendance

Dental attendance was assessed through the question 'About how long ago was your last visit to the dentist?' with 9 possible response categories: in the middle of treatment, in the last 6 months, in the last 12 months, more than 1 up to 2 years ago, more than 2 up to 3 years ago, more than 3 up to 5 years ago, more than 5 up to 10 years ago, more than 10 up to 20 years ago and never. For analysis and conceptual reasons, last dental attendance was categorised into regular attendance (within the last year) and irregular attendance (more than a year ago or never).

5.9.3.4.2 Tooth brushing

Tooth brushing frequency was dichotomised into 'once a day or never' and 'twice a day or more than twice a day'.

5.9.3.4.3 Tobacco consumption

Information on tobacco consumption was collected through the question: 'Do/Did you use tobacco in any way?' with 3 possible responses: 'No (never)', 'Yes (currently)', 'Yes (in the past)'. For analysis purposes and conceptual reasons, tobacco consumption was re-categorized into 2 groups, those who responded 'No (never)' and 'Yes (in the past)' were categorized into one group labelled as 'No', while those who responded 'Yes (currently)' was categorized into the group labelled 'Yes'.

5.9.3.5 Periodontitis status

Information on periodontitis status was obtained by measuring the pocket depths (mesial and distal) on each tooth (bucally for upper teeth and lingually for lower teeth) and the worst score for each tooth was coded. Pocketing was recorded from the gingival crest to the base of the pocket. The scores were noted as follows: less than 4mm, 4-5mm, 6-7mm, 8-9mm, 10-11mm, 12-13mm and 13mm or more. Using these scores, periodontitis status was analysed according to the definition of chronic periodontitis adopted in this study, where chronic periodontitis is defined by the presence of at least one site with periodontal pocket depth of ≥ 4 mm.

5.9.3.6 Family functioning domains

Information on family functioning was obtained using the McMaster Family Assessment Device, which includes 60 statements regarding healthy and unhealthy family functioning. Each statement correlates with 4 possible answers: 1= 'strongly agree', 2 = 'agree', 3 = 'disagree' and 4= 'strongly disagree'. Negative statements are re-coded to become positive statements by subtracting them from 5. Then all scores for the positive and re-coded negative statements are again subtracted from 5 to allow higher scores

on family functioning domain to denote more effective family function. Family functioning was analysed as 6 separate domains: problem solving, communication, role functioning, affective involvement, affective response and behaviour control. Each domain score was calculated by summing up the scores for all statements belonging to each particular domain and dividing it by the number of statements in the domain. The score for each domain is only calculated if less than 40% of the items per scale are missing. If more than 40% of the items are missing, the score is not calculated and is designated as missing. The scale scores will range from 1, being inefficient, to 4, being efficient. The domains of family functioning were analysed as a continuous variable.

5.9.4 Sample Weighting

Weighting of the sample was done to enable estimates to be generated that are representative of the underlying North East London population from which study participants were selected.

To ensure that survey estimates were consistent with the age, sex and ethnicity distribution of the North East London population, it was necessary to create sampling weights for use during statistical analysis. A person's chance of selection in the survey was determined by the ward and postcode from which their address was selected and the number of people aged 16 years to 65 years living in the selected household. Weights were calculated to reflect these probabilities of selection and to adjust for different participation rates across postcodes and among age, sex and ethnicity categories.

When data are used without weights, each record counts the same as any other record. Implicit in such use are the assumptions that each record has an equal probability of being selected and that non-response and non-coverage are equal among all segments

of the population. When deviations from these assumptions are large enough to affect the results obtained from a dataset, then weighting each record appropriately can help to adjust for assumption violations.

The formula below reflects all factors taken into account in weighting the adult ONEL-FS data:

$$\mathbf{RAWadults} = \mathbf{SAMPWT} \times \mathbf{NRWT} \times \mathbf{PSTWT}$$

RAWadults is the final weight assigned to each participant, which has been rescaled (i.e. dividing each weight by the maximum weight value before any rescaling was done) so the sum of sample weights equals actual total number of adults aged 16 to 65 years in the sample.

SAMPWT accounts for differences in the basic probability of selection of participants. It is calculated as the inverse of the product of the probability of selection of households within wards (in the first stage of sampling) and the probability of selection of individuals within households (in the second stage of sampling).

NRWT refers to the adjustment of SAMPWT for non-response. It is calculated as the inverse of the non-response rate. In ONEL-FS, response rates for each borough were estimated at household level rather than at individual level.

PSTWT is the proportion of adults in an age-by-ethnicity-by-sex category of the study population divided by the proportion of participants in the same age-by-ethnicity-by-sex category. Such post-stratification forces the total number of cases in the sample (weighted frequencies) to equal population estimates in the three ONEL-FS boroughs.

5.9.5 Descriptive data analysis

The first step of data analysis included a description of the sample by conducting a frequency distribution for all variables in order to assess the characteristics of the sample.

Gender, ethnicity, types of family, socio-economic classification, and prevalence of chronic periodontitis experience were described as frequencies and weighted percentages, while age, family functioning scores in the general functioning, behaviour control, problem solving, role functioning, communication, affective involvement and affective responsiveness domains were described as mean scores and 95% confidence intervals.

5.9.6 Univariate data analysis

The second step of the data analysis included simple univariate logistic regressions to investigate the association between the explanatory variables and the outcome of the study. Logistic regression was used in this study as it is an appropriate method of regression to predict binary outcome variables from a set of variables that may be continuous, discrete, dichotomous or categorical (Altman, 1996). The Wald test was used in order to obtain a P-value. The P-value tells us if an explanatory variable is making a statistically significant contribution to the prediction of the outcome variable by dividing the regression coefficient by its standard error. A relationship is considered to be statistically significant if the P-value is ≤ 0.05 .

However, it is worth mentioning that in the case of multiple hypotheses testing, such as those involving each of the family functioning domains, it has been suggested that a Bonferroni correction be applied. The Bonferroni correction is based on the idea that when testing n dependent or independent hypotheses in a set of data, the one way of

maintaining the Type 1 error below 5% is to test each individual hypothesis at a statistical significance level of $1/n$ times, which is what it would be if only one hypothesis were tested. This can be done by calculating a level of significance by dividing the chosen significance level (0.05) by the number of domains (0.05/7) so that the cumulative Type I error remains below 5%. However, it has been argued that while the Bonferroni correction for multiplicity is recommended, in the absence of a sound theoretical hypothesis and where the probability that many of the results are due to chance, when applied in sound hypothesis generating studies it potentially 'overcorrects' resulting instead in too many Type II errors (Streiner and Norman, 2011). This may close off potentially fruitful observations prematurely. Hence it has been suggested that such observational studies should not correct for multiple testing but should be conservative in the inference of their findings and, as such, that positive results should be seen as hypothesis generating and not as definitive findings (Streiner and Norman, 2011). Therefore, and taking this consideration into account, the Bonferroni correction has not been applied in this study.

5.9.7 Multivariate analysis

In the third step, a hierarchical model was built to test the theoretical framework. Hierarchical modelling is a type of multiple regression analysis in which predictor variables are entered into the theoretical model according to the hierarchy guided by a conceptual framework. Within this study, the selection of variables for inclusion in the multiple logistic regression models was based on statistical associations observed in simple logistic regression and on conceptual grounds based on the theoretical framework in this study.

Hierarchical models were constructed following a hierarchical relationship between explanatory variables and outcome variables established in the theoretical framework of this study.

Figure 5.2 Study proposed theoretical framework

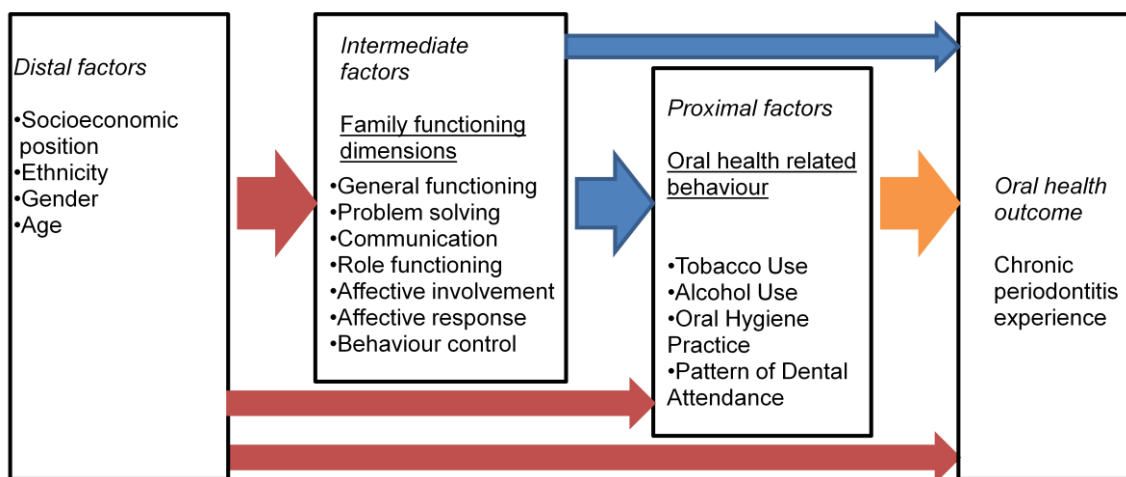


Figure 5.2 illustrates the theoretical framework of this study, in which variables at the left of the diagram influence those to their right. The distal factors in this model, i.e. socio-economic status, may affect either directly or indirectly all other groups of explanatory variables. The intermediate variable, the dimension of family functioning, may in turn affect the proximal explanatory variable, which is oral health related behaviour. Finally, all of the above variables and the proximal explanatory variable, oral health-related behaviour, may affect the outcome variable, which is chronic periodontitis experience. A variable was selected and included in the model only if its relationship with chronic periodontitis experience was significant at the 0.2 level, as recommended by Altman (1991).

The following describes the stages used in the modelling:

Stage one: Entering level 1: Demographic factor, namely ethnicity.

Stage two: Adding level 2: Socio-economic factor, namely NS-SEC.

Stage three: Adding level 3: One dimension of family functioning was added, namely general functioning, problem solving, communication, role functioning, affective involvement, affective response or behaviour control.

Stage four: Adding level 4: Periodontal health related behaviour factors, namely tobacco use, percentage of plaque score.

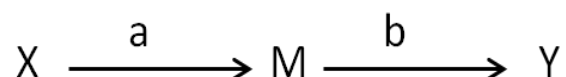
This was repeated for each of the six dimensions of family functioning and the general functioning scale.

5.9.8 Testing mediation

The next step in the data analysis involved testing for mediating effects of relevant dimensions of family functioning on chronic periodontitis experience. Testing mediation effect is useful because this examines processes by which variables are related (MacKinnon et al., 2002).

Mediation can be hypothesized as a causal chain in which one variable affects a second variable and that, in turn, affects a third variable. The intervening variable, M or a family functioning domain, is the mediator of the relationship between a predictor, X; socio-economic position and an outcome Y; chronic periodontitis. The mediator, family functioning domain M, is the variable that is in a causal sequence between two variables socio-economic position; X and chronic periodontitis; Y (MacKinnon et al., 2007).

Graphically, mediation can be depicted in the following way:



Paths a and b are called direct effects. The mediation effect, in which X leads to Y through M, is called the indirect effect. The indirect effect represents the portion of the relationship between X and Y that is mediated by M.

There are various methods of testing mediation: A review of 14 of the most commonly used methods classified them into 3 main approaches: the causal steps test of the intervening variable effect: difference in coefficient test of the intervening variable effect; and product of coefficient tests of the intervening variable effect (MacKinnon et al., 2002). The most commonly used approach in the psychological literature is the causal steps approach which is based on the work of Baron and Kenny (1986) and Judd and Kenny (1981). This approach takes into account partial mediation observed in complex causal pathways which rarely has one main variable that mediates the effect of the independent variable on the dependant variable (Baron and Kenny, 1986, Judd and Kenny, 1981). The causal steps approach requires that:

1. The independent variable should be significantly associated with the mediator.
2. The mediator should be significantly associated with the dependant variable.
3. The independent variable should be significantly associated with the dependant variable
4. This association should be attenuated after controlling for the mediator.

Mediation was assessed using the four steps proposed by Baron and Kenny (1986). If all four of these steps are fulfilled, complete mediation is indicated; and if the first three steps are met but the Step 4 is not, then partial mediation is indicated. Since this analysis involves a multi-categorical causal agent X, -socio-economic position, it is not

possible to estimate the direct and indirect effects of X (socio-economic position) using a single c, c' or a that represents X's (socio-economic position) effect on M (family functioning domain) or Y (chronic periodontitis experience). Instead, in order to represent fully the effect of a categorical variable with k mutually exclusive categories on some dependant variable (whether M or Y in Figure 1), k – 1 parameter estimates are needed. The K-1 X categories are denoted as X¹ and X². K-1 parameters are denoted as path c₁, c₂, a₁, a₂, c'₁ and c'₂. This approach specifies the demonstration of the steps as shown in the figures 5.3 and 5.4 and as listed below.

Step 1: This step establishes that there is an effect that may be mediated through a significant association between socio-economic position and chronic periodontitis experience, path c₁ and c₂.

Step 2: This step essentially involves treating the mediator as if it were an outcome variable by assessing a significant association between each socio-economic position and the family functioning domain, path a₁ and a₂.

Step 3: This step involves showing that the mediator affects the outcome variable through a significant association between the family functioning domain and chronic periodontitis experience, adjusting for socio-economic position, path b.

Step 4: This step involves assessing a non-significant association between socio-economic position and chronic periodontitis experience after controlling for the family functioning domain, path c'₁ and c'₂.

Figure 5.3 Step one of the mediation analysis

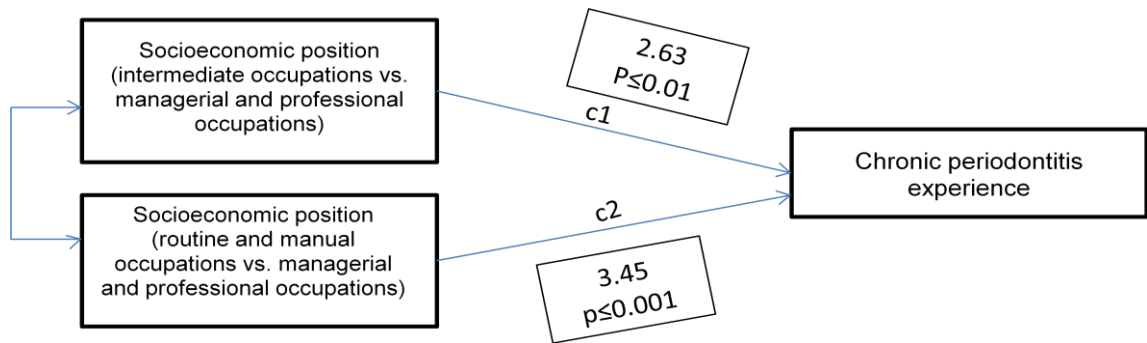
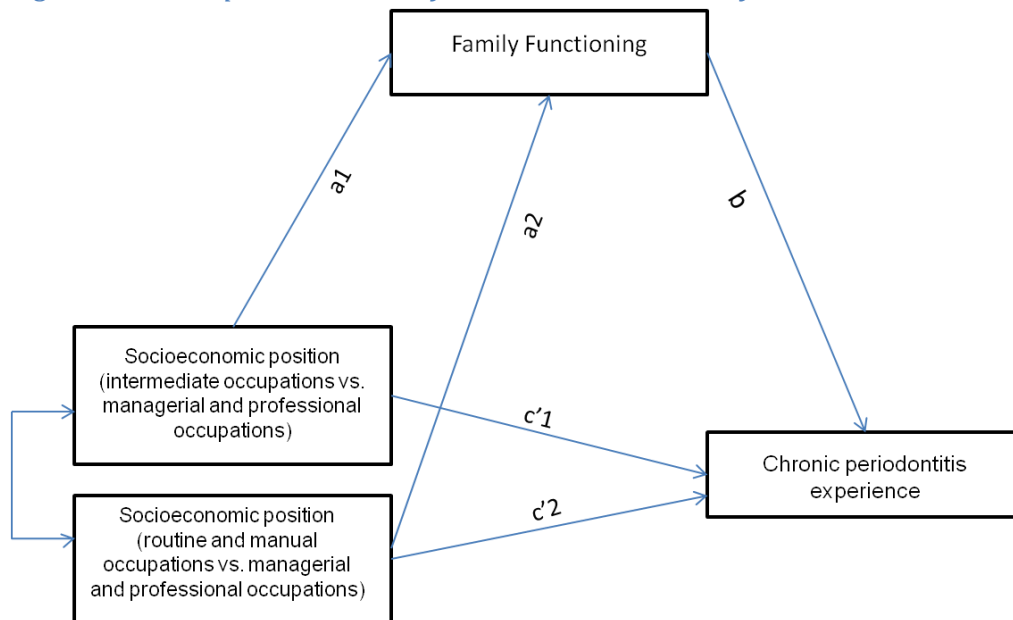


Figure 5.3 shows step 1 of the mediation analysis, which is the association between socio-economic position ('intermediate occupations vs. managerial and professional occupations' and 'routine and manual occupations vs. managerial and professional occupations') and chronic periodontitis experience without controlling for the proposed mediator (family functioning domain). Path c1 shows the relative total effect for the association 'intermediate occupations vs. managerial and professional occupations' and chronic periodontitis experience and is common for each of the domains tested while path c2 shows the relative total effect for the association 'routine and manual occupations vs. managerial and professional occupation's and chronic periodontitis experience and is also common for each of the domains tested.

Figure 5. 4 Steps 2,3 and 4 of the mediation analysis



If all four of these steps are fulfilled, complete mediation is indicated, and if the first three steps are met but the Step 4 is not, then partial mediation is indicated

In this study X^1 refers to socio-economic position group (intermediate occupations vs. managerial and professional occupations) and X^2 refers to socio-economic position group (routine and manual occupations vs. managerial and professional occupations). Y refers to chronic periodontitis experience and M refers to a family functioning dimension.

Findings must be interpreted with caution as this method does not provide a joint test of the three conditions (conditions 1, 2, and 3), a direct estimate of the size of the indirect effect of socio-economic position; X on chronic periodontitis; Y , or standard errors to construct confidence limits, although the standard error of the indirect effect of socio-economic position; X on socio-economic position; Y is given in the descriptions of the causal steps method (MacKinnon et al., 2002). This study selected a very large sample size and thus it may detect mediation even if paths a and b (or in this case a_1 ,

a2 and b) are small. However, it still requires a statistically significant relationship between path X and Y.

In this study, the mediator is observed and is not experimentally manipulated, and therefore a reverse hypothesis that the dependent variable causes the mediator cannot be ruled out (Wu and Zumbo, 2008).

Therefore, carrying out all four steps does not conclusively establish that the hypothesized mediation model has occurred because there are other alternative models that meet the above specification.

In spite of these limitations, because this approach uses data analysis as a tool to examine whether a mediation effect is in place, it is a suitable test for use in observational studies and is therefore the method used here (Wu and Zumbo, 2008).

5.9.9 Testing Moderation

According to Baron and Kenny, conceptually a moderator specifies on whom or under what conditions another variable will operate to produce an outcome. A variable M_o is a moderator of the relationship between an independent variable X and an outcome Y if M_o explains under what conditions X is related to Y (Kraemer et., 2008). The distinction between a moderator and a mediator is that a moderator is supposed to affect the relationship between an independent variable and the outcome, whereas a mediator is supposed to be influenced by the independent variable directly.

For a variable to be considered a moderator, it is required to fulfill certain criteria. More recently, it is considered essential that the moderator should not be correlated with the independent variable (Kraemer et al., 2008) whereas, previously, it was just 'desirable'

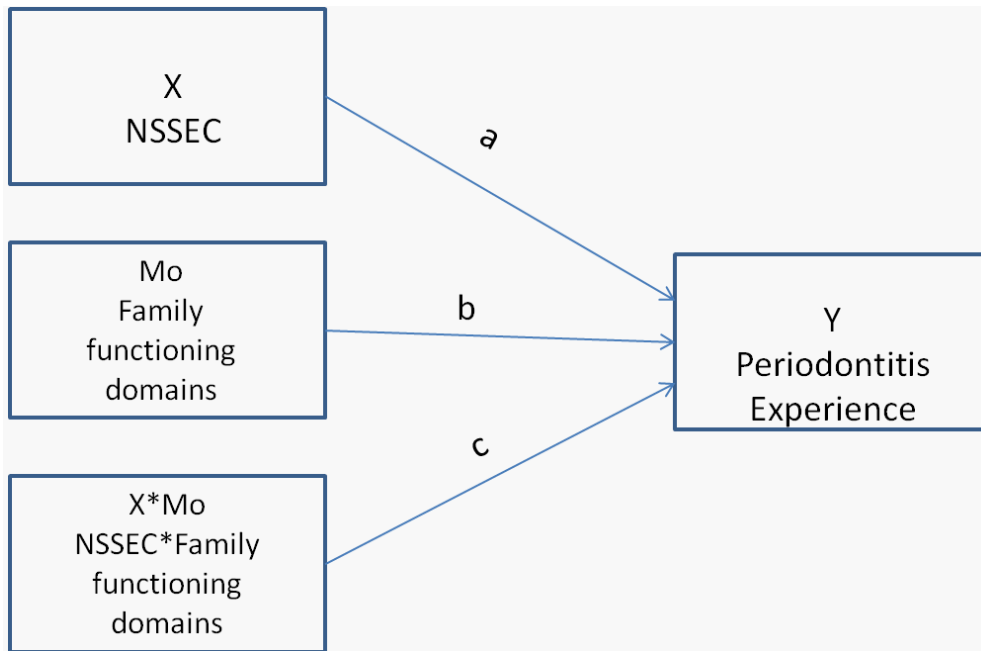
for there to be no association between the two (Baron and Kenny, 1986). The second criterion is that both independent variable and moderator variable should be independently associated with the outcome; and the third criterion is that the moderator should have temporal precedence over the independent and dependent variables. The last criterion is considered as the minimal criterion to be met, for a variable to be considered a moderator.

For linear relationships, the moderation model is written as follows and is adapted from WU and Zumbo, 2008:

$$Y = i + Ax + bMo = C(X * Mo)$$

In this model, **i** is the regression intercept, **a** is the partial regression coefficient for the independent variable **X** (socio-economic status-NS-SEC), **b** is the partial regression coefficient for the moderator (Wu and Zumbo, 2008)

Figure 5. 5 Moderation model (Adapted from Wu and Zumbo, 2008)



In the figure above, **X** is the independent variable, **Y** is the dependent variable, **Mo** is the moderator variable. **X*Mo** is the interaction of the independent and moderator variables. '**a**' is the effect of the independent variable on the outcome controlling for **Z** and **X*Mo**. '**b**' is the effect of the moderator on the outcome controlling for **X** and **X*Mo**, and '**c**' is the effect of the **X*Mo** interaction on the outcome controlling for the lower order effects.

6. Results

6.1 Introduction.

This chapter presents the findings of this study. The first part of this chapter, presents information on the ONEL sample, as compared to the OHNA - adult sample and the population. This is followed by a description of the study sample; the results of the Univariate analysis; the results of the multivariate analysis; the results of the mediation analysis; and the results of the interaction analysis. Finally, the last section presents the summary of the results chapter.

6.2 Response rate.

Table 6.1 Response rate for the ONEL- OHNA adults sample

	Waltham Forest	Redbridge	Barking & Dagenham	ONEL Family Study
Number of addresses sampled	1148	1051	994	3193
Number of valid addresses	820	885	823	2528
Number of addresses refusing to participate	355	423	313	1091
Number of addresses agreeing to participate	465	462	510	1437
Household response rate	56.7%	52.2%	61.9%	56.8%

The response rate for the ONEL- OHNA was estimated at the household level for each borough. Table 6.1 shows the response rate of each borough involved as well as the response rate for the overall ONEL family study. The overall response rate of the adult ONEL family study was 56.8%, which was calculated as the proportion of addresses

whose residents agreed to participate and had completed the questionnaires and clinical examinations out of all valid addresses.

6.3 Representativeness of study sample

Table 6.2 Distribution of scores of the Index of Multiple Deprivations in the ONEL adult sample by quintiles of distribution in England

IMD quintiles	Range of average IMD scores in England	Frequency (%) in ONEL-OHNA adult sample
1 st quintile (least deprived)	0.0-8.32	27(2.74)
2 nd quintile	8.33-13.74	144(8.54)
3 rd quintile	13.75-21.22	341(18.92)
4 th quintile	21.23-34.42	968(42.12)
5 th quintile (most deprived)	34.43-highest	786(27.68)

The distributions of scores for the Index of Multiple Deprivation in the ONEL-OHNA study sample by quintiles of distribution in England are presented here.

The mean index of multiple deprivations (IMD) scores for the ONEL-OHNA sample and for the ONEL population from the census (Department of Communities and Local Government, Indices of Deprivation 2007) matched exactly.

Table 6. 3 Representativeness of the ONEL-OHNA adult sample and ONEL population by gender, age and ethnicity.

Variables	Percentage in population	Number (%) in unweighted ONEL-OHNA adult sample	Number (%) in weighted ONEL – OHNA adult sample
<i>Gender</i>			
Male	48.84	742(31.67)	710(48.25)
Female	51.56	1601(68.33)	1556(51.75)
<i>Age in groups</i>			
16-25 years old	18.38	205(8.75)	192(17.80)
26-35 years old	26.37	857(36.58)	831(25.02)
36-45 years old	23.81	855(36.49)	826(24.27)
46-55 years old	18.17	248(10.58)	243(18.93)
56-65 years old	13.28	178(7.60)	174(13.98)
<i>Ethnicity</i>			
White	69.06	832(35.78)	807(67.91)
Asian	16.82	820(35.27)	798(19.49)
Black	10.59	605(26.02)	594(9.44)
Mixed other	3.53	68(2.92)	67(3.16)
<i>All</i>	100	2343(100)	2266(100)

Representativeness of the study sample could not be directly compared to the ONEL population as the study sample consisted of a subset of the ONEL-OHNA population, namely those individuals meeting the inclusion criteria of this study; and such data from the ONEL population is unavailable for comparison. However, as the study sample is derived from the ONEL-OHNA, the representativeness of the ONEL-OHNA study sample in comparison to the ONEL population is presented here. Table 6.3 shows that there were some differences in age, gender, and ethnic distribution in the ONEL-OHNA sample and ONEL population, therefore the data was weighted to ensure the ONEL-OHNA was fully representative of the ONEL population. The pre-weighted percentages reflect the relative proportion of respondents in each category in the sample, whereas

the post-weighted percentages reflect the relative proportion of respondents in each group in the population.

6.4 Characteristics of the study sample

The sample for this study included adults aged 16-65 living in Waltham Forest, Redbridge and Barking & Dagenham who had participated in the ONEL-OHNA and that had a family defined as ‘a combination of 2 or more persons that includes one or more dyadic subsystem such as a spousal subsystem, parental subsystem or a sibling-sibling subsystem’.

Table 6.4 Study sample distribution by demographic characteristics; age, gender, ethnicity, family type and socio-economic position indicator; NS-SEC.

Variables	n	Weighted proportion (%) or Mean (C.I)
<i>Gender</i>		
Male	444	46.39
Female	1025	53.61
<i>Age in years</i>	1469	36.81(36.39-37.23)
<i>Ethnicity</i>		
White	504	65.17
Asian	542	21.56
Black	381	10.07
Mixed other	42	03.18
<i>Family type</i>		
Nuclear Orientation	56	07.69
Nuclear Procreation	279	17.83
Single Parent Orientation	17	02.24
Single Parent Procreation	39	03.14
Childless Family	35	02.99
Sibling Dyad	16	01.90
Extended Nuclear Orientation	17	03.01
Extended Nuclear Procreation	819	47.66
Extended Single Parent Orientation	6	00.39
Extended Single Parent Procreation	117	07.47
Extended Childless Family	68	05.66
<i>NS-SEC</i>		
Managerial and professional occupations	631	45.00
Intermediate occupations	153	10.10
Small employers and own account workers	81	06.44

Lower supervisory and technical occupations	105	09.40
Semi-routine and routine occupations	175	12.77
Never worked and long term unemployment	271	12.17
Full time students	53	04.11
<i>NS-SEC- collapsed</i>		
Managerial and professional occupations	631	42.95
Intermediate occupations	234	15.93
Routine and manual occupations	280	19.06
Never worked and long term unemployed	324	22.06

Table 6.4 shows the distribution of the study sample by demographic characteristic and socio-economic indicator. The weighted percentages reflect the relative proportion of each group in the population, while the frequencies represent the actual number of respondents in the specified group. There was a slightly higher percentage of female participants as compared to males, and the mean age of the population was 37 years. A majority (65.17%) of the sample were of White ethnicity, 21.56% were of Asian ethnicity, 10.07% were of Black ethnicity and 3.18% were of mixed or other ethnicity. Almost half of the sample (47.66%) was classified as belonging to the extended nuclear family of procreation type, followed by the nuclear procreation family type (17.83%). Participants' socio-economic position was reported using the National Statistics Socio Economy Classification (NSSEC). Table 6.4 shows both the distribution of the sample according to the five class NSSEC classifications and also the three class classification that is being used for analysis. Slightly less than half of the sample (42.15%) reported that they belonged to the 'managerial and professional occupation' group, while the remainder of the sample was distributed among the 'intermediate occupations' group (15.93%), 'routine and manual occupations' group (19.06%) and the 'never worked and long term unemployed' group (22.06%). The 'never worked and long term unemployed' group consisted of a non-homogenous group of people who had never worked, students, and long term unemployed.

Table 6.5 Distribution of oral health-related behaviour and oral health behaviour indicator of the study sample

Variable	N	Post-weighted proportion (%) or Mean (CI)
<i>Tobacco consumption</i>		
No (never)	1011	56.82
Yes (currently)	233	21.48
Yes (in the past)	225	21.70
<i>Tobacco consumption-re-categorized</i>		
No	1236	78.53
Yes	233	21.48
<i>Dental attendance</i>		
In the middle of treatment	41	02.40
In the last six months	504	38.74
In the last 12 months	260	17.62
More than 1 up to 2 years ago	197	11.85
More than 2 up to 3 years ago	104	06.41
More than 3 up to 5 years ago	122	09.00
More than 5 up to 10 years ago	82	06.11
More than 10 up to 20 years ago	60	03.98
Never	99	03.81
<i>Dental attendance-re-categorized</i>		
Attendance within last year	805	58.74
Attendance more than a year ago	664	41.26
<i>Tooth brushing frequency</i>		
Never	8	00.56
Once a day	423	27.81
Twice a day	927	63.46
More than twice a day	109	07.99
Others	2	00.18
<i>Tooth brushing frequency- re-categorized</i>		
Once a day or less often	431	28.37
Twice a day or more often	1038	71.63
<i>Plaque percentage (mean)</i>	1469	41.82 (40.37-43.26)

Table 6.5 shows the distribution of periodontal health-related behaviour and a periodontal health-related behaviour indicator for the study sample. When asked about their current and past tobacco usage related to cigarettes, cigars, pipes, cannabis, snuff and paan, a majority of the sample (56.82%) reported never having consumed tobacco while smaller proportions of the sample reported current consumption of tobacco (21.48%) and having consumed tobacco in the past (21.70%). Those answering positively to having consumed tobacco in the past were considered as never having consumed tobacco for analysis purposes. In terms of dental attendance, 58.74% of the sample reported visiting the dentist within the last year, while 41.26% reported visiting the dentist more than a year ago. A majority of the sample (71.63%) reported to have cleaned their teeth twice a day or more often, with the balance reportedly cleaning their teeth once a day or less often. The mean percentage of teeth with visible plaque in the sample was 41.82%.

Table 6.6 Mean family functioning scores by domain in the study sample

Family functioning domains	Mean (95% CI)
General functioning	3.11(3.09- 3.13)
Behaviour control	3.00(2.98-3.02)
Problem solving	3.03(3.02-3.04)
Communication	2.91(2.90-2.92)
Roles	2.75(2.74-2.77)
Affective responsiveness	2.90(2.89-2.92)
Affective involvement	2.88(2.86-2.89)

Table 6.6 shows the mean family functioning scores by domain. The scores ranged from 1 to 4, with higher scores reflecting more efficient family functioning as compared to lower scores. The general functioning scale reported the highest mean score (3.14) followed by problem solving (3.03) and behaviour control (3.00). The remaining 4 domains all had mean scores below 3 with the domain roles reporting the lowest mean score of 2.75.

Table 6.7 Sample distribution and univariate association of demographic characteristics; age, gender, ethnicity and socio-economic position indicator; NS-SEC by chronic periodontitis experience (at least one tooth with ≥ 4 mm pocketing).

Variables (n)	<4mm pocket depth N (95% CI)	at least one tooth with ≥ 4 mm pocketing N(%) Mean(95% CI)	OR(95% CI)	P value
<i>Gender</i>				
Male (431)	69(16.35)	375(83.65)	1	0.791
Female (1014)	184(17.12)	842(82.88)	0.95(0.63-1.42)	
<i>Age in years (mean)</i>	36.62(33.75-39.50)	38.63(37.17-40.09)	1.01(0.99-1.03)	0.231
<i>Ethnicity</i>				
White (499)	121(19.69)	383(80.31)	1	<0.001
Asian (534)	67(9.65)	475(90.35)	2.29(1.44-3.65)	
Black (371)	57(15.52)	324(84.48)	1.33(0.78-2.26)	
Mixed other (41)	8(9.06)	34(90.94)	1.55(1.00-6.02)	
<i>NS-SEC¹</i>				
Managerial and professional occupations (620)	138(23.53)	493(76.47)	1	0.001
Intermediate occupations (233)	32(10.54)	202(89.46)	2.61(1.46-4.64)	
Routine and manual occupations (273)	35(9.15)	245(90.85)	3.06(1.69-5.52)	
Never worked and long term unemployed (319)	48(14.74)	276(85.26)	1.78(2.38-4.43)	
<i>All</i>	253(18.47%)	1216(81.53%)		

Table 6.7 shows 81.53% of the sample had chronic periodontitis, signified by at least one tooth with more than 4mm pocketing which is consistent with the proportion reported in the ONEL Adult Dental Health Survey 2008-2010 (81.26%) but higher than the proportion found in the England and United Kingdom (Adult Dental Health Survey, 2009). Almost an equal proportion of male (83.65%) and female (82.88%) participants had chronic periodontitis in the sample. There was no significant difference in the mean age of those with more than 4mm pocketing (38.63) and those who had less than 4mm pocketing (36.62). When age was analysed in groups (10 year intervals) no noticeable trends was noticed.

Regarding ethnicity, the proportion of participants having at least one tooth with more than 4mm pocketing differed significantly ($p < 0.001$) between ethnic groups. The highest proportions were those of mixed ethnicity (90.94%) and Asian ethnicity (90.35%), followed by Black ethnicity (84.48%) and the lowest proportion was those of white ethnicity (80.31%).

With reference to NSSEC, the proportion of participants having at least one tooth with more than 4mm pocketing differed significantly ($p < 0.001$) between occupational classes. As the three categories of the NSSEC may be assumed to equate to a form of hierarchy, a distinct trend can be seen whereby the proportion of the sample having at least one tooth with ≥ 4 mm pocketing increased the lower down the classification the participant belonged. The highest proportion of participants having at least one tooth with more than 4mm pocketing were the 'routine and manual occupations' group (90.85%) followed by the 'intermediate occupations' group (89.46%), with the 'managerial and professional occupations' groups (76.47%) having the lowest proportion. The 'never worked and long term unemployed' group were reported to illustrate the distribution of participants having at least one tooth with ≥ 4 mm pocketing

within this group as they were included in further analysis for statistical power. However, as the 'never worked and long term unemployed' group is a 'residual group' and is considered to be non-homogenous, it was decided that the measurement and reporting of trends in socio-economic inequality would be restricted to the occupation-based classes only.

Table 6.7 also shows the univariate associations between the socio-demographic variables (age, gender, ethnicity, and NSSEC) and chronic periodontitis experience characterized as having at least one tooth with ≥ 4 mm pocketing. Although not significant, the trends for gender and age were in expected directions with male participants and older participants (every one year increase in age) more likely to present with chronic periodontitis (characterized as having at least one tooth with ≥ 4 mm pocketing) as compared to female participants and younger participants.

Participants of Asian ethnicity and participants of Mixed/Other ethnicity were significantly 2.29 times (95% CI: 1.44-3.65) and 1.55 times (95% CI: 1.00-6.02) more likely, respectively, to have chronic periodontitis characterized as having at least one tooth with ≥ 4 mm pocketing as compared to participants of White ethnicity. Participants of Black ethnicity were 1.33 times (95% CI: 0.78-2.26) more likely respectively to have chronic periodontitis characterized as having at least one tooth with ≥ 4 mm pocketing as compared to participants of White ethnicity. However, this was not statistically significant.

With regard to NSSEC, participants in the 'routine and manual occupations' category and in the 'intermediate' category were, significantly, 3.06 times (95% CI: 1.69-5.52) and 2.61 times (95% CI: 1.46-4.64) more likely, respectively, to have chronic

periodontitis (characterized as having at least one tooth with ≥ 4 mm pocketing) as compared to participants in the 'managerial and professional occupations'.

Table 6.8 Sample distribution and univariate association of family type by chronic periodontitis experience (at least one tooth with ≥ 4 mm pocketing).

Family Type	N (%)	>4mm pocket depth	Odds Ratio (95%C.I)	P value
Nuclear Orient	56(7.69)	48(80.15)	1	
Nuclear Pro	279(17.83)	234(84.78)	1.38(0.32-5.97)	0.667
SinglePrntOrient	17(2.24)	13(86.66)	1.61(0.21-12.56)	0.650
SinglePrntPro	39(3.14)	35(93.36)	3.48(0.50-24.20)	0.207
Childless	35(2.99)	31(89.79)	2.18(0.28-16.86)	0.456
Sibling dyad	16(1.90)	11(85.45)	1.45(0.23-9.16)	0.690
EXTNuclearOrient	17(3.01)	10(76.8)	0.82(0.09-6.88)	0.855
EXTNuclearPro	819(47.66)	668(81.46)	1.09 (0.27-4.47)	0.906
EXTSinglePrntOrient	6(0.39)	6(100)	Omitted	
EXTSinglePrntPro	117(7.47)	103(89.32)	2.07 (0.44-9.65)	0.354
EXTChildless	68(5.66)	57(80.57)	1.02(0.19-5.30)	0.975
Total	1469(100)	1216(83.24)		

In terms of family type, table 6.8 presents the distribution of chronic periodontitis for the 11 family categories. This was to illustrate that there was no significant difference in terms of chronic periodontitis distribution between the nuclear family of orientation (80.15%), nuclear family of procreation (84.78%), the extended nuclear family of orientation (76.80%) and the extended nuclear family of procreation (81.46%); between the single parent family of orientation (86.6%) and procreation (93.36%); extended single parent of procreation family (89.32%); between the childless family (89.79%) and extended childless family (80.57%), hence excluding these variables from further analysis.

Table 6.9 Sample distribution and Univariate association of oral health related behaviour and oral health related behaviour indicator by chronic periodontitis experience (at least one tooth with ≥4mm pocketing)

Variable (n)	<4mm pocket depth n(%) / Mean(95%CI)	at least one tooth with ≥4mm pocketing n (%)	OR(95% CI)	p value
<i>Tobacco consumption</i>				
No	228(19.01)	1008(80.99)	1	0.002
Yes	25(8.53)	208(91.47)	2.52 (1.39- 4.55)	
<i>Dental attendance</i>				
Regular attendance	161(18.48)	644(81.52)	1	0.237
Irregular attendance	92(14.32)	572(85.68)	1.35(0.82-2.25)	
<i>Tooth brushing frequency</i>				
Once a day or less often	50(10.25)	381(89.75)	1	0.058
Twice a day or more often	203(19.34)	835(80.66)	0.48(0.22-1.02)	
<i>Plaque percentage(mean)</i>	25.03(17.02-33.05)	40.49(37.68-43.31)	1.02(1.00-1.03)	0.004

Table 6.9 shows the sample distribution and univariate association of periodontal health-related behaviours and periodontal health-related behaviour indicator by chronic periodontitis experience (at least one tooth with ≥ 4 mm pocketing).

In terms of tobacco consumption, the proportion of those having at least one tooth with ≥ 4 mm pocketing was significantly ($p=0.002$) different between the two categories where the higher proportion were those who reported positively to consumption of tobacco (91.47%) while the proportion of those who reported not consuming tobacco was lower (80.99%).

There was no statistically significant difference in the proportion of those having at least one tooth with ≥ 4 mm pocketing in terms of dental attendance. However, a higher proportion of irregular attendees (85.68%), or those who visited a dentist more than a year ago, had at least one tooth with ≥ 4 mm pocketing as compared to those who visited a dentist within the last year (81.52%).

In terms of tooth brushing frequency, there was no statistically significant difference in the proportion of those having at least one tooth with ≥ 4 mm pocketing between the 2 groups. However, a higher proportion of those who brush once a day or less often (89.75%) had at least one tooth with ≥ 4 mm pocketing, as compared to those who brush twice a day or more often (80.66%).

The mean percentage of teeth with visible plaque (among those having at least one tooth with ≥ 4 mm pocketing) was significantly higher than among those having less than 4mm pocketing at 40.49%, as compared to 25.03%.

Table 6.9 also shows the univariate associations between periodontal health-related variables and indicators and chronic periodontitis experience (characterized as having at least one tooth with ≥ 4 mm pocketing). Although not significant, the trends for dental attendance and tooth brushing frequency were in expected directions with participants who last visited a dentist more than a year ago were more likely to

experience chronic periodontitis (at least one tooth with ≥ 4 mm pocketing) as compared to those who last visited a dentist within the last year. Participants who brushed their teeth twice a day or more were also less likely to experience chronic periodontitis (at least one tooth with ≥ 4 mm pocketing) as compared to those who brushed once a day or less often.

Those who reported affirmatively for tobacco consumption were 2.52 times (95% CI: 1.39- 4.55) more likely to experience chronic periodontitis (at least one tooth with ≥ 4 mm pocketing) as compared to those who reported negatively for tobacco consumption.

Plaque percentage score was significantly associated with chronic periodontitis (at least one tooth with ≥ 4 mm pocketing) where every unit increase in the percentage of teeth with visible plaque made a participant 1.02 times (95% CI: 1.01-1.10) more likely to experience chronic periodontitis (at least one tooth with ≥ 4 mm pocketing).

The 'tooth brushing frequency' and 'plaque percentage' scores both measure the same thing, oral hygiene behaviour. A reported behaviour such as 'tooth brushing frequency' is considered to be a poor measure of oral hygiene behaviour as compared to plaque percentage, which measures the efficacy of the behaviour. As such, plaque percentage is included as the measure of oral hygiene behaviour in the multivariate analysis.

Table 6.10 Univariate association between family functioning domains and chronic periodontitis experience (at least one tooth with ≥ 4 mm pocketing)

Family Functioning Domains	OR (95% CI)	P value
General functioning	0.34(0.19-0.59)	<0.001
Problem solving	0.59(0.29-1.21)	0.157
Communication	0.42(0.24-0.74)	0.003
Role functioning	0.48(0.27-0.86)	0.014
Affective involvement	0.43(0.27-0.67)	<0.001
Affective response	0.38(0.22-0.64)	<0.001
Behaviour control	0.30(0.17-0.52)	<0.001

Table 6.10 shows the univariate association between family functioning domains and chronic periodontitis experience characterized as having at least one tooth with ≥ 4 mm pocketing. Five out of the six family functioning domains and the general functioning scale were significantly associated with chronic periodontitis experience when not adjusted for any confounders. The domain problem solving was, however, found not to be statistically significantly associated with chronic periodontitis experience. In each of the significantly associated domains and the general functioning scale, the odds or the risk of experiencing chronic periodontitis experience decreased as perceived family functioning scores increased. The greatest reduction of odds or risk of experiencing chronic periodontitis was greatest for the behaviour control domain where there was a 70% reduction in risk for every unit increase in the behaviour control score. This was followed by a 66% reduction with every unit increase in the general functioning scale score and a 62%, 58, 57%, and 52% reduction per unit increase in the respective scores in the following domains: affective responsiveness, communication, affective involvement and role functioning.

6.5 Summary of Univariate results.

Tables 6.7, 6.8 and 6.9 and 6.10 showed the unadjusted associations between the explanatory variables and the outcome, chronic periodontitis experience (at least one tooth with ≥ 4 mm pocketing). Although not significant, the trends for gender and age were in expected directions with male participants ($p=0.791$) and older participants (every one year increase in age) ($p=0.231$) more likely to present with chronic periodontitis characterized as having at least one tooth with ≥ 4 mm pocketing as compared to female participants and younger participants.

Family types were not significantly associated with chronic periodontitis experience ($p > 0.2$). The trends for dental attendance ($p=0.237$) and tooth brushing frequency (0.058) were in expected directions but were not statistically significant. Meanwhile, tobacco consumption ($p=0.002$) and plaque percentage ($p=0.004$) score were significantly associated with chronic periodontitis experience.

Five out of the six family functioning domains and the General functioning scale were significantly associated with chronic periodontitis experience characterized as having at least one tooth with ≥ 4 mm pocketing when not adjusted for any confounders. The domain problem solving ($p=0.157$) was however found to be not statistically significantly associated with chronic periodontitis experience characterized as having at least one tooth with ≥ 4 mm pocketing. In each of the significantly associated domains and the general functioning scale, the odds of experiencing chronic periodontitis experience characterized as having at least one tooth with ≥ 4 mm pocketing decreased as perceived family functioning scores increased.

6.6 Multivariate analysis

A hierarchical model was built to assess the associations of the relevant variables with chronic periodontitis experience characterized as having at least one tooth with $\geq 4\text{mm}$ pocketing. Selection of variables for inclusion in the multiple logistic regression models was based on statistical associations observed in the Univariate logistic regression analysis where a variable was selected and included in the model only if its relationship with chronic periodontitis experience was significant at the 0.2 level as recommended by Altman (1991). The variables included were ethnicity, NSSEC, family functioning domains, plaque percentage score, and tobacco consumption. The variable tooth brushing frequency was not included even though it had a p value of less than 0.2 because tooth brushing frequency and plaque percentage score both measure the same thing which is oral hygiene behaviour. A reported behaviour such as tooth brushing frequency is considered as a poor measure of oral hygiene behaviour as compared to plaque percentage which measures the efficacy of the behaviour. As such plaque percentage was included as the measure of oral hygiene behaviour included in the multivariate analysis.

The sequence of which variables were entered into the hierarchical model was based on conceptual grounds in accordance to the theoretical framework of this study.

Stage one: Entering level 1: Demographic factor; namely ethnicity.

Stage two: Adding level 2: Socioeconomic factor; namely NS-SEC.

Stage three: Adding level 3: One domain of family functioning was added; general functioning, communication, role functioning, affective involvement, affective response and behaviour control.

Stage four: Adding level 4: Periodontal health related behaviour factors; namely tobacco use, percentage of plaque score.

This was repeated for each of the relevant domains of family functioning and the general functioning scale.

6.6.1 Models with family functioning domain General Functioning Scale

Table 6.11 shows that in the fully adjusted model, the results confirm that family functioning in the general functioning scale was significantly associated with chronic periodontitis experience (OR 0.51; 95%CI: 0.27-0.97). It was apparent from the unadjusted model in table 6.10 that family functioning in the general functioning scale had a protective effect on chronic periodontitis experience characterized as having at least one tooth with equal or more than 4 mm pocketing. The odds of experiencing chronic periodontitis decreased by 67% with every unit increase in the general functioning scale. This protective factor decreased to 53% after adjusting for ethnicity and NS-SEC in model 3 and further decreased to 49% when periodontal health related behaviours was added to model 4, however, this association remained highly significant in all models.

With regards to ethnicity, in the first model, there were statistically significant differences in the chronic periodontitis experience between Asian ethnic group and White ethnic group, and between mixed/other ethnic group and White ethnic group. The Asian group and the mixed other group were 2.29 (95% CI: 1.44-3.65) and 1.55 times (95% CI: 1.00-6.02) more likely, respectively, to experience chronic periodontitis (at least one tooth with ≥ 4 mm pocketing) as compared to the White group. This association was slightly reduced (OR 2.26; 95%CI: 1.41-3.61), (OR 2.38; 95%CI: 0.99-5.75) respectively, when adjusted for NS-SEC in model 2 and was further attenuated (OR 2.00 95%CI: 1.24-3.26), (OR 2.28; 95%CI: 0.95-5.28) respectively, when adjusted for the general functioning scale in model 3 but remained statistically significant for the Asian group but lost significance for the mixed other group. The association for the Asian group was further attenuated (OR 1.93; 95%CI: 1.09-3.40), when adjusted for periodontal health related behaviours in the fourth model. This indicates that general functioning scale and periodontal health related behaviours may explain some of the differences between these

groups. The attenuation in the OR was also noted in the Black ethnic group; however these associations were not statistically significant in any of the models.

Univariate analysis showed that the routine and manual occupations category and the intermediate category were significantly 2.61 times (95% CI:1.46-4.64) and 3.06 times (95% CI: 1.69-5.52) more likely, respectively to have chronic periodontitis characterized as having at least one tooth with ≥ 4 mm pocketing as compared to participants in the managerial and professional occupations. This association was increased for the intermediate occupations group (OR 2.69; 95%CI: 1.28-4.30) and for the routine and manual occupations group (OR 2.65; 95%CI: 1.42-4.96) when adjusted for ethnicity in the second model. Both associations were attenuated when adjusted for general functioning scale in the third model (OR 2.23; 95% CI: 1.19-4.19), (OR 2.03; 95CI: 1.04-3.96) respectively. The association for the intermediate group remained fairly stable and statistically significant when adjusted for periodontal health related behaviours while the association for the routine and manual occupations group was slightly attenuated but remained statistically significant indicating that family functioning in the general functioning scale and periodontal health related behaviours may explain some of the differences between the NS-SEC groups.

The association between tobacco consumption and chronic periodontitis experience characterized as having at least one tooth with ≥ 4 mm pocketing was slightly attenuated in the adjusted model 4 (table 6.11) but remained statistically significant ($p < 0.01$).

The association between percentage of plaque score and chronic periodontitis experience characterized as having at least one tooth with ≥ 4 mm pocketing remained relatively unchanged between unadjusted model (table 6.9) and the adjusted model 4 (table 6.11) and remained statistically significant ($p < 0.05$).

In order to further explain the role played by family functioning in the general functioning scale on chronic periodontitis experience we examined the process by which the variables are related. Family functioning in the general functioning scale was correlated with socioeconomic position hence making it unsuitable to be considered as a moderator but rather it fulfils the criteria of being a mediator. Hence further analysis was done to assess family functioning in the general functioning scale as a mediator in the relationship between socioeconomic position and chronic periodontitis experience.

Table 6.11 Hierarchical logistic regression models for the associations of socio-demographic variables, family functioning domain General Functioning Scale and periodontal health related variables with chronic periodontitis experience characterized as having at least one tooth with ≥ 4 mm pocketing.

Variables	Model 1	Model 2	Model 3	Model 4
<i>Ethnicity</i>				
White	1	1	1	1
Asian	2.29(1.44-3.65)***	2.26(1.41-3.61)***	2.00(1.24-3.26)**	1.93(1.09-3.40)*
Black	1.33(0.78-2.26)	1.32(0.78-2.23)	1.24(0.73-2.10)	1.31(0.75-2.28)
Mixed/Other	1.55(1.00-6.02)*	2.38(0.99-5.75)	2.28(0.95-5.48)	2.17 (0.88-5.35)
<i>NS-SEC</i>				
Managerial and professional occupations		1	1	1
Intermediate occupations		2.69(1.50-4.83)***	2.35(1.28-4.30)**	2.23(1.19-4.19)*
Routine and manual occupations		2.91(1.59-5.33)***	2.65 (1.42-4.96)**	2.03(1.04-3.96)*
<i>Family Functioning-</i>				
General Functioning Scale			0.45(0.25-0.84)*	0.51(0.27-0.97)*
<i>Oral health related behaviour</i>				
<i>Tobacco consumption</i>				
No				1
Yes				2.06(1.07-3.97)*
Plaque score (percentage)				1.01(1.00-1.02)*

*p \leq 0.05, **p \leq 0.01, ***p \leq 0.001

Model 1: Ethnicity

Model 2: Variables in model 1 plus NS-SEC

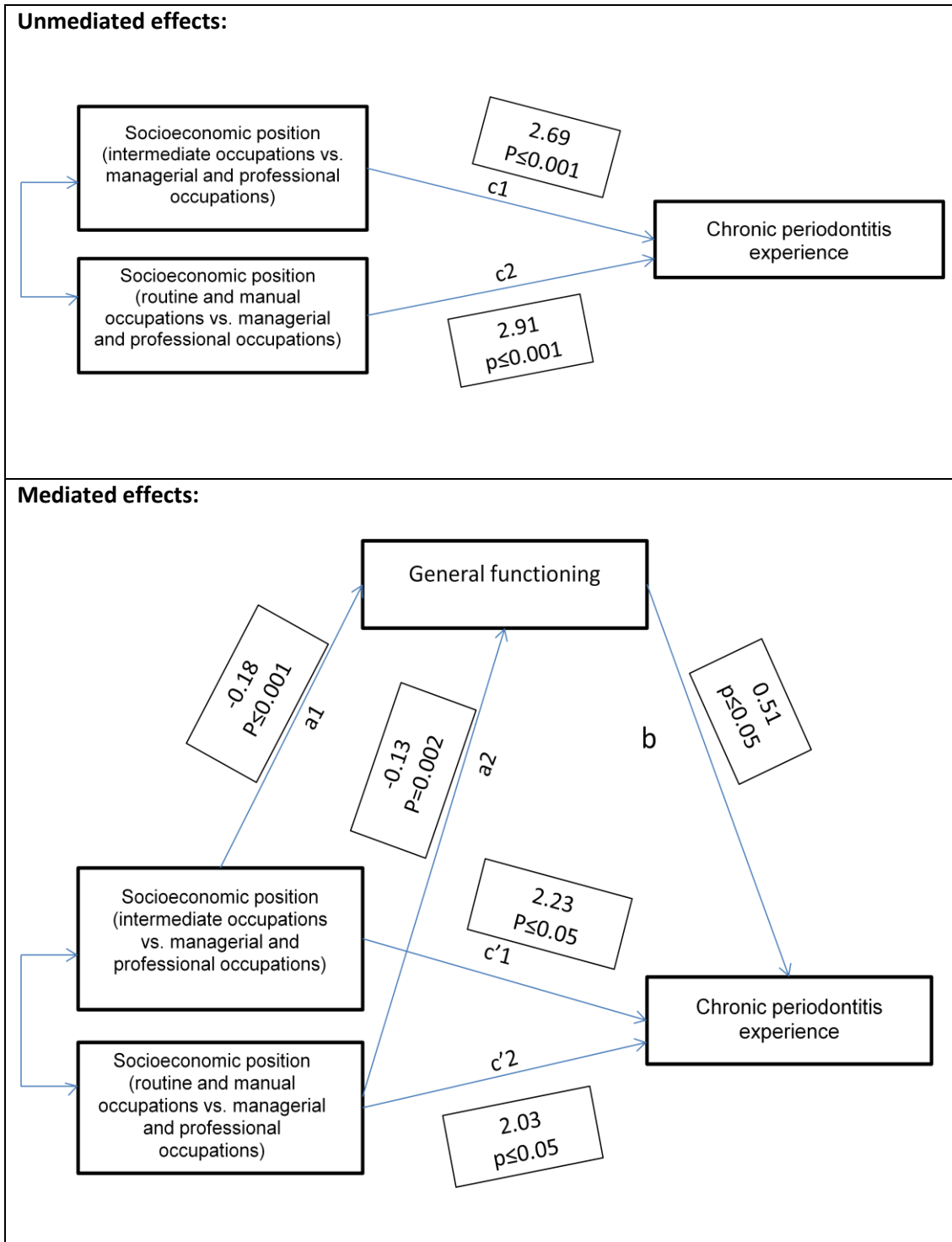
Model 3: Variables in model 2 plus family functioning domain

Model 4: Variables in model 3 plus oral health related variable

6.6.1.1 Assessing the role of family functioning in the general functioning scale as mediator in the relationship between socioeconomic position (intermediate occupations vs. managerial and professional occupations and routine and manual occupations vs. managerial and professional occupations) and chronic periodontitis experience.

Figure 6.1 shows how steps 1 (c1) (c2), 2(a1) (a2) and 3(b) were fulfilled in this study but step 4(c'1)(c'2) was not fulfilled indicating that the family functioning domain general functioning potentially partially mediates the relationship between socioeconomic position (routine and manual occupations vs. managerial and professional occupations and intermediate occupations vs. managerial and professional occupations) and chronic periodontitis experience.

Figure 6.1 Results for unmediated effects and mediator effects of the general family functioning between socio-economic position and periodontitis after adjusting for ethnicity Odds ratio and P-value are presented for paths, c1, c2, a, b, c'1 and c'2.



6.6.2 Models with family functioning domain Communication

Univariate analysis had showed that the likelihood of experiencing chronic periodontitis characterized as having at least one tooth with ≥ 4 mm pocketing was reduced by 61% for every unit increase in the communication score. This decreased to 48 % (OR 0.52; 95%CI: 0.29-0.96) but remained statistically significant when adjusted for potential confounders (model 3). The association was further attenuated when adjusted for periodontal health related behaviours (OR 0.61; 95%CI: 0.32-1.14) and lost statistical significance.

Table 6.12 also shows that in regards to ethnicity, the association for the Asian and mixed other group was attenuated but remained significant in model 3 with the OR for the Asian ethnic group reduced by 10% and for the mixed other group reduced by 15%. These associations then further decreased (OR 2.02; 95%CI: 1.17-3.51), (OR 2.20; 95CI: 0.90-5.38) respectively when adjusted for periodontal health related behaviours in the fourth model. This indicates that communication and periodontal health related behaviours may explain some of the differences between these groups.

In terms of NS-SEC, adjusting for the domain communication in model 3 resulted in a 16% and 15 % decrease in the OR for NS-SEC intermediate occupations group and routine and manual occupations group respectively. This association was attenuated further when adjusted for periodontal health related behaviour but remained statistically significant indicating that family functioning in the domain communication and tobacco consumption may explain some of the differences between the NS-SEC groups.

The association between percentage of plaque score and chronic periodontitis experience characterized as having at least one tooth with ≥ 4 mm pocketing was

relatively unchanged between unadjusted model (table 6.9) and the adjusted model 4 (table 6.12) and remained statistically significant ($p < 0.01$). The association for tobacco consumption was slightly attenuated in the adjusted model 4 but remained statistically significant for those reporting no for tobacco consumption.

In order to further explain the role played by family functioning in the domain communication on chronic periodontitis experience we examined the process by which the variables are related. Family functioning in the domain communication was correlated with socioeconomic position hence making it unsuitable to be considered as a moderator but rather it fulfils the criteria of being a mediator. The effect of family functioning in the domain communication was fully attenuated once it was adjusted for oral health related behaviour. Hence further analysis was done to assess family functioning in the domain communication as a mediator in the relationship between socioeconomic position and chronic periodontitis between socioeconomic position and oral health behaviour.

Table 6.12 Hierarchical logistic regression models for the associations of socio-demographic variable , family functioning domain Communication and periodontal health related variables with chronic periodontitis experience characterized as having at least one tooth with $\geq 4\text{mm}$ pocketing.

Variables	Model 1	Model 2	Model 3	Model 4
<i>Ethnicity</i>				
White	1	1	1	1
Asian	2.29(1.44-3.65)***	2.26(1.41-3.61)***	2.12(1.31-3.42)**	2.02(1.17-3.51)*
Black	1.33(0.78-2.26)	1.32(0.78-2.23)	1.27(0.75-2.16)	1.34(0.78-2.33)
Mixed/Other	1.55(1.00-6.02)*	2.38(0.99-5.75)	2.36(0.99-5.67)	2.20(0.90-5.38)
<i>NS-SEC</i>				
Managerial and professional occupations		1	1	1
Intermediate occupations		2.69(1.50-4.83)***	2.53(1.40-4.57)**	2.38(1.29-4.39)**
Routine and manual occupations		2.91(1.59-5.33)***	2.76(1.50-2.36)***	2.09(1.08-4.05)*
<i>Family Functioning-Communication</i>			0.55(0.30-0.98)*	0.61(0.32-1.14)
<i>Oral health related behaviour</i>				
<i>Tobacco consumption</i>				
No				1
Yes				2.11(1.11-4.01)*
Plaque score (percentage)				1.01(1.00-1.02)**

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Model 1: Ethnicity

Model 2: Variables in model 1 plus NS-SEC

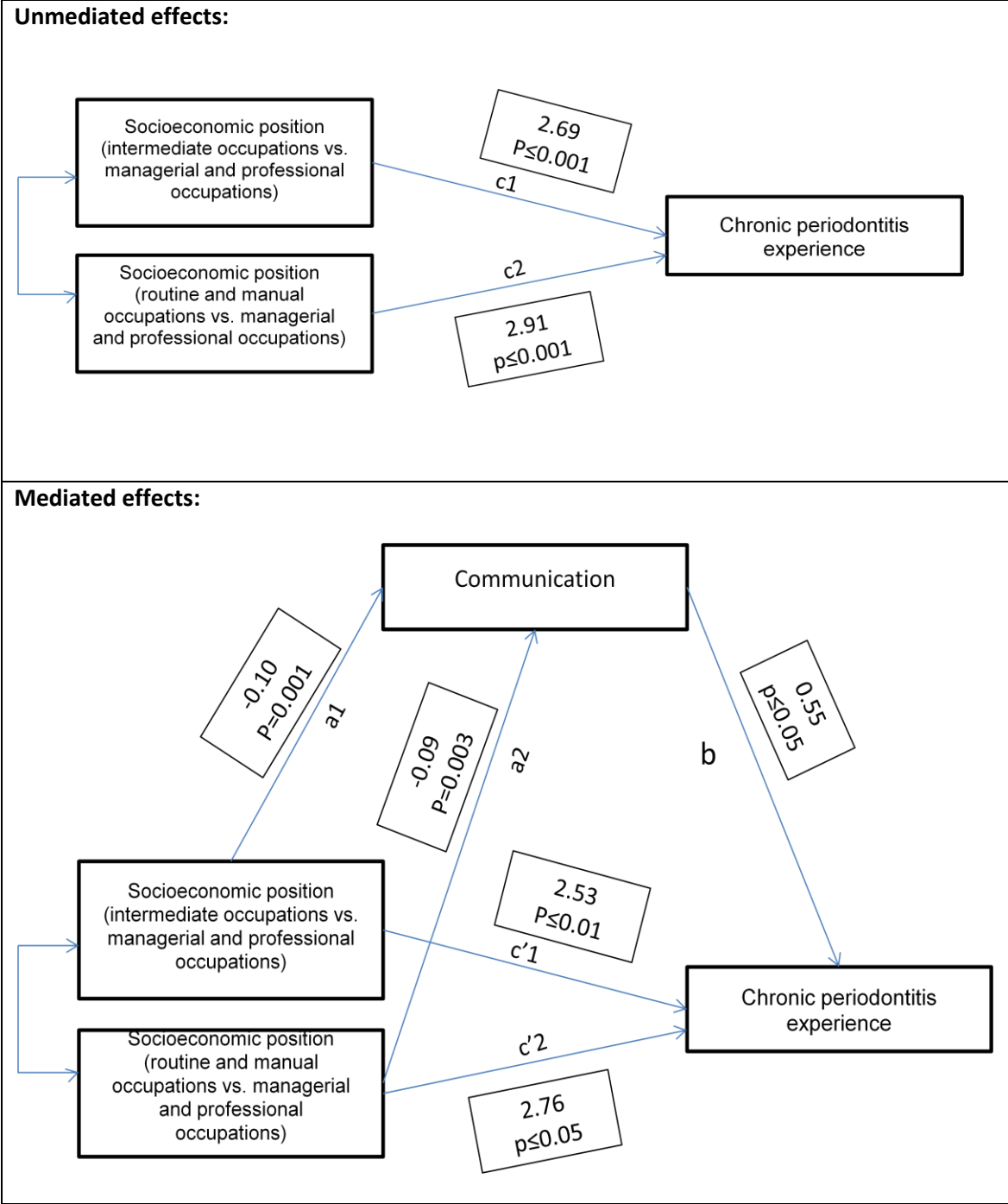
Model 3: Variables in model 2 plus family functioning domain

Model 4: Variables in model 3 plus oral health related variable

6.6.2.1 Assessing the role of family functioning domain communication as mediators in the relationship between socioeconomic position (intermediate occupations vs. managerial and professional occupations and routine and manual occupations vs. managerial and professional occupations) and chronic periodontitis experience.

Figure 6.2 shows how steps 1 (c1) (c2), 2(a1) (a2) and 3(b) were fulfilled in this study but step 4(c'1)(c'2) was not fulfilled indicating that the family functioning domain communication potentially partially mediates the relationship between socioeconomic position (routine and manual occupations vs. managerial and professional occupations and intermediate occupations vs. managerial and professional occupations) and chronic periodontitis experience.

Figure 6.2 Results for unmediated effects and mediator effects of the family functioning domain communication between socio-economic position and periodontitis after adjusting for ethnicity. Odds ratio and P-value are presented for paths, c1, c2, a, b, c'1 and c'2.



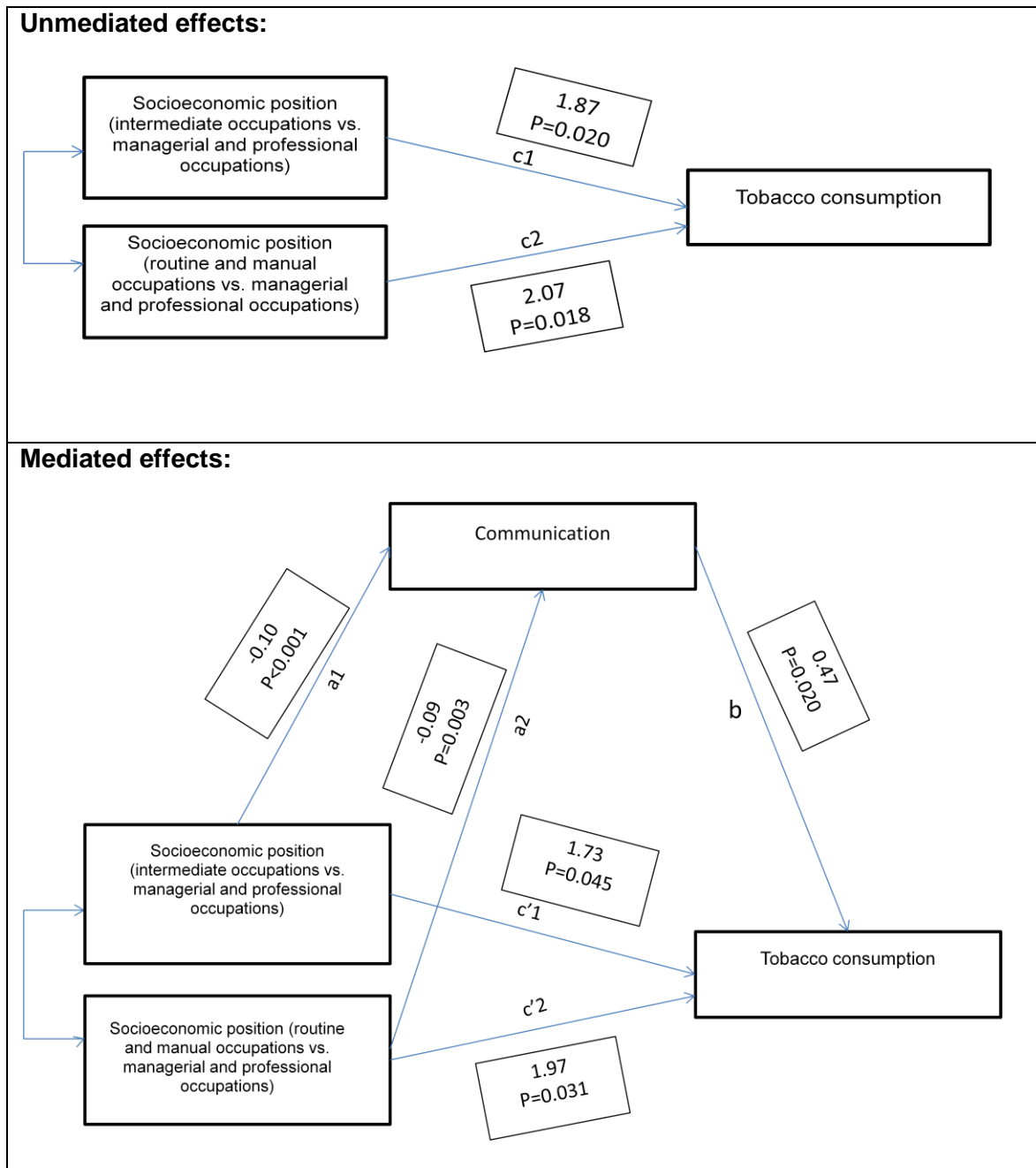
However, it is important to note that the effect of communication disappeared once it was adjusted for oral health behaviour suggesting that oral health behaviour is a stronger predictor of chronic periodontitis experience.

Further analysis to see how communication acts on socioeconomic position in predicting tobacco consumption as oral health behaviour was done. The analysis was only done using tobacco consumption as an outcome as plaque percentage was found to not be correlated to socioeconomic position.

6.6.2.2 Assessing the role of communication as a mediator in the relationship between socioeconomic position (intermediate occupations vs. managerial and professional occupations and routine and manual occupations vs. managerial and professional occupations) and tobacco consumption.

Figure 6.3 shows how steps 1 (c1) (c2), 2(a1) (a2) and 3(b) were fulfilled in this study but step 4(c'1)(c'2) was not fulfilled indicating that communication potentially partially mediates the relationship between socioeconomic position (routine and manual occupations vs. managerial and professional occupations and intermediate occupations vs. managerial and professional occupations) and tobacco consumption experience.

Figure 6.3 Results for unmediated effects and mediator effects of the family functioning domain communication between socio-economic position and tobacco consumption after adjusting for ethnicity. Odds ratio and P-value are presented for paths, c1, c2, a, b, c'1 and c'2.



6.6.3 Models with family functioning domain Role Functioning

Results from the fully adjusted model showed that family functioning in the domain role functioning was not associated with chronic periodontitis experience. Univariate analysis had showed that the likelihood of experiencing chronic periodontitis characterized as having at least one tooth with ≥ 4 mm pocketing was reduced by 52% for every unit increase in the role functioning score and was statistically significant ($p=0.008$). This decreased to 38% (OR 0.62; 95%CI: 0.34-1.10) and lost statistical significance when adjusted for potential confounders (model 3). The association was further attenuated when adjusted for oral health related behaviour (OR 0.64; 95%CI: 0.35-1.16) and remained statistically non significant.

Table 6.13 shows that in regards to ethnicity, the association for the Asian and mixed other group was attenuated in model 3 with the OR for the Asian ethnic group reduced by 5% and for the mixed other group reduced by 9%. The association for the Asian group remained significant but the association for the mixed other group lost significance. The association for the Asian group then further decreased (OR 2.10; 95%CI: 1.22-3.60) when adjusted for periodontal health related behaviour in the fourth model but remained statistically significant. This indicates that role functioning and oral health related behaviour may explain some of the differences between these groups.

In terms of NS-SEC, adjusting for the domain role functioning in model 3 resulted in a 14% and 17 % decrease in the OR for both NS-SEC intermediate occupations group and routine and manual occupations group respectively. These associations were further attenuated when adjusted for oral health related behaviour but remained

statistically significant indicating that family functioning in the domain role functioning and oral health related behaviour may explain some of the differences between the NS-SEC groups.

The association between tobacco consumption and chronic periodontitis experience characterized as having at least one tooth with ≥ 4 mm pocketing was slightly attenuated in the adjusted model 4 (table 6.13) (OR 2.14 95%CI:1.14-4.05) but remained statistically significant ($p < 0.01$). The association between plaque score and chronic periodontitis experience remained fairly unchanged in the adjusted models.

Table 6.13 Hierarchical logistic regression models for the associations of socio-demographic variables, family functioning domain role functioning and periodontal health related variables with chronic periodontitis experience characterized as having at least one tooth with $\geq 4\text{mm}$ pocketing.

Variables	Model 1	Model 2	Model 3	Model 4
<i>Ethnicity</i>				
White	1	1	1	1
Asian	2.29(1.44-3.65)***	2.26(1.41-3.61)***	2.21(1.38-3.55)***	2.10(1.22-3.60)**
Black	1.33(0.78-2.26)	1.32(0.78-2.23)	1.27(0.75-2.15)	1.32(0.76-2.32)
Mixed/Other	1.55(1.00-6.02)*	2.38(0.99-5.75)	2.31(0.97-5.49)	2.19(0.89-5.39)
<i>NS-SEC</i>				
Managerial and professional occupations		1	1	1
Intermediate occupations		2.69(1.50-4.83)***	2.56(1.43-4.61)**	2.41 (1.32-4.40)**
Routine and manual occupations		2.91(1.59-5.33)***	2.75(1.49-5.10)***	2.10(1.10-4.01)*
<i>Family Functioning- Role functioning</i>			0.62(0.34-1.10)	0.69(0.38-1.24)
<i>Oral health related behaviour</i>				
<i>Tobacco consumption</i>				1
No				2.14(1.14-4.05)*
Yes				
Plaque score (percentage)				1.01(1.00-1.02)*

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Model 1: Ethnicity

Model 2: Variables in model 1 plus NS-SEC

Model 3: Variables in model 2 plus family functioning domain

Model 4: Variables in model 3 plus oral health related variable

6.6.4 Models with family functioning domain Affective involvement

Results in the fully adjusted model showed that family functioning in the domain affective involvement was not significantly associated with chronic periodontitis experience. Univariate analysis had showed that the likelihood of experiencing chronic periodontitis characterized as having at least one tooth with ≥ 4 mm pocketing was reduced by 57% for every unit increase in the affective involvement score. This decreased to 44% (OR 0.56; 95%CI: 0.34-0.94) but remained statistically significant when adjusted for potential confounders (model 3, table 6.14). The association was fully attenuated when adjusted for oral health related behaviour (OR 0.64; 95 CI: 0.38-1.06 and had lost statistical significance.

Table 6.14 also showed that in regards to ethnicity, the association for the Asian and mixed other group was attenuated but remained significant in model 3 with the OR for the Asian ethnic group reduced to 2.02 (95%CI: 1.24-3.30) and for the mixed other group reduced to 2.23(0.94-5.32) indicating that the family functioning domain affective involvement may account for a small part in the difference between the groups. The association for both groups was further attenuated when adjusted for periodontal health related behaviour.

In terms of NS-SEC, adjusting for the domain affective involvement in model 3 resulted in a 7% and 8 % decrease in the OR for NS-SEC intermediate occupations group and routine and manual occupations group respectively. This suggests that the family functioning domain affective involvement may account for a small part in the difference between the NS-SEC groups.

The association between plaque score and chronic periodontitis experience characterized as having at least one tooth with ≥ 4 mm pocketing remained relatively unchanged in the unadjusted model (table 6.9) and in the adjusted model 4 (table 6.14) and remained statistically significant ($p < 0.05$).

The association between tobacco consumption and chronic periodontitis experience was attenuated in the adjusted model but remained statistically significant ($p < 0.05$).

The multivariate analysis indicates that oral health behaviour may be a strong predictor of chronic periodontitis in the socioeconomic pathway. Hence further analysis to see how affective involvement acts on socioeconomic position in oral health behaviour was done. The analysis was only done using tobacco consumption as an outcome as plaque percentage was found to not be correlated to socioeconomic position.

Table 6.14 Hierarchical logistic regression models for the associations of socio-demographic variables, family functioning domain Affective involvement and periodontal health related variables with chronic periodontitis experience characterized as having at least one tooth with ≥ 4 mm pocketing.

Variables	Model 1	Model 2	Model 3	Model 4
<i>Ethnicity</i>				
White	1	1	1	1
Asian	2.29(1.44-3.65)***	2.26(1.41-3.61)***	2.02(1.24-3.30)**	1.96(1.12-3.43)*
Black	1.33(0.78-2.26)	1.32(0.78-2.23)	1.21(0.71-2.06)	1.29(0.74-2.25)
Mixed/Other	1.55(1.00-6.02)*	2.38(0.99-5.75)	2.23(0.94-5.32)	2.08(0.85-5.09)
<i>NS-SEC</i>				
Managerial and professional occupations		1	1	1
Intermediate occupations		2.69(1.50-4.83)***	2.50(1.38-4.53)**	2.37(1.28-4.36)**
Routine and manual occupations		2.91(1.59-5.33)***	2.68(1.45-4.93)**	2.07(1.03-3.98)*
<i>Family Functioning-Affective involvement</i>			0.56(0.34-0.94)*	0.64(0.38-1.06)
<i>Oral health related behaviour</i>				
<i>Tobacco consumption</i>				1
No				2.08(1.09-3.96)*
Yes				1.01(1.00-1.02)*
Plaque score (percentage)				

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Model 1: Ethnicity

Model 2: Variables in model 1 plus NS-SEC

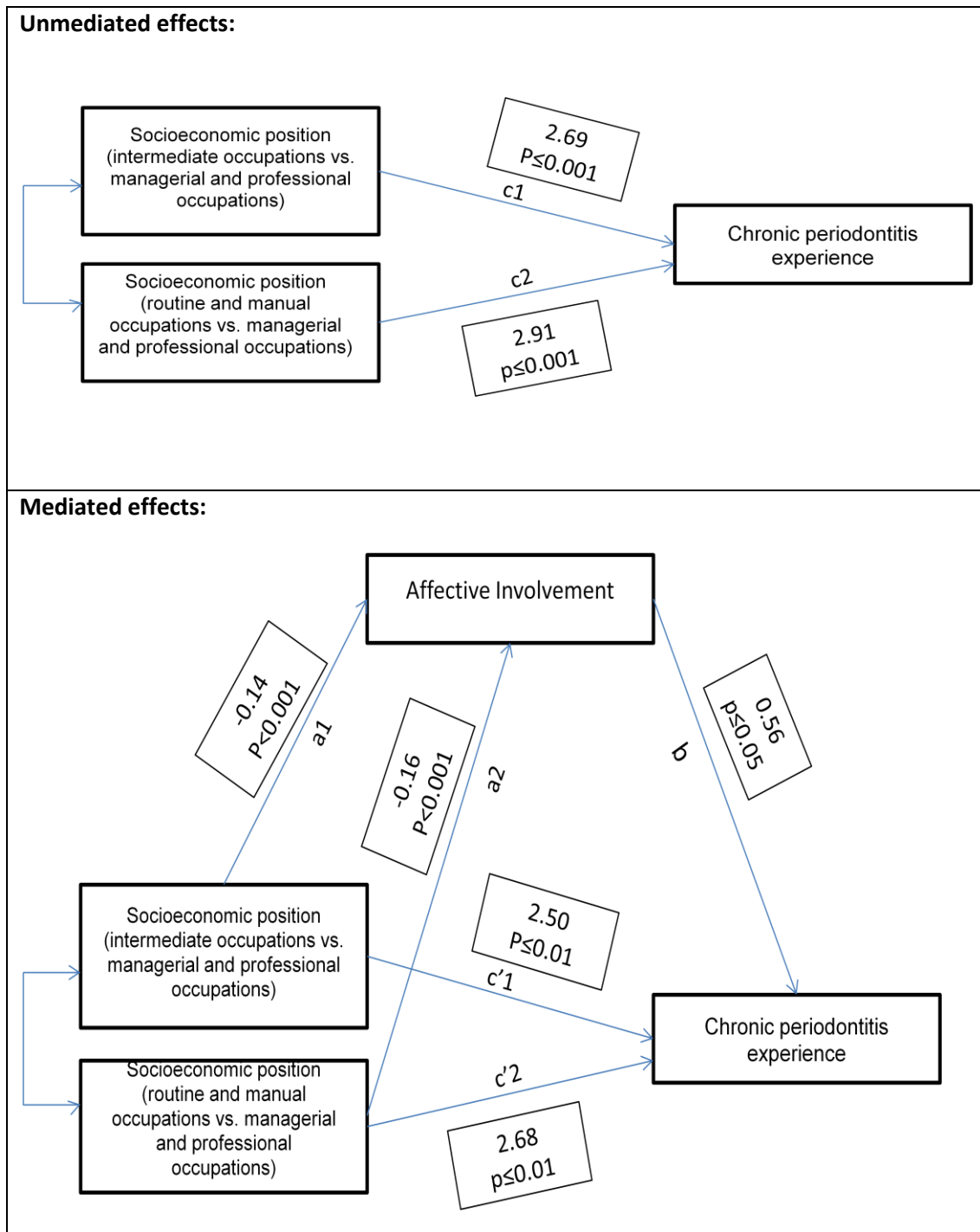
Model 3: Variables in model 2 plus family functioning domain

Model 4: Variables in model 3 plus oral health related variable

6.6.4.1 Assessing the role of affective involvement as a mediator in the relationship between socioeconomic position (intermediate occupations vs. managerial and professional occupations and routine and manual occupations vs. managerial and professional occupations) and chronic periodontitis.

Figure 6.4 shows how steps 1 (c1) (c2), 2(a1) (a2) and 3(b) were fulfilled in this study but step 4(c'1)(c'2) was not fulfilled indicating that the family functioning domain affective involvement potentially partially mediates the relationship between socioeconomic position (routine and manual occupations vs. managerial and professional occupations and intermediate occupations vs. managerial and professional occupations) and tobacco consumption.

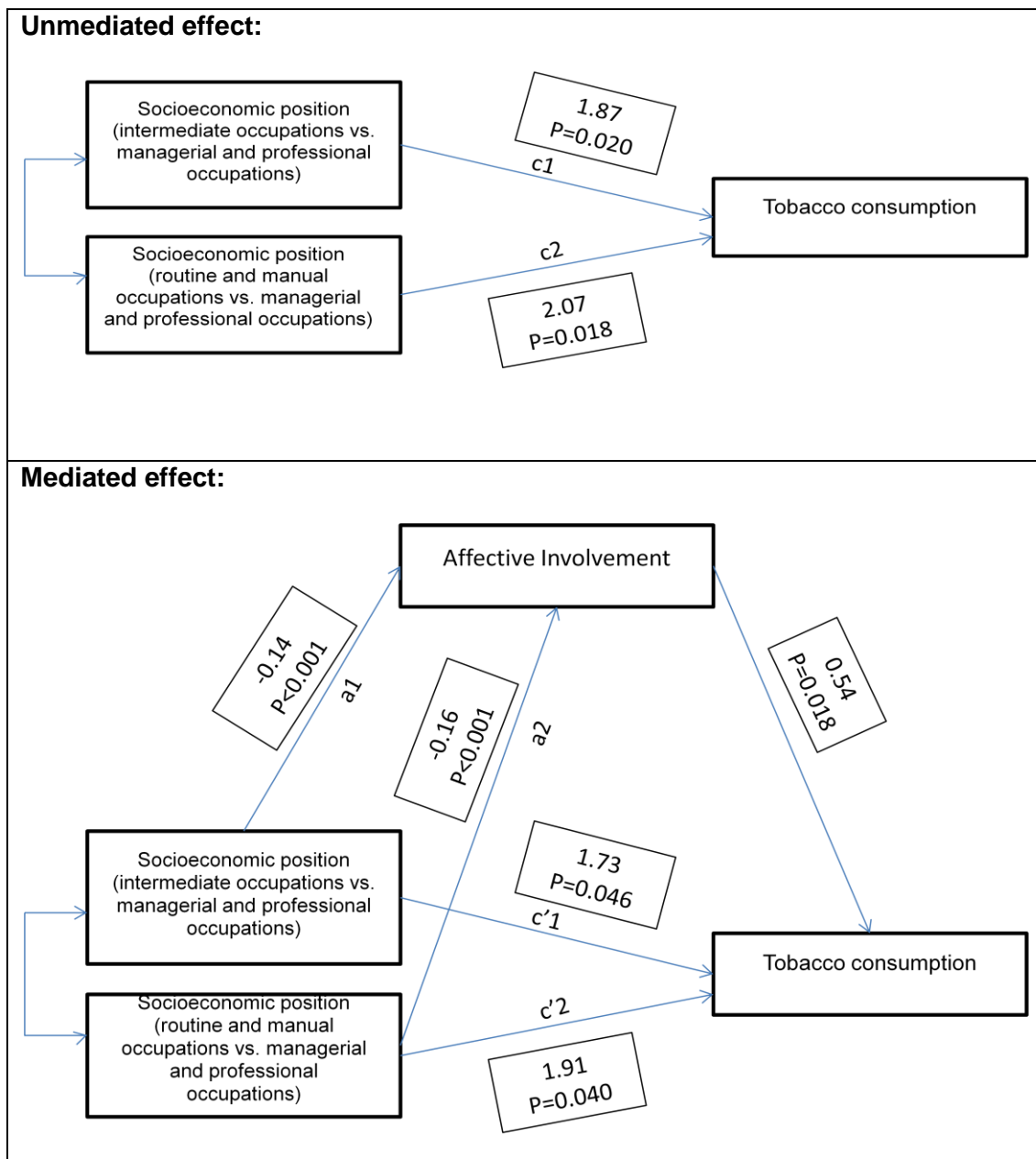
Figure 6.4 Results for unmediated effects and mediator effects of the family functioning domain affective involvement between socio-economic position and chronic periodontitis after adjusting for ethnicity Odds ratio and P-value are presented for paths, c1, c2, a, b, c'1 and c'2.



6.6.4.1 Assessing the role of affective involvement as a mediator in the relationship between socioeconomic position (intermediate occupations vs. managerial and professional occupations and routine and manual occupations vs. managerial and professional occupations) and tobacco consumption.

Figure 6.5 shows how steps 1 (c1) (c2), 2(a1) (a2) and 3(b) were fulfilled in this study but step 4(c'1)(c'2) was not fulfilled indicating that the family functioning domain affective involvement potentially partially mediates the relationship between socioeconomic position (routine and manual occupations vs. managerial and professional occupations and intermediate occupations vs. managerial and professional occupations) and tobacco consumption.

Figure 6.5 Results for unmediated effects and mediator effects of the family functioning domain affective involvement between socio-economic position and tobacco consumption after adjusting for ethnicity. Odds ratio and P-value are presented for paths, c1, c2, a, b, c'1 and c'2.



6.6.5 Models with family functioning domain Affective responsiveness

The fully adjusted model in table 6.15 confirms that family functioning in the domain affective responsiveness was significantly associated with chronic periodontitis experience. The likelihood of experiencing chronic periodontitis characterized as having at least one tooth with ≥ 4 mm pocketing was reduced by 62% for every unit increase in the affective responsiveness score. This decreased to 53% (OR 0.47; 95%CI: 0.26-0.81) but remained statistically significant when adjusted for potential confounders (model 3). This association was further attenuated when adjusted for periodontal health related behaviours (OR 0.52; 95%CI: 0.29-0.92) but remained statistically significant.

In regards to ethnicity, the association for the Asian and mixed other group was attenuated in model 3 with the OR for the Asian ethnic group reduced to 1.94; 95%CI: 1.17-3.20 and for the mixed other group reduced to OR 2.19 95%CI 0.92-5.20 and lost statistical significance for the other/mixed group, indicating that the family functioning domain affective responsiveness may account for a small part in the difference between the groups. The association for the Asian group then further decreased (OR 1.89; 95%CI: 1.05-3.39) when adjusted for periodontal health related behaviours in the fourth model. This indicates that affective responsiveness and periodontal health related behaviours may explain some of the differences between these groups.

In terms of NS-SEC, adjusting for the domain affective responsiveness in model 3 resulted in a decrease in the OR for NS-SEC intermediate occupations group and routine and manual occupations group respectively. This association was attenuated further when adjusted for oral health related behaviours but remained statistically significant indicating that family functioning in the affective responsiveness and oral health related behaviours may explain some of the differences between the NS-SEC groups.

The association between plaque score and chronic periodontitis experience characterized as having at least one tooth with ≥ 4 mm was statistically significant in the unadjusted model (table 6.9) and while it remained unchanged in the adjusted model 4 (table 6.15) it lost its statistical significance ($p < 0.05$).

The association between tobacco consumption and chronic periodontitis experience was attenuated in the adjusted model but remained statistically significant ($p < 0.05$).

In order to further explain the role played by family functioning in the domain affective responsiveness on chronic periodontitis experience we examined the process by which the variables are related. Family functioning in the domain affective responsiveness was correlated with socioeconomic position hence making it unsuitable to be considered as a moderator but rather it fulfils the criteria of being a mediator. Hence further analysis was done to assess family functioning in the domain affective responsiveness as a mediator in the relationship between socioeconomic position and chronic periodontitis experience.

Table 6.15 Hierarchical logistic regression models for the associations of socio-demographic variables , family functioning domain Affective responsiveness and periodontal health related variables with chronic periodontitis experience characterized as having at least one tooth with $\geq 4\text{mm}$ pocketing.

Variables	Model 1	Model 2	Model 3	Model 4
<i>Ethnicity</i>				
White	1	1	1	1
Asian	2.29(1.44-3.65)***	2.26(1.41-3.61)***	1.94(1.17-3.20)*	1.89(1.05-3.39)*
Black	1.33(0.78-2.26)	1.32(0.78-2.23)	1.18(0.68-2.03)	1.26(0.71-2.22)
Mixed/Other	1.55(1.00-6.02)*	2.38(0.99-5.75)	2.19(0.92-5.20)	2.05(0.85-5.00)
<i>NS-SEC</i>				
Managerial and professional occupations		1	1	1
Intermediate occupations		2.69(1.50-4.83)***	2.43(1.24-3.86)**	2.32(1.25-4.33)**
Routine and manual occupations		2.91(1.59-5.33)***	2.70(1.43-4.87)*	2.03(1.03-3.98)*
<i>Family Functioning- Affective responsiveness</i>			0.47(0.26-0.81)**	0.52(0.29-0.92)*
<i>Oral health related behaviour</i>				
<i>Tobacco consumption</i>				1
No				2.07(1.08-3.99)*
Yes				
Plaque score (percentage)				1.01(0.99-1.02)

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Model 1: Ethnicity

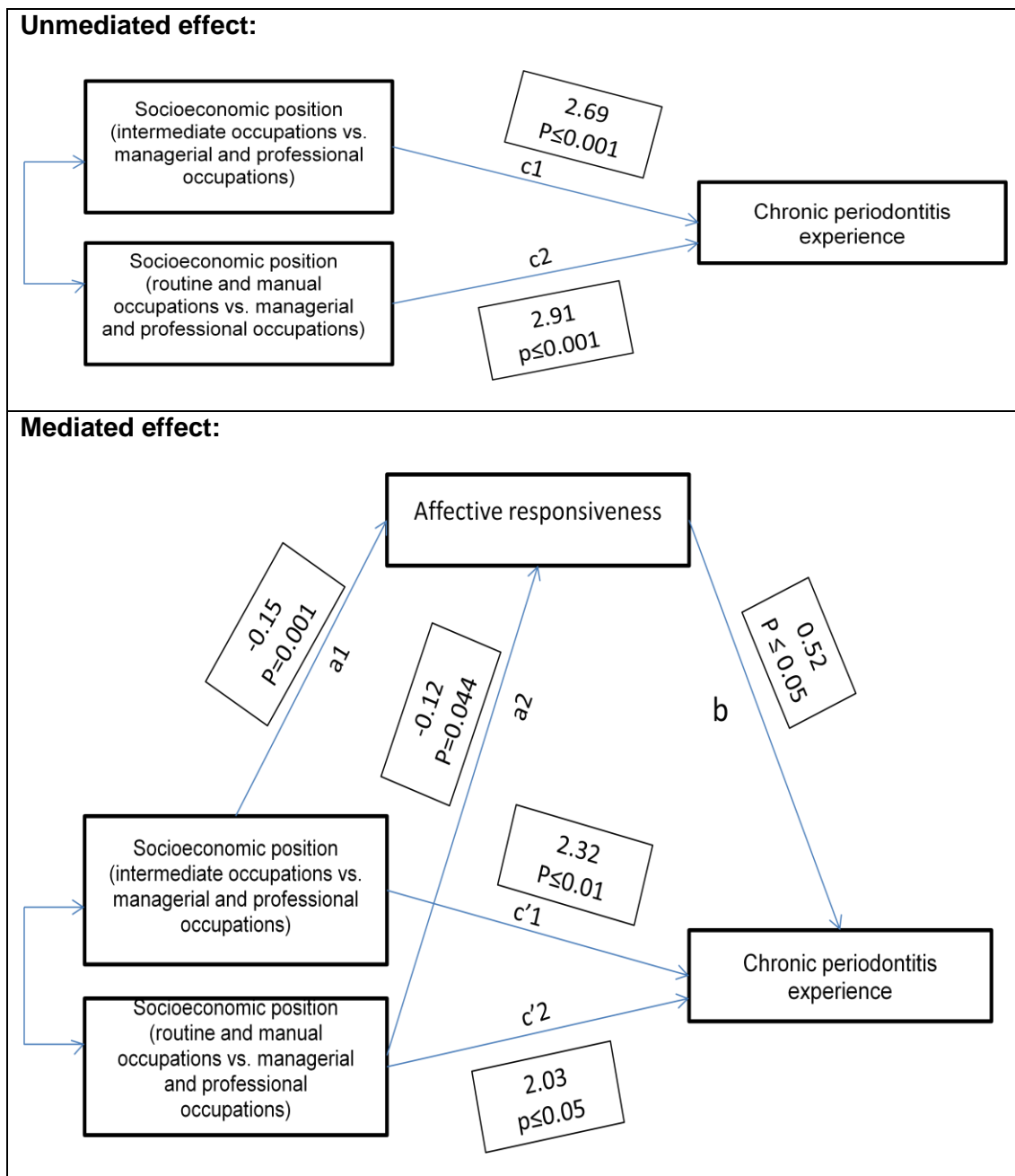
Model 2: Variables in model 1 plus NS-SEC

Model 3: Variables in model 2 plus family functioning domain
 Model 4: Variables in model 3 plus oral health related variable

6.6.5.1 Assessing the role of family functioning domain affective responsiveness as a mediator in the relationship between socioeconomic position (intermediate occupations vs. managerial and professional occupations and routine and manual occupations vs. managerial and professional occupations) and chronic periodontitis experience.

Figure 6.6 shows how steps 1 (c1) (c2), 2(a1) (a2) and 3(b) were fulfilled in this study but step 4(c'1)(c'2) was not fulfilled indicating that the family functioning domain affective responsiveness potentially partially mediates the relationship between socioeconomic position (routine and manual occupations vs. managerial and professional occupations and intermediate occupations vs. managerial and professional occupations) and chronic periodontitis experience.

Figure 6.6 Results for unmediated effects and mediator effects of the family functioning domain affective responsiveness between socio-economic position and chronic periodontitis after adjusting for ethnicity. Odds ratio and P-value are presented for paths, $c1$, $c2$, a , b , $c'1$ and $c'2$.



6.6.7 Models with family functioning domain behaviour control

Results in the fully adjusted model confirmed that family functioning in the domain behaviour control is statistically associated with chronic periodontitis experience. Univariate analysis had showed that the likelihood of experiencing chronic periodontitis characterized as having at least one tooth with ≥ 4 mm pocketing was reduced by 70% for every unit increase in the behaviour control score. This decreased to 60% but remained statistically significant when adjusted for potential confounders (model 3, table 6.16). The association was further attenuated when adjusted for periodontal health related behaviours (OR 0.46 95%CI: 0.25-0.83) but remained statistically significant.

Table 6.16 also shows that in regards to ethnicity, the association for the Asian and mixed other group was attenuated in model 3 where the mixed other group lost statistical significance. The association for the Asian group then decreased further (OR 1.85; 95%CI: 1.02-3.33) when adjusted for oral health related behaviours in the fourth model but remained statistically significant. This indicates that family functioning domain behaviour control and oral health related behaviours may explain some of the differences between these groups.

In terms of NS-SEC, adjusting for the domain behaviour control in model 3 resulted in a decrease in the OR for NS-SEC intermediate occupations group and routine and manual occupations group respectively. This association was attenuated further when adjusted for periodontal health related behaviours but remained statistically significant indicating that family functioning in behaviour control and oral health related behaviours may explain some of the differences between the NS-SEC groups.

The association between plaque score and chronic periodontitis experience characterized as having at least one tooth with ≥ 4 mm pocketing remained relatively

unchanged in the unadjusted model (table 6.9) and in the adjusted model 4 (table 6.16) and remained statistically significant ($p < 0.05$).

The association between tobacco consumption and chronic periodontitis experience was attenuated in the adjusted model but remained statistically significant ($p < 0.05$).

In order to further explain the role played by family functioning in the domain behaviour control on chronic periodontitis experience we examined the process by which the variables are related. Family functioning in the domain behaviour control was correlated with socioeconomic position hence making it unsuitable to be considered as a moderator but rather it fulfils the criteria of being a mediator. Hence further analysis was done to assess family functioning in the domain behaviour control as a mediator in the relationship between socioeconomic position and chronic periodontitis experience.

Table 6.16 Hierarchical logistic regression models for the associations of socio-demographic variables, family functioning domain Behaviour control and periodontal health related variables with chronic periodontitis experience characterized as having at least one tooth with $\geq 4\text{mm}$ pocketing.

Variables	Model 1	Model 2	Model 3	Model 4
<i>Ethnicity</i>				
White	1	1	1	1
Asian	2.29(1.44-3.65)***	2.26(1.41-3.61)***	1.89(1.13-3.15)*	1.85(1.02-3.33)*
Black	1.33(0.78-2.26)	1.32(0.78-2.23)	1.18(0.69- 2.01)	1.26(0.71-2.21)
Mixed/Other	1.55(1.00-6.02)*	2.38(0.99-5.75)	2.25(0.95-5.31)	2.17(0.88-5.31)
<i>NS-SEC</i>				
Managerial and professional occupations		1	1	1
Intermediate occupations		2.69(1.50-4.83)***	2.32(1.26-4.26)**	2.18(1.16-4.09)*
Routine and manual occupations		2.91(1.59-5.33)***	2.63(1.39-4.96)**	2.01(1.02-3.96)*
<i>Family Functioning- Behaviour control</i>			0.40(0.22-0.74)**	0.46(0.25-0.83)*
<i>Oral health related behaviour</i>				
<i>Tobacco consumption</i>				
No				1
Yes				2.11(1.10-4.06)*
Plaque score(percentage)				1.01(1.00-1.02)*

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Model 1: Ethnicity

Model 2: Variables in model 1 plus NS-SEC

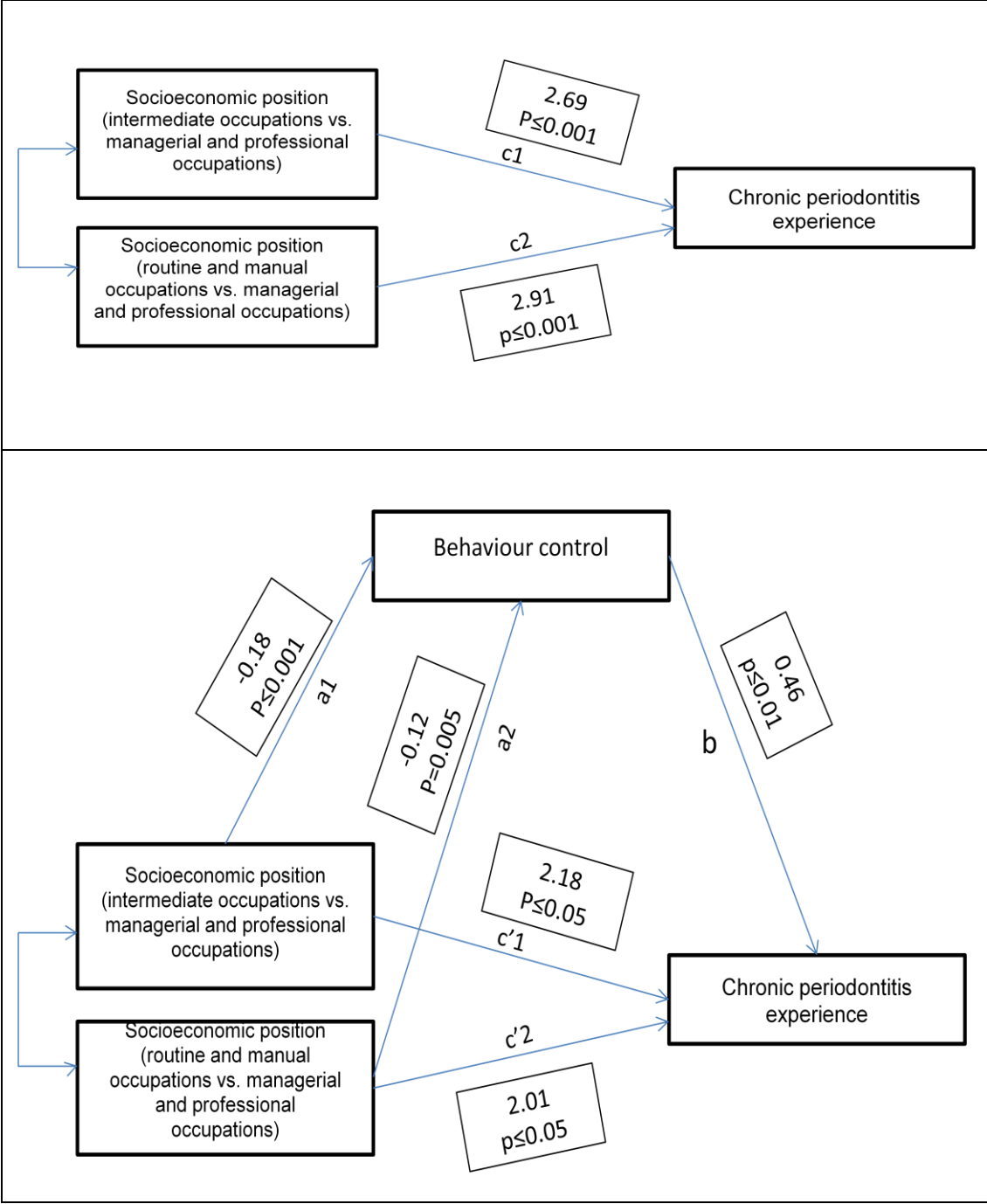
Model 3: Variables in model 2 plus family functioning domain

Model 4: Variables in model 3 plus oral health related variable

6.6.7.1 Assessing the role of family functioning domain behaviour control as mediator in the relationship between socioeconomic position (intermediate occupations vs. managerial and professional occupations and routine and manual occupations vs. managerial and professional occupations) and chronic periodontitis experience.

Figure 6.7 shows how steps 1 (c1) (c2), 2(a1) (a2) and 3(b) were fulfilled in this study but step 4(c'1)(c'2) was not fulfilled indicating that the family functioning domain behaviour control potentially partially mediates the relationship between socioeconomic position (routine and manual occupations vs. managerial and professional occupations and intermediate occupations vs. managerial and professional occupations) and chronic periodontitis experience.

Figure 6.7 Results for unmediated effects and mediator effects of the family functioning domain behaviour between socio-economic position and chronic periodontitis after adjusting for ethnicity. Odds ratio and P-value are presented for paths, c1, c2, a, b, c'1 and c'2.



6.7 Interaction effects of socioeconomic position and family functioning domains on chronic periodontitis experience.

Table 6.17 shows the significance levels for the interaction effects of socioeconomic position and each of the six family functioning domains and the general functioning scale on chronic periodontitis experience. None of the interaction effects of socioeconomic position on any of the six family functioning domains and the general functioning scale on chronic periodontitis experience was statistically significant.

Table 6.17 Significance levels for the interactive effects of socioeconomic position and family functioning domains on chronic periodontitis experience

Variables	P value
Socioeconomic position x General Functioning	0.17
Socioeconomic position x Problem Solving	0.23
Socioeconomic position x Communication	0.18
Socioeconomic position x Role Functioning	0.52
Socioeconomic position x Affective involvement	0.92
Socioeconomic position x Affective responsiveness	0.32
Socioeconomic position x Behaviour Control	0.92

6.8 Summary

The results show that there were no significant differences in terms of gender and age in regards to chronic periodontitis experience even though the trends for gender and age were in expected directions and consistent with current literature.

Dental attendance and tooth brushing frequency was also not significantly associated with chronic periodontitis although the trends of these associations were also in the expected directions and consistent with current literature.

The difference in chronic periodontitis experience attributable to ethnicity was partially attenuated by family functioning in the general functioning scale and in the domains behaviour control, affective responsiveness, affective involvement, roles and communication and by oral health related behaviour.

The difference in chronic periodontitis experience attributable to socioeconomic position was partially attenuated by family functioning in the general functioning scale, and in the domains behaviour control and affective responsiveness. Further analysis showed that the relationship between socioeconomic position and chronic periodontitis was potentially partially mediated through the family functioning domains behaviour control, affective responsiveness and through the general functioning scale.

Results also shows that family functioning in the domains communication and affective involvement loses statistical significance in the relationship with chronic periodontitis once controlled for oral health related behaviour. When tested further for mediation it was found that family functioning in these two domains; communication and affective responsiveness potentially partially mediates the effect of socioeconomic position on tobacco consumption.

When tested for interaction effects, it was found that family functioning in the general functioning scale and in the domains behaviour control, roles, problem solving, affective involvement, communication and affective responsiveness did not interact with socioeconomic position in determining chronic periodontitis.

7. Discussion

7.1 Introduction

This study hypothesised that effective family functioning (in the domains problem solving, communication, role functioning, affective involvement, affective responsiveness, behaviour control and in the general functioning scale) would act as protective factors in chronic periodontitis experience. The first aim of this study was to assess the independent association between socio-demographic factors and chronic periodontitis experience in the sample. In general, the direction of the results was found to be consistent with the findings in the literature. The proportion of the sample with chronic periodontitis (signified by at least one tooth with more than 4mm pocketing) was higher than the proportion found in the England and United Kingdom 2009 Adult Dental Health Survey. However, it was consistent with the proportion reported in the ONEL Adult Dental Health Survey 2008-2010. Associations between age, gender, ethnicity, and socio-economic position were all found to be in the same direction as reported in the literature. However, only ethnicity and socio-economic position were found to be statistically significant.

The second objective was to assess the independent contribution of family functioning (in each of the six domains: problem solving, communication, role functioning, affective involvement, affective responsiveness, behaviour control and in the general functioning scale) to chronic periodontitis experience. The analysis showed that effective family functioning (in the domains affective responsiveness, behaviour control and in the general functioning scale) was associated with lower chronic periodontitis experience. This association was found after controlling for all relevant and potential confounders as identified in the literature and of statistical significance such as ethnicity, socio-

economic status, tobacco consumption and plaque score therefore supporting the premise of the independent role of these family functioning domains.

The third objective was to assess the independent association between periodontal health-related behaviour and chronic periodontitis. The analysis showed that tobacco consumption and oral hygiene measured as plaque score was significantly associated with chronic periodontitis experience, even after adjusting for all potential confounders.

The final objective was to explore the possible manner in which family functioning, in each of the significantly associated domains, works with other risk or protective factors in influencing chronic periodontitis experience. This study hypothesised that family functioning (in each of the statistically significantly associated domains) would be in the pathway between socio-economic position and chronic periodontitis experience. The analysis found that the relationship between socio-economic status and chronic periodontitis experience was partially mediated via family functioning (in the domains affective responsiveness, behaviour control and in the general functioning scale).

7.2 Socio-economic position and chronic periodontitis.

In this study, socio-economic position was assessed according to an individual based socio-economic indicator, as measured by the National Statistics Socio Economic Classification (NS-SEC) using the self-coded method of derivation. The NS-SEC is based on occupation, employment status, supervisory status and size of organisation. Within this study, the proportion of individuals at the top of the socio-economic position hierarchy was high. Individuals in the managerial and professional occupations group could have been over-represented in this sample as they are more likely to be motivated to participate in a study. As for other chronic diseases, the relationship between socio-economic position and chronic periodontitis shows a gradient, whereby

individuals lower down the social hierarchy are more likely to experience chronic periodontitis than those further up the hierarchy. This finding is consistent with other studies which demonstrate a social gradient in chronic periodontitis. Findings regarding the socio-economic gradient are also consistent with results from the literature on general health (Sheiham and Nicolau, 2005) thus strengthening the postulation that there is a social gradient in chronic periodontitis.

The fact that the socio-economic position gradients were attenuated but did not disappear in the adjusted models implies that the confounders, such as ethnicity, family functioning and periodontal health-related behaviour explained part but not all of the factors affecting the gradients. These findings also support the postulation that determinants of oral health inequality with regard to chronic periodontitis cannot be explained only by proximal determinants such as periodontal health-related behaviour.

7.3 Tobacco consumption and chronic periodontitis

The relationship between tobacco consumption and chronic periodontitis experience showed that individuals who consumed tobacco were more likely to experience chronic periodontitis as compared to non-consumers even after adjusting for confounders.

This finding, which is consistent with the evidence in current literature (Sham et al., 2003), also serves to validate this study.

7.4 Plaque and chronic periodontitis

The relationship between plaque and chronic periodontitis showed a small but significant association. There was a 1.02 increase in the odds ratio of chronic periodontitis experience with every percentage increase of teeth with visible plaque, even after adjusting for confounders.

7.5 Dental attendance and chronic periodontitis

The relationship between dental attendance and chronic periodontitis showed a trend that was consistent with a recent epidemiological study reported in the literature (Ellershaw and Spencer, 2011) but did not have statistical significance. Although variations in dental attendance pattern are present in the sample, as demonstrated in the frequency distribution, a majority of participants in this study reported attending the dentist in the last year and therefore are likely to be above the threshold for maintaining periodontal health. It is also important to note that dental attendance in this study was measured by the patient's last visit to the dentist, without taking into consideration the purpose of the last visit. One may argue that a visit to the dentist within the last year for a regular check-up may have different connotation as compared with a visit for acute pain or extraction. The inconclusiveness of this finding only serves to reaffirm what was stated in the literature review section, namely more definitive studies are needed before the association between dental attendance pattern and chronic periodontitis experience can be confirmed.

7.6 Contribution of family functioning domains

This study found a statistically significant relationship between five out of six of the family functioning domains and chronic periodontitis. These domains were: communication, role functioning, affective involvement, affective responsiveness, behaviour control. A statistically significant relationship was also found between the general functioning scale and chronic periodontitis. These relationships were found before any adjustments for potential confounders were made. When ethnicity and socio-economic position were added to the model, an independent association was seen for the following domains: behaviour control, affective responsiveness, affective involvement and communication, and the general functioning scale. Complete

attenuation was seen for the role functioning domain. A possible explanation for this could be that socio-economic position (defined by NS-SEC) influences an individual's ability in role functioning. It would be fair to assume that socio-economic position (defined by NS-SEC, which is a measure of social class based on occupation class) is also likely to account for other measures of social class. For example, people who are defined as belonging to the 'managerial and professional occupations' group as a result of their occupation are also likely to be well educated, and to enjoy a high standard of living. Conversely, it is very unlikely that people in poorly paid manual work with limited personal wealth would be highly educated and enjoy high standards of living. In terms of role functioning, higher education, a sense of stability and the availability of resources, which is associated with a higher NS-SEC class, may assist in fulfilling necessary family roles such as provision of resources and maintenance and management of the family system; and also the recognition and employment of the appropriate degree of involvement and interest in family members. It may be reasonable to assume that being from a higher NS-SEC class, with the likelihood of having higher education, feeling secure in an occupation and having more resources, may equip an individual in the role functioning domain. Therefore, once socio-economic position is controlled for, the association between this domain and chronic periodontitis loses its significance as they both tap into a related construct.

The roles of each of the remaining significant domains were then elucidated through testing for mediation.

When oral health-related behaviour was added to the model, an independent association was seen for the behaviour control, affective responsiveness domains, and the general functioning scale. Complete attenuation was seen for the communication and affective involvement domains. This suggests that the potential association

between the communication and affective involvement domains was through oral health-related behaviour. This is consistent with what was postulated in this study, namely that effective family functioning in the communication domain moderates the effect of the social environment on oral health-related behaviour. It was postulated that effective communication, or communication that is clear and direct, may allow individuals within a family to help one another make healthier choices. It was also postulated that effective affective involvement, where families shows interest in, and value the activities and interests of family members, may regulate oral health-behaviour, as empathic involvement makes people invest in each other's actions. This can help the adoption of good oral health behaviour among family members, where empathic involvement suggests that individuals in the family would be inclined to motivate each other to adopt healthy behaviours for the betterment of all.

7.7 Role of family functioning domains in the relationship between socio-economic status and chronic periodontitis experience

A fuller explanation of the role of the social gradient in modifying host response in the genesis of chronic periodontitis requires the recognition of a second set of processes that might be envisioned as protective factors, buffering or cushioning an individual from the physiological, psychological or behavioural consequences of exposure to these stressors or distal determinants (Cassel, 1995). The family, a locus of a person's social activity and one of the most basic social institutions which forms an individual's social environment, has been postulated as an important explanatory component of the psychosocial pathway, by producing profound effects on host susceptibility to disease (Cassel, 1976).

The unique contribution of this study lies in the evaluation of the role played by each of the domains of family functioning in the social gradient in chronic periodontitis.

The family functioning domains behaviour control, affective responsiveness, affective involvement, communication and general functioning scale partially mediates the association between socio-economic position (measured as NS-SEC). Partial mediation was expected as the family functioning domains of behaviour control, affective responsiveness, communication and general functioning scale were postulated to reduce the effect of the social gradient on chronic periodontitis by modifying the host response of the individual and without eliminating the relationship.

This study was analysed using the causal steps method (Baron and Kenny, 1986) to test for mediation. This has the lowest type 1 error rates and the highest type 2 error rates, suggesting that any mediating effects of the family functioning domains are unlikely to be chance findings.

7.8 Strengths and limitations of the study

The present findings should be interpreted in relation to the methodological strengths and limitations of the study.

7.8.1 Study design

A strength of this study is in its external validity. This study analysed data from the ONEL-Family Study, which was a major cross-sectional survey that utilised a stratified two-stage random sampling procedure in order to select a representative sample of 16-65 year olds from the general non-institutionalised population. This procedure ensured that there was a good representation from the various sub-groups that made up the Outer North East London Population in the study sample.

A second strength of this study is in the wide range of variables analysed. Variables which were relevant and considered to be potential confounders based on the literature were analysed in this study. They include a theoretically appropriate socio-economic

indicator (NS-SEC), socio-demographic indicators (age, gender, ethnicity), periodontal health-related behaviours (dental attendance, tobacco consumption, oral hygiene measure, plaque score), family functioning domains (problem solving, communication, role functioning, affective involvement, affective responsiveness, behaviour control and the general functioning scale) and chronic periodontitis indicator. Findings consistent with the current literature for the variables analysed increased the credibility of the evidence.

However, as this is a cross-sectional study, it is not possible to assure the sequence or temporality of processes or variables studied. There exists a possibility of reverse causation in that it could be argued that individuals with better periodontal health are more likely to get a better job and be in a higher NS-SEC position by comparison with an individual with poor periodontal health. Also, with a cross-sectional design there is a possibility of getting different results when measured at different points in time, which may affect the study's validity. However, while family functioning is a relatively stable construct, it is not static and chronic periodontitis (as measured by having at least one interproximal site with more than 4mm pocketing) is a measure of current disease rather than a cumulative measure which makes it appropriate for these two variables, predictor and outcome to be measured at one point of time. However, despite these limitations and because there is a growing recognition of the importance of the functioning within a family, as compared to marital status *per se* (Marcenes and Sheiham, 1996), in chronic periodontitis experience, a cross-sectional design was considered appropriate to explore the psychosocial and behavioural component of the social gradient in chronic periodontitis.

7.8.2 Study measure

7.8.2.1 Family assessment device

Family functioning data were collected using the validated Family Assessment Device (Ryan et al., 2005). The FAD is based on the McMaster Model of Family Functioning (MMFF), a clinically oriented conceptualization of families which identifies six dimensions of family functioning. The FAD was chosen because of its good psychometric properties, its cross cultural application, its extensive use in peer reviewed studies and because the domains assessed have the most impact on the health outcomes of its members. The instrument is also designed so that participants are not asked directly how the family functions but are led to reveal this. This feature is important in reducing self-report bias, which is crucial in studies of a sensitive nature such as the study of families, as individuals may tend to answer in the way they think they are expected to do or in a socially desirable manner. The FAD, which only requires a reading age of around 12 years, also allowed this device to be used in this sample, which included adults from the age 16-65.

The issue of unit of analysis is critical in studying family functioning. A major critique with many studies of family life is that of reliance on single informant reporting. While many researchers argue that collecting data from multiple family members results in a richer and more intricate description of what is going on within a family, as compared to single informants, the meaning and usefulness of these reports must be established at the theoretical rather than the methodological level. As such, the issue of unit of analysis depends on the purpose of the analysis. Within this study, we are interested in the family transactional processes, which are everyday duties or routine activities in which family members engage, as these are the most relevant to their periodontal health behaviour and periodontal health. Family functioning, using the FAD, is

assessed either by averaging the scores for all the members in the family or by assessing the perception of the member most relevant to the study outcome, in this instance the individual being studied. As mentioned earlier in the literature review, the justification for using single informants in understanding family processes is that there is no reason to assume that an individual's perception of his or her family functioning is not an aspect of the individual's family reality, as it is reasonable to suggest that perceptions of reality are 'reality' to the perceiver (Larson, 1974, Foxcroft and Lowe, 1995). Each person's perceived reality is significant as it is each person's perceived reality that affects his psychological wellbeing (Burt et al., 1988), behaviour, style and quality of interpersonal relationships (Safilios-Rothschild, 1970).

Data collected from individuals or single informants qualify as research about families if the intention to use an individual's report as either a) an objective reality, implying that the report is independent of the individual's view, (e.g. a report of the number of family members, length of time a marriage has existed); or b) a subjective individual reality that is interpreted as one family member's perception of himself, his family, or other family members (Pruchno et al., 1994). From this perspective, the report is accepted as an individual's construction or perception of the family.

Hence, within this study, the usage of a single informant, the participant's report on family functioning is valid when it is interpreted in the context of the participant's perception of their family functioning.

7.8.2.2 NS-SEC

Different socio-economic indicators such as the Index of Multiple Deprivation, IMD, income and social class can be used to assess different aspects of socio-economic position. In this study, it was decided that the NS-SEC was to be used as the indicator

of choice as it may be a better measure of social standing than years of education; and it is more theoretically appropriate to use in psycho-sociological correlations. The NS-SEC has been constructed to measure employment relations and conditions of occupations which, conceptually, are central to a portrayal of the structure of socio-economic positions in modern societies and to help to explain variations in social behaviour and other social phenomena.

However, the way socio-economic position indicated by NS-SEC was analysed may present as a limitation, as socio-economic position was analysed only using the participant's NS-SEC and did not take into consideration the partners', parents' or other family members' NS-SEC. One may argue that the socio-economic position of an individual could be dependent on the combined NS-SEC of all the family members, rather than on the individual's personal NS-SEC. Analysing individual NS-SEC does not allow a distinction to be drawn between single income and double income families. If a couple are both in paid employment, they may enjoy a relatively high standard of living even if they are both in a relatively "low class" occupations. This may mask both the effect of the social gradient on chronic periodontitis experience and the interaction between the social gradient and family functioning domains.

7.8.2.3 Measure of chronic periodontitis

The issue of the validity of the chronic periodontitis definition is fundamental in any risk-association study. One may argue that the most adequate measure by which to assess chronic periodontitis is to use a 'two threshold' measure based on severity, as suggested by the CDC. However, in a hypothesis generating study such as this, it would be more valuable to define or measure chronic periodontitis in a dichotomy. This

is because the clinical manifestations of chronic periodontitis create an obstacle to precise classification based on severity and thus, by using 4mm of pocketing as the minimal requirement for disease classification, we reduced the risk for false negative classifications giving more power to the test. The exclusion of third molars and the clinical criteria where a periodontal pocket must be measured at the interproximal area to reduce the risk of measuring false pocketing also gave more power to the test. Meanwhile, it could also be argued that the usage only of pocket depth measurement without the gold standard clinical attachment loss measurement may result in an overestimation of disease leading to an invalid measure of chronic periodontitis. Having said that, pockets and loss of attachment may be difficult to detect and bleeding may not always be obvious, so false negatives are very much more likely than false positives. In other words, periodontal examination in a field survey is always likely to underestimate rather than overestimate the prevalence of the condition (UK adult dental health survey 2009).

The issue of whether clinical attachment loss is necessarily an expression of chronic periodontitis should be considered (Hujoel et al., 2005b) as this may have a profound effect in populations that experience differences in clinical attachment loss as an expression of chronic periodontitis, such as those of Asian ethnicity (Corbet et al., 2002, Corbet and Leung, 2011) which made up about 22% of this study sample.

The validity of the definition of chronic periodontitis reported here is also supported, to some extent, by the consistent direction of associations found between age, ethnicity, socio-economic classification and oral health-related behaviour, tobacco consumption, plaque percentage, variables that are established determinants of chronic periodontitis.

However, it is important to realize that current evidence from the literature shows that different case definitions can have a considerable impact on the apparent prevalence of chronic periodontitis (Costa Guimar et.al., 2009) and can also influence the results of associations between chronic periodontitis and the researched risk factor (Preshaw, 2009). Hence, the findings from this study should be interpreted in the context of chronic periodontitis as defined in this study.

7.8.3 Data analysis

7.8.3.1 Using regression analysis with high prevalence outcome

The data in this study was analysed using logistic regression and measured in terms of odds ratio. Several papers have raised the issue of using logistic regression models when dealing with data with a frequent outcome or high prevalence. However, when conditions for causal inference in cross-sectional studies are met, it is important to consider that the only measure that provides an unbiased estimate of incidence density ratio is the prevalence odds ratio. Based on this, it is suggested that logistic regression models remain the appropriate choice to capture the contrast in incidence between exposure groups (Coutinho and Reichenheim, 2010).

7.8.3.2 Assessing mediation

This study tested for mediation using regression models, with the assumption that there were no measurement errors in the measured variables. However, there are usually some inherent errors when a measured variable is involved, resulting in overestimation of the effect of the independent variable and an underestimation of the effect of the mediator. This can usually be addressed through structural equation modelling;

however, structural equation modelling was not used in this analysis as there were not enough measured variables to create a latent variable. Ideally, three measured variables are required to create a latent variable which can be tested using confirmatory factor analysis to ensure that the measured variable is a true and measurable manifestation of the latent variable.

In this study, the mediator was observed and was not experimentally manipulated and, as such, a reverse hypothesis that the dependent variable caused the mediator cannot be ruled out (Wu and Zumbo, 2008).

Therefore, meeting all four steps does not conclusively establish that the hypothesized mediation model has occurred because there are other alternative models that meet the above specification.

Another limitation of the causal steps approach used in this study is that it does not test the significance of the indirect pathway, as stated by Gelfand et.al (2009), whereby a reduction in significance from c to c' fails to demonstrate that a difference between c and c' is significant (Gelfand et al., 2009). However, it can be argued that, while statistical significance is important, this is not absolutely necessary in order to infer mediation because path c will not be significant if the power of the test is insufficient or when there is inconsistent mediation where the mediator acts as a suppressor (MacKinnon et al., 2002).

In spite of these limitations, because this approach uses data analysis as a tool to examine whether a mediation effect is in place, it is a suitable test for use in observational studies and it is therefore the method used here (Wu and Zumbo, 2008).

7.9 Conclusions

Taking into consideration its hypothesis, aims and objectives, this study concluded that:

1. Socio-economic position measured as NS-SEC was found to be associated with chronic periodontitis experience, with individuals ranking higher in the NS-SEC classification presenting with less risk of experiencing chronic periodontitis as compared to those ranking lower in the NS-SEC classification. This social gradient persisted even after adjusting for other confounders.
2. Family functioning in the behaviour control and affective responsiveness domains and the general functioning scale were independently associated with chronic periodontitis experience in Outer North East London.
3. Effective family functioning in the behaviour control and affective responsiveness domains and on the general functioning scale are partial mediators in the association between socio-economic position and chronic periodontitis outcome.
4. Periodontal health-related behaviour was concluded to be an important determinant of chronic periodontitis. Tobacco consumption was significantly associated with chronic periodontitis experience even after adjusting for confounders. Individuals with inadequate oral hygiene, indicated in terms of percentage of teeth with visible plaque, were also significantly associated with chronic periodontitis.
5. The effect of the family functioning domains of affective involvement and role functioning on chronic periodontitis experience must not be discounted.

Although they were found not to be statistically significant after adjustment for socio-economic position, this could have occurred due to the fact that these two domains share similar constructs as socio-economic position rather than being confounded by it.

7.10 Implications for future research

This study confirmed that a social gradient exists in chronic periodontitis experience, defined as having at least one pocket depth of more than 4mm. It would be important to test this association using other definitions of chronic periodontitis, as different definitions may produce different results. More research is needed to examine the potential mechanism behind the association between the social gradient and chronic periodontitis experience. Future studies should include multiple socio-economic indicators to allow us to disentangle and elucidate what component of the social environment truly contributes to the social gradient, (ie. education, income, social status etc).

A fuller explanation of the potential role of the social environment or social gradient in modifying host response in the genesis of chronic periodontitis also requires the recognition of a second set of processes. These might be envisioned as protective factors, buffering or cushioning an individual from the physiological, psychological or behavioural consequences of exposure to these stressors or distal determinants (Cassel, 1995).

The family, being the most basic form of social support, was a logical unit to explore in terms of health. Families have a primary responsibility for developing self-care and dependent care competencies within the family, fostering resilience among family members, providing resources and promoting healthy individuation while providing

resources. The task of fostering health and healthy behaviour is seen as an integral part of a functional family process.

Based on this premise, this study has explored and provided a new resource for understanding the association between social gradient and chronic periodontitis. Using the stress disease model as a theoretical framework, this study has proven the importance of psychosocial factors for chronic periodontitis experience and added to the understanding of how family functioning could reduce inequality by mediating the effects of the social environment on disease experience. Family functioning acts by creating a supportive environment that allows the individual to cope with and to tackle the stressors that exist in their social environment.

Findings from this study can be considered as contributing to the knowledge or study of protective factors for chronic periodontitis. Although efficient family functioning in the domains behavioural control and affective responsiveness and general functioning scale was able to partially mediate the effects of social gradient on chronic periodontitis it was unable to fully explain the association between socio-economic position and chronic periodontitis. Further studies should explore other factors that may influence this association.

Findings from this study suggest that the family institution may be an invaluable resource in reducing inequality in chronic periodontitis specifically and in health in general. As such, family therapy or counselling to improve family functioning could serve as an alternative intervention or prevention strategy with regard to health in general.

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Appendices

1. Invitation Letter



INVITATION LETTER

RE: Dental Needs Assessment Survey for 18-65 years old Adults

Your address has been randomly sampled to be included in a survey commissioned by NHS Waltham Forest to assess the dental health needs of the local community.

Barts & The London School of Medicine & Dentistry, Queen Mary University of London (QMUL), have been asked to carry out a survey of local residents to understand their dental health needs. The outcome of the survey will enable the Primary Care Trust to ensure they provide appropriate levels of dental care in the future.

If you agree to take part, you will be offered an appointment in your own home, at a local PCT venue or at the Barts & The London School of Medicine & Dentistry at a time to suit you. Also, please let us know if you have any preference to be examined by a male or female dentist. There will be a simple check-up and a short interview to collect information on such things as whether you have ever been to the dentist and if so, what your experience was at that visit.

If you are found to be in need of dental treatment, we will arrange for you to attend an appropriate dental practitioner.

If you have any questions about this survey please contact Professor Wagner Marcenes (QMUL) on 020 7882 8632 in the first instance or Sue Clark, NHS Waltham Forest on 020 8430 7364.

Please complete the attached slip and return it in the prepaid envelope provided to confirm your availability, however, if we do not hear from you within one-week from the date of this letter then an appointment will be sent by default.

Yours sincerely

Wagner Marcenes

Professor of Oral Epidemiology

Project leader

2. Opt-in card



Dental Needs Assessment Survey

Name(s) of adults aged 18-65 years or more living in this address:

Name	Age	Name	Age
1		3	
2		4	

Contact telephone numbers if you prefer to be contacted by phone:

Home: _____ Mobile: _____ Work: _____

Please tick to indicate availability and enter the choice of venue

	Morning	Afternoon		Evening	Choice of Venue
Day	8:00-12 noon	12 noon-14:00	14:00-18:00	After 18:00	Please indicate Home, PCT or Barts & The London
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					
Saturday					
Sunday					

Please tick to indicate you want to be clinically examined by a female dentist
or to indicate you do not want to be clinically examined

I want to be clinically examined by a female Dentist	
I do not want to be clinically examined	

Address _____

Postcode _____

Signed by Patient: _____ Dated:

Please return this form in the prepaid envelope provided to Professor Wagner Marcenes at the Institute of Dentistry, Barts and The London School of Medicine and Dentistry.

Thank you

3. Information Sheet

Participant Information Sheet (Version: 3 Dated: 21-01- 2009)

Title of project: Oral Health in Outer North East London

Chief Investigator: Professor Wagner Marcenes

Participant Identification Number for this study:

We would like to invite you to participate in an academic research project, which we think is important. Before you decide if you want to participate please read the following information carefully. It will tell you why the research is being done and what it would involve for you. Please ask if there is anything that is not clear or if you would like more information. Talk to others about the study if you want to.

What is the purpose of the study?

Barts & The London School of Medicine & Dentistry, Queen Mary University of London (QMUL), have been asked to carry out a survey of local residents to understand their dental health needs. The outcome of the survey will enable the Primary Care Trust to ensure they provide appropriate levels of dental care in the future. Oral diseases are a common problem in the UK; they are also preventable and treatable. Prevention of oral diseases reduces the burden on PCTs to provide dental treatment. Information on oral health status and behaviour are crucial for planning dental care. Also we want to further understand why some families living in certain areas have less disease than others. By carrying out this research we hope to identify the factors that have a beneficial effect on the dental health of your family. This study will also contribute to the education of researcher students.

Why have I been invited?

You have been invited to take part in this study because your address has been randomly sampled to be included in a survey commissioned by Waltham Forest, Redbridge, Barking and Dagenham PCTs and conducted by Barts and the London School of Medicine and Dentistry, Queen Mary University of London.

Do I have to take part?

You should only agree to take part if you want to; choosing not to take part will not disadvantage you in anyway, it will not affect your access to treatment or services. You are still free to withdraw at any time and without giving a reason.

What will happen to me if I take part?

If you decide to take part there will be a simple routine check-up which will take 5-10 minutes and a short interview using a questionnaire. The interview should take approximately 15 minutes to complete. You will be asked to sign a consent form before undergoing the examination and answering the questionnaire. You can stop part way through if you do not want to continue. The first part of this questionnaire will collect information on things such as whether you have ever been to the dentist, the second part contains questions on some key features of your family such as the structure of your family and how your family functions on a day to day basis. For each question you will be asked to select a response that best reflects your situation. There are no right or wrong answers.

What are the possible disadvantages or risks of taking part?

There are no risks or disadvantages to taking part in this study. The only additional commitment will be the time required to complete the examination and interview. The opt-in card allows you to tell us when it's convenient to contact you and you have the option to stop part way through if you do not wish to continue.

What are the possible benefits of taking part?

If you are found to be in need of dental treatment, we will arrange for you to attend an appropriate dental practitioner. Some of the information from this study will be used by the Waltham Forest, Redbridge and Barking & Dagenham health authorities in planning service provision and formulating policies that would translate to improved quality of service for you and to develop health promotion strategies for your local community.

What if something goes wrong or there is a problem?

If there is a problem or you have any concerns you may get in touch with Professor Wagner Marcenes on 020 7882 2608 or E-mail: w.marcenes@gmul.ac.uk. If you remain unhappy and wish to complain formally, you can do this through the NHS complaints procedure. Details can be obtained from any hospital, clinic or surgery.

Queen Mary University of London has agreed that if you are harmed as a result of your participation in the study, you will be compensated, provided that, on the balance of probabilities, an injury was caused as a direct result of the intervention or procedures you received during the course of the study. These special compensation arrangements apply where an injury is caused to you that would not have occurred if you were not in the study. These arrangements do not affect your right to pursue a claim through legal action.

Will my details be kept confidential?

All personal identifiable data will be destroyed at the end of the study. All data collected in this study will be anonymised and held securely and confidentially. Your name and any identifiable data will be removed from the questionnaire and it will be assigned a code number. This code will be used to link the questionnaire data with the clinical data. This coded data will be entered into a computer and researchers at Queen Mary University of London will analyse this anonymous database. Data generated in the course of this study is the property of the college and will be kept securely in paper or electronic format for a minimum of 10 years. This will assure that proper practice was adopted and any subsequent questions asked about either the conduct of the research or the results obtained can be addressed.

What will happen to the results of the study?

The results of this study will be published in service reports, in peer reviewed scientific journals and as conference presentations. Any service report or academic publication will present only aggregated data, such as average levels of dental decay in outer north east London. No individual data/ information can be identified from any reports both published and unpublished. These reports will enable the PCTs to assess the dental needs of their communities and to commission appropriate services.

Who has reviewed the study?

The scientific quality of this study has been assessed within the chief investigators institution (Barts & The London School of Medicine & Dentistry, Queen Mary University of London (QMUL). In addition it is looked at by an independent group of people called a Research Ethics Committee. They make sure that your safety, rights, wellbeing and dignity are protected. This study has been reviewed and given a favourable opinion by Redbridge and Waltham Forest Research Ethics Committee. Project reference No: 08/H07071/93.

4. Consent Form

CONSENT FORM (Version: 3 Dated : 21-01- 2009)

<p>Title of project: Oral Health in Outer North East London</p> <p>Chief Investigator: Professor Wagner Marcenes</p>
--

Participant Identification Number for this study:

Please initial box to indicate agreement

1.	I confirm that I have read and understand the information sheet dated 21-01-2009 (version 3) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	
2	I understand that my participation is voluntary and that I am free to withdraw their participation at any time, without giving any reason, without their medical care or legal rights being affected.	
3	I understand that data collected in the clinical examination will be linked through a coding system to data collected using the questionnaire. This anonymous data will be used for academic purposes by researchers from The Barts and the London/ Queen Mary University of London. I give permission for these individuals to have confidential access to my records. I understand that data generated in the course of this research is the property of the college and will be kept securely in paper or electronic format for a minimum of 10 years, while personal identifiable data will be destroyed at the end of the study.	
4.	I understand that relevant data collected during the study, may be looked at by responsible individuals from regulatory authorities or from the Barts and the London School of Medicine and Dentistry/ Queen Mary University of London, where it is relevant to my taking part in this research. I give permission for these individuals to have access to the data collected in this study	
5.	I agree to to take part in the above study.	

Name of person giving consent

Date

Signature

Name of person taking consent

Date

Signature

5. Clinical Examination Form

Adult Data Collection Form

Participant

Data of birth/...../..... Sex:

Address.....

Postcode..... Tel.....

Examiner/DentistDate...../...../.....

	Yes	No
ASK ALL		
Clear medical history for periodontal examination?	1	2
Natural teeth present in both arches?	1	2

IF NO:

Natural teeth present in upper arch only?

1

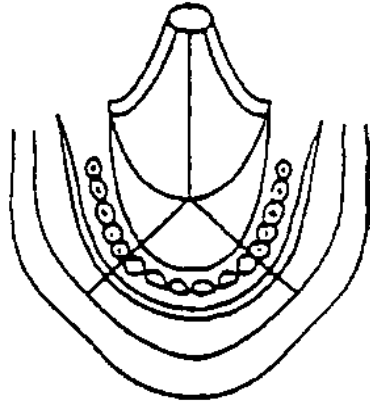
2

Natural teeth present in lower arch only?

1

2

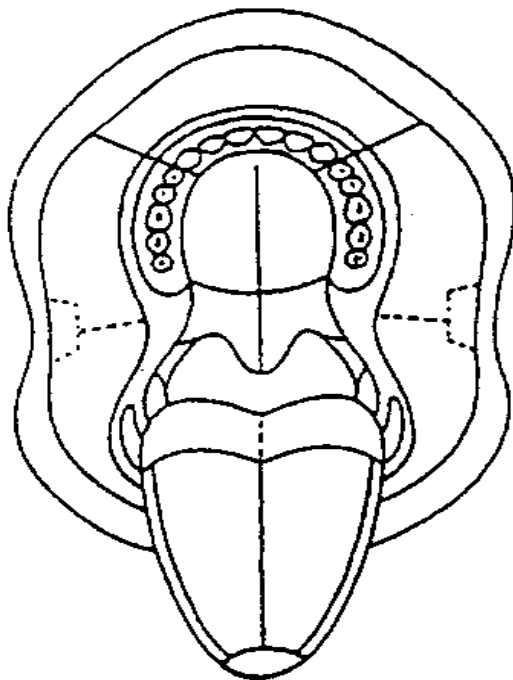
EXTRA-ORAL AND ORAL MUCOSA ASSESSMENT



Extra-oral assessment

- [1] Normal extra-oral appearance
- [2] Ulceration, sores, erosions, fissures
- [3] Abnormalities of upper/lower lips
- [4] Enlarged lymph nodes
- [5] Other swellings of face and jaws
- [6] Other (specify)

.....
.....



Oral mucosa assessment

Change in Colour

- [1] White patch/Not removable
- [2] Red patch
- [3] Mixed White & Red patch

Change in Texture

- [1] Granular
- [2] Fissured
- [3] Firm to touch

	<p>[4] Velvety</p> <p>[5] Tender to touch</p> <p><u>Ulcers</u></p> <p>[1] Raised everted edges</p> <p>[2] Induration</p> <p>[3] Aphthous</p> <p>[4] Herpetic</p> <p><u>Lumps</u></p> <p>[1] Raised area/Swelling</p> <p><u>Suspected diagnosis</u></p> <p>[1] No abnormal condition</p> <p>[2] Pre-cancer lesion</p> <p>[3] Cancer lesion (Malignant tumor)</p>
--	--

TOOTH ASSESSMENT:

Tooth Condition	PL	CROW	
UPPER RIGHT 8			
UPPER RIGHT 7			
UPPER RIGHT 6			
UPPER RIGHT 5			
UPPER RIGHT 4			
UPPER RIGHT 3			
UPPER RIGHT 2			
UPPER RIGHT 1			

Tooth Condition	PL	CROW	
UPPER LEFT 1			
UPPER LEFT 2			
UPPER LEFT 3			
UPPER LEFT 4			
UPPER LEFT 5			
UPPER LEFT 6			
UPPER LEFT 7			
UPPER LEFT 8			

Tooth Condition	PL	CROW	

LOWER LEFT 8			
**LOWER LEFT 7*			
**LOWER LEFT 6*			
**LOWER LEFT 6*			
**LOWER LEFT 4*			
**LOWER LEFT 3*			
**LOWER LEFT 2*			
**LOWER LEFT 1*			

Tooth Condition	PL	CROW	
LOWER RIGHT 1			
LOWER RIGHT 2			
LOWER RIGHT 3			
LOWER RIGHT 4			
LOWER RIGHT 5			
LOWER RIGHT 6			
LOWER RIGHT 7			
LOWER RIGHT 8			

ROOT ASSESSMENT

Root Condition	Root	
UPPER RIGHT 8		
UPPER RIGHT 7		
UPPER RIGHT 6		
UPPER RIGHT 5		
UPPER RIGHT 4		
UPPER RIGHT 3		
UPPER RIGHT 2		
UPPER RIGHT 1		

Root Condition	Root	
UPPER LEFT 1		
UPPER LEFT 2		
UPPER LEFT 3		
UPPER LEFT 4		
UPPER LEFT 5		
UPPER LEFT 6		
UPPER LEFT 7		
UPPER LEFT 8		

Root Condition	Root	
LOWER LEFT 8		
LOWER LEFT 7		
LOWER LEFT 6		
LOWER LEFT 5		
LOWER LEFT 4		
LOWER LEFT 3		
LOWER LEFT 2		
LOWER LEFT 1		

Root Condition	Root	
LOWER RIGHT 1		
LOWER RIGHT 2		
LOWER RIGHT 3		
LOWER RIGHT 4		
LOWER RIGHT 5		
LOWER RIGHT 6		
LOWER RIGHT 7		
LOWER RIGHT 8		

POSTERIOR CONTACT ASSESSMENT

RIGHT	Contact
** ZONE 1**	
** ZONE 2**	
** ZONE 3**	
** ZONE 4**	
** ZONE 5**	
** ZONE 6**	
** ZONE 7**	
** ZONE 8**	

LEFT	Contact
** ZONE 1**	
** ZONE 2**	
** ZONE 3**	
** ZONE 4**	
** ZONE 5**	
** ZONE 6**	
** ZONE 7**	
** ZONE 8**	

ANTERIOR CONTACT ASSESSMENT

What is the anterior occlusion total?

0 1 2 3 4 5 6

SPACES ASSESSMENT

Spaces	Space
UPPER RIGHT 1	
UPPER RIGHT 2	
UPPER RIGHT 3	
UPPER RIGHT 4	
UPPER RIGHT 5	

Space	Space
UPPER LEFT 1	
UPPER LEFT 2	
UPPER LEFT 3	
UPPER LEFT 4	
UPPER LEFT 5	

Spaces	Space
LOWER LEFT 1	
LOWER LEFT 2	
LOWER LEFT 3	
LOWER LEFT 4	
LOWER LEFT 5	

Space	Space
LOWER RIGHT 1	
LOWER RIGHT 2	
LOWER RIGHT 3	
LOWER RIGHT 4	
LOWER RIGHT 5	

DENTURES ASSESSMENT

- Is the denture upper, lower or both? [1] Yes
[2] No

IF YES:

- Is the denture upper, lower or both? [1] Upper
[2] Lower
[3] Both

IF UPPER OR BOTH

- What is the upper denture type? [1] Partial
[2] Full
[3] Complete
[4] Implant

- What is the upper denture base material? [1] Metal
[2] Plastic

- What is the upper denture support? [1] ToothBorne
[2] TissueBorne
[3] BothBorne

What is the status of upper denture? [1] Intact
[2] Repair

IF LOWER OR BOTH

What is the lower denture type? [1] Partial
[2] Full
[3] Complete
[4] Implant

What is the lower denture base material? [1] Metal
[2] Plastic

What is the lower denture support? [1] ToothBorne
[2] TissueBorne
[3] BothBorne

What is the status of lower denture? [1] Intact
[2] Repair

Complete = Complete Overdenture

Implant = Implant Retained

BothBorne = Both Tooth and Tissue Borne

PERIODONTAL ASSESSMENT

Periodontal Condition	Pocket	Attach	Calculus
UPPER RIGHT 8			
UPPER RIGHT 7			
UPPER RIGHT 6			
UPPER RIGHT 5			
UPPER RIGHT 4			
UPPER RIGHT 3			
UPPER RIGHT 2			
UPPER RIGHT 1			

Periodontal Condition	Pocket	Attach	Calculus
UPPER LEFT 1			
UPPER LEFT 2			
UPPER LEFT 3			
UPPER LEFT 4			
UPPER LEFT 5			
UPPER LEFT 6			
UPPER LEFT 7			
UPPER LEFT 8			

Periodontal Condition	Pocket	Attach	Calculus
LOWER LEFT 8			
LOWER LEFT 7			
LOWER LEFT 6			
LOWER LEFT 5			
LOWER LEFT 4			
LOWER LEFT 3			
LOWER LEFT 2			
LOWER LEFT 1			

Periodontal Condition	Pocket	Attach	Calculus
LOWER RIGHT 1			
LOWER RIGHT 2			
LOWER RIGHT 3			
LOWER RIGHT 4			
LOWER RIGHT 5			
LOWER RIGHT 6			
LOWER RIGHT 7			
LOWER RIGHT 8			

6. Referral form

Referral – Adults

Dear Sir/Madam,

Having seen you as part of the Oral Health Needs Assessment we believe you would benefit from a more detailed examination.

Please complete **ONE** of the following sections:

A. My dentist is (name of dentist).....

I will arrange an appointment as soon as possible.

Signed.....Date.....

Name.....

Address.....

Postcode..... Tel.....

B. I do not go to the dentist. Please arrange an appointment at a dentist near to me.

Signed.....Date.....






Name.....

Address.....

Postcode..... Tel.....

7. Oral Health Risk Assessment Form

<u>Demographic/Habits Information</u>		© Written permission to use this tool may be obtained from Prof. W Marcenes (w.marcenes@qmul.ac.uk)	
(1) Date: / / / (day/month/year)		(3) Surname:	
(2) First Name:		(5) Country of Birth:	
(4) Date of Birth: / / / (day/month/year)		(7) Postcode:	
(6) Address:		(9) Access to Internet at Home <input type="checkbox"/> Yes <input type="checkbox"/> No	
(8) Home ownership <input type="checkbox"/> Yes <input type="checkbox"/> No		(12) What is your sex?	
(10) Marital Status: <input type="checkbox"/> Single (never married) <input type="checkbox"/> Married (first marriage) <input type="checkbox"/> Re-married <input type="checkbox"/> Cohabiting <input type="checkbox"/> Separated <input type="checkbox"/> Divorced <input type="checkbox"/> Widowed		(11) What was the highest degree or qualification that you obtained? <input type="checkbox"/> No qualification or degree <input type="checkbox"/> Secondary school (GCSE, O'Levels) <input type="checkbox"/> A Levels <input type="checkbox"/> Technical qualifications <input type="checkbox"/> First Degree (University) <input type="checkbox"/> Higher Degree (Post graduate)	
(13) Ethnic group: <input type="checkbox"/> Asian British <input type="checkbox"/> Asian Indian <input type="checkbox"/> Asian Bangladeshi <input type="checkbox"/> Asian Pakistani <input type="checkbox"/> Asian Middle East/Arabic <input type="checkbox"/> Asian Chinese <input type="checkbox"/> Asian Japanese		<input type="checkbox"/> Black British <input type="checkbox"/> Black European <input type="checkbox"/> Black African <input type="checkbox"/> Black Caribbean <input type="checkbox"/> Black American <input type="checkbox"/> Latino <input type="checkbox"/> Mixed Asian/Black <input type="checkbox"/> Mixed Asian/White <input type="checkbox"/> Mixed Black/White <input type="checkbox"/> White British <input type="checkbox"/> White West European <input type="checkbox"/> White East European <input type="checkbox"/> White Mediterranean <input type="checkbox"/> White North American <input type="checkbox"/> White Latin American Other (Specify)	
(14) Do/Did you use <u>tobacco</u> in any way? (Tobacco cigarettes, cigars, or pipes, with cannabis, snuff)			

<input type="checkbox"/> No, never (Go to question 13) <input type="checkbox"/> Yes, currently <input type="checkbox"/> Yes, in the past									
(14a) <u>If YES currently,</u>		How old were you when you <u>started</u> using tobacco?				(a)[] years			
(14bc) <u>If YES in the past</u>		How old were you when you <u>started</u> using tobacco?				(b)[] years			
		How old were you when you <u>stopped</u> using tobacco?				(c)[] years			
(15) Do/Did you chew paan?									
<input type="checkbox"/> No, never (Go to question 14) <input type="checkbox"/> Yes, currently (with tobacco) <input type="checkbox"/> Yes, currently (without tobacco) <input type="checkbox"/> Yes, with tobacco in the past, but not anymore <input type="checkbox"/> Yes, without tobacco in the past, but not anymore									
(15a) <u>If YES currently,</u>		How old were you when you <u>started</u> chewing paan?				(a)[] years			
(15bc) <u>If YES in the past</u>		How old were you when you <u>started</u> chewing paan?				(b)[] years			
		How old were you when you <u>stopped</u> chewing paan?				(c)[] years			
(16) Do you drink <u>alcohol</u> ? <input type="checkbox"/> No (Go to question 17) <input type="checkbox"/> Yes, currently <input type="checkbox"/> Yes, in the past									
(16a) <u>If YES</u> , How often do (did) you usually have an alcoholic drink?									
<input type="checkbox"/> 6-7 times/week <input type="checkbox"/> 3-5 times/week <input type="checkbox"/> Once-twice/week <input type="checkbox"/> Less often									
(16b-f) In a <u>typical week</u> , how many of each of these drinks do (did) you have? (Please, write the number of drinks you had in the empty box below each type of drink)									
Number of cans of Beer/Cider (b)[]cans		Number of 1/2 Pints of Beer/Cider (c)[]1/2 Pints		Number of Singles Spirits/Liqueurs (d)[]singles		Number of Glasses of Wine (e)[]glasses		Number of Bottles of Alcopop (f)[]bottles	
(17) How often do you exercise for more than 30 minutes that you get out of breath or sweat (E.g.: Frisky walk, stretching, strengthening, swimming, dancing)							[] times a week		
(18ab) About how many portions of fruit and vegetables do you usually eat in a week?					(a)[] portions of fruits a week (b)[] portions of vegetables a week				
(19) And what about the following types of food?							Number of portions		
a) Meet other than fish or chicken: e.g. beef.							(a)[] week		
b) Fried food: e.g. fried English breakfast, chips/crisps, savoury, fried chicken.							(b)[] week		
c) Spicy food: e.g. most Asian food such madras curry, samosas, bhajis.							(c)[] week		
d) Fatty food: e.g. full fat milk, Bacon, cheese.							(d)[] week		
e) Unprocessed food: e.g. raw vegetables, cereals (grains).							(e)[] week		
f) Sugary food: e.g. sweets, chocolate, sweet biscuits.							(f) [] week		
g) Sugary drinks: juices, coke (not diet)							(g) [] week		

(20)What is your height? [] centimeters	(21)What is your weight? [] kilograms
--	--

(19) How is your general health currently?				
<input type="checkbox"/> Excellent	<input type="checkbox"/> Good	<input type="checkbox"/> Average	<input type="checkbox"/> Bad	<input type="checkbox"/> Very bad


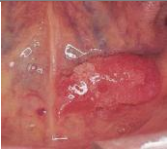


(22) Do any of these members of your family have or have had cancer?

Father/Mother
 Sister/Brother
 Aunt/Uncle
 Grandparent
 First Cousin
 2nd degree blood related relative
 No member of my family have or have had cancer

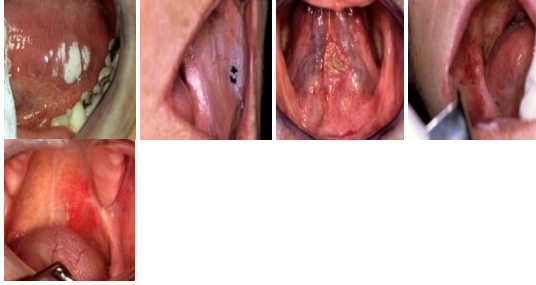

(23) Have you ever had a test for oral cancer in which the doctor or dentist pulls on your tongue, and feels under the tongue and inside the cheeks?	<input type="checkbox"/> Yes <input type="checkbox"/> No
(24) Are you aware that a small lesion in your mouth can develop into oral cancer?	<input type="checkbox"/> Yes <input type="checkbox"/> No
(25) Are you aware that early treatment can prevent a lesion to develop into oral cancer?	<input type="checkbox"/> Yes <input type="checkbox"/> No

(26) Do you have <u>any</u> of these mouth problems: Limitation of opening the mouth or of tongue movements; burning sensation, pain or soreness; bleeding; enlarged nodes (mass) in your neck (<i>Use your fingers to palpate and search for a mass in your neck</i>).	<input type="checkbox"/> Yes <input type="checkbox"/> No
---	---

(27a-g) Think carefully about all parts of your mouth (or check with the aid of a mirror), in particular the tongue, floor and top of the mouth, and inside the cheeks, and tick Yes if you have any mouth problem similar to those in the pictures below:

Change in <u>Colour</u> (Not removable White patch)	Change in <u>Colour</u> (Red patch)	Change in <u>Colour</u> (Mixed White & Red patch)	Mass (Growth)
			
(a) <input type="checkbox"/> Yes <input type="checkbox"/> No	(b) <input type="checkbox"/> Yes <input type="checkbox"/> No	(c) <input type="checkbox"/> Yes <input type="checkbox"/> No	(d) <input type="checkbox"/> Yes <input type="checkbox"/> No

Change in <u>Texture</u>	<u>Ulcer</u> (Non-healing only)
--------------------------	---------------------------------

	
<p>(f) <input type="checkbox"/> Yes <input type="checkbox"/> No</p>	<p>(g) <input type="checkbox"/> Yes <input type="checkbox"/> No</p>

<p>(28) When did you last visit to the dentist? (29) When did you last visit to the doctor?</p>	<p><input type="checkbox"/> last month <input type="checkbox"/> last 6 months <input type="checkbox"/> last year <input type="checkbox"/> Longer ago <input type="checkbox"/> last month <input type="checkbox"/> last 6 months <input type="checkbox"/> last year <input type="checkbox"/> Longer ago</p>
--	---

THANK YOU FOR FILLING IN THIS FORM

8. Adult Questionnaire



Barts and The London

School of Medicine and Dentistry

Welcome,

You are invited to answer this questionnaire. Your responses will help us to understand your oral health needs and help us plan your local oral health services in a more cost effective and efficient way.

Instructions for completion of the questionnaire

Each of the following questions has a list of options from which you can choose the response that best reflects your situation.

Please remember:

- There are no right or wrong answers
- Give only one answer for each question
- All the questions are mandatory

Data Protection

All data collected in this survey will be held securely and confidentially. No personal or identifiable data is retained. Researchers at Queen Mary University of London will analyse the anonymous database. Only aggregated data will be included in any report and it will not be possible to identify a particular person or family from the questionnaire responses.

The questionnaire should take approximately 15 - 20 minutes to complete.

Thank You!

Address

.....

.....

Adult Questionnaire

1. What is your Name :

The following questions are about your dental attendance
(For each of the following please tick the box next to your response)

2. About how long ago was your last visit to the dentist?			
In the middle of treatment	1	More than 3 up to 5 years ago	6
in the last 6 months	2	More than 5 up to 10 years ago	7
in the last 12 months	3	More than 10 up to 20 years ago	8

More than 1 up to 2 years ago	4	Never	9
More than 2 up to 3 years ago	5		

3. The last time you went to the dentist what made you go? Was it because you were having some trouble with your teeth or for a check-up or for some other reason?	Trouble with teeth	1
	For a check-up	2
	Other (Specify):	3

4. Is the dental practice (you went to the last time) nearer to your home or to your work?	Nearer to home	1
	Nearer to work /school	2
	The same	3

5. How far is it?	Up to half a mile	1	More than 10 up to 20 miles	6
	More than half up to one mile	2	More than 20 up to 30 miles	7
	More than 1 up to 2	3	More than 30 miles	8

	miles			
	More than 2 up to 5 miles	4	Other (Specify):	9
	More than 5 up to 10 miles	5		

6. Do you usually take time off work when you go to the dentist?	Yes (go to 7)	1	No (go to 8)	2
--	---------------	---	--------------	---

7. How much work time does a dental visit usually take, including travelling? (in hours)	Under 1 hour	1	3 hours but less than 4	4
	1 hour but less than 2	2	Or 4 hours or more?	5
	2 hours but less than 3	3		

8. Was your treatment under the NHS, was it private or was it something else?	National Health Service (NHS)	1	Dental hospital (hospital)	6
	Private	2	Dentist at your workplace	7
	N.H.S and Private	3	Through insurance	8
	School/Community dental service	4	With a dental plan	9
	Armed forces	5	Something else? Specify:	10

9. How much did the treatment cost you?	Specify amount:
--	-----------------

10. Thinking about the dental practice you went to last time had you been there before or was that your first time at that practice?	Been before (go to 11)	1
	First time (go to 12)	2

11. For about how many years have you been going to that dental practice?	Less than a year	1	5 years or more	4
	One year less than two	2	Don't know	5
	Two years less than five	3		

The following questions are about your oral hygiene habits
(For each of the following please tick the box next to your response)

12. This question is about cleaning your teeth. How often do you clean your teeth nowadays?	Never	1	More than twice a day	4
	Once a day	2	Other (Specify):	5

	Twice a day	3		
--	-------------	---	--	--

13. Nowadays there are several things available in chemist shops to help with dental hygiene purpose. Do you use any of them?			
Dental floss	1	Dental disclosing tablets	6
Interdens/ toothpicks/ woodsticks	2	Dental chewing gum	7
Mouthwash	3	Sensodyne or smokers' toothpaste	8
Interspace brush	4	Something else (Specify)	9
Electric toothbrush	5		

The following question is about your diet

(For each of the following foods please tick the box next to your response)

14. How often on average do you eat the following foods?

		More than once a day	Once a day	Most days	At least once a week	At least once a month	Less than once a month	Never
A	Chocolate	1	2	3	4	5	6	7
B	Biscuits or cookies- (only sweet varieties)	1	2	3	4	5	6	7
C	Cakes (sweet)	1	2	3	4	5	6	7
D	Ice cream or ice lollies	1	2	3	4	5	6	7
E	Yogurt (Sweet)	1	2	3	4	5	6	7
F	Confectionary or other sweets	1	2	3	4	5	6	7
G	Cheese or cheese spread (not fromage frais)	1	2	3	4	5	6	7
H	Fruit Juice (sweetened)	1	2	3	4	5	6	7

I	Fruit Juice (un-sweetened)	1	2	3	4	5	6	7
J	Frizzy drinks (sweet)	1	2	3	4	5	6	7
K	Frizzy drinks (un-sweetened)	1	2	3	4	5	6	7
L	Meat other than fish or chicken: e.g. beef	1	2	3	4	5	6	7

		More than once a day	Once a day	Most days	At least once a week	At least once a month	Less than once a month	Never
M	Fried food: e.g. fried English breakfast, chips/crisps, savoury, fried chicken	1	2	3	4	5	6	7
N	Spicy food: e.g. most Asian food such as madras curry, samosas, bhajis	1	2	3	4	5	6	7
O	Fatty food: e.g. full fat milk, Bacon, cheese	1	2	3	4	5	6	7
P	Unprocessed food: e.g. raw vegetables, cereals (grains)	1	2	3	4	5	6	7

This section includes questions on the impact that dental diseases can have on the quality of your life.

Please tick the box on the right hand side of your response

15. In the last 12 months have you had trouble PRONOUNCING ANY WORDS because of problems with your teeth, mouth or dentures?	Never	1	Fairly Often	4
	Hardly Ever	2	Very Often	5

	Occasionally	3		
--	--------------	---	--	--

16. In the last 12 months have you felt that your SENSE OF TASTE has worsened because of problems with your teeth, mouth or dentures?	Never	1	Fairly Often	4
	Hardly Ever	2	Very Often	5
	Occasionally	3		

17. In the last 12 months have you had PAINFUL ACHING in your mouth?	Never	1	Fairly Often	4
	Hardly Ever	2	Very Often	5
	Occasionally	3		

18. In the last 12 months have you found it UNCOMFORTABLE TO EAT ANY FOODS because of problems with your teeth, mouth or dentures?	Never	1	Fairly Often	4
	Hardly Ever	2	Very Often	5
	Occasionally	3		

19. In the last 12 months have you been SELF-CONSCIOUS because of problems with your teeth, mouth or dentures?	Never	1	Fairly Often	4
	Hardly Ever	2	Very Often	5
	Occasionally	3		

20. In the last 12 months have you FELT TENSE because of problems with your teeth, mouth or dentures?	Never	1	Fairly Often	4
	Hardly Ever	2	Very Often	5
	Occasionally	3		

21. In the last 12 months has your DIET BEEN UNSATISFACTORY because of problems with your teeth, mouth or dentures?	Never	1	Fairly Often	4
	Hardly Ever	2	Very Often	5
	Occasionally	3		

22. In the last 12 months have you had to INTERRUPT MEALS because of problems with your teeth, mouth or dentures?	Never	1	Fairly Often	4
	Hardly Ever	2	Very Often	5
	Occasionally	3		

23. In the last 12 months have you found it DIFFICULT TO RELAX because of problems with your teeth, mouth or dentures?	Never	1	Fairly Often	4
	Hardly Ever	2	Very Often	5
	Occasionally	3		

24. In the last 12 months have you been a bit	Never	1	Fairly Often	4
---	-------	---	--------------	---

EMBARRASSED because of problems with your teeth, mouth or dentures?	Hardly Ever	2	Very Often	5
	Occasionally	3		

25. In the last 12 months have you been a bit IRRITABLE WITH OTHER PEOPLE because of problems with your teeth, mouth or dentures?	Never	1	Fairly Often	4
	Hardly Ever	2	Very Often	5
	Occasionally	3		

26. In the last 12 months have you had DIFFICULTY DOING YOUR USUAL JOBS because of problems with your teeth, mouth or dentures?	Never	1	Fairly Often	4
	Hardly Ever	2	Very Often	5
	Occasionally	3		

27. In the last 12 months have you felt that life in general was LESS SATISFYING because of problems with your teeth, mouth or dentures?	Never	1	Fairly Often	4
	Hardly Ever	2	Very Often	5
	Occasionally	3		

28. In the last 12 months have you been TOTALLY UNABLE TO FUNCTION because of problems with your teeth, mouth or dentures?	Never	1	Fairly Often	4
	Hardly Ever	2	Very Often	5
	Occasionally	3		

The following questions are about your satisfaction with your teeth

29. (Thinking about both your natural teeth and your dentures) In general, how do you feel about the appearance of your teeth (and/or dentures), are you satisfied or not satisfied with the way they look?

Very satisfied	1	Dissatisfied	3
Satisfied	2	Very dissatisfied	4

30. If you went to the dentist with an aching back tooth would you prefer the dentist to take it out or fill it (supposing it could be filled)?

Take it out	1
Fill it	2

31. If the dentist said a front tooth would have to be extracted (taken out) or crowned, what would you prefer?

Extracted	1
Crowned	2

32. If the dentist said a back tooth would have to be extracted (taken out) or crowned, what would you prefer?

Extracted	1
Crowned	2

33. If you had several missing teeth at the back would you

Back partial denture	1
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prefer to have a partial denture or manage without?	Manage without	2
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This section is about toothache, pain or sensitivity from your teeth or gums.

If you have NOT experienced PAIN in the previous ONE MONTH go to question 47.

34. In the past ONE month have you experienced pain in your ... (You may tick more than 1 answer)	Tooth/ Teeth	1	Floor of mouth	5
	Gums	2	Inside of cheek	6
	Tongue	3	Jaw	7
	Palate	4	Jaw joint	8

35. How long did you have the pain for?	less than 1 week	1	6 months or longer, but less than 1 year	4
	1 week or longer, but less than 1 month	2	1 year or longer	5
	1 month or longer, but less than 6 months	3		

36. How would you describe the intensity of your pain at its WORST?	Mild	1	Horrible	4
	Discomforting	2	Excruciating	5
	Distressing	3		

37. Thinking about the pain you have had in the past one month, how would you describe its pattern of occurrence?			
Episodic: It comes and goes	1	Continuous: It's constant	2

38. Please indicate the extent to which your pain radiates to the surrounding area	Not at all	1	A large extent	4
	A small extent	2	Complete extent	5
	Moderate extent	3		

39. Please indicate the extent to which it is worse when you chew or eat on the side of your mouth with the pain	Not at all	1	A large extent	4
	A small extent	2	Complete extent	5
	Moderate extent	3		

40. Please indicate the effect of eating or drinking something	Makes it a lot more painful	1	Makes it a little better	4
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COLD	Makes it a little more painful	2	Makes it a lot better	5
	No effect	3		

Please indicate the extent to which					
	Not at all	A small extent	Moderate extent	A large extent	Complete extent
41. The gums in the area where you experienced the pain had felt swollen	1	2	3	4	5
42. The tooth where you experienced the pain had felt loose	1	2	3	4	5
43. It was difficult to swallow because of the pain	1	2	3	4	5
44. The tooth where you experienced the pain felt like it was sticking out a little	1	2	3	4	5

45. Please indicate the extent to which you had difficulties with sleeping because of the pain.	Full extent	1	A small extent	4
	A large extent	2	Not at all	5
	Moderate extent	3		

46. Which of the following words, if any, would you use to describe the pain you experienced in the past ONE month?			
		Yes	No
A	Pulling	1	2
B	Numb	1	2
C	Exhausting	1	2
D	Electric shocks	1	2

The following questions are related to your socio-demographic characteristics

(For each of the following questions please tick the box next to your response)

47. How long have you lived in this country?	All my life	1
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	Other: specify number of years:	2
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The following questions are related to your occupation (*please tick the box next to your response*)

48. Last week, were you any of the following?	In training/ Student	1	Retired	6
	Casually employed	2	Currently sick/ disabled	7
	Full-time employed	3	I have never worked	8
	Part-time employed	4	None of the options:	9
	Looking after home/ family	5	Specify:	10



If you have never worked go to question 56

The following questions are related to your current or last main job and occupation

49. What is (was) your main job?

Answer the following questions according to your current or last main job and occupation. For example, primary school teacher, state registered nurse, car mechanic, television service engineer, benefits assistant.

Civil Servants, local Government Officers- give job title not grade or pay band.

Please write your answer below

50. Describe what you do (did) in your main job?

Please write your answer below

51. What does (did) the firm/organisation you work for mainly make or do (at the place where you worked)?

For example, making shoes, repairing cars, secondary education, food wholesale, clothing retail, doctor's surgery.

If you are (were) self employed/ freelance or have (had) your own business, what is (was) the nature of your business?

Civil Servants, local Government Officers- please specify your department

Please write your answer below

52. Do (did) you work as an employee or are (were) you self employed? (please tick the box next to your response)	Employee	1
	Self employed with employees	2
	Self employed/ freelance without employees	3

53. If you are (were) an <u>employee</u>: how many people work (worked) for your employer at the place where you work (worked)? (please tick the box next to your response)	1 to 9	1
	10 to 24	2
	25 to 499	3
	500 or more	4

<p>If you are (were) self employed with employees: How many people do (did) you employ? <i>(please tick the box next to your response)</i></p>	1 to 9	1
	10 to 24	2
	25 to 499	3
	500 or more	4

54. Do (did) you supervise any other employees?
A supervisor or foreman is responsible for overseeing the work of other employees on a day to day basis.

Please, do not include:

- *Supervisors of children, for example, teachers, nannies, childminders*
- *Supervisors of animals*
- *People who supervise security of buildings only, for example, caretakers, security guards*

(please tick the box next to your response)

Yes	1	No	2
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55. Which of the following best describes the sort of work you do? If you are not working now, please indicate what you did in your last main job.

Modern professional occupations such as : teacher- nurse-physiotherapist- social worker- welfare officer- artist- musician- police officer (sergeant or above)- software designer	1
Clerical and intermediate occupations such as: secretary- personal assistant- clerical worker- office clerk- call centre agent- nursing auxiliary- nursery nurse	2
Senior managers or administrators (usually responsible for planning, organising and coordinating work) - finance manager- chief executive	3
Technical and craft occupations such as : motor mechanic – fitter- inspector- plumber- printer- tool maker- electrician – gardener- train driver	4

Semi-routine manual and service occupations such as : postal worker- machine operative- security guard- caretaker- farm worker- catering assistant- receptionist- sales assistant	5
Routine manual and service occupations such as: HGV driver- van driver- cleaner- porter- packer- sewing machinist- messenger- labourer- waiter/waitress- bar staff	6
Middle or junior managers such as : office manager- retail manager- bank manager- restaurant manager- warehouse manager- publican	7
Traditional professional occupations such as: accountant – solicitor- medical practitioner- scientist- civil/mechanical engineer	8

Question 56 only applies if you have never worked

<p>56. If you had a choice, what would you like to be doing next year? (please tick all boxes that apply next to your response)</p>	Be unemployed	1
	Doing A levels	2
	Doing some other course at school (6th form) or at College	3
	Getting an apprenticeship/employment training course	4
	Getting a part or full-time job	5

PART –II

This section contains a number of statements about families. Studies have found that family characteristics affect oral health behaviours such as utilisation of dental services and dietary habits. Your answers will help us in identifying family characteristics that improve health.

Different people have different definitions of what a family is. When answering questions in this section, please consider all the people in your family who have played a role, either positive or negative, in your life during the past year.

57. Please tick, from the list provided, those you will consider as family when answering the following section.

Mother	1	Brother	6
Father	2	Sister	7
Step/ foster mother	3	Step siblings	8
Step/ foster father	4	Grand parent(s)	9
Partner (Husband/ Wife/ Cohabitant)	5	Children	10
Other Specify:			11

Read each statement carefully, and decide how well it describes your own family. You should answer according to how you see your family. Try not to spend too much time thinking about each statement, but respond as quickly and as honestly as you can. If you have difficulty,

answer with your first reaction. Please be sure to answer every statement.

		Strongly Agree	Agree	Disagree	Strongly Disagree
58.	Planning family activities is difficult because we misunderstand each other	1	2	3	4
59.	We resolve most everyday problems around the house	1	2	3	4
60.	When someone is upset the others know why	1	2	3	4
61.	When you ask someone to do something, you have to check that they did it	1	2	3	4
62.	If someone is in trouble, the others become too involved.	1	2	3	4
63.	In time of crisis we can turn to each other for support.	1	2	3	4
64.	We don't know what to do when an emergency comes up.	1	2	3	4
65.	We sometimes run out of things that we need	1	2	3	4
66.	We are reluctant to show our affection for each other	1	2	3	4
67.	We make sure members meet their family responsibilities	1	2	3	4

		Strongly Agree	Agree	Disagree	Strongly Disagree
68.	We cannot talk to each other about sadness we feel	1	2	3	4
69.	We usually act on our decisions regarding problems.	1	2	3	4
70.	You only get the interest of others when something is important to them	1	2	3	4
71.	You can't tell how a person is feeling from what they are saying	1	2	3	4
72.	Family tasks don't get spread around enough	1	2	3	4
73.	Individuals are accepted for what they are	1	2	3	4
74.	You can easily get away with breaking the rules	1	2	3	4
75.	People come right out and say things instead of hinting at them	1	2	3	4
76.	Some of us just don't respond emotionally	1	2	3	4
77.	We know what to do in an emergency	1	2	3	4
78.	We avoid discussing our fears and concerns	1	2	3	4
79.	It is difficult to talk to each other about tender feelings	1	2	3	4

		Strongly Agree	Agree	Disagree	Strongly Disagree
80.	We have trouble meeting our bills	1	2	3	4
81.	After our family tries to solve a problem, we usually discuss whether it worked or not	1	2	3	4
82.	We are too self centred	1	2	3	4
83.	We can express feelings to each other	1	2	3	4
84.	We have no clear expectations (rules) about toilet habits (toilet use).	1	2	3	4
85.	We don't show our love for each other	1	2	3	4
86.	We talk to people directly rather than through go –betweens	1	2	3	4
87.	Each of us has particular duties and responsibilities	1	2	3	4
88.	There are lots of bad feelings in the family	1	2	3	4
89.	We have rules about hitting people	1	2	3	4
90.	We get involved with each other only when something interests us	1	2	3	4
91.	There's little time to explore personal interests	1	2	3	4
92.	We often don't say what we mean	1	2	3	4

		Strongly Agree	Agree	Disagree	Strongly Disagree
93.	We feel accepted for what we are	1	2	3	4
94.	We show interest in each other only when we can get something out of it personally	1	2	3	4
95.	We resolve most emotional upsets that come up	1	2	3	4
96.	Tenderness takes second place to other things in our family	1	2	3	4
97.	We discuss who is to do household jobs	1	2	3	4
98.	Making decisions is a problem for our family	1	2	3	4
99.	Our family shows interest in each other only when they can get something out of it	1	2	3	4
100	We are frank with each other	1	2	3	4
101	We don't hold any rules or standards	1	2	3	4
102	If people are asked to do something, they need reminding	1	2	3	4
103	We are able to make decisions about how to solve problems	1	2	3	4
104	If the rules are broken, we don't know what to expect	1	2	3	4

		Strongly Agree	Agree	Disagree	Strongly Disagree
105	Anything goes in our family	1	2	3	4
106	We express tenderness	1	2	3	4
107	We confront problems involving feelings	1	2	3	4
108	We don't get along well together	1	2	3	4
109	We don't talk to each other when we are angry	1	2	3	4
110	We are generally dissatisfied with the family duties assigned to us	1	2	3	4
111	Even though we mean well, we intrude too much into each other's lives	1	2	3	4
112	There are rules about dangerous situations	1	2	3	4
113	We confide in each other	1	2	3	4
114	We cry openly	1	2	3	4
115	We don't have reasonable transport	1	2	3	4
116	When we don't like what someone has done, we tell them	1	2	3	4
117	We try to think of different ways to solve problems	1	2	3	4

The next section applies only if you currently have a partner. If you do not have a partner this is the end of the questionnaire for you. Thank you for your participation

The following questions are about your partner's socio -demographic characteristics

<p>118.Date of birth</p>	<p>_____/_____/_____</p> <p>date month year</p>	
<p>119.Sex</p>	<p>Male</p>	<p>1</p>
	<p>Female</p>	<p>2</p>
<p>120.Country of Birth</p>		

<p>121.How long has your partner lived in this country?</p>	<p>All his/her life</p>	<p>1</p>
	<p>Other: specify number of years:</p>	<p>2</p>

122.Which category best describes your partner? This is their race or ethnic group.					
Asian British	1	Black British	8	White British	17
Asian Indian	2	Black European	9	White West European	18
Asian Bangladeshi	3	Black African	10	White East European	19
Asian Pakistani	4	Black Caribbean	11	White Mediterranean	20
Asian Middle East/ Arabic	5	Black American	12	White North American	21
Asian Chinese	6	Latino	13	White Latin American	22
Asian Japanese	7	Mixed Asian/White	14	Other (Specify):	23
		Mixed Black/White	15		
		Mixed Asian/Black	16		

The following questions are related to your partner's education
(Please tick the box next to your response)

123.Did your partner ever attend school?	No (Go to question 125)	1
	No, but he/she can read and write (Go to question 125)	2
	Yes	3

124.What was the highest degree or qualification that your partner obtained?			
Elementary/ Primary school	1	A/AS/S levels	5
Secondary school without O level(s)	2	University	6
Secondary school with O level(s)	3	Post-graduate	7
Technical qualification	4		

The following questions are related to your partner's occupation
(Please tick the box next to your response)

125.Last week, was your partner any of the following?	In training/ Student	1	Retired	6
	Casually employed	2	Currently sick/ disabled	7
	Full-time employed	3	has never worked	8
	Part-time employed	4	None of the options:	9
	Looking after home/ family	5	Specify:	10

If your partner has never worked, this is the end of the questionnaire.
Thank you!

The following questions are related to your partner's current or last main job and occupation

126. What is (was) your partner's main job?

For example, primary school teacher, state registered nurse, car mechanic, television service engineer, benefits assistant.

Civil Servants, local Government Officers- give job title not grade or pay band.

Please write your answer below

127. Describe what your partner does (did) in his/her main job?

Please write your answer below

128. What does (did) the firm/ organisation your partner work for mainly make or do ?

For example, making shoes, repairing cars, secondary education, food wholesale, clothing retail, doctor's surgery.

If your partner is (was) self employed/ freelance or has (had) their own business, what is (was) the nature of the business?

Civil Servants, local Government Officers- please specify your department

Please write your answer below

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129. Does (did) your partner work as an employee or is (was) he/she self employed?	Employee	1
	Self employed with employees	2
	Self employed/ freelance without employees	3

130. If your partner is (was) an <u>employee</u>: how many people work (worked) for his/her employer at the place where he/she work (worked)? <i>(Please tick the box next to your response)</i>	1 to 9	1
	10 to 24	2
	25 to 499	3
	500 or more	4
If he/she is (was) <u>self employed</u> with employees: How many people do (did) he/she employ?	1 to 9	1
	10 to 24	2
	25 to 499	3
	500 or more	4

131. Do (did) your partner supervise any other employees?

A supervisor or foreman is responsible for overseeing the work of other employees on a day to day basis.

Please, do not include:

- ***Supervisors of children, for example, teachers, nannies, childminders***
- ***Supervisors of animals***
- ***People who supervise security of buildings only, for example, caretakers, security guards***

(Please tick the box next to your response)

Yes	1	No	2
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132. Which of the following best describes the sort of work your partner does . If your partner is not working now, please indicate what he/she did in their last main job.
(Please tick the box next to your response)

Modern professional occupations such as : teacher- nurse-physiotherapist- social worker- welfare officer- artist- musician- police officer (sergeant or above)- software designer	1
Clerical and intermediate occupations such as: secretary- personal assistant- clerical worker- office clerk- call centre agent- nursing auxiliary- nursery nurse	2
Senior managers or administrators (usually responsible for planning, organising and coordinating work) - finance manager- chief executive	3
Technical and craft occupations such as : motor mechanic – fitter- inspector- plumber- printer- tool maker- electrician – gardener- train driver	4
Semi-routine manual and service occupations such as : postal worker- machine operative- security guard- caretaker- farm worker- catering assistant- receptionist- sales assistant	5

Routine manual and service occupations such as: HGV driver- van driver- cleaner- porter- packer- sewing machinist- messenger- labourer- waiter/waitress- bar staff	6
Middle or junior managers such as : office manager- retail manager- bank manager- restaurant manager- warehouse manager- publican	7
Traditional professional occupations such as: accountant – solicitor- medical practitioner- scientist- civil/mechanical engineer	8

Thank you for your help!