

**Socio-environmental factors associated with
self-rated oral health: a mixed effects model**

by

Bukola Ganiyat Olutola

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Supervisor: **Prof. O.A Ayo-Yusuf**

DECLARATION

I hereby declare that every aspect of this dissertation, entitled *Socio-environmental factors associated with self-rated oral health: a mixed effects model* was undertaken by me. It has not been submitted for any degree or examination at any other university, and all the resource materials used have been duly acknowledged.

Bukola Ganiyat Olutola

Date

SUPERVISOR
Prof. O.A. Ayo-Yusuf
Department of Community Dentistry
University of Pretoria

Date

DEDICATION

This dissertation is dedicated to my parents, **Mr and Mrs Olateju**, in gratitude for their prayers and endless love.

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LIST OF ABBREVIATIONS

AOR	Adjusted odds ratio
CI	Confidence Interval
GHS	General household Survey
HSRC	Human Sciences Research Council
NRF	National Research Foundation
SADHS	South African Demographic and Health Survey
SASAS	South African Social Attitude Survey
SD	Standard deviation

SUMMARY

Background: Studies of self-rated oral health are always done at either the individual level or the aggregate level. Partitioning individual and neighbourhood sources of variation also enables explorations of the influences of people's social context on their self-rated oral health.

Objective: The main objective of the study was to examine the influence of the social context in which people live on their self-rating of their oral health, independent of individual indicators of good oral health.

Method: This study used a secondary analysis of data on a nationally representative sample of 2 907 South African adults (aged ≥ 16 years) who had participated in the 2007 annual South African Social Attitude Survey (SASAS). The 2007 SASAS used a multi-stage probability sampling strategy, with census enumeration areas as the primary sampling unit. Using an interviewer-administered questionnaire, the information obtained included socio-demographic data, the respondents' level of trust in people (a proxy measure for social capital), oral health behaviours and self-rated oral health. Using the 2005 General Household Survey (GHS) (persons' $n=107\ 987$; households' $n=28\ 129$), the living environment characteristics of participants of the SASAS were obtained, including sources of water and energy supply and household cell phone ownership as a proxy measure for social networking. A mixed-effects model was then constructed to determine factors associated with a self-rating of oral health as 'very good/good'.

Results: Of the respondents, 51.7% were female. Among the respondents, 76.3% self-rated their oral health as good. There was a significant gender modifying effect, thus analyses was stratified by gender. The odds of self-rating oral health as good was significantly higher only among females living in areas with higher household cell phone ownership density, even after controlling for potential confounders. At the individual level, trust was positively associated with good self-rated oral health only among males, and higher social ranking in the society was positively associated with

good self-rated oral health only among females. Overall, 55% of the total variance in self-rated oral health was explained by factors operating at the individual level, whereas 18% of the total variance was explained by factors operating at the community level. Self-report of recent oral health problems such as toothache and oral malodour were significantly associated with lower odds of self-rating their oral health as good, as was with reporting less frequent brushing.

Conclusion: Good self-rated oral health may be positively associated with indicators of higher levels of social capital both at the level of the individual and the community and with less physical impairments of oral functioning. Furthermore, the findings indicate that unlike men's oral health ratings, women's oral health ratings are more likely to be influenced by women's social relationships with others in the society.

Keywords: self-rated oral health, South Africa, mixed-effects model, social capital, trust, cell-phone, individual-level, community-level, gender, variance.

CHAPTER 1

INTRODUCTION

1.1 Background

Health can be defined as a state of complete physical, mental and social well-being, rather than as merely an absence of disease or infirmity.¹ Self-rated health is the perception an individual has about his/her health which has been shown to be directly associated with a person's experience of physical symptoms.² Self-rated oral health is commonly regarded as a person's global rating of his/her oral health-related quality of life.³

Oral health is an important aspect of general health because it can affect a person's quality of life.⁴ If a person's mouth or a tooth does not function properly, it can affect the person's whole body.⁵ Factors such as having higher education,⁷ current employment,⁶ ⁷ being white,⁸⁻⁹ earning a higher income,^{7,10} being female ⁷⁻⁸ and of younger age⁸ have all been positively associated with better self-rated oral health. People use discomfort in the mouth, an inability of the mouth to function properly, as well as its effect on social interactions in assessing their oral health. A better self-rating of oral health has also been positively associated with the extent of dentulousness and a recent visit to a dental professional.¹¹

In South Africa, there is limited public subsidy of health care. The health sector is divided into a public sector and a private sector. About 84% of South Africans do not have private health insurance and who probably use public hospitals or clinics, where minimal fees are charged.¹² The remaining 16% of the population, who do have private health insurance, mostly visit private practitioners, private clinics and hospitals, using either medical insurance and/or partly or fully reimbursable cash to pay for treatment.¹² Because of the high cost of dentistry and the limited human resources available in the

public sector to provide comprehensive services, most public dental clinic patients go for relief of dental pain or sepsis. Very few visit those clinics for routine preventive care at least once per year, as recommended.¹³

In the 2003/2004 South African Demographic and Health Survey (SADHS), 16% of the respondents reported problems with their mouths and/or teeth in the six months preceding the survey date.¹⁴ Self-reported oral health conditions also varied between the nine provinces.¹⁴ The geographical variation in self-reported oral health outcomes could be related to variations between respondents' cultural beliefs and traditions, levels of education, degree of access to and quality of dental services and other socio-economic characteristics of the respondents and the provinces where they lived.

Gauteng is the richest of South Africa's nine provinces and recorded the highest percentage of adults (15 year-olds and older) who visited a dentist, as well as the lowest number of people who reported having had some problem with their mouths during the 2003/2004 survey.¹⁴ By contrast, Limpopo, the poorest and the most rural province, had the lowest percentage of people who reported dental visits, but it was second to Mpumalanga with regard to the percentage of people who reported perceived oral health problems (Mpumalanga=30.6%, Limpopo = 23%).¹⁵ These variations suggest that an individual's self-rating of his/her oral health is probably influenced by the social environment in which the person lives. It therefore also appears that oral health may vary even between areas within each province.

1.2 Study problem

Only limited information is available on the influence of neighbourhood characteristics on the oral health of South Africans. However, addressing socio-economic disparities in health remains a public health priority in South Africa.

Studies on self-rated general health or oral health are usually conducted at either the individual level or the aggregate level. Analytical approaches that focus on data collected at individual-level alone can cause atomic fallacies, which refers to making variability inferences across higher level units based on data collected only for lower level units.¹⁶ An ecological fallacy which is likely to result when data are aggregated is that inferences may be drawn at the lower level, based on data collected only for higher level units.¹⁷ Ecological studies are often unable to distinguish between area level compositional and contextual influences.¹⁸

The use of a multilevel analytical approach, unlike an ecological approach, allows a partitioning or division of individual and neighbourhood sources of variation (such as compositional and contextual influences).¹⁸ This study therefore applied a multilevel analytical approach to distinguish between community or neighbourhood level sources of variation in oral health on the one hand, and individual level sources of variation in oral health on the other.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Low socio-economic status has been associated with stress-related outcomes such as material hardship, financial problems, racial discrimination, living in a neighbourhood that is not safe, unemployment, and housing and transportation problems.⁷ It may also affect people's access to and their use of oral health care facilities.⁸ By contrast, people with a higher socio-economic status tend to have positive attitudes towards and perceptions of dental visits.¹⁹

A study by Turrell et al.²⁰ revealed a significant positive association between people's neighbourhood socio-economic characteristics and self-reported oral health, irrespective of the socio-economic status of a particular individual. Variations in self-rated oral health have thus been attributed to differences in many socio-economic and demographic factors that may be observed at both the level of the individual and in the person's neighbourhood.²⁰ Several mechanisms have been proposed as a possible explanation for socio-economic disparities in health in general,²¹⁻²² and thus, by implication, in oral health.

2.2 Demographic factors

2.2.1 Gender

Men tend to rate their oral health as poorer than women do.⁷⁻⁸ This may be so because men tend to smoke more frequently than women,²³ and frequently also tend not to go for preventive dental care, because they tend not to be as health-conscious as women.²⁴⁻²⁵ The gender differences that have been observed may be related to these factors, given that smoking has been associated with an increased risk of periodontal problems⁸ and other oral health conditions.

However, in other studies women were found to rate their oral health poorer than men²⁶⁻²⁷ and this was attributed to the fact that women were more likely to report oral symptoms than men which could lead to their rating of oral health as poor.²⁸

2.2.2 Age

Younger age groups have been reported to have a more positive perception towards dental visits.²⁹ Older adults are more prone to periodontal problems and subsequent tooth loss.⁸ This probably explains why younger people report better (self-rated) oral health than older people.¹⁴

2.3 Socio-economic factors and oral health

2.3.1 Education

The higher a person's level of education, the less likely it is that the person will rate his/her oral health as poor.^{6,9,30} A study carried out by Subramanian et al.³⁰ showed that, among adults, education was positively associated with self-reported health. Thus, adults in the group with the lowest level of education reported poor health. Similarly, in the first National Oral Health Survey conducted in South Africa during 1988 and 1989, it was demonstrated that as the respondents' level of education increased, complaints about tooth and gum problems decreased.⁹ In the 2003 SADHS, respondents in the higher education groups also reported fewer problems with their teeth than their counterparts in the lower education groups.¹⁴ However, women in the higher education groups reported more gum problems than those in the lower education groups in the 1998 SADHS.³¹ Hence, it seems that gender modifies the relationship between education and self-reported oral health among South Africans.

2.3.2 Race/ethnicity

Most studies suggest that whites have better self-rated oral health than non-whites.⁸⁻¹⁰ This is probably because whites are often more educated, have better attitudes towards oral health and go for preventive dental visits more often than people from the other races.^{9,24} These findings are corroborated by evidence from South Africa, where blacks complain more frequently of tooth and gum problems than whites do, and are more dissatisfied with their teeth appearance than whites are.⁹ The 2003 SADHS also showed that white and Indian respondents were more likely to have private health insurance and use dental services more often than black and coloured respondents.¹⁴ However, it may also be argued that whites and Indians often reside in urban areas with greater health and social infrastructure, and therefore have greater access to dental services than members of other race groups.

2.3.3 Employment and income

Employed individuals have been found to be more likely to report good oral health than the unemployed.⁶⁻⁷ Among the employed, the higher the income, the higher the probability of reporting good oral health.^{7,10} This finding is also reflected at the area level, since those who live in low-income neighbourhoods more frequently report poor self-rated health than those who live in higher income neighbourhoods.³² These findings may be attributed to the likelihood that the unemployed and low income earners are less likely to be able to afford dental services,^{24,33} or a result of disproportionately higher rates of health risk behaviour such as smoking among the socially disadvantaged.³⁴

2.3.4 Subjective social status

Subjective social status refers to a person's perception of his/her social standing or positioning. Studies on self-rated health and self-rated oral health often use indicators of objective socio-economic positioning only in measuring socio-economic status.⁶⁻⁹

However, Adler et al.³⁵ suggest that subjective social status is more consistent with and strongly related to overall health than a person's objective socio-economic status. Sanders et al.³⁶ also noted in their study that low perceived social positioning is significantly associated with fair or poor self-rated oral health. However, only limited information is available on the association between subjective social status and oral health in Africa in general, and in South Africa in particular.

2.3.5 Physical infrastructure

Those who live in areas with limited access to basic infrastructure are more likely to self-report poor health than those who live in areas with adequate infrastructure.³⁷⁻³⁸ For example, if there are no good roads, clinics or hospitals, people cannot access medical services.³⁹ Similarly, people living in poor communities, like the rural areas which usually do not have access to social amenities such as health facilities, electrification, good roads and reticulated water supply, have also been shown to be more likely to report poor oral health.^{20,32} However, limited information is available in the literature on this relationship.

2.4 Access to health care services and oral health status

2.4.1 Dental service utilization

Those who rated themselves as having an excellent oral health in the 1989 National Health Interview Survey in the USA were more likely to have had a dental visit in the year prior to the survey, or to have private dental insurance coverage, than those who self-rated themselves as having only fair or poor oral health.⁴⁰ A study conducted in Brazil among the elderly revealed that those who had never gone for a dental appointment were more likely to report poor oral health.⁸ Moreover, a lack of good roads, water and electricity supply have been reported to be some of the problems

facing dental public health officials in poorly resourced communities, preventing them from providing even minimal care for a poor population.⁴¹

Existing evidence suggests that any environmental or social factor that imposes a limitation on the availability of dental services may also affect self-rated oral health. An important factor is the long waiting time experienced in hospitals and clinics, which causes patient dissatisfaction and frustration, leading people to defer their visits.⁴² A lack of transportation is another potential barrier to accessing dental services, especially in disadvantaged areas where there is little public transport and low access to private transport.²⁰

2.4.2 Health insurance

It has been found that people who reside in the urban areas may use dental facilities more than the rural population, because people in urban areas are more likely have medical and/or dental insurance cover.⁴³ Those who have dental insurance cover have been reported to use dental facilities more often than those without such insurance.²⁴ In particular, people with dental insurance tend to make routine or preventive visits, unlike people without it, who will probably only go to see a dentist as a result of pain. In a study conducted in the United States, respondents who rated themselves as having excellent oral health were more likely to have made a dental visit during the year prior to the survey, or to have dental insurance coverage than respondents who rated themselves as having fair to poor oral health.⁴⁰ In South Africa in 2003, 68% of whites and 32% Indians had medical aid, while the other groups had much lower access to medical aid and thus correspondingly poorer self-reported oral health status.¹⁴

2.5 Social capital and oral health

An emerging contextual factor that is gaining popularity in attempts to understand the reasons for social disparities in health is social capital.⁴⁵ This has been found to be an

important factor that may have an effect on self-rated oral health, as well as self-assessed general health. It is related to positive health outcomes. It includes social networks, norms of reciprocity, mutual assistance and trustworthiness.⁴⁴ The relationship between social capital and oral health may function through behavioural and psychological routes that include health-promoting behaviours and stress reduction activities.⁴⁵ If a person has someone to share his/her burdens with, stress is reduced. Hence, for example, a study conducted in Russia demonstrated that people living in areas with low social capital have lower life expectancies than people living in areas with higher social capital.⁴⁶

However, as a result of advances in technology, social capital and support have taken a new turn – the way many people communicate with friends and family has changed from being restricted face-to-face interaction, the use of landline phones and mail to include the use of cell phones and the internet.⁴⁷

In Africa, four in ten people have a cell phone, which is compensating for bad roads and poor postal services,⁴⁸ which may lower social capital. In South Africa, the percentage of households with at least one cell phone rose from 32.3% (as recorded during the 2001 census) to 72.9% (as recorded in a community survey in 2007).⁴⁹ Thus, communication possibilities such as those offered by cell phones may cut across social strata in a developing country such as South Africa (see Figure 1).



Figure 1: Cell phone ownership cuts across social strata in South Africa

A positive effect of social capital through the use of cell phones on health is seen in the case of mHealth, a service used in rural KwaZulu-Natal to network with people living with HIV/AIDS.⁵⁰

2.6 Rationale for the study

Thus far, little is known of the effects of cell phone network density on oral health, although recent studies suggest that psychosocial factors such as cell phone density may explain continued social disparities in oral health similar to those observed with general health in many populations, both in developed and developing countries.⁵¹

CHAPTER 3

AIM AND OBJECTIVES

3.1 Aim of the study

The aim of this study was to examine the influence of the social context in which people live on their self-rating of their oral health, independent of personal risk indicators for poor oral health. The long-term goal is to inform the design of appropriate community-level interventions for the improvement and the reduction of social disparities in oral health in South Africa.

3.2 Specific objectives

The specific objectives of the study were the following:

- to determine the factors associated with self-rated good oral health among adult South Africans; and
- to explore the community-level or neighbourhood-level factors affecting self-rated oral health.

3.3 Null hypotheses

The following null hypotheses were tested:

- H_0 1: Socio-economic factors do not affect self-rated oral health.
- H_0 2: There are no significant variations in self-rated oral health that can be attributed to area/community characteristics.
- H_0 3: Cell phone ownership or network density does not affect self-rated oral health.

CHAPTER 4

METHODS AND STUDY DESIGN

4.1 Study design

This study was a population-based cross-sectional study using a multilevel modelling approach.

4.2 Study setting

The individual-level variables were obtained from the 2007 South African Social Attitudes Survey (SASAS), while the area-level variables were obtained from the General Household Survey (GHS) conducted in South Africa in 2005.⁵²

The master samples of the datasets consist of enumeration areas, which are the smallest geographical units that make up local municipalities in South Africa. The local municipalities are the lowest level of government administration and service delivery: Hence, they are likely to have meaning and significance to the places where the study participants reside with regard to potential interventions that can be focused on environmental factors that may influence the participants' oral health. Therefore, the two datasets were linked at the municipality level through similar codes which were uniquely assigned to each municipality in the two datasets. A new dataset was then created to form the basis of analysis in the current study.

4.3 Creation of the data for the study

The first three digits of the enumeration areas were extracted to generate the municipalities in the datasets. To link these two data, the area-level variables from the 2005 GHS were incorporated into the 2007 SASAS. This was done by cross-tabulating these variables with the municipalities in the 2005 GHS, province by province. The values from this cross-tabulation were then entered into the 2007 SASAS for each

respondent interviewed in the same municipality for which the aggregate characteristics of the people or households were computed using a very large dataset, namely the 2005 GHS. The use of the 2005 GHS (n=107 987) allowed a more accurate computation of neighbourhood characteristics, given the large sample that was derived per municipality.

4.4 Study population and sampling

4.4.1 Study population

The study population included all the respondents who participated in the 2007 SASAS and whose municipality of residence could be linked to that contained in the 2005 GHS (n=2 791).

4.4.2 The SASAS sampling method

The 2007 SASAS is a representative sample of adults (people aged 16 years and older) that were selected using a multi-stage probability sampling method. The sample was drawn from the master sample of the South African Human Sciences Research Council (HSRC). This master sample which consisted of 1 050 enumeration areas drawn from the 2001 South African census. From each of the enumeration areas, ten visiting points were randomly selected, resulting in a total of 10 500 visiting points in the master sample. The enumeration areas were stratified by socio-demographic domain of the province, geographical sub-types, tribal areas (formal rural, formal and informal urban) and the four population groups.⁵³

For the 2007 SASAS, 4 000 households/visiting points were randomly selected from the master sample. Each person was then randomly selected from each household, without replacement. Efforts were made to secure an interview with the selected person by making three visits before registering the person as non-responding. A

sampling weight which took account of response patterns was applied to produce a representative sample of South Africans aged 16 years or more.

4.4.3 The GHS sampling method

In the 2005 GHS, the multi-stage stratified samples were drawn for the 2005 GHS from Statistics South Africa's master samples from the enumeration areas established during the 2001 census. The detailed methods used in ensuring standardized data collection, interviews and consent procedures for the 2005 GHS have been previously published.⁵²

4.4.4 Sample size

The response rate of the 2007 SASAS was 72.6% (n=2 907). For the 2005 GHS, the response rate was 87.5% of the targeted 32 146 households (n=107 987 individuals). The very large sample achieved in the 2005 GHS thus provided a unique opportunity to compute area-level characteristics for the corresponding municipalities where the participants of the 2007 SASAS lived. However, data from two of the municipalities from the 2007 SASAS could not be merged because there were no corresponding municipalities in the 2005 GHS. This reduced the sample size by 4%, resulting in n=2 791 instead of the original n=2907.

4.5 Measurement

The 2007 SASAS used an interviewer-administered questionnaire to obtain the demographic characteristics of the population, including information on age, gender, race and socio-economic status.

4.5.1 Individual-level measures obtained from the 2007 SASAS

4.5.1.1 Socio-economic status measures

- *Education:* The respondents were asked: 'What is the highest level of education that you have ever completed?' All the options were collapsed into four categories, namely (1) None (no education), (2) Grades 1-7, (3) Grades 8-12, and (4) Higher than Grade 12.
- *Employment status:* The respondents were asked about their current employment status by requesting them to pick one of several options. The options were collapsed into three categories, namely (1) Employed, (2) Unemployed, and (3) Permanently sick/Student/Pensioner/Housewife not looking for a job.
- *Household income:* During the 2007 SASAS, the participants were asked to indicate a category that best described their level of income from the fourteen options in the questionnaire that described the total monthly household income brackets before tax and other deductions of all the people in the household. The categories were subsequently recoded into six categories for analysis. These categories were: (1) No income - R1 500, (2) R1 501 - R5 000, (3) R5 001 - R10 000, (4) Greater than R10 000, (5) Those that refused to answer, and (6) Those that claimed they were not certain or claimed they did not know their income.
- *Subjective social status:* This was assessed on a continuous scale using responses to the following question asked in the 2007 SASAS: 'In our society there are groups which tend to be towards the top and groups which tend to be towards the bottom. Where would you put yourself on a scale of 1 to 10, where 10 is the top and 1 the bottom?'

4.5.1.2 Tobacco use status

In the 2007 SASAS, participants were asked: 'Do you use or have you used any of the following tobacco products in the past?' The tobacco products that were listed were manufactured cigarettes, hand-rolled cigarettes (Zols), pipes or cigars, nasal snuff and oral snuff. For each of these products, the options 'Every day', 'Some days', 'Stopped less than 6 months ago', 'Stopped more than 6 months ago' and 'Never before' were given. Those categorised as current smokers were those who responded 'Every day' and 'Some days'. A similar approach was used to categorize current snuff use, irrespective of whether respondents reported using nasal or oral snuff.

4.5.1.3 Oral health status and behaviour

- *Past use of dental services:* In the 2007 SASAS, participants were asked how satisfied or dissatisfied they were with dental services they had received in the year prior to the study. For the purposes of this study, those who were either satisfied or dissatisfied were categorized as those who used dental services in the year prior to the survey, while those who answered 'not applicable' (did not visit) were categorized as those who had not visited a dentist during the year preceding the survey.
- *Recent history of oral health problems:* Participants in the 2007 SASAS were asked whether, in the previous month, they had experienced any of the following common oral conditions: (1) Bleeding gums when brushing (symptoms indicative of gum disease), (2) Teeth sensitive to heat or cold (3) Bad breath or (4) None. Those who chose any of the first three options were classified as having had oral health problems, whereas those who chose the fourth option were classified as being without any oral health problems.

- *Oral hygiene practice:* The participants in the 2007 SASAS were asked to pick all the options that applied to them from the options given to the question ‘Which of the following do you do regularly to look after your mouth?’ The options were (1) Brush once or twice or more, (2) Use mouthwash daily, (3) Floss my teeth at least twice every week, (4) Use toothpicks at least twice every week, and (5) None of the above. Each of these options, except Option 5, were turned into variables and dichotomized into 0 and 1. For each of the variables, 0=all those that said ‘No’ and 1= all those that said ‘Yes’.
- *Frequency of tooth brushing:* In continuation of the above questions on oral hygiene practice, those that claimed they brushed their teeth were asked about the frequency of tooth brushing. The options are: (1) Brush, but not every single day, (2) Brush at least once every day, and (3) Brush at least twice a day.

4.5.1.4 Social capital proxy measures

Trust was, as in the approach used in a prior study,⁵⁴ measured by asking respondents the extent to which they believed people could be trusted. In particular, respondents were asked the following question: ‘Generally speaking, would you say that people can be trusted or that one can’t be too careful in dealing with people?’ Response options were (1) People can almost always be trusted, (2) People can usually be trusted, (3) You usually can’t be too careful in dealing with people, (4) You almost always can’t be too careful in dealing with people, (5) Can’t choose. Responses were then dichotomized. Respondents who selected Options (1) or (2) were categorised as having trust in people (coded 1), otherwise they were categorised as not having trust (coded 0).

4.5.2 Main outcome measure/dependent variable

Self-rated oral health was rated by asking the respondents of the 2007 SASAS how they would rate their oral health, and they were asked to pick one of the following options: 'very good', 'good', 'neither very good nor good', 'poor' and 'very poor'. Following the approach used in similar studies,^{8,20} the options were dichotomized into very good/good (good), coded 1 and others (neither good nor poor/poor/very poor), coded 0.

4.5.3 Community-level measures obtained from the 2005 GHS

4.5.3.1 Social capital proxy measures

Cell phone use was used as a social capital proxy. In the 2005 GHS, participants were asked: 'Is there a cellular telephone available to this household for regular use?' The response was either 'Yes' or 'No'. The aggregate percentage of cell phone availability per household or cell phone network density of each municipal area was calculated, and was assigned to the respective municipal area where the respondents to the 2007 SASAS resided.

4.5.3.2 Measures of access to health services

- *Access to a health worker:* The households in the 2005 GHS who indicated that they did not consult with a health worker were asked why they had not consulted any health worker during the past month. Five options were provided, including the option 'Not necessary'. For this analysis, the responses were dichotomized into two sets, namely, those that indicated they had experienced a form of barrier or the other in contacting a health worker (1) and those who indicated no barrier (0). The proportion of those who had experienced a barrier in contacting a health worker

was calculated for each municipal area as a proxy measure for level of access to health services among those living in that municipality.

- *Hospital and clinic consultation:* In the 2005 GHS, each occupant in a household was asked where his/her latest (during the past month) hospital or clinic consultation took place. The options were divided into public and private sector facilities. The responses were dichotomized into (1) Those who attended a public hospital or clinic in the past month, and (2) Those who did not (this included those who attended private facilities, but excluded those who did not attend any hospital or clinic at all). The proportion of those who attended a public hospital or clinic in the past month was computed for each area as a proxy measure of level of use of public services for those living in the various municipalities.

4.5.3.3 Measures of physical infrastructure

- *Source of water supply:* In the 2005 GHS, participants were asked about each household's main source of water and the respondents had to choose one of many options. Their responses were dichotomized into piped and non-piped water sources. From this, the proportion of households with non-piped water in each area was calculated.
- *Source of energy:* These data were derived from the 2005 GHS question that asked about the main source of energy/fuel for the household. Like the other questions, it had many options which were collapsed into two categories: (1) Those whose main energy source was electricity, and (2) Those whose main energy source was not electricity. The proportion of households whose source of energy was not electricity was computed for each area.

Each of these municipal or community-level variables were auto ranked into three categories, namely those in the under 33.3th percentile, those in the 33.3th-66.7th percentiles and those in the over 66.7th percentile.

4.6 Data analysis

The data were analysed using STATA Version 10. A multilevel binomial logit link model was used to assess the effect of community-level factors on self-rated oral health after the individual-level factors had been controlled for.⁵⁵ The outcome was good self-rated oral health. Three sequential models were generated.¹⁷

Model 1 is the empty model which contains only the outcome variable with no independent variable. In this model, the individual is nested within the area and the equation can be represented as

$$Y_{ij} = B_{0j} + E_{ij}$$

where :

Y_{ij} = self-rated oral health for individuals 'i' nested within community 'j'.

B_{0j} = average self-rated oral health in a community.

E_{ij} = individual-level error.

Model 2's equation is as follows:

$$Y_{ij} = B_{0j} + \alpha_1 (X_{1ij}) + U_{0j}$$

where :

X_{1ij} = the individual-level variable for the ith individual in jth group/area;⁵⁵

U_{0j} = the random effect at the magisterial/community-level; and

α_1 = the estimated effect of potential community factor(s) that may be associated with the probability of reporting good self-rated oral health

$$B_{0j} = B_0 + U_{0j}$$

Model 3's equation is thus:

$$Y_{ij} = B_0 + B_1 X_{1ij} + \dots + \alpha_1 X_{1ij} + \dots + U_{0j} + E_{ij}$$

where :

B_0 = the average intercept for all the magisterial districts; and

B_1 = the group specific effect of the individual-level variable⁵⁵ and the regression coefficient or odds predicting Y from an individual level primary independent variable X_{1ij} .

The variance in self-rated oral health at the community level was noted for each of the models. Changes in this variance estimates were noted as the model was built from empty to sequentially include the area-level factors and then the individual-level factors. This is to denote the level of contribution made by each set of factors/variables in explaining variations in self-rated oral health across municipalities.

The overall significance of the contribution of the fixed effects to the model fit was evaluated by doing chi-squared tests²⁰ for the categorical variables and t-tests for the continuous variables. The criterion for inclusion of the variables into the logistic model from the bivariate analysis was set at $p < 0.25$ while the decisive factor for retention in the model was $p < 0.05$.⁵⁶ Following suggestion by Hosmer & Lemeshow, factors not meeting the $p < 0.25$ criteria were finally introduced into the model to identify factors that by, themselves were not significantly related to self-rated good oral health but made an important contribution in the presence of other variables. The log-likelihood ratio test (LR-test) was then used to examine if the multilevel/random effect model was significantly better than an ordinary logistic regression model.

Considering the previously noted modifying effect of gender on the observed association between level of education and self-rated oral health during 2003/2004 SADHS, the interaction between gender and education as well as social positioning as

a measure of socio-economic status was explored. As a result, additional analyses were carried out separately for male and female.

The interaction between gender and indicators of social capital was also explored based on the findings from different studies showing gender differences in the relationship between health and social capital.⁵⁷⁻⁵⁸

4.7 Ethical considerations

Permission to conduct the study was obtained from the HSRC and the National Research Fund (NRF) in South Africa to access the datasets of the 2007 SASAS and 2005 GHS respectively.

Confidentiality of participants' details was guaranteed, since none of the datasets had any personal identifiers. Furthermore, none of the municipalities were identified by name, nor was any attempt made to identify respondents of any of the surveys.

The study protocol was approved by the University of Pretoria's Faculty of Health Sciences' Research Ethics Committee (Protocol #: 192/2010).

CHAPTER 5

RESULTS

5.1 Introduction

The objectives of this study were to determine the factors associated with self-rated good oral health and to explore the community-level factors affecting self-rated oral health among adult South Africans.

The average age of the respondents who answered the self-rated oral health question was 36.9 (SD=0.6) years. Of the respondents, 48% were male and 52% were female. The majority, 76.3% (95% CI: 71.96--80.15), reported good oral health (Figure 2).

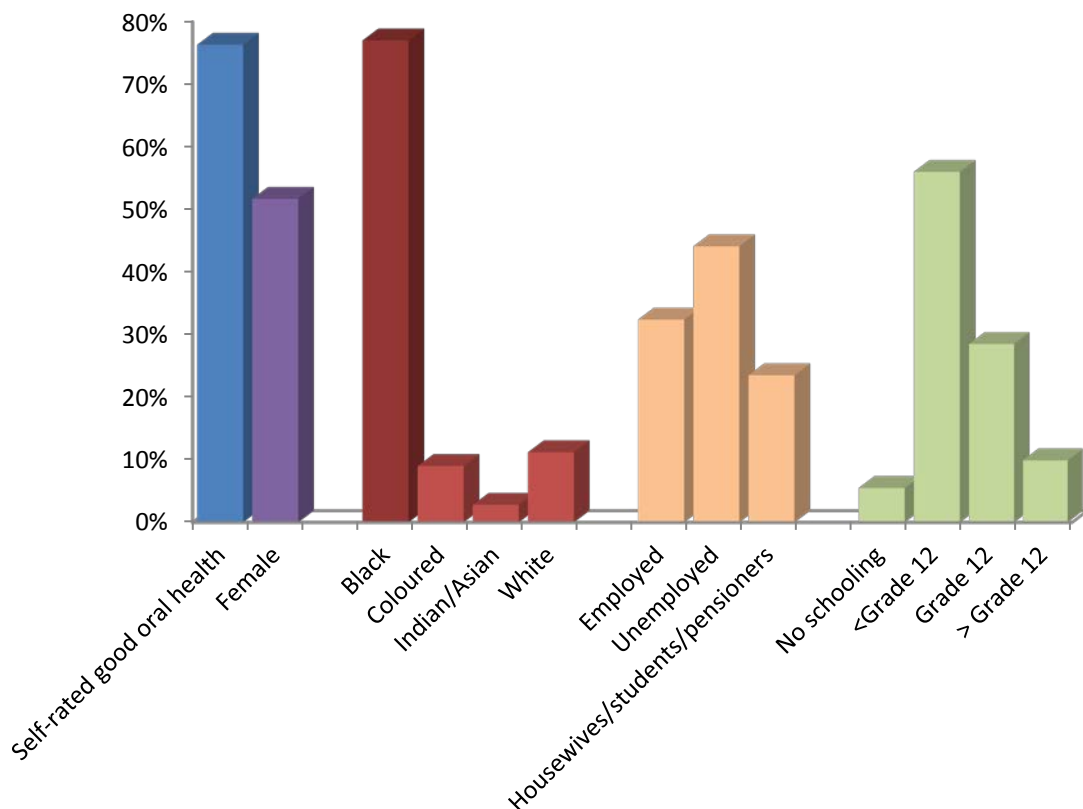


Figure 2: Socio-demographic characteristics of the study population

5.2 Bivariate analyses

This section presents the findings of the bivariate (unadjusted) relationship between self-rated good oral health and potential risk factors. Table 1 presents the full set of results. Some of the significant results are discussed in detail.

Table 1: Bivariate relationship between self-rated good oral health status and individual-level risk factors

Characteristics		Self-rated good oral health % (n)	p-value
Socio-demographic factors			
Gender			0.00
	Male	80.6 (939)	
	Female	71.8 (1 189)	
Ethnicity			0.03
	Black	75.6 (1 315)	
	Coloured	69.5 (278)	
	Indian or Asian	87.7 (273)	
	White	81.5 (262)	
Age (Years)			0.00
	16-24	89.8 (604)	
	25-34	84.6 (523)	
	35-44	77.3 (474)	
	45-54	65.7 (270)	
	55-64	53.4 (154)	
	>65	38.1 (96)	
Education			0.00
	None	30.9 (61)	
	< Grade 12	71.5 (1101)	
	Grade 12	89.2 (663)	
	> Grade 12	90.3 (297)	
Employment status			0.00
	Employed	85.3 (838)	
	Housewives/student s/ Pensioners	81.9 (542)	
	Unemployed	66.1 (739)	
Household income			0.00
	No income-R1 500	66.9 (589)	
	R1 501-R5 000	76.8 (538)	
	R5 001-R10 000	80.6 (241)	
	> R10 001	92.0 (230)	
	Refused to answer	82.7 (267)	
	Uncertain/ did not know the income	79.8 (253)	



Characteristics		Self-rated good oral health % (n)	p-value
Resident			0.01
	Urban	79.4 (1476)	
	Rural	70.0 (591)	
Social capital proxy measure			
Trust in people			0.46
	Not trusted	75.4 (1419)	
	Trusted	77.6(708)	
Tobacco use			
Currently smoking			0.00
	No	78.3 (1675)	
	Yes	68.6 (433)	
Currently using snuff			0.00
	No	77.8 (2048)	
	Yes	47.6 (60)	
Oral health status and behaviour			
Past year attendance for dental care			0.03
	No	78.5 (1301)	
	Yes	71.8 (823)	
Recent history of oral health problems			
Tooth sensitivity to heat or cold			0.00
	No	79.9 (1851)	
	Yes	56.9 (277)	
Bleeding gums when brushing			0.00
	No	80.5 (1 859)	
	Yes	57.4 (269)	
Bad breath			0.00
	No	78.5 (1 996)	
	Yes	55.4 (132)	
Oral hygiene practice			
Frequency of tooth-brushing			0.00
	No brushing	51.7 (85)	
	Brushed not everyday	52.9 (120)	
	Brushed at least	74.8 (753)	

Characteristics		Self-rated good oral health % (n)	p-value
Daily use of mouthwash	once daily	85.0 (1 109)	0.26
	Brushed at least twice daily		
Flossing at least twice a week	No	75.7 (1 870)	0.13
	Yes	80.1 (258)	
Used toothpicks at least twice a week	No	75.8 (2 019)	0.30
	Yes	84.1 (109)	
	No	75.8 (1 998)	
	Yes	81.2 (109)	

5.2.1 Demographic factors and self-rated oral health

Male respondents reported a higher prevalence of good oral health (80.6%) compared to 71.8% female respondents ($p < 0.01$).

Those who self-identified as Indian/Asian reported the highest proportion of good oral health (87.7%), followed by the whites (81.5%).

The self-rating of oral health as 'good' tended to decrease as respondents' age increased. A significantly greater proportion of respondents in the age group 16 and 24 years rated their health as good, compared to those who were 65 years and older (89.8% vs. 38.1%; $p < 0.01$).

5.2.2 Socio-economic factors and self-rated oral health

More subjects who were employed rated their oral health as good, compared to a lower proportion of those who were unemployed (85.3% vs. 66.1%; $p < 0.01$). Households who earned more than R5001 also rated their oral health as good compared to households with an income of less than R5 001.

5.2.3 Tobacco use

Tobacco use, either in the form of cigarette smoking or snuff use, was significantly negatively associated with a self-rating of oral health as good. Current smokers and current snuff users had a lower proportion of those self-rating their oral health as good than non-current smokers (68.6% vs. 78.3%; $p < 0.01$) and non-current snuff users (47.6% vs. 77.8%; $p < 0.01$) respectively.

5.2.4 Oral health status and behaviour

A higher proportion of those who did not report dental attendance rated their oral health as good, compared to those who reported past year attendance for dental care (78.5% vs. 71.8%; $p = 0.03$).

Self-rated good oral health increased with increasing frequency of tooth-brushing. Those who brushed at least twice daily were most likely to report good oral health (85%) compared to those who did not brush at all; the latter were least likely to report good oral health (Table 1).

Table 2: Descriptive characteristics of community-level variables by self-rated good oral health

Area-level characteristics	Total Mean (SE)	Self-rated oral health grouping	Group Mean (SE)	p-value
% Households with cell phone	61.9 (2.0)	Poor	58.7(1.6)	0.00
		Good	62.9 (2.2)	
% Residents using public health facilities	59.5 (2.6)	Poor	62.6 (2.4)	0.00
		Good	58.6 (2.8)	
% Households without tap water	12.1 (2.3)	Poor	16.2 (2.9)	0.01
		Good	11.0 (2.2)	
% Households that had experienced a barrier in accessing health care services	25.9 (3.0)	Poor	29.4 (2.8)	0.01
		Good	24.8 (3.1)	
% Households whose main source of energy was not electricity	19.8 (1.9)	Poor	22.5 (2.1)	0.02
		Good	19.0 (1.9)	

*SE=standard error

In general, 61.9% of households reported having a cell-phone and 12.1% reported having no tap water (Table 2). Compared to those who rated their oral health as poor, a higher proportion of those who rated their oral health as good lived in areas with a significantly higher proportion of households with cell-phone (58.7% vs. 62.9%; $p < 0.01$). Self-rated good oral health was also more common among those who lived in areas with fewer households using the public health facilities and areas with fewer households not having access to basic infrastructure such as piped water or electricity (Table 2). Compared to those who rated their oral health as good, a higher proportion

of those who rated their oral health not good (poor) lived in areas with a higher proportion of households without tap water (11% vs. 16.2%; $p=0.01$).

5.3 Multivariate analyses

This section presents independent associations between self-rated oral health in the studied population and potential risk factors after adjusting for potential confounders (Table 3).

Table 3: Association of self-rated good oral health with individual and community-level characteristics determined by multilevel logistic regression

		Model 1 (Null model)	Model 2	Model 3
Random effects				
	Area-level variance(SE)	0.60 (0.14)	0.49 (0.13)	0.22 (0.09)
Fixed effects				
<i>Area-level characteristics</i>				
Households with cell phone	Area with lowest proportion		1.0(referent)	1.0 (referent)
	Intermediate		1.53(1.04-2.25)	1.60 (1.12-2.27)
	Highest		1.74(1.16-2.61)	1.48 (1.02-2.15)
<i>Individual-level variables</i>				
Gender				
	Male			1.0 (referent)
	Female			0.61 (0.48-0.78)
Age				
	16-24			1.0 (referent)
	25-34			0.67 (0.46-0.97)
	35-44			0.48 (0.33-0.69)
	45-54			0.24 (0.16-0.34)
	55-64			0.16 (0.11-0.24)
	>65			0.12 (0.08-0.19)
Education				
	> Grade 12			1.0 (referent)
	Grade 12			0.89 (0.57-1.41)
	< Grade 12			0.55 (0.36-0.85)
	None			0.30 (0.17-0.54)
Employment status				



	Model 1 (Null model)	Model 2	Model 3
Employed			1.0 (referent)
Housewives/students/ Pensioners			0.69 (0.50-0.96)
Unemployed			0.58 (0.44-0.76)
Subjective social position (on scale of 1 – 10)			1.10 (1.03-1.17)
Trust in people			
Not trusted			1.0 (referent)
Trusted			1.32 (1.04-1.67)
Smoking status/currently smoking			
No			1.0 (referent)
Yes			0.41 (0.31-0.53)
<i>Oral hygiene practices</i>			
Past use of dental services			
No			1.0 (referent)
Yes			0.59 (0.47-0.74)
Frequency of tooth-brushing			
No brushing			1.0 (referent)
Brushed but not every day			1.74 (1.01-3.01)
			2.90 (1.86-4.54)
			3.87 (2.47-6.06)
Brushed at least once daily			
Brushed at least twice daily			
Mouthwash			
No			1.0 (referent)
Yes			2.33 (1.52-3.57)
<i>Recent history of oral health problems</i>			
Tooth sensitivity			
No			1.0 (referent)
Yes			0.54 (0.42-0.71)
Bleeding gum			
No			1.0 (referent)
Yes			0.39 (0.30-0.51)
Bad breath			
No			1.0 (referent)
Yes			0.60 (0.42-0.86)

	Model 1 (Null model)	Model 2	Model 3
-2 Log-likelihood	3021.72	3013.80	2275.17
P-value	0.00	0.00	0.00

5.3.1 Model 1

Model 1 is the empty model. It shows statistically significant variation in self-rated oral health at the area level (variance =0.60; $p < 0.01$).

5.3.2 Model 2

No significant independent association was found between self-rated good oral health and the following area-level characteristics:

- a high proportion of households using public health facilities,
- households without tap water,
- households that experienced a barrier in contacting a health worker and
- households whose main source of energy was not electricity.

However, self-rated good oral health was positively associated with the proportion of households with cell phones in a particular municipal area. The adjusted odds (AOR) for reporting good oral health was 1.74 (95% CI; 1.16-2.61) in communities with the highest proportion of households with cell phones (highest cell phone ownership) compared to those with the lowest proportion of households with cell phones (Table 3).

5.3.3 Model 3

After controlling for personal or individual-level risk factors, those living in areas with an intermediate proportion of households with cell phones became those most likely to

have self-rated good oral health. The effect of highest cell phone density was attenuated by individuals' socio-economic circumstances.

5.4 Individual-level characteristics

5.4.1 Socio-demographic factors

The significant positive association between higher education and self-rated good oral health was confirmed, with those with no education being 70% less likely to report good oral health than those with a Grade 12 or more (AOR; 0.30:95% CI; 0.17-0.54) .

Unlike education and employment status, age had a negative relationship with self-rated good oral health. The older the respondent, the lower the odds that he/she would self-rate his/her oral health as good. The 55 to 64 year age-group and those who were older than 65 years had adjusted odds ratios of 0.16 (95%; 0.11-0.24) and 0.12 (95%; 0.08-0.19) respectively, compared to the 16- to 24-year age group.

For subjective social status, those who ranked themselves higher on a scale of 1 to 10 were more likely to have self-rated their oral health as good (AOR; 1.10. 95%; 1.03-1.17).

5.4.2 Social capital

Those who believed people could be trusted were significantly more likely to rate their oral health as good (AOR; 1.32: 95% CI; 1.04-1.67) than those who believed that people could not be trusted. However, it should be noted that the association between self-rated oral health and trust was not significant in the bivariate analyses that did not simultaneously control for the demographic and socio-economic characteristics of the respondents.

5.4.3 Oral health -related behaviours and self-rated oral health

Current smokers were less likely to have rated their oral health as good when compared to non-current smokers. Those who made use of dental services in the year prior to the survey were less likely to rate their oral health as good (AOR; 0.59; 95% CI: 0.47-0.74). Frequency of tooth-brushing displayed a positive dose-dependent relationship with self-rated good oral health. Those in the general population who brushed their teeth at least once daily (AOR; 2.90; 95%; 1.86-4.54) or at least twice daily (AOR; 3.87; 95%; 2.47-6.06) were more likely to rate their oral health as good than those who did not brush at all (Table 3).

5.4.4 Recent history of oral health problems

Reporting recently having oral health problem such as tooth sensitivity (AOR; 0.54; 95%; 0.42-0.71), bleeding gums (AOR; 0.39; 95%; 0.30-0.51) or bad breath (AOR; 0.60; 95%; 0.42-0.86) decreased the odds of a respondent rating his/her oral health as good.

5.4.5 Random effects

When the individual-level characteristics were included in Model 3, there was a further reduction in the total variance explained (from 0.49 in Model 2, to 0.22 in Model 3). It is pertinent to note that 55% of the total variance in self-rated good oral health was explained by individual-level factors, while only 18% was explained by the community-level characteristics.

Table 4: Test of potential modifying effect of gender on self-rated oral health

Interaction term	p-value
Gender*Education	0.05
Gender*Subjective social status	0.24
Gender*Trust	0.00
Gender*Cell phone density	0.95

NB: All interactions were tested while adjusting for all other variables as in Model 3 in Table 3.

Table 5: Multilevel model of determinants of self-rated good oral health among men

Characteristics	AOR (95% Conf. Interval)
Age	
16-24	1.0 (referent)
25-34	0.57 (0.29-1.11)
35-44	0.45 (0.23-0.89)
45-54	0.18 (0.09-0.35)
55-64	0.16 (0.08-0.32)
>65	0.17 (0.08-0.36)
Education	
>Grade 12	1.0 (referent)
None	0.15 (0.07-0.35)
<Grade 12	0.53 (0.30-0.96)
Grade 12	1.21 (0.62-2.37)
Employment	
Employed	1.0 (referent)
Housewives/students/pensioners	0.69 (0.34-1.39)
Unemployed	0.44 (0.29-0.66)
Trust in people	
Not trusted	1.0 (referent)
Trusted	1.91 (1.29-2.83)
Currently smoking	
No	1.0 (referent)
Yes	0.37 (0.25-0.53)
Past use of dental services	
No	1.0 (referent)
Yes	0.53 (0.36-0.77)
Frequency of tooth-brushing	
No brushing	1.0 (referent)

	Brushed but not every day	1.83 (0.82-4.10)
	Brushed at least once daily	3.16 (1.63-6.12)
	Brushed at least twice daily	4.12 (2.10-8.06)
Bad breath		
	No	1.0 (referent)
	Yes	0.56 (0.34-0.94)
Bleeding gum		
	No	1.0 (referent)
	Yes	0.34 (0.22-0.53)

Table 6: Multilevel model of determinants of self-rated good oral health among women

Characteristics		AOR (95% Conf. Interval)
Households with cell phone		
	Area with the lowest proportion	1.0 (referent)
	Intermediate	1.96 (1.28-3.01)
	High	1.74 (1.11-2.74)
Age		
	16-24	1.0 (referent)
	25-34	0.68 (0.42-1.09)
	35-44	0.46 (0.29-0.74)
	45-54	0.26 (0.16-0.42)
	55-64	0.15 (0.09-0.26)
	>65	0.10 (0.05-0.17)
Education		
	>Grade 12	1.0 (referent)
	None	0.35 (0.15-0.79)
	<Grade 12	0.44 (0.23-0.83)
	Grade 12	0.64 (0.33-1.24)
Employment		
	Employed	1.0 (referent)
	Unemployed	0.68 (0.47-0.98)
	Housewives/students/pensioners	0.65 (0.44-0.98)
Subjective social status		
		1.17 (1.08-1.27)
Currently smoking		
	No	1.0 (referent)
	Yes	0.40 (0.27-0.59)
Past use of dental services		
	No	1.0 (referent)
	Yes	0.61 (0.45-0.81)
Tooth sensitivity		
	No	1.0 (referent)
	Yes	0.48 (0.34-0.67)
Bad breath		

	No	1.0 (referent)
	Yes	0.56 (0.34-0.92)
Bleeding gum		
	No	1.0 (referent)
	Yes	0.40 (0.28-0.57)
Mouth wash		
	No	1.0 (referent)
	Yes	2.63 (1.51-4.60)
Frequency of tooth-brushing		
	No brushing	1.0 (referent)
	Brushed but not every day	1.67 (0.80-3.48)
	Brushed at least once daily	2.62 (1.45-4.75)
	Brushed at least twice daily	3.60 (1.99-6.50)

5.5 Effects of gender on the relationship between socio-economic factors/social capital and self-rated oral health

When gender and socio-economic/social capital interactions were tested, only education ($p=0.05$) and trust ($p<0.01$) displayed significant interactions with gender (Table 4). These potential modifying roles of gender on self-rated oral health were further examined in a stratified multilevel logistic regression (Tables 5 and 6).

Men who reported that people could be trusted were more likely to report self-rated good oral health than those who said people could not be trusted (AOR; 1.91: 95% CI; 1.29-2.83). Among men, no statistically significant association was found between self-rated oral health and any of the area-level factors. (see Table 5). Moreover, relative social positioning within the society was not statistically significant in men's self-rating of their oral health.

Among women, the variations in self-rated oral health were seen both at the area level and at the individual level (see Table 6). Women from areas with an intermediate proportion of households with cell phones were most likely to rate their oral health as

good (AOR; 1.96: 95% CI; 1.28-3.01), after controlling for individual-level factors. Furthermore, relative social positioning within the society was significantly positively associated with self-rated good oral health among women (see Table 6). However, there was no significant association between self-rated good oral health and level of trust in people among women (see Table 6).

The social gradient with regards level of education among men (Table 5) was steeper than that observed among women (Table 6). In particular, compared to men with more than a Grade 12 education, men with no education were 85% less likely to report good oral health (Table 5) and the gradient for the same comparison among women was only 65% (Table 6).

CHAPTER 6

DISCUSSION

6.1 Introduction

In addition to exploring personal risk factors, this study examined the influence of the social context in which people lived on their self-ratings of their oral health. This study found a direct association between area-level and individual-level social capital and self-rated good oral health, after controlling for potential confounders at the individual level. In particular, male respondents who trust people and women who live in areas with high cell phone penetration were more likely to rate their oral health as good. However, there was no evidence of a significant association with the other area-level factors explored in the study.

6.2 Social capital and oral health

In general, living in an area with high cell phone ownership/network density increases the odds that a respondent will rate his/her oral health as good, compared to respondents living in the lowest network density areas. This observation may be related to the fact that areas with high household cell-phone ownership may also be those with more physical infrastructure, including dental services. Alternatively, the observation may be related to the fact that cell phones represent increasingly stronger social networking, which has already been shown to be positively associated with better self-reported oral health.

Previous studies have suggested that the use of cell phones and other mobile technologies enable human interaction with greater mobility than ever before.⁵⁹ In particular, they are important in developing, strengthening and maintaining friendships; they also affect relationships with family members.⁵⁹ Mobility, which facilitates and transforms social interaction, is central as a 'glue' in social networks.⁵⁹ These social

networks, norms of reciprocity, mutual assistance and trustworthiness are components of social capital.⁴⁴ Cell phones can therefore be used to ask for help from friends when needed and thus help people to maintain psychological health.⁵⁹⁻⁶⁰

Several studies have shown a relationship between social capital and oral health.⁶¹⁻⁶³ The results of this study are therefore consistent with the findings in a study by Pattusi et al.,⁶¹ who reported that areas with low social cohesion had a higher level of caries experience. In Pattusi et al.'s study, homicide was used as the indirect measure of social cohesion, because it was argued that a high rate of homicide or violence would lead to low level of trust, which was one of the main measures of social cohesion in that study.⁶¹

In communities where there is cohesion and trust, health information (for example, on the use of preventive services) spreads more rapidly, thereby influencing health-related behaviours, such as the need to reduce sugar consumption, which can lead to dental caries.⁶⁴ Individuals can also share experiences and seek advice on symptoms from relatives and friends (this creates a lay referral system).⁶⁵⁻⁶⁶

Trust and social networking within a community can also give rise to community-organised efforts. Cohesive communities can bring about change by mobilizing and lobbying for local services such as dental centres from the government; these centres usually have health care professionals who can give oral health information.^{65,67}

Aida et al.⁶² also have shown that the number of community centres per 100 000 residents was significantly associated with caries experience. These centres bring about contact among residents through social activities, thereby enhancing social cohesion.⁶² This is similar to what cell phones do in uniting distant communities, and also serves as a social 'glue' between family members and friends.^{60,68} Cell phones

give people a sense of well-being and can be used to ask for assistance, especially in cases of emergency.⁶⁹ Through cell phone usage, people in the rural areas can get money from their family members working in the cities through cash transfers, which can contribute up to 40% of household income,⁶⁰ which would increase access to dental care.

Among the less-disadvantaged population, cell phones are used mainly for social interaction, which further strengthens social capital.⁶⁰ Socially connected individuals may have greater social support, which may in turn lower the risk of psychological stress among people.⁷⁰ Psychosocial stress has indeed been demonstrated to be a significant determinant of oral health, as a high proportion of adults in one study who had poor psychosocial scores also had poor self-rated oral health, regardless of income.⁷¹

It was striking that the positive influence of living in the areas with the highest cell phone density was attenuated after controlling for socio-economic status. It is conceivable that high cell phone usage may also cut into the disposable income available for self-care, especially among very poor people, which then compromises oral health care.

6.3 Socio-economic factors and self-rated oral health

6.3.1 Objective socio-economic factors

Both education and employment status, which were the measures of socio-economic status, were related to self-rated oral health as good in this study. This is consistent with what has been reported in many other studies.^{9,20,72} Similarly, the prevalence of good self-rated oral health has also been found to be higher in adolescents from the

upper socio-economic class and educated families than among adolescents from the lower class and uneducated families.²⁶

In contrast to Locker's finding,⁷³ this study did not find any significant independent association between income and self-rated oral health after controlling for other variables – Locker controlled for psycho-social variables such as self-esteem, depression, life satisfaction and severity of life stress, which this study did not control for.

Common oral diseases such as periodontitis are reported more among respondents in the lower socio-economic class than among respondents in the higher socio-economic class.⁷⁴⁻⁷⁵ Periodontitis is well known to be associated with the presence of smoking;⁷⁶ thus it was no surprise that smokers were less likely to rate their oral health as good. Several studies have also shown that having untreated dental caries and missing teeth increase the likelihood that a person will rate his/her oral health as poor.^{26, 75,77} These oral conditions are also more common among those of low socio-economic status.⁷⁵⁻⁷⁶

Family affluence and higher social status were attributed to good oral health-enhancing behaviours, such as higher tooth brushing frequency, interdental cleaning habits and dental service use.⁷⁸⁻⁷⁹ There is a positive association between favourable lifestyles such as the ones mentioned and good self-reported oral health because those whose behaviours are advantageous to health in general feel healthier as a result.²⁷ This is similar to the findings of this study where good oral hygiene practices such as brushing at least twice daily and the use of mouthwash were associated with self-rated good oral health.

However, favourable lifestyles have limited effect on the oral health of the underprivileged, because the health-damaging effects of poor material and social circumstances are greater than those of (un)favourable lifestyles.²⁷

Poorer health-related behaviours are more common among the less educated and among poorer people.⁸⁰ Being in a higher socio-economic class increases the chance of making routine dental visits for the prevention of oral health problems.⁸¹

A recent history of oral health problems such as tooth sensitivity, bleeding gums and bad breath were significantly associated with self-rated oral health in this study. In a study by Chen and Hunter, some of those who experienced at least one dental symptom in the past year also perceived their oral health as poor.⁸²

6.3.2 Subjective social status

Subjective social status is an important correlate of health – it can capture the dimensions of social status that the indicators of objective socio-economic status cannot.⁸³ Subjective social status can affect health through psychological pathways and has been shown to be related to health, independent of objective socio-economic status.⁸⁴ In this study, the association between subjective social status remained strong even after controlling for education and employment, which were the indicators of objective socio-economic status. There was a better self-rated oral health for every increment in social position ranking, which was consistent with the findings of Marmot et al. (cited in Operario, Adler and Williams),⁸⁴ who found that higher socio-economic status was associated with better health for every increment of social status from the lowest through the middle to the highest classes. Increased subjective social status has been associated with reduced levels of psychological distress, which in turn has a positive effect on health.⁸⁴ It is however to be noted that the effect of subjective social status on self-rated oral health in this study was particularly relevant only for women.

6.4 Demographic factors

6.4.1 Gender

In this study, social positioning had a positive significant association with self-rated good oral health only among females. Social positioning among women has been negatively associated with emotional stress in a study by Reitzel et al.⁸⁵ Moreover, according to Benyamini et al.,⁸⁶ women, unlike men, take into account both emotional stress and physical health when rating their health.⁸⁶ Therefore, a woman who scored herself higher on the subjective socio-economic gradient would conceivably be more likely to have less emotional stress and more likely to rate her oral health as good than another woman who rated herself lower on the social status gradient.

This study has also showed that the social context in which men live, unlike with women, did not influence their self-ratings of oral health; that is, none of the area-level variables were significant in men. Men are said to be more individualistic and more engaged in formal collaborations⁸⁷ and not as community-oriented and informal in their associations as women.⁸⁷⁻⁸⁸ Women belong to more informal groups, which allows them to form stronger kinship and friendship relations,⁸⁹ which can be used in influencing health-related behaviours.⁶⁴ In many communities in southern Africa, women form associations that develop solidarity networks and a collective identity by saving and lending small amounts of money on a daily basis, thereby enhancing social capital.⁹⁰ This source of solidarity may also arise from strong community and kinship ties among women which eventually give rise to organised collective action used in neighbourhood mobilization for basic infrastructure,⁸⁷ such as the provision of dental care.

Of all the area-level variables, only the proportion of households with cell phones in a particular municipality was found to be associated with self-rated good oral health

among women. This observation may be related to the fact that in South Africa, more women than men own cell phones⁶⁹ and that women are more likely to use the cell phones mainly for social reasons, such as maintaining informal relationships and also to contact family or friends in case of an emergency. By contrast, men use cell phones more for work-related issues such as maintaining employment or professional contacts, which are forms of formal relationships.⁶⁹

However, this study also showed that, unlike women, men who claimed they generally trusted people were more likely to rate their oral health as good. This further shows the individualistic characteristic of men and 'community' characteristic of women, because 'trust' in this study was a measure of social capital at an individual level.

Furthermore, this study and other studies have shown that a greater proportion of males than females rated their oral health as good.^{27,82} This observation may be related to the fact that, on the one hand, women have been found to be more likely to report oral and facial symptoms than men²⁸ and, on the other hand, it has been shown in this study and other studies^{28,91} that people often rate their oral health as poor as a result of displaying oral symptoms. The observed gender differences in self-rated oral health may also be related to the fact that women have been shown to be more critical of themselves.⁹² The gender differences in self-rated oral health may also be reflective of the fact that women in South Africa have significantly lower disposable income and level of education⁹³ and thus less access to oral health care.

6.4.2 Age

In Australia, the proportion of respondents rating their oral health as fair or poor increased with age,⁹⁴ which is consistent with this study's finding. Middle-aged men were more likely to report poorer oral health than younger men.⁷⁵ This may be a result

of a deterioration in functional health status with age⁹⁵ because people's medical status and perceived functional limitations contribute to self-rated health.⁹⁶

6.4.3 Ethnicity/race

The elimination of observed racial differences in self-rated oral health after controlling for individual-level and area-level socio-economic factors suggest that racial differences in self-rated oral health are mediated by differences in the social context in which different races live in South Africa. Indeed whites and Indians who had the highest proportion of those with self-rated good health often reside in urban areas⁹⁷ with greater health and social infrastructure, and therefore have greater access to dental services than members of other race groups.

6.5 Lifestyle factors

6.5.1 Tobacco use

Current and former smokers, as well as low vegetable eaters, are more likely to self-rate their oral health as poor.⁹⁶ Cigarette smoking has been found to be an important predictor of self-rated oral health. Smoking has been associated with unfavourable dental health perceptions.⁴⁰ Smoking has also been associated with a lower rate of dental visits,⁴³ and poor self-rated oral health.⁷⁵ Smokers have a greater accumulation of plaque and calculi than non-smokers which increases the risk of periodontitis among smokers.^{81,98} Smokers also tend to develop halitosis, tooth-staining and suppressed gingivitis;⁹⁹ and are less likely to make use of dental services for routine care;¹⁰⁰ all of which could make smokers self-rate their oral health as poor.

6.6 Dental services use and self-reported oral health

Those who have made use of the dental services in the past were less likely to rate their oral health as good. The reason for a visit might indeed be symptomatic. Indeed, most dental visits in South Africa are symptomatic.¹⁰¹ Preventive visits have been associated with a self-rating of oral health as good, while restorative or symptomatic visits are linked to self-rating of oral health as poor.¹⁰²⁻¹⁰³ Those who regularly visit a dentist for preventative purposes are people who care about their oral health and are more likely to have a higher education and higher socio-economic status.¹⁰⁰

6.7 Limitations and strengths of the study

One limitation of the current study was its cross-sectional nature, which precluded any clear evidence on causality, given the limited information on the temporal order of events. However, the inclusion of the 2005 GHS data to some extent provided some information on a temporal order of events for area level factors. However, it might also well be that some people living in the respective areas during the 2007 SASAS might not have resided in the same area in 2005. However, it is unlikely that the proportion of people who moved out of the municipalities has changed so significantly over the two-year period as to significantly change the findings in this study.

The use of self-rated oral health over clinical measurement may have introduced reporting bias. However, it has been suggested that self-reported health status may be a better determinant of demand for care or services than professional and clinical diagnosis; hence the use of this measure may better inform service demand and thus service planning.¹⁰⁴

It is pertinent to note that there was still a large unexplained residual random or effect after controlling for potential confounders. The residual effect could be as a result of some as yet unmeasured factors, such as the level of fluoridation of the water in the

different areas, which has been shown to influence the prevalence of dental caries,¹⁰⁵ a condition that may affect self-rating of oral health status.

The strength of this study lies in the use of large nationally representative datasets and the use of a statistical approach that allowed for the separation of composition influences from contextual influences on health outcomes. This is indeed the first study in the region that we are aware of that has examined the self-rated oral health of a national sample using this statistical approach. Thus the study has the potential to make a significant scientific contribution to the evidence-based development of policies that could address the social determinants of oral health beyond South Africa.

CHAPTER 7

CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

This study's findings show that only 76.3% of South Africans aged 16 years or above rated their oral health as good.

- South African males are more likely to rate their oral health as good than females are.
- A self-rating of oral health as good decreases with increasing age, but increases with an increase in the number of years of education.
- Only 18% of variance in self-rated good oral health was explained by the area-level factors, while 55% of the variance was explained by individual-level characteristics.
- People living in areas with an intermediate proportion of households with cell phones were most likely to rate their oral health as good, particularly among women. Among men, believing that people could be trusted was significantly associated with higher odds of rating oral health as good. These findings further show the individualistic and community characteristics of men and women respectively.
- Reporting using dental services in the past year was significantly associated with lower odds of rating oral health as good.
- However, this study failed to demonstrate a significant association between race/ethnicity and self-rated oral health.

7.2 Recommendations

The following recommendations are made based on the findings of this study:

- Attention should be paid to areas with limited infrastructure, such as areas with low cell phone density; telecommunication companies should be encouraged to extend their networks to these impoverished areas.
- Community-based oral health promotion should be encouraged.
- Oral health should be promoted among the less educated, as well as the unemployed, by incorporating oral health care into primary health care facilities. Dental services should not only target treatment but also prevention. Preventive dental interventions should be made attractive and cheaper than treatment.
- Prevention of the initiation of tobacco use and the promotion of cessation among those who have already initiated tobacco use should be prioritized.

This study's findings are consistent with the social health framework, namely that self-rated health was a combination of consideration of physical oral functioning and of social relationships.¹⁰⁶ There is need for policy makers and oral health stakeholders to develop intervention strategies targeting both personal factors and factors related to where people reside. According to the Rio Political Declaration on social determinants of health, taking action on societal conditions in which people are born, grow, live and work is essential to create inclusive, equitable, economically productive and healthy societies.¹⁰⁷ This will also enhance the reduction of oral health disparities in the society.

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Appendix A

The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has IHS Federal wide Assurance.

- * FWA 00002567. Approved dd 22 May 2002 and Expires 13 Jan 2012.
- * IRB 0000 2235 IORG0001762 Approved dd Jan 2006 and Expires 13 Aug 2011.



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences Research Ethics Committee
Fakulteit Gesondheidswetenskappe Navorsingsetiekkomitee

DATE: 1/11/2010

PROTOCOL NO.	192/2010
PROTOCOL TITLE	Socio-environmental factors associated with self-rated oral health: a mixed effects model
INVESTIGATOR	Principal Investigator: Dr B G Olutola
SUBINVESTIGATOR	Prof O.A Ayo-Yusuf
SUPERVISOR	Prof O.A Ayo-Yusuf
DEPARTMENT	Dept: SHSPH Phone: 012-386-1924 E-Mail: s28448287@tuks.co.za Cell: 0743 28 29 71
STUDY DEGREE	M Sc Epidemiology
SPONSOR	Not Applicable
MEETING DATE	27/10/2010

The Protocol was approved on 27/10/2010 by a properly constituted meeting of the Ethics Committee subject to the following conditions:

1. The approval is valid for 2 years period [End of December 2012], and
2. The approval is conditional on the receipt of 6 monthly written Progress Reports, and
3. The approval is conditional on the research being conducted as stipulated by the details of the documents submitted to and approved by the Committee. In the event that a need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

Members of the Research Ethics Committee:

Prof M J Bester	(female) BSc (Chemistry and Biochemistry); BSc (Hons)(Biochemistry); MSc(Biochemistry); PhD (Medical Biochemistry)
Prof R Delpont	(female) BA et Scien, B Curatoris (Hons) (Intensive care Nursing), M Sc (Physiology), PhD (Medicine), M Ed Computer Assisted Education
Prof VOL Karussiet	MBChB; MFGP (SA); MMed(Chir); FCS(SA) - Surgeon
Prof JA Ker	MBChB; MMed(Int); MD - Vice-Dean (ex officio)
Dr NK Likibi	MBBCh - Representing Gauteng Department of Health
Prof TS Marcus	(female) BSc(LSE), PhD (University of Lodz, Poland) - Social scientist
Dr MP Mathebula	(female) Deputy CEO: Steve Biko Academic Hospital
Prof A Nienaber	(female) BA (Hons)(Wits); LLB; LL.M(UP); PhD; Dipl. Datametrics (UNISA) - Legal advisor
Mrs MC Nzeku	(female) BSc(NUL); MSc(Biochem)(UCL, UK) - Community representative
Prof L M Ntlhe	MBChB(Natal); FCS(SA)
Snr Sr J Phatoli	(female) BCurr(Fet A); BTec(Oncology Nursing Science) - Nursing representative
Dr R Reynders	MBChB (Prêt), FCPaed (CMSA) MRCPCH (Lon) Cert Med. Onc (CMSA)
Dr T Rossouw	(female) M.B., Ch.B. (cum laude); M.Phil (Applied Ethics) (cum laude), MPH (Biostatistics and Epidemiology (cum laude), D.Phil
Dr L Schoeman	(female) B.Pharm, BA(Hons)(Psych), PhD - Chairperson: Subcommittee for students' research
Mr Y Sikweyiya	MPH, SARETI Fellowship in Research Ethics, SARETI ERCTP; BSc(Health Promotion) Postgraduate Dip (Health Promotion) - Community representative



Dr R Sommers
Prof TJP Swart
Prof C W van Staden

(female) MBChB; MMed(Int); MPharmMed – **Deputy Chairperson**
BChD, MSc (Odont), MChD (Oral Path), PGCHE – School of Dentistry representative
MBChB; MMed (Psych); MD; FCPsych; FTCL; UPLM - **Chairperson**

DR R SOMMERS; MBChB; MMed(Int); MPharmMed.

Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria

◆Tel:012-3541330

◆Fax:012-3541367 / 0866515924

◆E-Mail: manda@med.up.ac.za

◆Web: [//www.healthethics-up.co.za](http://www.healthethics-up.co.za)

◆H W Snyman Bld (South) Level 2-34

◆P.O. BOX 667, Pretoria, S.A., 0001



Appendix B



Human Sciences Research Council
Leqoqo la Dinyololo la Semothole ts'a Satho
Road of Research and Knowledge
Umhlanga Wapulelophing'ngas Ngusayeni Yedabu
Ibhunga Lophanso Ngenzulu-Lwazi Kanti

HSRC Research Ethics Committee
FWA Registration: Organisation No. 0000 6347
IRB No. 0097202

12 October 2007

Mrs Jare Struwig
Knowledge Systems cross-cutting unit
Human Science Research Council

Dear Mrs Struwig

Ethics clearance of HSRC Ethics Committee Protocol REC 8/1/12/09/07: South African Social Attitudes Survey (SASAS)

Thank you for your application for ethics approval of the above study. This was considered by the Research Ethics Committee at its meeting on 12 September 2007.

Ethics clearance of the study is hereby granted, and the Committee wishes you success in your research.

Yours sincerely,

Prof. D R Wassenaar PhD
Chairperson: HSRC REC

Pretoria Office
Room 1411, 134 Pretorius Street, Pretoria, 0002, South Africa. Private Bag X41, Pretoria, 0001, South Africa. Tel: +27 12 302 2800 Fax: +27 12 302 2825

Cape Town Office
Plain Park Building, 69-83 Plain Street, Cape Town, 8001, South Africa. Private Bag X9192, Cape Town, 8000, South Africa. Tel: +27 21 466 8000 Fax: +27 21 466 8001

Durban Office
750 Francols Road, Inbuthuko Junction, Cato Manor, Durban, 4001, South Africa. Private Bag X07, Dalbridge, 4014, South Africa. Tel: +27 31 242 5400 Fax: +27 31 242 5401

www.hsrc.ac.za



Appendix C

**Permission to access Records / Files / Data base at
HUMAN SCIENCES RESEARCH COUNCIL, PRETORIA**

TO: The Custodian
Human Sciences Research Council
Pretoria

FROM: Investigator
DR B OLUTOLA
SCHOOL OF HEALTH SYSTEMS AND
PUBLIC HEALTH
UNIVERSITY OF PRETORIA

**Re: Permission to conduct a study using the tobacco and health module in the
2007 South African Social Attitude Survey (SASAS)**

**TITLE OF STUDY: Socio-environmental factors associated with self-rated oral health: a mixed
effects model**

This request is lodged with you in terms of the requirements of the Promotion of Access to Information Act. No. 2 of 2000.

I am a student at the School of Health Systems and Public Health at the University of Pretoria under the supervision of Prof OA Ayo-Yusuf at the school of Dentistry, Department of Community Dentistry. I plan to conduct a study on the above topic. This study involves access to dataset collected as part of the 2007 South African Social Attitude Survey (SASAS), conducted by the Human Sciences Research Council. I herewith request access to the dataset.

We intend to publish the findings of the study in a professional journal and or to present them at professional meetings like symposia, congresses, or other meetings of such a nature. I intend to protect the personal identity of the participants by not attempting to link any code/number assigned in the dataset to any of the participants.

I undertake not to proceed with the study until we have received approval from the Faculty of Health Sciences Research Ethics Committee, University of Pretoria.

Yours sincerely,

Signature of the principal investigator

**Permission to do the research study at this institution/facility and/or to access
the information as requested is hereby approved.**

Title and name of the custodian: Mrs Jare Struwig

Name of institution: Human Sciences Research Council

Signature:

Date: 25/10/2010

Appendix D

SOUTH AFRICAN SOCIAL ATTITUDES SURVEY 2007 QUESTIONNAIRE (Extracts)

1 Generally speaking, would you say that people can be trusted or that you can't be too careful in dealing with people?

People can almost always be trusted	1
People can usually be trusted	2
You usually can't be too careful in dealing with people	3
You almost always can't be too careful in dealing with people	4
Can't choose	5

SMOKING & TOBACCO BEHAVIOUR

2. Do you use or have you used any of the following tobacco products in the past?

	Every day	Some days	Stopped less than 6 months ago	Stopped more than 6 months ago	Never before
Manufactured Cigarettes	1	2	3	4	5
Hand rolled cigarettes (Zol)	1	2	3	4	5
Pipes or cigars	1	2	3	4	5
Nasal Snuff	1	2	3	4	5
Oral Snuff	1	2	3	4	5

ORAL HEALTH

3. How would you rate your oral health status?

Very good	1
Good	2
Neither nor	3
Poor	4
Very poor	5
(Do not know/ Can't choose)	8

4. How satisfied or dissatisfied are you with the following?

	Very satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Very dissatisfied	(Can't choose)	(Not applicable)
Dental services received in the past year?	1	2	3	4	5	8	9 (Did not visit dentist in past year)

5. In the past month, have you experienced any of the following oral health problems?

FIELDWORKER: MULTIPLE RESPONSES ALLOWED – CIRCLE ALL THAT APPLY

a	Bleeding gums when brushing	1
b	Teeth sensitive to heat or cold	2
c	Bad breath	3
d	None of the above	4

6. Which of the following do you regularly do to look after your mouth?

FIELDWORKER: MULTIPLE RESPONSES ALLOWED – CIRCLE ALL THAT APPLY

a	Brush, but not every single day	1
b	Brush at least once everyday	2
c	Brush at least twice everyday	3
d	Use mouthwash daily	4
e	Floss my teeth at least twice every week	5
f	Use toothpicks at least twice every week	6
g	None of the above	7

RESPONDENT CHARACTERISTICS

7. Sex of respondent [copy from contact sheet]

Male	1
Female	2

8. Race of respondent [copy from contact sheet]

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

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

Years
(Don't know) = 997

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

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

11. What is your current employment status? (WHICH OF THE FOLLOWING BEST DESCRIBES YOUR PRESENT WORK SITUATION?)

Unemployed, not looking for work	01
Unemployed, looking for work	02
Pensioner (aged/retired)	03
Temporarily sick	04
Permanently disabled	05
Housewife, not working at all, not looking for work	06
Housewife, looking for work	07
Student/learner	08
Self-employed - full time	09
Self-employed - part time	10
Employed part time (if none of the above)	11
Employed full time	12
Other (specify)	13

12. In our society there are groups which tend to be towards the top and groups which tend to be towards the bottom. Where would you put yourself on a scale of 1 to 10, where 10 is the top and 1 the bottom?

Highest	10
.....	9
	8
	7
	6
	5
	4
	3
	2
Lowest	1
.....	

13. HOUSEHOLD INCOME

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

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

Appendix E

GENERAL HOUSEHOLD SURVEY 2005 QUESTIONNAIRE (Extracts)

1.

	01	02	03	04	05	06	07	08	09	10
Where did the consultation take place? If more than one consultation, ask about the most recent one										
Public sector (<i>i.e. government, provincial or community institution</i>)										
01 = HOSPITAL	<input type="checkbox"/> 01	<input type="checkbox"/> 01	<input type="checkbox"/> 01	<input type="checkbox"/> 01	<input type="checkbox"/> 01	<input type="checkbox"/> 01	<input type="checkbox"/> 01	<input type="checkbox"/> 01	<input type="checkbox"/> 01	<input type="checkbox"/> 01
02 = CLINIC	<input type="checkbox"/> 02	<input type="checkbox"/> 02	<input type="checkbox"/> 02	<input type="checkbox"/> 02	<input type="checkbox"/> 02	<input type="checkbox"/> 02	<input type="checkbox"/> 02	<input type="checkbox"/> 02	<input type="checkbox"/> 02	<input type="checkbox"/> 02
03 = OTHER IN PUBLIC SECTOR, <i>specify.</i>	<input type="checkbox"/> 03	<input type="checkbox"/> 03	<input type="checkbox"/> 03	<input type="checkbox"/> 03	<input type="checkbox"/> 03	<input type="checkbox"/> 03	<input type="checkbox"/> 03	<input type="checkbox"/> 03	<input type="checkbox"/> 03	<input type="checkbox"/> 03
Private sector (<i>including private clinics, surgery, private hospitals and sangomas</i>)										
04 = HOSPITAL	<input type="checkbox"/> 04	<input type="checkbox"/> 04	<input type="checkbox"/> 04	<input type="checkbox"/> 04	<input type="checkbox"/> 04	<input type="checkbox"/> 04	<input type="checkbox"/> 04	<input type="checkbox"/> 04	<input type="checkbox"/> 04	<input type="checkbox"/> 04
05 = CLINIC	<input type="checkbox"/> 05	<input type="checkbox"/> 05	<input type="checkbox"/> 05	<input type="checkbox"/> 05	<input type="checkbox"/> 05	<input type="checkbox"/> 05	<input type="checkbox"/> 05	<input type="checkbox"/> 05	<input type="checkbox"/> 05	<input type="checkbox"/> 05
06 = PRIVATE DOCTOR/SPECIALIST	<input type="checkbox"/> 06	<input type="checkbox"/> 06	<input type="checkbox"/> 06	<input type="checkbox"/> 06	<input type="checkbox"/> 06	<input type="checkbox"/> 06	<input type="checkbox"/> 06	<input type="checkbox"/> 06	<input type="checkbox"/> 06	<input type="checkbox"/> 06
07 = TRADITIONAL HEALER	<input type="checkbox"/> 07	<input type="checkbox"/> 07	<input type="checkbox"/> 07	<input type="checkbox"/> 07	<input type="checkbox"/> 07	<input type="checkbox"/> 07	<input type="checkbox"/> 07	<input type="checkbox"/> 07	<input type="checkbox"/> 07	<input type="checkbox"/> 07
08 = PHARMACY/CHEMIST	<input type="checkbox"/> 08	<input type="checkbox"/> 08	<input type="checkbox"/> 08	<input type="checkbox"/> 08	<input type="checkbox"/> 08	<input type="checkbox"/> 08	<input type="checkbox"/> 08	<input type="checkbox"/> 08	<input type="checkbox"/> 08	<input type="checkbox"/> 08
09 = HEALTH FACILITY PROVIDED BY EMPLOYER	<input type="checkbox"/> 09	<input type="checkbox"/> 09	<input type="checkbox"/> 09	<input type="checkbox"/> 09	<input type="checkbox"/> 09	<input type="checkbox"/> 09	<input type="checkbox"/> 09	<input type="checkbox"/> 09	<input type="checkbox"/> 09	<input type="checkbox"/> 09
10 = ALTERNATIVE MEDICINE, E.G.HOMEOPATHIST	<input type="checkbox"/> 10	<input type="checkbox"/> 10	<input type="checkbox"/> 10	<input type="checkbox"/> 10	<input type="checkbox"/> 10	<input type="checkbox"/> 10	<input type="checkbox"/> 10	<input type="checkbox"/> 10	<input type="checkbox"/> 10	<input type="checkbox"/> 10
11 = OTHER IN PRIVATE SECTOR, <i>specify</i>	<input type="checkbox"/> 11	<input type="checkbox"/> 11	<input type="checkbox"/> 11	<input type="checkbox"/> 11	<input type="checkbox"/> 11	<input type="checkbox"/> 11	<input type="checkbox"/> 11	<input type="checkbox"/> 11	<input type="checkbox"/> 11	<input type="checkbox"/> 11
12 = DON'T KNOW	<input type="checkbox"/> 12	<input type="checkbox"/> 12	<input type="checkbox"/> 12	<input type="checkbox"/> 12	<input type="checkbox"/> 12	<input type="checkbox"/> 12	<input type="checkbox"/> 12	<input type="checkbox"/> 12	<input type="checkbox"/> 12	<input type="checkbox"/> 12



2.

	01	02	03	04	05	06	07	08	09	10
Why did.....not consult any health worker during the past month?										
1 = TOO EXPENSIVE	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> 1
2 = TOO FAR	<input type="checkbox"/> 2	<input type="checkbox"/> 2	<input type="checkbox"/> 2	<input type="checkbox"/> 2	<input type="checkbox"/> 2	<input type="checkbox"/> 2	<input type="checkbox"/> 2	<input type="checkbox"/> 2	<input type="checkbox"/> 2	<input type="checkbox"/> 2
3 = NOT NECESSARY	<input type="checkbox"/> 3	<input type="checkbox"/> 3	<input type="checkbox"/> 3	<input type="checkbox"/> 3	<input type="checkbox"/> 3	<input type="checkbox"/> 3	<input type="checkbox"/> 3	<input type="checkbox"/> 3	<input type="checkbox"/> 3	<input type="checkbox"/> 3
4 = DON'T KNOW	<input type="checkbox"/> 4	<input type="checkbox"/> 4	<input type="checkbox"/> 4	<input type="checkbox"/> 4	<input type="checkbox"/> 4	<input type="checkbox"/> 4	<input type="checkbox"/> 4	<input type="checkbox"/> 4	<input type="checkbox"/> 4	<input type="checkbox"/> 4
5 = OTHER, <i>specify in column underneath</i>	<input type="checkbox"/> 5	<input type="checkbox"/> 5	<input type="checkbox"/> 5	<input type="checkbox"/> 5	<input type="checkbox"/> 5	<input type="checkbox"/> 5	<input type="checkbox"/> 5	<input type="checkbox"/> 5	<input type="checkbox"/> 5	<input type="checkbox"/> 5

3.

What is the household's main source of water? Mark one code only	Drinking	Other
01 = PIPED (TAP) WATER IN DWELLING	<input type="checkbox"/> 1	<input type="checkbox"/> 1
02 = PIPED (TAP) WATER ON SITE OR IN YARD	<input type="checkbox"/> 2	<input type="checkbox"/> 2
03 = NEIGHBOURH'S TAP	<input type="checkbox"/> 3	<input type="checkbox"/> 3
04 = BOREHOLE ON SITE	<input type="checkbox"/> 4	<input type="checkbox"/> 4
05 = RAIN-WATER TANK ON SITE	<input type="checkbox"/> 5	<input type="checkbox"/> 5
06 = PUBLIC TAP	<input type="checkbox"/> 6	<input type="checkbox"/> 6
07 = WATER-CARRIER/ TANKER	<input type="checkbox"/> 7	<input type="checkbox"/> 7
08 = BOREHOLE OFF SITE/COMMUNAL	<input type="checkbox"/> 8	<input type="checkbox"/> 8
09 = FLOWING WATER/STREAM/RIVER	<input type="checkbox"/> 9	<input type="checkbox"/> 9
10 = DAM/POOL/STAGNANT WATER	<input type="checkbox"/> 10	<input type="checkbox"/> 10
11 = WELL	<input type="checkbox"/> 11	<input type="checkbox"/> 11
12 = SPRING	<input type="checkbox"/> 12	<input type="checkbox"/> 12
13 = OTHER, <i>specify</i>	<input type="checkbox"/> 13	<input type="checkbox"/> 13



4.

What is the main source of energy/fuel for this household?	Lighting
01 = ELECTRICITY FROM MAINS	<input type="checkbox"/> 01
02 = ELECTRICITY FROM GENERATOR	<input type="checkbox"/> 02
03 = GAS	<input type="checkbox"/> 03
04 = PARAFFIN	<input type="checkbox"/> 04
05 = WOOD	<input type="checkbox"/> 05
06 = COAL	<input type="checkbox"/> 06
07 = CANDLES	<input type="checkbox"/> 07
08 = ANIMAL DUNG	<input type="checkbox"/> 08
09 = SOLAR ENERGY	<input type="checkbox"/> 09
10 = OTHER, <i>specify</i>	<input type="checkbox"/> 10
11 = NONE	<input type="checkbox"/> 11

5.

Is there a cellular telephone available to this household for regular use?	
1 = YES	<input type="checkbox"/> 1
2 = NO	<input type="checkbox"/> 2