

Center for International Health
Department of Oral Sciences – Community Dentistry
University of Bergen

**Examining tooth loss, oral impacts on daily performances
and satisfaction with chewing ability:
a household survey of older adults in Tanzania**

Irene Anderson Kida

The thesis is submitted in partial fulfillment of the requirements of the degree of Doctor of
Philosophy at the University of Bergen 2007

Copyright © Irene Anderson Kida, 2007

ISBN 978-82-308-0431-5
Bergen, Norway 2007

*Dedicated to my precious daughter
Danielle*

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	V
ACRONYMS	VI
LIST OF PAPERS.....	VII
ABSTRACT	VIII
INTRODUCTION.....	1
<i>OUTLINE OF THE THESIS</i>	1
<i>ORAL HEALTH IN OLDER PEOPLE</i>	2
<i>CONCEPTUAL MODEL GUIDING THE PAPERS IN THE THESIS</i>	3
<i>Tooth loss - Paper I (Biological and physiological level)</i>	5
<i>Chewing difficulties Paper II (Symptom status level)</i>	12
<i>Oral health related quality of life Paper III (Functional status level)</i>	13
<i>Satisfaction / dissatisfaction with oral health /chewing ability-Papers II and III (General health perceptions and overall quality of life)</i>	19
PURPOSE OF THE STUDY	20
<i>AIM</i>	20
<i>RESEARCH QUESTIONS</i>	20
MATERIALS AND METHODS	22
<i>STUDY AREA</i>	22
<i>SAMPLING AND PROCEDURE</i>	24
<i>THE SURVEY INSTRUMENT</i>	27
<i>Focus group discussion</i>	27
<i>CLINICAL EXAMINATION</i>	27
<i>CHARACTERISTICS OF DATA AND STATISTICAL ANALYSES</i>	27
<i>ETHICAL CLEARANCE</i>	28
RESULTS.....	29
DISCUSSION	32
<i>METHODOLOGICAL ISSUES</i>	32
<i>Reliability</i>	32
<i>Validity</i>	34
<i>Cross cultural adaptation</i>	36
<i>FINDINGS</i>	37
<i>Urban rural differentials</i>	37
<i>Socio-economic differentials</i>	39

<i>Age differences</i>	40
<i>IMPLICATION</i>	40
CONCLUSIONS.....	42
REFERENCES.....	43
ORIGINAL PAPERS I – III.....	49
APPENDICES I – VII.....	50

Acknowledgements

This work has been carried out as collaboration between the Center for International Health (CIH) and the Faculty of Dentistry, University of Bergen and the Muhimbili University College of Health Sciences. My appreciation goes to the Norwegian State Education Loan Fund (Staten Lanekasse) for the financial support.

I am greatly indebted to my main supervisor Professor Anne Nordrehaug Åstrøm for her valuable advice and support throughout my study period. Her tireless effort, encouragement and constructive inputs made this work a success. I truly appreciate it. I am grateful to the co-supervisors, Professor Gunhild V. Strand and Dr Joyce R. Masalu for their scholarly guidance. My sincere appreciation goes to Professor Ola Haugejorden for valuable comments throughout the work of this thesis.

I would also like to thank the staff at the Center for International Health (particularly the IT department) and Faculty of Dentistry for their kind assistance during the course of my study.

I am particularly indebted to the staff and management of the Muhimbili University College of Health Sciences, the School of Dentistry and the Department of Restorative Dentistry for granting me permission to undertake this study. Special thanks to the research assistants, Sr. Elieshi, Dr Beate and Dr Masaganya, for their tireless work in field. I am thankful to the regional, district and village administration leaders and the willing participation of the community members.

Thanks to my husband, my parents, my in-laws and my brothers and sisters for their encouragement and prayers. I would also like to express my sincere appreciation to my colleagues, friends and all those who have, in various ways, made this work possible.

Finally, I thank the Almighty God for the blessings and for keeping me strong and healthy throughout my study period.

Acronyms

AOU	Anterior occluding units
FDI	Federation Dentaire Internationale
GDP	Gross Domestic Product
MUCHS	Muhimbili University College of Health Sciences
OHIP	Oral Health Impact Profile
OIDP	Oral Impacts on Daily Performance
OR	Odds ratio
POU	Posterior occluding units
REK VEST	ethical research committee in Norway
SES	Socio-economic status
WHO	World Health Organization

List of papers

The thesis is based on the following papers.

Paper I

Kida IA, Åstrøm AN, Strand GV, Masalu JR. Clinical and socio-behavioral correlates of tooth loss: a study of older adults in Tanzania. *BMC oral Health* 2006, 6:5

Paper II

Kida IA, Åstrøm AN, Strand GV, Masalu JR. Chewing problems and dissatisfaction with chewing ability: a survey of older Tanzanians. *European Journal of Oral Sciences* 2007, 115: 265-274.

Paper III

Kida IA, Åstrøm AN, Strand GV, Masalu JR. Psychometric properties and the prevalence, intensity and causes of oral impacts on daily performances (OIDP) in a population of older Tanzanians. *Health and Quality of Life Outcomes* 2006, 4:56

Abstract

Objective: The main objective of this study was to assess the prevalence, extent and risk indicators of tooth loss, and how it impacts on the quality of life of older adults living in rural and urban areas of Tanzania.

Methods: A cross sectional survey of older adults aged 50 years and above, residing in the two districts of Pwani region and one district of Dar es Salaam city, was conducted from November 2004 to June 2005. A stratified (disproportionate) two stage cluster sample design with villages as the primary sampling unit was utilized (N = 1200). Participants from the selected villages were clinically examined for decayed teeth and missing teeth due to caries / other reasons than caries, according to the criteria described by the World Health Organization (third molars included).

Tooth mobility was assessed using Millers' index; and oral health and hygiene using Mucosal-Plaque score. Functional premolar and molar occluding units were counted based on existing natural tooth contacts between maxilla and mandible in the bilateral regions, and anterior occluding units, (i.e. pairs of opposing canines and incisors that support occlusion) were identified from clinical photographs taken under field conditions. Interview schedules were conducted using structured questionnaires, which included socio-demographic details, perceived chewing ability, satisfaction / dissatisfaction with chewing ability and Kiswahili version of the Oral Impacts on Daily Performances (OIDP) and also questions regarding their perceived general and oral health conditions.

Data were analyzed using Statistical Package for Social Scientists, SPSS versions 13 and 14. Cross tabulation and Chi-square statistics were used to assess bivariate relationships. Prevalence of tooth loss and risk indicators for tooth loss, reduced premolar/molar support, dissatisfaction with chewing ability and having any oral impacts (OIDP >0), were estimated by stepwise logistic regression, with 95% confidence interval (CI) given for the odds ratios indicating statistically

significant relationship if both values were above or below 1. Psychometric properties of the Kiswahili version of OIDP were assessed using Mann-Whitney U test and Kruskal-Wallis test. Weighted prevalence of OIDP was also assessed. To adjust for the effect of the cluster design, re-analyses were conducted with STATA 9.0 and 9.2 using the svylogit command.

Results: The mean DMFT of older adults was 6.7 SD=6.4 and 5.6 SD=5.6, for the urban and rural subjects, respectively. Over eighty three percent had experienced at least one tooth lost due to any reason, due to caries 61.7% and due to other reason than caries, 29.2%. The mean tooth loss was 6.1 SD=6.4 and 5.9 SD=6.6 among older adults in the urban and rural areas, respectively.

Predictors of prevalence of tooth loss due to caries associated with being a female, living in urban areas, having 2 or more decayed teeth and attending a dental clinic mainly when having problems. While prevalence of losing teeth due to other reasons than caries associated with being male and over 60 years of age, being most poor, having mobile teeth, not attending a dental clinic and confirming use of tobacco.

In total, 38.8% reported problems with chewing at least one food item and 23.3% were dissatisfied with their chewing ability. Those with reduced anterior and posterior occluding units were more likely to report problems with chewing any food. Subjects dissatisfied with their chewing ability were less likely to be females (OR=0.6) and more likely to have reduced anterior/posterior occluding units (OR=3.4), to report dental pain (OR=2.5), chewing problems (OR=4.7) and OIDP (OR=3.2). The OIDP scores discriminated between satisfied and dissatisfied groups irrespective of confirmed chewing problems.

The Kiswahili version of OIDP demonstrated good construct and criterion validity. The OIDP inventory varied systematically in the expected direction with the reported perceived oral health status and perceived chewing ability. The weighted prevalence of oral impacts of older adults in urban and rural areas was 51.2% and 62.1%, respectively. The most prevalent impact was eating

and perceived causes of impacts being mostly tooth ache. The impacts were prevalent among the rural than urban older adults.

Conclusion: The study showed that, caries was the principle cause of tooth loss and molar teeth were the teeth most commonly lost. Tooth loss due to caries and due to reasons other than caries was differently related to disease- and socio- behavioral risk factors. Community dwelling older adults had prevalent chewing problems and dissatisfaction with chewing ability. Oral impacts affecting their performances, using a Kiswahili version OIDP inventory, were relatively common but not very severe. Clinical measures of dentition status together with reported functional- and psychosocial impact scores determined subjects' evaluation of their chewing ability and should be taken into account when estimating treatment needs.

Introduction

Outline of the thesis

The overall goal of the three papers constituting the present thesis was to provide information regarding the status of oral health in older Tanzanian adults (50 years of age and older) in terms of tooth loss, reduced occlusal support, symptom status, functional disadvantage or oral impacts on daily performances and overall oral health perceptions. Such information is of importance for the planning and implementation of oral health care interventions among the older age groups of the Tanzanian population. The thesis also addresses risk indicators pertaining to the oral health status of older adults resident in socio-economically diverse areas of Tanzania. So far, epidemiological studies conducted in Tanzania have primarily considered children and adolescents, and little is known when it comes to the oral health situation of the older adults (Luhanga and Ntabaye, 2001, Sarita et al., 2004). The majority of older people in Tanzania belong to the poorest and most vulnerable groups of the population, especially in rural areas, having difficulties in meeting their basic needs and having limited access to health and oral health services (Luhanga and Ntabaye, 2001, Ministry of Labor; Youth development and Sports, 2003). Oral health promotion programs have been included in the School Health Program and in the Mother and Child Health (MCH) clinics, aiming at fostering proper oral health behavior among school age children and mothers of 0-5-year-olds, respectively (Ministry of Health and Social Welfare, 1988). There are, however, no systematic surveillance systems to address oral health issues of older age groups of the Tanzanian population. The magnitude of significance of this age group should not be underestimated due to the considerable change in demography of the world, with a rapid increase in the proportion of elderly people, referred to as the aging population. Aging population refers to a decline in the proportion of children and young people, and an increase in the proportion of elderly people 60 years and above (WHO, 2002). It is speculated

that, in the next half of a century, there will be a total of about 2 billion elderly people with 80% of them living in the developing countries. This situation has been ascribed to a decrease in fertility rates and increasing longevity despite setbacks in life expectancy in the developing countries (WHO, 2002). This situation might create tremendous challenges to health and social policy planners due to the concurrent shift of disease patterns from infectious to non-communicable, chronic diseases (Petersen and Yamamoto, 2005).

Oral health in older people

Oral health has been defined as a comfortable and functional dentition which allows individuals to continue in their desired social role (Dolan, 1993). Apart from oro-pharyngeal cancers and immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) - related oral disease, oral diseases such as dental caries, periodontal disease, tooth loss, oral mucosal lesions and oro-dental trauma, though not life threatening, constitute major public health problems worldwide (Myburgh et al., 2004, Petersen et al., 2005). This is due to their high prevalence, public demand and their impact on the quality of life of individuals and communities. There has been great improvements in oral health of populations in several countries, but problems still persist among underprivileged both in developed and developing countries (Petersen, 2003).

Globally, poor oral health among older people has been assessed in terms of high levels of tooth loss, dental caries experience, high prevalence rates of periodontal disease, xerostomia and oral precancer / cancer (Schou, 1995). Deterioration of oral health with increasing age has been reported in a number of epidemiological studies in terms of; increasing number of teeth lost, higher prevalence of dental caries, poor oral hygiene, presence of calculus, gingival recession and deep probing depth (Baelum et al., 1997, Milstein and Rudolph, 2000). Moreover, studies show

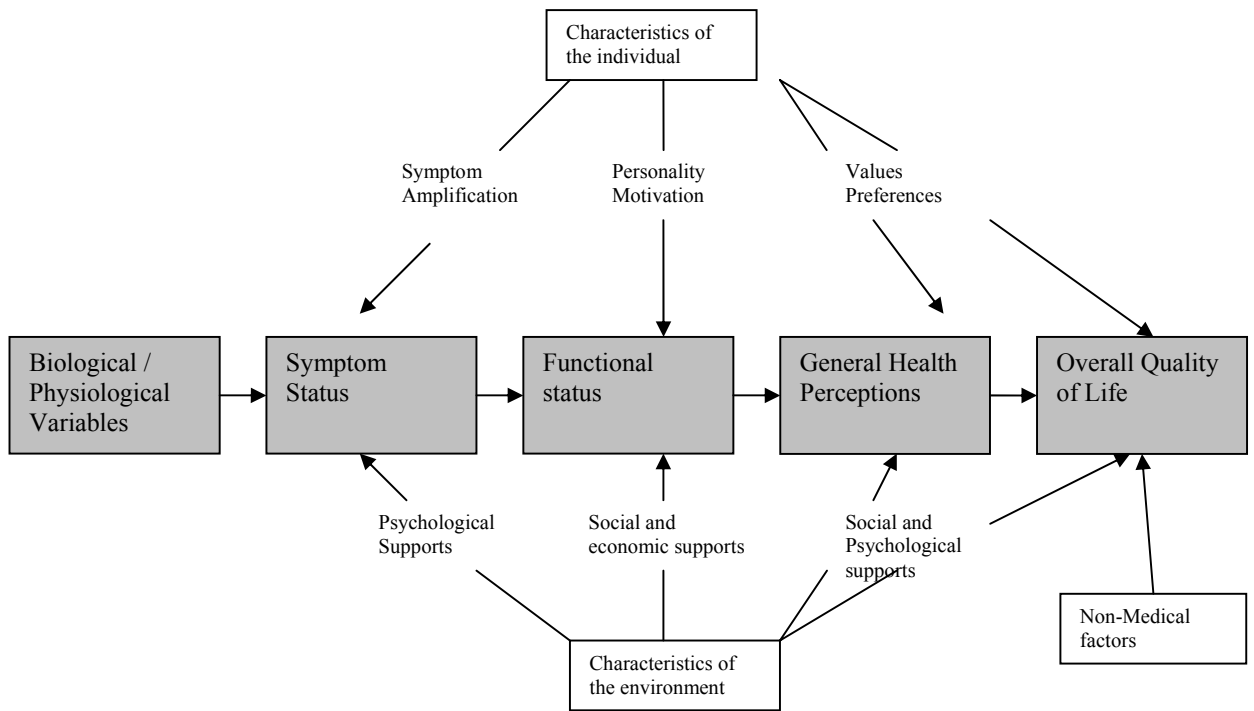
an increase in percentage edentulousness with increasing age (Steele et al., 2000, Petersen et al., 2004, Beltran-Aguilar et al., 2005).

Conceptual model guiding the papers in the thesis

The conceptual framework guiding papers I to III presented in this thesis is adapted from the model by Wilson and Cleary (1995) (Figure 1). This model integrates two different paradigms of health: the clinical paradigm and the socio-environmental paradigm. The former focuses on the biological / physiological clinical parameters whilst the latter paradigm focuses on the dimensions of functioning and overall well-being (Wilson and Cleary, 1995). This model has five levels, assuming that, tooth loss; '*the biological and physiological variable*' (which focuses on the organ or organ system and is applied in routine clinical practice) may influence '*symptoms*' at the second level hence the focus shifts from the organ to the organism as a whole. Symptom denotes a patient's perception of an abnormal physical, emotional or cognitive state in this case inability to chew food adequately and experience of pain and dry mouth. Symptom status in turn influences '*Functioning*' the ability of the individual to perform certain domains of functioning such as performing ones daily activities (physical, social, role and psychological function). Subjective ratings and integration of the above health concepts may affect an individual's perceived general and oral health status at the '*General health perceptions*' level, which in turn determines the '*overall quality of life*' level (Figure 1). Whilst this model highlights the dominant relationships between the main adjacent levels of oral health outcomes as depicted in Figure 1, it is also assumed that there might be direct and indirect (mediated) relationships between variables at non-adjacent levels. For example the impact of tooth loss and reduced occlusal support at the clinical level on overall well-being and satisfaction with chewing and oral health status is likely to be mediated by symptom status and functional disadvantages. Also indicated by this model

(Figure 1) is the fact that non-medical factors in terms of individual and environmental characteristics influence oral health outcomes at the various levels as well as the relationships among the various outcomes.

Figure 1. A conceptual model of oral health



(Wilson and Cleary, 1995)

Tooth loss - Paper I (Biological and physiological level)

Loss of teeth (tooth mortality) is generally the result of disease processes and it may, therefore, be classified as an oral problem. However, the most common oral diseases, dental caries and periodontal disease, have not been considered the sole causes of edentulousness. Other factors such as attitudes, behavior, dental attendance and characteristics of the health care system, and socio-economic factors, to name a few, also play an important role regarding the probability of becoming edentulous (Zarb and Schmitt, 1997). Tooth loss being the final common pathway for most dental diseases and conditions, is considered an important indicator of oral health of a population; providing information regarding the prevalence of dental diseases as well as the availability and adequacy of dental services in a population (Klock, 1995).

Table 1 presents cross sectional and longitudinal studies from industrialized countries, considering the prevalence/incidence of tooth loss i.e. losing at least one tooth (or mean number of remaining teeth) and edentulousness (complete loss of all natural teeth), in various age groups and according to various risk factors/risk indicators. As shown in Table 1a, the prevalence rates of edentulousness ranges from 6% among Finnish adults to 36% among adults in the United Kingdom. (Suominen-Taipale et al., 1999, Steele et al., 2000). Tooth loss in terms of mean number of remaining teeth has been reported to range between 17 to 21 among Norwegian and Swedish elderly 65 years of age and older-, suggesting that there has been improvements in oral health of those populations across time (Ainamo and Osterberg, 1992, Suominen-Taipale et al., 1999, Henriksen et al., 2003, Osterberg et al., 2006). Mean number of remaining teeth has been reported to range from 19.4 among people 60 years and older in the USA to 24.8 among people aged 16 years and above from UK (Steele et al., 2000).

Table 1. Studies conducted in industrialized countries, published between 1986 and 2006 concerned with prevalence / incidence of tooth loss and edentulousness and their associated risk indicators/risk factors.

Author(s)	Country	Area	Year Examined	I / CD	Age (years)	N	% tooth loss	% edentulous	Risk indicators identified
<i>Cross-sectional (prevalence) studies</i>									
Suominen-Taipale et al., (1999)	Finland	U & R	1978 and 1997	CD	15-64	5037 - 3418	77-60	14 to 6	Older age; Rural areas Low education Perceived poor oral health
Steele et al., (2000)	United Kingdom	U&R	1998	CD	≥ 16	3817	24.8*	36	Older age Dental caries Low social class; Region
Dolan et al., (2001)	U.S.A	U&R	1994	CD	45+	5254	-	19	Older age; Rural areas Poor general health Low SES; White
Henriksen et al., (2003)	Norway	U&R	1996/99	Both	67+	582	17*	31.6	Northern Norway
Petersen et al., (2004)	Denmark	U&R	2000	CD	65+	3002	-	36	Low education / income Not receiving childhood dental care
Beltran-Aguilar et al., (2005)	U.S.A NHANES	U&R	1999-02	CD	(60+)	3011	19.4*	24.9	Older age; Blacks Low income / education Smokers
Osterberg et al., (2006)	Sweden	U	2000/01	CD	70	484	20.9*	7	Low education Smoking Un married High waist circumference Physical inactivity

Table 1. continued on next page.

Table 1. (continued)

Author(s)	Country	Area	Year Examined	I / CD	Age (years)	N	% tooth loss	% edentulous	Risk factors identified
<i>Longitudinal (incidence) studies</i>									
Burt et al., (1990)	U.S.A	-	1959 to 1987 (28 years)	CD	-	167	60.3	14.4	LPA \geq 4mm Number of teeth present
Hand et al., (1991)	U.S.A	R	-	CD	65+	-	40.0	-	Males
Locker et al., (1996)	Canada	U&R	1989 to 1992 (3years)	CD	50+	491	23.2	1.2	LPA \geq 4mm
Baelum et al., (1997)	China	R	1984 to 1994 (10years)	CD	60+	86	96.0	-	Older age Dental caries LPA \geq 7mm Mobile teeth
Slade et al., (1997)	Australia	U&R	1991/92 (2years)	CD	60+	693	19.5	0.7	Men; Not brushing More missing teeth Recent extraction Root decay; Smokers Periodontal pockets / recession
Fure and Zickert, (1997)	Sweden	U	1987 to 1992 (5years)	CD	60,70 and 80	148	40	1.0	Older age Men Dental caries
Warren et al., (2002)	U.S.A	R	1983 to 96/98 (13-15 years)	CD	\geq 65	73	62	4.1	Severe LPA
Haugejorden et al., (2003)	Norway	U&R	1999 to 2000 (1year)	CD	20-79	2511	6.5	-	Lower education
Klein et al., (2004)	U.S.A	R	1998 to 2000 (2years)	CD	53-96	2794	68.2	15.3	Older age Cigarette smoking Heavy drinking Diabetes Low education

U – Urban

I – Institutionalized

* mean number of remaining teeth.

R – Rural

CD – Community Dwelling

LPA - Loss of periodontal attachment level

Table 2 provides an overview of cross-sectional studies concerning the prevalence of tooth loss and edentulousness in various age groups of populations living in non-industrialized countries. In most parts of Africa, the prevalence of tooth loss (≥ 1 lost tooth) are reported to range from 48% (6 – 85-year-olds in Kenya) to 96% (40 years and older in rural Tanzania) (Sanya et al., 2004, Mumghamba and Fabian, 2005). In contrast, one hundred percent of the examined urban residents and about 98% of the semi-urban residents in Sri Lanka had lost at least one tooth (Ekanayake and Perera, 2004, Pallegedara and Ekanayake, 2005). In Tanzania, like most other developing African countries, the prevalence of edentulousness among adults in rural and urban areas was reported to be low, ranging from 0.5% among adults 20 years and older to 2.5% among 40 year olds and above (Sarita et al., 2004, Mumghamba and Fabian, 2005). Contrary to the findings in most African countries, the prevalence of edentulousness among elderly 60 years and above has been reported to range from 15% in India to 27% in Sri Lanka (Shah et al., 2004, Ekanayake and Perera, 2004). Change in life style such as increase in sugar- and tobacco consumption together with inadequate exposure to fluorides in low income countries, coupled with inadequate health care use and type of services rendered, is expected to have detrimental oral health impacts (Sheiham et al., 1985, Gilbert et al., 2003, Petersen, 2004). This will create a ‘double burden of disease’, in those countries that are still afflicted with infectious diseases (Petersen, 2003).

Table 2. Studies conducted in non-industrialized countries, published between 1986 and 2006 concerned with prevalence of tooth loss and edentulousness and their associated risk indicators.

Author(s)	Country	Area	Year Examined	I / CD	Age (years)	N	% tooth loss	% edentulous	Risk indicators identified
Baelum and Fejerskov, (1986)	Tanzania	U&R	1982	CD	≥50	42	90	-	Dental caries Periodontal disease
Manji et al., (1988)	Kenya	R	1985-1986	CD	55-65	224	90	0.3	Dental caries Periodontal disease Traditional practice extraction Older age
Hamasha et al., (2000)	Jordan	U&R	-	CD	45+	285	14.7*	0	Males; Older age Smoking; Not brushing Low income / education
Naidoo et al., (2001)	South Africa	U&R	1998	-	45-65+	13,800	80-91	6-29	Older age Urban Low education
Ekanayake and Perera (2004)	Sri Lanka	U	-	Both	≥ 60	235	100	27	High OHIP score
Sanya et al., (2004)	Kenya	-	2001	CD	6-85	722	47.8	0	Female; Dental caries Periodontal disease Traditional practice
Shah et al., (2004)	India	U&R	-	CD	60+	1240	-	15.2	Rural; Older age; Low SES / education
Sarita et al., (2004)	Tanzania	U&R	1998-2000	CD	≥60	5532 ()	95	0.5	Older age
Mumghamba and Fabian, (2005)	Tanzania	R	-	CD	≥ 40	206	95.6	2.4	Older age Chewing stick
Pallegedara and Ekanayake, (2005)	Sri Lanka	Semi-U	-	CD	60 - 98	630	98.3	17	Older age; Female Low income
Susin et al., (2005)	Brazil	U	2001	CD	30-103	974	94.4	-	Female; Older age Smoking; Dental caries Attachment loss Low SES
Taiwo and Omokhodion, (2006)	Nigeria	-	-	CD	≥ 65	690	52	1.3	Periodontal disease Older age

U – Urban

I – Institutionalized

R – Rural

CD – Community Dwelling

* mean number of remaining teeth.

Risk indicators for tooth loss

The term risk is very often used to express the probability that a particular outcome (usually bad) will occur, following a particular exposure – for instance tooth loss (Burt, 2005). In order to establish a risk factor which involves causality, prospective studies are required. Cross-sectional data provide information about risk indicators since exposure and outcome data are collected at the same time (Burt, 2005). A risk indicator may be a probable risk factor, but causality cannot be inferred from cross-sectional data alone. For this reason, in this thesis, correlates of tooth loss are referred to as ‘risk indicators’ since it utilized cross sectional data.

Despite the achievements in oral health, in most developed countries, disparities still remain (Beltán-Aguilar et al., 2005). A few groups that are at risk bear most of the burden both in the developed and developing countries (Tables 1 and 2). Similar findings have been reported in a study from Great Britain (Watt and Sheiham, 1999). According to the risk indicators for tooth loss and edentulousness identified (for overview see Tables 1 and 2), partial and total tooth loss is still associated with the disadvantaged and socially marginalized groups of the populations, meaning that those with low education / income and belonging to a low social class are the groups most seriously affected (Suominen-Taipale et al., 1999, Dolan et al., 2001, Petersen et al., 2004). With regard to geographical areas, those living in the rural areas of developed countries and urban areas of developing countries are reported to have the highest prevalence/incidence of tooth loss. Furthermore, people who rated their oral and general health as poor were found to be at high risk of losing teeth (Suominen-Taipale et al., 1999, Dolan et al., 2001).

Dental caries and periodontal disease as biological factors, have featured as risk factors and indicators of losing teeth in several studies emanating from both developed and developing

countries (Tables 1 and 2). This has been verified in longitudinal studies , indicating that: clinical factors such as untreated decayed teeth, deep periodontal pockets $\geq 4\text{mm}$, and attachment loss $\geq 4\text{mm}$, plaque and increased tooth mobility have been seen to increase the risk of losing teeth (Table 1) (Locker et al., 1996, Slade et al., 1997, Warren et al., 2002).

The term ‘demographic factors’ is used for risk factors that are not modifiable, such as age, gender and ethnicity (Burt, 2005). Evidence for a link between older age and tooth loss has been documented in several cross-sectional and longitudinal studies reported both from developed and developing countries. Furthermore, gender has been reported to be associated with tooth loss in some studies but not in others (Tables 1 and 2). Similarly, the National Health and Nutrition Survey (NHANES) in the U.S.A report that generally, non-Hispanic black adults were more at risk of losing teeth than other races (Beltran-Aguilar et al., 2005).

Lifestyle related risk factors such as poor dietary choices, tobacco and excessive alcohol consumption and poor oral hygiene have been reported to be associated tooth loss (Table 1 and 2). Dietary habits influence the development of dental caries, likewise, tobacco use (in different forms) and excessive alcohol consumption are associated with aggravation of periodontal breakdown and consequently tooth loss (WHO, 2002, Petersen, 2003).

Chewing difficulties Paper II (Symptom status level)

The number and distribution of teeth in the oral cavity may interfere with efficiency of oral function in terms of ability to chew. Being able to bite and chew is considered to be particularly important in older people and might influence their nutritional status (Sheiham et al., 1999). Moreover, oral conditions, such as dry mouth and discomfort / pain associated with dental caries and periodontal disease may affect chewing ability (Ikebe *et al.*, 2001). Impaired masticatory function has been reported to be one of the factors that influence food choices and consequently have detrimental effects on health, due to reduced intake of some key nutrients from foods perceived as difficult to chew (Krall et al., 1998, Sheiham et al., 1999, Mojon et al., 1999, Walls et al., 2000). Furthermore, inefficient chewing ability may increase the likelihood of over preparing / cooking of foods in an effort to make consumption practical, while in the process, lose a number of nutrients (Walls et al., 2000, Anastassiadou and Heath, 2002). A study of the relationship between oral health status and nutritional deficiency among frail older adults (85+ years) in Switzerland, report on a significant reduced Body Mass Index and serum albumin concentration among elderly with compromised oral functional status (Mojon *et al.*, 1999). It has been advocated that having 20 well distributed teeth is necessary to satisfy biting and chewing ability (Kayser, 1981). A study done among Tanzanian adults aged 20 years and above to determine chewing ability of subjects with shortened dental arches (SDA defined as a dentition with reduction of teeth starting from posterior) showed that perceived difficulty of chewing increased with decreasing numbers of occluding pairs of teeth (Sarita *et al.*, 2003). It was concluded that, an SDA comprising 20 teeth (intact anterior region and four pairs of occluding posterior teeth), can provide satisfactory chewing ability for soft foods but not for hard foods (Sarita *et al.*, 2003). Objective evaluations of masticatory ability in terms of recording bite force,

have also showed that individuals with 20 or more remaining teeth had the highest score for bite force (Tatematsu et al., 2004).

Oral impacts on daily performances (OIDP) Paper III (Functional status level)

To assess the functional status level according to Wilson and Cleary's (1995) model (Figure 1), this thesis utilized the OIDP, which features as the ultimate impacts according to the World Health Organization's International classification of impairment, disability and handicap model (ICIDH) (Figure 2) discussed later in this chapter (WHO, 1980).

Emerging consensus in the literature has identified oral health related quality of life (OHRQoL) as a multidimensional construct containing physical, social and psychological domains (Slade, 1997b). Over the years several socio-dental indicators have been developed, ranging from single item indicators to composite inventories or scoring systems, covering the aforementioned OHRQoL domains. The indices are requested to be simple to use, reliable, valid, precise, acceptable, amenable to statistical analysis, correspond to decision making criteria and to be supported by a relevant theoretical model.

In order to capture the non-clinical aspect of oral diseases, socio-dental indicators were developed and advocated by Cohen and Jago (1976). A remarkable increase in development and testing of oral health related quality of life (OHRQoL) measures, their use in health surveys, clinical trials and studies evaluating oral health service has been noted over the past decade or two. Considerable efforts have been invested by research groups internationally to develop ways of measuring impacts of diseases on well-being and quality of life. A number of research tools

are developed and modified that focus on subjective measures (which address perceptions, feelings and behaviors) to assess health, well-being and quality of life (Slade, 1997b).

These instruments, or socio-dental indicators, developed to assess the functional, social and psychological outcomes of oral disorders, are similar in that they are theory based and rely on self-report measures (Slade, 1997b, Buck and Newton, 2001). They vary, however, in terms of length, content, sub-scale structure, response format and methods of obtaining quality of life scores. As concluded in a recent review by Slade et al., (1998), no single instrument can be regarded as a gold standard set of questions.

The OHRQoL indicators are to a varying extent based on the conceptual framework derived from the World Health Organization's (WHO) International Classification of Impairment, Disabilities and Handicaps (ICIDH) which has been amended for dentistry by Locker (1988, WHO, 1980) (Figure 2). The ICIDH provides a basis for the empirical exploration of the links between different dimensions or levels of consequence variables and consists of the following key concepts: impairments, functional limitations, pain and discomfort and disability and handicap. Impairments refer to the immediate biophysical outcomes of disease, commonly assessed by clinical indicators. Functional limitations at the second level are concerned with functioning of body parts whereas pain and discomfort refer to the experiential aspects of oral conditions in terms of symptoms. In addition to dissatisfaction with dental appearance, they comprise the intermediate impacts, caused by oral health status. Any of the dimensions mentioned at the first and second level may lead to the third level of outcomes which refer to any difficulties in performing activities of daily living and to broader social disadvantages – named “ultimate

impacts” and corresponding to the WHO and Locker’s concept of disability and handicap (WHO, 1980, Locker, 1988).

Figure 2. Theoretical Framework of consequences of oral impacts

(Modified from WHO’s International Classification of Impairment, Disabilities and Handicaps)

(WHO, 1980)

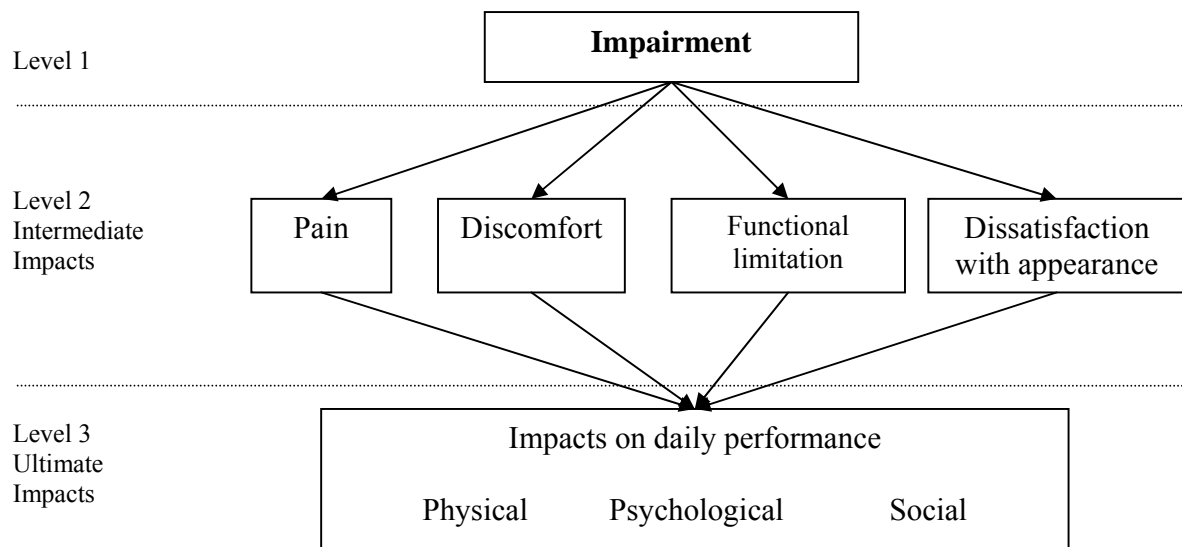


Table 3. Oral Health Related Quality of Life instruments, their abbreviations, number of items contained and original reference.

Instrument	Abbreviation	Number of items	Original Reference
Oral Health Impact Profile	OHIP-49	49	Slade & Spencer, (1994)
Oral Health Impact Profile OHIP-14	OHIP-14	14	Slade, (1997a)
UK Oral Health Related Quality of Life Measure	OHQoL-UK	16	McGrath & Bedi, (2001)
Oral Impacts on Daily Performance	OIDP	9 (8)	Adulyanon & Sheiham, (1997)
Geriatric (General) Oral Health Assessment Index	GOHAI	12	Atchison & Dolan, (1990)
Orthognatic Quality of Life Questionnaire	OQoLQ	22	Cunningham et al., (2000)
Oral Health Impact Profile (OHIP-EDENT)	OHIP-20	20	Allen & Locker, (2002)

Table 3 lists a number of the widely applied OHRQoL instruments (Skaret et al., 2004).

Unlike the other measures, the Oral Impact on Daily Performance scale (OIDP) concentrates only on the third level of measurement of the ICIDH theoretical framework, thus demonstrating strong theoretical coherence and reducing the possibility of double scoring of the same oral impacts at different levels (Tsakos et al., 2001). Considering respondent burden, this instrument is advantageous for use in population surveys, not only in terms of being easier when measuring behaviors rather than feeling states, but also in being short. The OIDP consists of 9 (8) items that covers the physical, psychological, and social dimensions of daily living (Adulyanon et al., 1996). This indicator is originally calculated by multiplying frequency and severity scores of

daily performances, providing an overall score for each OIDP item. Since its development, the OIDP has been adopted for epidemiological studies of populations of various ages and has proved to be reliable and valid. Table 4 shows a number of observational epidemiological studies considering the prevalence of OIDP in various age groups and socio-cultural contexts. Studies of patients with specific disorders and interventional studies are not included in the table.

Table 4. Population based studies from industrialized and non-industrialized countries published between 1996 and 2007 concerning the prevalence of OIDP (OIDP>0), prevalence of various performances affected and causes of impacts.

Author	Country (s)	Inst/ free living	Age	N	Prevalence of oral impacts -%	Reported most affected performance (%)	Causes of impacts
Adulyanon et al., (1996)	Thailand	-	35- 44	501	73.6	Eating - 49.7 Emotion-46.5 Smiling – 26.1	Pain and discomfort - toothache
(Tsakos et al., 2001)	Greece	Free living	65	681	39.1 (47.6 edent.)	Eating - 29.9 (41.2)	-
	Great Britain			753	12.3 (16.3 edent.)	Eating – 7.5 (11.9)	
Srisilapanan and Sheiham (2001)	Thailand	-	60-74	707	52.8	Eating - 47.2	Functional limitation Pain
Masalu et al., (2003)	Tanzania	University students	19-45	1123	51.0	Eating – 40.0	-
Astrom and Okullo (2003)	Uganda	-	13-19	1146	62.0	Eating – 44.0 Cleaning – 35.0	-
Gherunpong et al., (2004)	Thailand	-	11-12	1126	89.8	Eating - 72.9	Sensitive tooth Oral ulcer Toothache
Soe et al., (2004)	Myanmar (Burma)	-	14	543	15.8	-	-
Tubert-Jeannin et al., (2005)	France	-	10	414	73.2	Eating – 43.5	Badly positioned teeth Ulcers; Erupting teeth Bleeding gums
Michel-Crosato et al., (2005)	Brazil	-	6-15	513	10.2	Cleaning – 40.9 Eating – 40.4	-
Astrom et al., (2006)	Norway	Free living	16-79	1309	18.3	Eating – 11.3 Cleaning – 5.4	-
Yusuf et al., (2006)	United Kingdom	-	10-11	228	40.4	Eating – 23.2 Cleaning – 18.0	-
Dorri et al., (2007)	Iran	Free living	20-50	285	64.9	Eating – 35.1	Toothache

Satisfaction / dissatisfaction with oral health /chewing ability-Paper II and III (General health perceptions and overall quality of life)

Single question measures that ask about how an individual rates his or her current health status are known as global measures of health and oral health (Jokovic et al., 2005). They are advantageous over multi-item measures in that they are not time consuming and provide a summary of how people perceive their health- and oral health conditions (Jokovic et al., 2005).

Measures of oral health perceptions constitute an important additional component to the information about health status, as they are personal judgments and evaluations of one's own health status, integrating different components, such as, disease, functioning, symptoms and feelings (Stewart, 1998). These measures are, therefore, useful in provision of reliable data to promote health, disease prevention programs and for allocation of health resources (Fitzpatrick et al., 1992). Global oral health ratings among older adults have been seen to have a positive associations with symptoms, dysfunction and disability (Locker et al., 2005).

Purpose of the study

In Tanzania like many other African countries treatment of oral diseases such as dental caries is costly and hence resources are allocated to emergency oral care and pain relief (Petersen et al., 2005). Older adults suffer from accumulation of untreated oral diseases that impact their quality of life (Sheiham, 2005). Studies related to the consequences of unavailability of restorative care for the Tanzanian population, have not been addressed in terms of oral function and OHRQoL. Reduction in the number of missing teeth in the elderly was a primary objective of the WHO / International Dental Federation Goals for the year 2000. This thesis applies a household survey to contribute new information regarding the oral health status of Tanzanian adults 50 years and older by reporting on clinical as well as non-clinical oral health indicators.

Aim

The main aim of the study is to provide information regarding oral health status, in terms of tooth loss, oral health related quality of life and satisfaction / dissatisfaction with chewing ability and risk indicators of those oral health indicators among older adults in Pwani region and Dar es Salaam city. This information is pivotal for the planning and implementation of programs aimed at promoting oral health of older adults in Tanzania.

Research questions

Paper I: Clinical and socio-behavioral correlates of tooth loss: a study of older adults in Tanzania.

Focusing 50 year olds and above, this study assessed:

1. Prevalence, extent and correlates of tooth loss due to various reasons.
2. Frequency and correlates of posterior occluding support.

Paper II: Chewing problems and dissatisfaction with chewing ability: a survey of older Tanzanians.

In this study, it was hypothesized that:

1. The prevalence of reported chewing problems would increase with reduced posterior/anterior occluding support.
2. Dissatisfaction with chewing ability would increase with reduced number of posterior/anterior occluding units, increased frequency of chewing problems and increased oral disadvantage in terms of OIDP scores.

Discrepancies between self-reported chewing problems and dissatisfaction with chewing ability were explored.

Paper III: Psychometric properties and the prevalence, intensity and causes of oral impacts on daily performance (OIDP) in a population of older Tanzanians.

The objective was to assess:

1. The validity and reliability of the Kiswahili version of oral impacts on daily performance (OIDP) inventory for use in a population of older adults in urban and rural areas of Tanzania.
2. The area specific prevalence, intensity and perceived causes of OIDP.

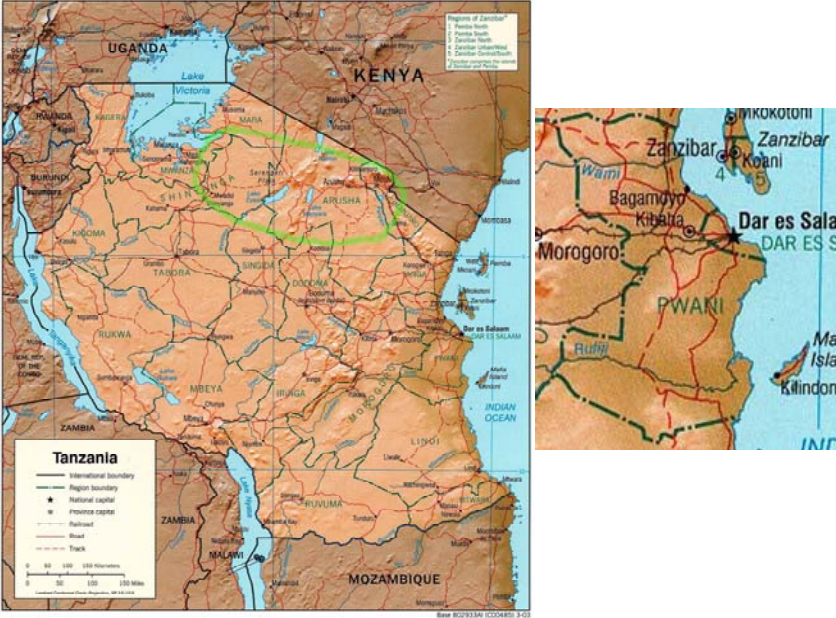
Materials and Methods

Study area

This study was conducted among older adults 50 years and above in two regions of Tanzania. Tanzania, one of the least developed countries, is located in the eastern Africa (Figure 3), with a total population of about 34 million, according to the 2002 population and housing census (<http://www.tanzania.go.tz/census/>), a gross domestic product (GDP) per capita of USD800 (<https://www.cia.gov/cia/publications/factbook/geos/tz.html>), and total health expenditure as percent of GDP (2003) of 4.3% (<http://www.who.int/countries/tza/en/>). About 78.2% of the population aged 15 years and above can read and write (<https://www.cia.gov/cia/publications/factbook/geos/tz.html>). Tanzania's national and official language is Kiswahili and almost all (more than 95%) of Tanzanians speak the language proficiently.

This cross sectional survey was conducted in Dar es Salaam city and Pwani region which constitute mostly urban and rural areas, respectively. The proportion of elderly aged 65 and above in Tanzania is about 4%, in Dar es Salaam and Pwani the proportions are 2% and 7% respectively. Dar es Salaam has a total population of approximately 3 times that of Pwani region, with highest population density in the country of 1,793 compared to 27 persons per square km for Pwani region. The districts have drinking water with fluoride content of about 1 mg fluoride/L (1 ppm). Older adults 50 years and above were recruited from two districts in Pwani region (Kibaha and Bagamoyo) and one in Dar es Salaam city (Kinondoni). The age of fifty years was chosen since the life expectancy has been at about 50 years and that most elderly retired at the age of 55 years.

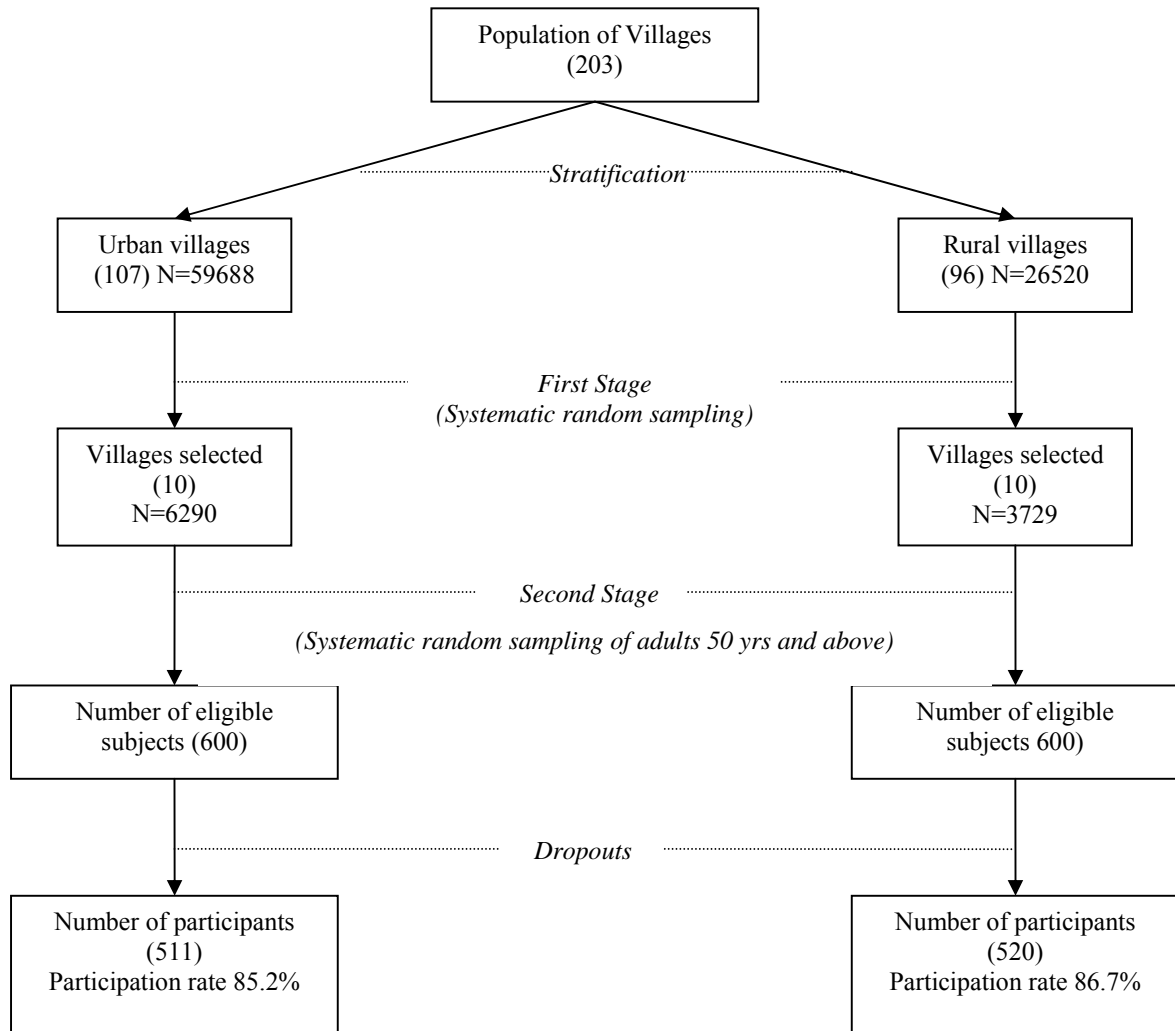
Figure 3. Map of Tanzania and Pwani region and Dar es Salaam city.



Sampling and procedure

The material for this survey which applies for paper I to III, was collected from November 2004 to June 2005. The sample size of 1200 older adults was estimated by assuming the prevalence rate of tooth loss and that of oral impacts of older adults of 50%, a precision of 4% and design effect of 2. Detailed description of sampling of older adults is described in respective papers I to III. Figure 4 shows selection procedure of older adults in Dar es Salaam city (urban) and Pwani region (rural).

Figure 4. Selection procedure.



A total of 1031 older adults (response rate 85.9%) participated in the interview followed by a clinical examination (Table 5). Test-retest of the clinical examination, involving 20 older adults three weeks after the main survey was also carried out. Test-retest for the interview could not be performed due to ethical requirements, whereby oral health education sessions and referrals were provided to participants after the clinical examination. A total of 967 good quality clinical

photographs taken under field condition were used to identify number of anterior occluding units (paper II).

Table 5. Total number of older adults who participated in the survey and percent response rate, according to place of residence.

Strata	Name of village	Participants (n)	Response rate (%)
Urban (n=511)	Ally Maua	60	100.0
	Kimamba	60	100.0
	Kwa Kopa	32	53.3
	Kwa Pakacha	32	53.3
	Mabibo	59	98.3
	Makuti 'A'	55	91.7
	Minazini	42	70.0
	Mwongozo	56	93.3
	Kisiwani	57	95.0
	Msewe	58	96.7
Rural (n=520)	Buma	48	80.0
	Dutumi	55	91.7
	Kerege	47	78.3
	Kiromo	48	80.0
	Kwa Matumbi	60	100.0
	Msata	60	100.0
	Ruvu Darajani	58	96.7
	Ruvu Station	51	85.0
	Vigwaza	33	55.0
	Visakazi	60	100.0
	Total	1031	85.9

The survey instrument

A structured interview schedule, including the OIDP inventory, questions on socio-demographic characteristics and other health and -oral-health issues was constructed in English (Appendix IV). The questionnaire had to be translated into Kiswahili (Appendix V), the national and official language in Tanzania. Description of the translation process has been provided in papers II and III.

Focus group discussion

Focus group discussion sessions were held separately for males and females in order to find out whether the OIDP items are applicable across culture, and to identify foods considered to be difficult to chew by older adults.

Clinical examination

One trained and calibrated dentist carried out all clinical examinations. A dentist was compared to an experienced clinician whose diagnosis served as the standard (gold standard) for comparison. For a detailed description of the clinical examination see papers I, II and III.

Characteristics of data and statistical analyses

Data were analyzed using the Statistical Package for Social Sciences (SPSS) versions 12, 13 and 14; and STATA version 9. Table 6 summarizes the statistical methods used for different papers.

Table 6. Statistical tests and methods that were used in papers I, II and III.

Statistical test / Method	Paper I	Paper II	Paper III
Chi-Square test	+	+	+
Cohen's Kappa	+	+	+
Principal Component Analysis	+	+	+
Logistic Regression	+	+	+
Spearman's Correlation Coefficient	-	-	+
Cronbach's alpha	-	-	+
Mann-Whitney U test	-	-	+
Kruska-Wallis test	-	-	+
Analysis of Variance (ANOVA-Post hoc)	-	+	-

Ethical clearance

Permission to carry out this study was given by the Research and Publication Committee at Muhimbili University College of Health Sciences, MUCHS, (Appendix II) regional and district administrative authorities, village leaders and from the ethical research committee in Norway, REK VEST (Appendix I). Informed verbal consent was obtained from all participating subjects (Appendix III).

Results

General

A total of 511 (participation rate 85.2%) urban and 520 (participation rate 86.7%) rural subjects between 50 and 100 years (mean age: 62.9, SD=10.6, men: 46.4%, no education: 44.7%), completed an extensive personal interview followed by a clinical examination.

Paper I: Clinical and socio-behavioral correlates of tooth loss: a study of older adults in Tanzania. The weighted prevalence of tooth loss due to any reason in the total population of Dar es Salaam and Pwani was 83.5 % (un-weighted 85.5%) , due to caries 61.7% (un-weighted 63.4%) and due to other reasons than caries, 29.2% (un-weighted 32.5%). The total scores of adults missing teeth due to caries and due to other reasons did not sum to 100% since some adults had lost teeth due to both caries and other reasons. A total of 87.9% urban and 77.3% rural had a reduced number of posterior occluding units (0-9). Compared to subjects having less than 5 teeth lost due to caries, those with 5 or more lost teeth were more likely to be females, having decayed teeth, confirming dental attendance and to be among the least poor residents. Compared to subjects who had lost less than 5 teeth due to reasons other than caries, those who had lost 5 or more teeth were more likely to be of higher age, having mobile teeth, being males, being very poor and to disconfirm dental attendance when having problems. Predictors of prevalence of tooth loss (1 or more lost teeth) due to various reasons and reduced number of occluding units followed similar patterns of relationships.

Paper II: Chewing problems and dissatisfaction with chewing ability: a survey of older Tanzanians.

In total 19.6% of the urban and 31.7% of the rural participants were dissatisfied with their chewing ability, whereas 37.1% urban and 43.1% rural had problems chewing at least one common Tanzanian food. The weighted prevalence of chewing problems and dissatisfaction for the total population was 38.8% (un-weighted 40%) and 23.3% (un-weighted 25%). Adjusted odds ratios, OR, for reporting problems with chewing any food were 1.6, 1.2 and 4.2 if having respectively, intact anterior/reduced posterior, reduced anterior/intact posterior and reduced anterior/posterior occluding units. The hypotheses were confirmed in that subjects dissatisfied with their chewing ability were less likely to be females (OR=0.6) and more likely to have reduced anterior/posterior occluding units (OR=3.4), to report dental pain (OR=2.5), chewing problems (OR=4.7) and oral impacts on daily performances, OIDP, (OR=3.2). The OIDP scores discriminated between satisfied and dissatisfied groups irrespective of confirmed chewing problems.

Paper III: Psychometric properties and the prevalence, intensity and causes of oral impacts on daily performance (OIDP) in a population of older Tanzanians.

The Kiswahili version of the weighted OIDP inventory preserved the overall concept of the original English version. Cronbach's alpha was 0.83 and 0.90 in urban and rural areas, respectively, and the OIDP inventory varied systematically in the expected direction with self-reported oral health measures. The respective prevalence of oral impacts was 51.2% and 62.1% in urban and rural areas. Problems with eating was the performance reported most frequently (42.5% in urban, 55.1% in rural) followed by cleaning teeth (18.2% in urban, 30.6% in rural).

More than half of the urban and rural residents with impacts had very little, little and moderate impact intensity. The most frequently reported causes of impacts were toothache and loose teeth.

Discussion

This section will consider methodological issues, and the main findings of the papers constituting the present thesis. In addition implications for oral health promotion for the older adults in Tanzania are discussed. A detailed discussion of the results is found in the individual papers included in this thesis.

Methodological issues

This thesis utilized data collected in a cross-sectional household sample survey that included an interview schedule and a clinical examination. A survey was utilized firstly, to provide estimates of clinical and self-reported oral health characteristics of the population of older adults in Tanzania (papers I and III), and secondly, to test statistical hypotheses regarding perceived oral functioning in this population (paper II). One of the main advantages of employing the sample survey method is that it yields information on many variables of a large number of people at a relatively low cost (Moser and Kalton, 1971). However, this approach may present several limitations which are discussed in detail in the separate papers. Some limitations are discussed below.

Reliability

A test is reliable to the extent that repeated measurements made under constant conditions will give the same result and is thus concerned with the degree of consistency or accuracy with which it measures an attribute (Moser and Kalton, 1971, Polit and Hungler, 1991). Measurement error plays a key role in reducing reliability; hence a reliable instrument minimizes the error component and maximizes the true component of a score. In this study, several measures were

taken to ensure data quality. They included training of research assistants, a pilot study done before the actual survey, and repeated checks during the data entry process.

For measurement of consistency, a sub-sample of older adults were re-examined clinically after a period of three weeks. Cohens' kappa statistics ranged from 0.51 for plaque score, to 1.00 for missing teeth due to caries, decayed teeth and posterior occluding support. Regarding measure of consistency for the anterior occluding units, random samples of 10% of the pictures of the subjects were re-assessed after two weeks, which gave kappa value of 0.85. However, due to ethical and logistical reasons, re-interviews could not be carried out hence could not be assessed for test-retest reliability estimation.

For internal consistency reliability estimation, a single test is administered on one occasion and the items are tested for homogeneity (Streiner and Norman, 2003). That is, all the items should be tapping different aspects of the same attribute (Streiner and Norman, 2003). Thus, the more homogenous the items, the higher the correlation (Cronbach's alpha) and therefore the more reliable the measure, indicating that, they measure the same underlying concept. In this study, the Kiswahili version of the OIDP inventory gave Cronbach's alpha of 0.83 among Kinondoni (urban) and 0.90 among Kibaha / Bagamoyo (rural) older adults, indicating exemplary internal consistency (Paper II) according to McDowell and Newell (1996). Item total correlation coefficient is the correlation of the individual item with the scale total omitting that item (Streiner and Norman, 2003). It is recommended that, the items should correlate with the total score above 0.20 for the instrument (test) to be reliable. Paper III shows that all the item total correlation coefficients for the OIDP inventory ($r \geq 0.42$), were above the recommended total score (Streiner and Norman, 2003).

Validity

An instrument is said to be valid if it measures what it purports to measure (McDowell and Newell, 1996). There are two aspects: internal validity deals with the question of whether a true measure is obtained for the subjects under study; and external validity, which relates to whether the findings can be generalized to a wider population (Moser and Kalton, 1971).

Internal validity

Acceptable reliability estimates obtained from the instruments utilized in this study do not necessarily ensure their validity. The most correct ways of obtaining correct diagnoses for decayed teeth and tooth loss would have required x-ray units, adequate lighting, etc. and patient's dental records to obtain reasons for tooth loss. The present study was conducted under field condition and assessment of causes of tooth loss chewing deficiencies and impacts on daily performances was conducted using self-report methods (Papers I-III), which are prone to recall bias. However, as reported in paper I, validity could be justified by positive associations between the self-reported missing teeth due to caries and due to other reasons than caries, and the clinical measures of decayed and missing teeth, respectively. Furthermore, predictive validity of self-reported chewing ability assessed by determining the level of agreement with the global measure of 'chewing all kinds of food' (see paper II), produced moderate level of congruence (Blicher et al., 2005). Studies show that self-reports have proven to be valid in assessing tooth counts although the validity varied with the degree of specificity required (Gilbert et al., 1997, Gilbert et al., 2002). Another threat to construct validity (construct validity is the degree to which an instrument measures the construct under investigation) of self-reports is social desirability, which indicates the respondents' tendency to represent a favorable image of one-self. Due to the fact

that the interviews were carried out at the respondents' home (before the clinical examination), and the nature of its content, this error has probably not played a major role in this study.

As construct validity is dependant on theory, the observed associations harmonizing the propositions of the Gilbert et al (1998) model (paper III) is as much a test of theory as of the validity of the measurements. Similarly, a recall of six months utilized in OIDP inventory has proved successful in a number of studies of adult populations (Table 4). Paper II describes in detail the validity of the Kiswahili version of the OIDP inventory.

To overcome misclassification due to field conditions when diagnosing dental status, mobile teeth, plaque score and number of posterior occluding units, the examining dentist was calibrated before the main survey. The dentist was compared to an experienced clinician whose diagnosis served as the standard (gold standard) for comparison. Furthermore, it was ensured that the clinical examinations adhered to the criteria set for field surveys by the World Health Organization (WHO, 1997).

External validity

A stratified – disproportionate – two stage cluster sample design was utilized in this study (Moser and Kalton, 1971). Using an equal sampling fraction to obtain a self-weighted sample would have provided an insufficient sample size for the rural area and difficulties with doing stratified analyses. For that matter, weighted estimates of the prevalence of tooth loss, dissatisfaction with chewing ability and reported chewing problems have been provided when combined figures for the urban and rural participants are presented. Utilization of cluster sampling design in this study was advantageous; firstly, for simplicity and cost effective reasons and secondly, practicability in underdeveloped areas with lack of adequate population register (Moser and Kalton, 1971). To avoid overestimating the standard errors of the estimates due to the relatively big clusters (i.e.

primary sampling units), data were transferred to STATA (version 9) and all estimates were adjusted for the design effect.

Response rates obtained in this survey of over 80% is considered to be good, according to the guidelines published for determining the adequacy of response rate in sample surveys (Locker, 2000). The study being a household survey might be the reason for such high response rates. However, lack of information regarding non-respondents is a limitation to this study.

The thesis is based on one urban and two rural districts only, which is probably not sufficient to generalize the findings to the whole country. However, comparison of some of the demographic distribution of selected villages and the rest in the regions revealed no differences hence the sample is likely to be representative of older adults in Pwani and Dar es Salaam region and constitutes a reasonable profile of rural and urban areas in Tanzania.

Cross cultural adaptation

Most measures of health related quality of life are developed in English and are intended for use in English speaking countries (Guillemin et al., 1993). It was therefore important to develop measures specifically designed for use in other non-English speaking populations like older Tanzanian adults, since cultural groups differ in disease expression and in use of various health care systems (Guillemin et al., 1993). However, this would be costly both in terms of time and money, hence translation and adaptation of health related quality of life measure (the OIDP-inventory) into Kiswahili was mandatory (paper III). In this study guidelines for cross cultural adaptation (paper III) were adhered to in order to preserve sensibility of the OIDP inventory among Tanzanian older adults (Guillemin et al., 1993). The interpretation of OIDP concepts was

further confirmed by the focus group discussions held among older adults 50 yrs and above, before the survey.

Findings

Urban rural differentials

This study has demonstrated that tooth loss, dissatisfaction with chewing ability, and impacts affecting the daily activities are substantial among the older adults investigated in this study showing prevalence rates of 83.5%, 23.3% and 55.5% (papers I-III). The findings reported in paper I with higher prevalence of tooth loss in urban Kinondoni (85.5%) than in rural Kibaha / Bagamoyo (82.1%), are consistent with what has been reported previously and might be attributed to better access to oral care among urban dwellers and to the treatment modalities employed i.e. removing a painful tooth by extraction (Petersen et al., 2005). Poor access to oral health care facility is further justified by the fact that a higher percentage of untreated decayed (55.4% vs. 46.0%) and mobile (22.7% vs. 16.2%) teeth were found among the rural subjects than their urban counterparts. The rural subjects have been reported to be disadvantaged when it comes to health care attendance, due to impaired mobility in rural areas with poor public transport, especially in developing countries (Walls and Steele, 2001, Petersen, 2003). Contrary to these findings, some developed countries report a high prevalence of tooth loss mainly among the rural subjects, with manifold explanations such as: internal migration by the young dentulous individuals to the urban parts of the countries, cultural / traditional aspects and also access to dental services and national economy (Suominen-Taipale et al., 1999, Henriksen et al., 2003). Generally, improvements in oral health in developed countries have been attributable to: enhanced awareness of dental health, fluoride use, and also greater access to dental care and

favorable dental insurance systems (Fure and Zickert, 1997, Walls and Steele, 2001, Petersen et al., 2004).

Chewing efficiency / ability are important components of oral function (Armellini and von Fraunhofer, 2004). These parameters can be objectively or subjectively evaluated; the former involves assessment of patient's ability to grind food while the later involves interviews of patients assessment of own chewing function (Armellini and von Fraunhofer, 2004). Single item global self-rating of perceived chewing ability and satisfaction / dissatisfaction with chewing ability were utilized in this study (paper II), whereby more rural than urban subjects reported having problems with chewing at least one food item (43% vs. 37%) and dissatisfied with chewing ability (32% vs. 20%). This was contrary to the previous study done among adults 20 years and above in Tanzania, which reported no difference in chewing ability between urban and rural subjects (Sarita et al., 2003). This difference might be attributable to difference in study population and design.

The observed urban - rural gradient on prevalence of oral impacts on daily performances is not astounding. A number of studies both in developed and developing countries report higher prevalence of impact among the disadvantaged group of the population (Adulyanon et al., 1996, Srisilapanan and Sheiham, 2001). Poor oral health can have a significant effect on quality of life (Petersen, 2003). As portrayed among the older adults examined in this study (paper III), more rural subjects rated their oral health as poor and had clinically detected poor oral health in terms of decayed and mobile teeth; and reduced anterior and posterior occluding units; which might affect their daily performances, more than urban subjects.

Oral health behavioral factors such as dental attendance, tooth brushing and tobacco use in different forms are preventable and related to lifestyle (Petersen, 2003). In this study a high percentage of participants attended a dentist when having problems, especially among the urban subjects, whereas only about a quota of the older adults attended a dentist in the previous two years (paper I). Tobacco was mostly used by the rural dweller (31% vs. 15%) and more than 70% reported to brush but plaque was reported in almost half of them. Change in attitude toward health and oral health to improved self care practices in oral care and general lifestyle, have been important in bringing improvements in oral health in developed countries (Petersen et al., 2004).

Socio-economic differentials

Socio-economic status in this study was assessed in terms of education level and family wealth. The family wealth index was constructed from household durable assets and has been used as a measure of socio-economic status in developing countries where conventional measure applied in occidental contexts in terms of occupation and income have shown to be difficult to use (Bollen et al., 2002). In these countries, having expensive household assets that are in working condition, reflect the income level of the household and also the degree of affluence of the family. Furthermore, the level of family affluence is of importance when it comes to use of health and dental health care services in these countries, where structured health insurance systems are limited. This indicator has been utilized before in studies from Uganda (Wamani, 2005). In this study urban dwellers were significantly more affluent and highly educated than rural dwellers. The least poor participants had more missing teeth due to caries while the poorest participants had lost more teeth due to other reasons than caries (paper I). This might be attributable to easier access to dental caries causing food substances by the affluent participants and also to health care services that provide extraction of teeth almost on routine basis. Contrary to these findings, in

developed countries the poor were most likely to loose teeth probably due to inability to afford treatment to preserve natural teeth. It has been reported that there are existing inequalities in restorative care related to economic factors among 35-44 year olds in the examined communities (Brunton et al., 2003). In Tanzania, retiring age was 55 years after which most of the retired older adults experience financial hardship to afford health care, including oral health care.

Age differences

Oral diseases are usually progressive and cumulative, and the interrelationship between oral and general health is more pronounced among older people (Petersen, 2003). In this study participants who were 70 years and above, had lost more teeth than their younger counterparts mostly due to other reasons than caries (paper I). On the other hand, aging was inversely related to perceived satisfaction with chewing ability and experience of oral impacts on their daily performances. Sarita et al (2003) reported that there were no significant differences in chewing ability among different age groups indicating a possibility that elderly people in developing countries might consider chewing difficulties as problems accepted as part of aging.

Implication

This study has contributed to the knowledge about extent and distribution of tooth loss, dental impacts on quality of life and perceived oral function of older adults in socio-economically different areas of Tanzania. This knowledge suggests a need to strengthen preventive and therapeutic dental services among this group of the population. In Tanzania there are relatively scarce resources available for oral health care, hence emphasis should be put on oral health education and promotion activities and simple procedures for dental treatment aiming at preserving teeth (paper I). The various risk indicators for tooth loss among older adults suggests

the need to review the health policy and methods for oral health promotion (Watt, 2003). Older adults are at risk of chronic / non-communicable diseases, other than dental caries, which are related to lifestyle. Adoption of the common risk factor approach should be employed, utilizing a holistic approach rather than a narrow disease focus in prevention of oral diseases and promotion of oral health (Sheiham and Watt, 2000, Watt, 2003).

Psychometric properties, in terms of reliability and validity were confirmed for the Kiswahili version of oral impacts on daily performances (OIDP) inventory and the global measures of oral health (perception of chewing ability), indicating that they are applicable in a cross-sectional survey of older adults in Tanzania (paper II and III). Self-reported oral health status and chewing ability together with socio-demographic variables, were significantly associated with the prevalence of oral impacts showing their importance in shaping the older adults responses to oral disorders. The study indicated that when assessing the oral health status of older adults, a more comprehensive picture was obtained by considering both objective (clinical) and subjective responses. It has been emphasized that oral health related quality of life (OHRQoL) measures cannot replace normative needs but should be used in combination in order to cover different dimensions of oral health (Tsakos et al., 2006).

Conclusions

This study of Tanzanian adults 50 years and older revealed that:

- The prevalence of tooth loss due to any reason was 85.5% and 82.1% in urban and rural areas, respectively. The prevalence (≥ 1 tooth) and extent (≥ 5 teeth) of tooth loss due to caries and due to reasons other than caries was greatest in the urban and the rural areas, respectively. Dental caries was the principal cause of tooth loss even at old age. Tooth loss due to caries and tooth loss due to other reasons than caries was closely but differently related to disease- and socio-behavioral factors. The prevalence of reduced posterior occluding support was 87.9% in urban and 77.3% in rural areas. Sex, age and degree of affluence were important risk factors of tooth loss and reduced posterior occluding support.
- Chewing inability and perceived dissatisfaction with chewing ability were prevalent among older Tanzanians. It was confirmed that subjects with reduced posterior and anterior occluding support reported chewing problems more frequently than their counterparts with complete anterior and posterior occluding support. Reduced occluding support and functional and psychosocial impact scores had a negative effect on subjects' overall evaluation of their chewing ability. This should be taken into consideration when estimating treatment needs.
- The Kiswahili OIDP inventory had acceptable psychometric properties among non-institutionalized adults 50 years and older in Tanzania. The areas specific prevalence of oral impacts (OIDP >0) was high, amounting to 51.2% in urban and 62.1% in rural areas. In both areas impacts on eating was most prevalent. The impacts affecting participants performances were relatively common but not very severe.

References

- ADULYANON, S. & SHEIHAM, A. (1997) Oral impacts on daily performances. IN SLADE, G. D. (Ed.) *Measuring Oral Health and Quality of Life*. Chapel Hill, University of North Carolina, Dental Ecology.
- ADULYANON, S., VOURAPUKJARU, J. & SHEIHAM, A. (1996) Oral impacts affecting daily performance in a low dental disease Thai population. *Community Dent Oral Epidemiol*, 24, 385-9.
- AINAMO, A. & OSTERBERG, T. (1992) Changing demographic and oral disease patterns and treatment needs in the Scandinavian populations of old people. *Int Dent J*, 42, 311-22.
- ALLEN, F. & LOCKER, D. (2002) A modified short version of the oral health impact profile for assessing health-related quality of life in edentulous adults. *Int J Prosthodont*, 15, 446-50.
- ANASTASSIADOU, V. & HEATH, M. R. (2002) Food choices and eating difficulty among elderly edentate patients in Greece. *Gerodontology*, 19, 17-24.
- ARMELLINI, D. & VON FRAUNHOFER, J. A. (2004) The shortened dental arch: a review of the literature. *J Prosthet Dent*, 92, 531-5.
- ASTROM, A. N., HAUGEJORDEN, O., SKARET, E., TROVIK, T. A. & KLOCK, K. S. (2006) Oral Impacts on Daily Performance in Norwegian adults: the influence of age, number of missing teeth, and socio-demographic factors. *Eur J Oral Sci*, 114, 115-21.
- ASTROM, A. N. & OKULLO, I. (2003) Validity and reliability of the Oral Impacts on Daily Performance (OIDP) frequency scale: a cross-sectional study of adolescents in Uganda. *BMC Oral Health*, 3, 5.
- ATCHISON, K. A. & DOLAN, T. A. (1990) Development of the Geriatric Oral Health Assessment Index. *J Dent Educ*, 54, 680-7.
- BAELUM, V. & FEJERSKOV, O. (1986) Tooth loss as related to dental caries and periodontal breakdown in adult Tanzanians. *Community Dent Oral Epidemiol*, 14, 353-7.
- BAELUM, V., LUAN, W. M., CHEN, X. & FEJERSKOV, O. (1997) Predictors of tooth loss over 10 years in adult and elderly Chinese. *Community Dent Oral Epidemiol*, 25, 204-10.
- BELTRAN-AGUILAR, E. D., BARKER, L. K., CANTO, M. T., DYE, B. A., GOOCH, B. F., GRIFFIN, S. O., HYMAN, J., JARAMILLO, F., KINGMAN, A., NOWJACK-RAYMER, R., SELWITZ, R. H. & WU, T. (2005) Surveillance for dental caries, dental sealants, tooth retention, edentulism, and enamel fluorosis--United States, 1988-1994 and 1999-2002. *MMWR Surveill Summ*, 54, 1-43.
- BLICHER, B., JOSHIPURA, K. & EKE, P. (2005) Validation of self-reported periodontal disease: a systematic review. *J Dent Res*, 84, 881-90.
- BOLLEN, K., GLANVILLE, J. & STECKLOV, G. (2002) Economic status proxies in studies of fertility in developing countries: Does the measure matter? *Population Studies*, 56, 81-96.
- BRUNTON, P. A., VRIHOEF, T. & WILSON, N. H. (2003) Restorative care and economic wealth: a global perspective. *Int Dent J*, 53, 97-9.
- BUCK, D. & NEWTON, J. T. (2001) Non-clinical outcome measures in dentistry: publishing trends 1988-98. *Community Dent Oral Epidemiol*, 29, 2-8.
- BURT, B. A. (2005) Concepts of risk in dental public health. *Community Dent Oral Epidemiol*, 33, 240-7.
- BURT, B. A., ISMAIL, A. I., MORRISON, E. C. & BELTRAN, E. D. (1990) Risk factors for tooth loss over a 28-year period. *J Dent Res*, 69, 1126-30.
- COHEN, L. K. & JAGO, J. D. (1976) Toward the formulation of sociodental indicators. *Int J Health Serv*, 6, 681-98.

- CUNNINGHAM, S. J., GARRATT, A. M. & HUNT, N. P. (2000) Development of a condition-specific quality of life measure for patients with dentofacial deformity: I. Reliability of the instrument. *Community Dent Oral Epidemiol*, 28, 195-201.
- DOLAN, T. A. (1993) Identification of appropriate outcomes for an aging population. *Spec Care Dentist*, 13, 35-9.
- DOLAN, T. A., GILBERT, G. H., DUNCAN, R. P. & FOERSTER, U. (2001) Risk indicators of edentulism, partial tooth loss and prosthetic status among black and white middle-aged and older adults. *Community Dent Oral Epidemiol*, 29, 329-40.
- DORRI, M., SHEIHAM, A. & TSAKOS, G. (2007) Validation of a Persian version of the OIDP index. *BMC Oral Health*, 7, 2.
- EKANAYAKE, L. & PERERA, I. (2004) The association between clinical oral health status and oral impacts experienced by older individuals in Sri Lanka. *J Oral Rehabil*, 31, 831-6.
- FITZPATRICK, R., FLETCHER, A., GORE, S., JONES, D., SPIEGELHALTER, D. & COX, D. (1992) Quality of life measures in health care. I: Applications and issues in assessment. *Bmj*, 305, 1074-7.
- FURE, S. & ZICKERT, I. (1997) Incidence of tooth loss and dental caries in 60-, 70- and 80-year-old Swedish individuals. *Community Dent Oral Epidemiol*, 25, 137-42.
- GHERUNPONG, S., TSAKOS, G. & SHEIHAM, A. (2004) The prevalence and severity of oral impacts on daily performances in Thai primary school children. *Health Qual Life Outcomes*, 2, 57.
- GILBERT, G. H., CHAVERS, L. S. & SHELTON, B. J. (2002) Comparison of two methods of estimating 48-month tooth loss incidence. *J Public Health Dent*, 62, 163-9.
- GILBERT, G. H., DUNCAN, R. P. & KULLEY, A. M. (1997) Validity of self-reported tooth counts during a telephone screening interview. *J Public Health Dent*, 57, 176-80.
- GILBERT, G. H., DUNCAN, R. P. & SHELTON, B. J. (2003) Social determinants of tooth loss. *Health Serv Res*, 38, 1843-62.
- GILBERT, G. H., FOERSTER, U. & DUNCAN, R. P. (1998) Satisfaction with chewing ability in a diverse sample of dentate adults. *J Oral Rehabil*, 25, 15-27.
- GUILLEMIN, F., BOMBARDIER, C. & BEATON, D. (1993) Cross-cultural adaptation of health-related quality of life measures: literature review and proposed guidelines. *J Clin Epidemiol*, 46, 1417-32.
- HAMASHA, A. A., SASA, I. & AL-QUDAH, M. (2000) Risk indicators associated with tooth loss in Jordanian adults. *Community Dent Oral Epidemiol*, 28, 67-72.
- HAND, J. S., HUNT, R. J. & KOHOUT, F. J. (1991) Five-year incidence of tooth loss in Iowans aged 65 and older. *Community Dent Oral Epidemiol*, 19, 48-51.
- HAUGEJORDEN, O., KLOCK, K. S. & TROVIK, T. A. (2003) Incidence and predictors of self-reported tooth loss in a representative sample of Norwegian adults. *Community Dent Oral Epidemiol*, 31, 261-8.
- HENRIKSEN, B. M., AXELL, T. & LAAKE, K. (2003) Geographic differences in tooth loss and denture-wearing among the elderly in Norway. *Community Dent Oral Epidemiol*, 31, 403-11.
- IKEBE, K., NOKUBI, T., SAJIMA, H., KOBAYASHI, S., HATA, K., ONO, T. & ETTINGER, R. L. (2001) Perception of dry mouth in a sample of community-dwelling older adults in Japan. *Spec Care Dentist*, 21, 52-9.
- JOKOVIC, A., LOCKER, D. & GUYATT, G. (2005) What do children's global ratings of oral health and well-being measure? *Community Dent Oral Epidemiol*, 33, 205-11.
- KAYSER, A. F. (1981) Shortened dental arches and oral function. *J Oral Rehabil*, 8, 457-62.

- KLEIN, B. E., KLEIN, R. & KNUDTSON, M. D. (2004) Life-style correlates of tooth loss in an adult Midwestern population. *J Public Health Dent*, 64, 145-50.
- KLOCK, K. S. (1995) *A multidimensional study of aspects relating to extraction of permanent teeth in Norway*, Bergen, Department of Community Dentistry, School of Dentistry, University of Bergen.
- KRALL, E., HAYES, C. & GARCIA, R. (1998) How dentition status and masticatory function affect nutrient intake. *J Am Dent Assoc*, 129, 1261-9.
- LOCKER, D. (1988) Measuring oral health: a conceptual framework. *Community Dent Health*, 5, 3-18.
- LOCKER, D. (2000) Response and nonresponse bias in oral health surveys. *J Public Health Dent*, 60, 72-81.
- LOCKER, D., FORD, J. & LEAKE, J. L. (1996) Incidence of and risk factors for tooth loss in a population of older Canadians. *J Dent Res*, 75, 783-9.
- LOCKER, D., MSCN, E. W. & JOKOVIC, A. (2005) What do older adults' global self-ratings of oral health measure? *J Public Health Dent*, 65, 146-52.
- LUHANGA, C. & NTABAYE, M. (2001) Geriatric oral health issues in Africa: Tanzanian perspective. *Int Dent J*, 51, 219-27.
- MANJI, F., BAELUM, V. & FEJERSKOV, O. (1988) Tooth mortality in an adult rural population in Kenya. *J Dent Res*, 67, 496-500.
- MASALU, J. R. & ASTROM, A. N. (2003) Applicability of an abbreviated version of the oral impacts on daily performances (OIDP) scale for use among Tanzanian students. *Community Dent Oral Epidemiol*, 31, 7-14.
- MCDOWELL, I. & NEWELL, C. (1996) *Measuring health : a guide to rating scales and questionnaires*, New York, Oxford University Press.
- MCGRATH, C. & BEDI, R. (2001) An evaluation of a new measure of oral health related quality of life--OHQoL-UK(W). *Community Dent Health*, 18, 138-43.
- MICHEL-CROSATO, E., BIAZEVIC, M. G. & CROSATO, E. (2005) Relationship between dental fluorosis and quality of life: a population based study. *Pesqui Odontol Bras*, 19, 150-5.
- MILSTEIN, L. & RUDOLPH, M. J. (2000) Oral health status in an institutionalised elderly Jewish population. *Sadj*, 55, 302-6.
- MINISTRY OF HEALTH AND SOCIAL WELFARE (1988) *The United Republic of Tanzania, National Plan for Oral Health 1988 - 2002*, Central Dental Unit, Dar es Salaam.
- MINISTRY OF LABOR; YOUTH DEVELOPMENT AND SPORTS (2003) *The United Republic of Tanzania, National ageing policy*.
- MOJON, P., BUDTZ-JORGENSEN, E. & RAPIN, C. H. (1999) Relationship between oral health and nutrition in very old people. *Age Ageing*, 28, 463-8.
- MOSER, C. & KALTON, G. (1971) *Survey methods in social investigation*, London, Heinemann.
- MUMGHAMBA, E. G. & FABIAN, F. M. (2005) Tooth loss among habitual chewing-stick and plastic toothbrush users in the adult population of Mtwara, rural Tanzania. *Int J Dent Hyg*, 3, 64-9.
- MYBURGH, N. G., HOBDELL, M. H. & LALLOO, R. (2004) African countries propose a regional oral health strategy: The Dakar Report from 1998. *Oral Dis*, 10, 129-37.
- NAIDOO, S., CHIKTE, U. M., MOOLA, H. & STEYN, K. (2001) Perceptions of oral health: the South African Demographic and Health Survey of 1998. *Sadj*, 56, 505-10.

- OSTERBERG, T., JOHANSON, C., SUNDH, V., STEEN, B. & BIRKHED, D. (2006) Secular trends of dental status in five 70-year-old cohorts between 1971 and 2001. *Community Dent Oral Epidemiol*, 34, 446-54.
- PALLEGEDARA, C. & EKANAYAKE, L. (2005) Tooth loss, the wearing of dentures and associated factors in Sri Lankan older individuals. *Gerodontology*, 22, 193-9.
- PETERSEN, P. E. (2003) The World Oral Health Report 2003: continuous improvement of oral health in the 21st century--the approach of the WHO Global Oral Health Programme. *Community Dent Oral Epidemiol*, 31 Suppl 1, 3-23.
- PETERSEN, P. E. (2004) Improvement of oral health in Africa in the 21st century - the role of the WHO Global Oral Health Programme. *African Journal of Oral Health*, 1, 2-16.
- PETERSEN, P. E., BOURGEOIS, D., OGAWA, H., ESTUPINAN-DAY, S. & NDIAYE, C. (2005) The global burden of oral diseases and risks to oral health. *Bull World Health Organ*, 83, 661-9.
- PETERSEN, P. E., KJOLLER, M., CHRISTENSEN, L. B. & KRUSTRUP, U. (2004) Changing dentate status of adults, use of dental health services, and achievement of national dental health goals in Denmark by the year 2000. *J Public Health Dent*, 64, 127-35.
- PETERSEN, P. E. & YAMAMOTO, T. (2005) Improving the oral health of older people: the approach of the WHO Global Oral Health Programme. *Community Dent Oral Epidemiol*, 33, 81-92.
- POLIT, D. F. & HUNGLER, B. P. (1991) *Nursing research : principles and methods*, Philadelphia, Lippincott.
- SANYA, B. O., NG'ANG'A, P. M. & NG'ANG'A, R. N. (2004) Causes and pattern of missing permanent teeth among Kenyans. *East Afr Med J*, 81, 322-5.
- SARITA, P. T., WITTER, D. J., KREULEN, C. M., MATEE, M. I., VAN'T HOF, M. A. & CREUGERS, N. H. (2004) Decayed/missing/filled teeth and shortened dental arches in Tanzanian adults. *Int J Prosthodont*, 17, 224-30.
- SARITA, P. T., WITTER, D. J., KREULEN, C. M., VAN'T HOF, M. A. & CREUGERS, N. H. (2003) Chewing ability of subjects with shortened dental arches. *Community Dent Oral Epidemiol*, 31, 328-34.
- SCHOU, L. (1995) *Disease prevention and oral health promotion : socio-dental sciences in action*, Copenhagen, Munksgaard.
- SHAH, N., PARKASH, H. & SUNDERAM, K. R. (2004) Edentulousness, denture wear and denture needs of Indian elderly--a community-based study. *J Oral Rehabil*, 31, 467-76.
- SHEIHAM, A. (2005) Oral health, general health and quality of life. *Bull World Health Organ*, 83, 644.
- SHEIHAM, A., MAIZELS, J., CUSHING, A. & HOLMES, J. (1985) Dental attendance and dental status. *Community Dent Oral Epidemiol*, 13, 304-9.
- SHEIHAM, A., STEELE, J. G., MARCENES, W., FINCH, S. & WALLS, A. W. (1999) The impact of oral health on stated ability to eat certain foods; findings from the National Diet and Nutrition Survey of Older People in Great Britain. *Gerodontology*, 16, 11-20.
- SHEIHAM, A. & WATT, R. G. (2000) The common risk factor approach: a rational basis for promoting oral health. *Community Dent Oral Epidemiol*, 28, 399-406.
- SKARET, E., ASTRØM, A. & HAUGEJORDEN, O. (2004) Oral Health-Related Quality of Life (OHRQoL). Review of existing instruments and suggestions for use in oral health outcome measure research in Europe. IN BOURGEOIS, D. & LLODRA, J. (Eds.) *European Global Oral Health Indicators Development Project*. Paris, Quintessence International.

- SLADE, G. D. (1997a) Derivation and validation of a short-form oral health impact profile. *Community Dent Oral Epidemiol*, 25, 284-90.
- SLADE, G. D. (1997b) *Measuring oral health and quality of life : proceedings of a conference held June 13-14, at the University of North Carolina-Chapel Hill, North Carolina*, Chapel Hill, N.C., Department of Dental Ecology, School of Dentistry, University of North Carolina.
- SLADE, G. D., GANSKY, S. A. & SPENCER, A. J. (1997) Two-year incidence of tooth loss among South Australians aged 60+ years. *Community Dent Oral Epidemiol*, 25, 429-37.
- SLADE, G. D. & SPENCER, A. J. (1994) Development and evaluation of the Oral Health Impact Profile. *Community Dent Health*, 11, 3-11.
- SLADE, G. D., STRAUSS, R. P., ATCHISON, K. A., KRESSIN, N. R., LOCKER, D. & REISINE, S. T. (1998) Conference summary: assessing oral health outcomes--measuring health status and quality of life. *Community Dent Health*, 15, 3-7.
- SOE, K. K., GELBIER, S. & ROBINSON, P. G. (2004) Reliability and validity of two oral health related quality of life measures in Myanmar adolescents. *Community Dent Health*, 21, 306-11.
- SRISILAPANAN, P. & SHEIHAM, A. (2001) The prevalence of dental impacts on daily performances in older people in Northern Thailand. *Gerodontology*, 18, 102-8.
- STEELE, J. G., TREASURE, E., PITTS, N. B., MORRIS, J. & BRADNOCK, G. (2000) Total tooth loss in the United Kingdom in 1998 and implications for the future. *Br Dent J*, 189, 598-603.
- STEWART, A. (1998) The Medical Outcomes Study Framework of Health Indicators. IN STEWART, A. & WARE, J. (Eds.) *Measuring Functioning and Well-Being. The Medical Outcome Study Approach*. Durham, Duke University Press.
- STREINER, D. L. & NORMAN, G. R. (2003) *Health measurement scales : a practical guide to their development and use*, Oxford, Oxford University Press.
- SUOMINEN-TAIPALE, A. L., ALANEN, P., HELENIUS, H., NORDBLAD, A. & UUTELA, A. (1999) Edentulism among Finnish adults of working age, 1978-1997. *Community Dent Oral Epidemiol*, 27, 353-65.
- SUSIN, C., OPPERMAN, R. V., HAUGEJORDEN, O. & ALBANDAR, J. M. (2005) Tooth loss and associated risk indicators in an adult urban population from south Brazil. *Acta Odontol Scand*, 63, 85-93.
- TAIWO, J. O. & OMOKHODION, F. (2006) Pattern of tooth loss in an elderly population from Ibadan, Nigeria. *Gerodontology*, 23, 117-22.
- TATEMATSU, M., MORI, T., KAWAGUCHI, T., TAKEUCHI, K., HATTORI, M., MORITA, I., NAKAGAKI, H., KATO, K., MURAKAMI, T., TUBOI, S., HAYASHIZAKI, J., MURAKAMI, H., YAMAMOTO, M. & ITO, Y. (2004) Masticatory performance in 80-year-old individuals. *Gerodontology*, 21, 112-9.
- TSAKOS, G., GHERUNPONG, S. & SHEIHAM, A. (2006) Can oral health-related quality of life measures substitute for normative needs assessments in 11 to 12-year-old children? *J Public Health Dent*, 66, 263-8.
- TSAKOS, G., MARCENES, W. & SHEIHAM, A. (2001) Cross-cultural differences in oral impacts on daily performance between Greek and British older adults. *Community Dent Health*, 18, 209-13.
- TUBERT-JEANNIN, S., PEGON-MACHAT, E., GREMEAU-RICHARD, C., LECUYER, M. M. & TSAKOS, G. (2005) Validation of a French version of the Child-OIDP index. *Eur J Oral Sci*, 113, 355-62.

- WALLS, A. W. & STEELE, J. G. (2001) Geriatric oral health issues in the United Kingdom. *Int Dent J*, 51, 183-7.
- WALLS, A. W., STEELE, J. G., SHEIHAM, A., MARCENES, W. & MOYNIHAN, P. J. (2000) Oral health and nutrition in older people. *J Public Health Dent*, 60, 304-7.
- WAMANI, H. (2005) Malnutrition and child health inequalities : the case of Uganda and Sub-Saharan Africa. Bergen, Centre for International Health University of Bergen.
- WARREN, J. J., WATKINS, C. A., COWEN, H. J., HAND, J. S., LEVY, S. M. & KUTHY, R. A. (2002) Tooth loss in the very old: 13-15-year incidence among elderly Iowans. *Community Dent Oral Epidemiol*, 30, 29-37.
- WATT, R. & SHEIHAM, A. (1999) Inequalities in oral health: a review of the evidence and recommendations for action. *Br Dent J*, 187, 6-12.
- WATT, R. G. (2003) New WHO diet and nutrition review: implications for dental disease prevention. *Nutrition*, 19, 1028-9.
- WHO (1980) *International classification of impairments disabilities and handicaps: a manual of classification*, Geneva, World Health Organization.
- WHO (1997) *World Health Organization: Oral health survey: Basic methods.*, Geneva.
- WHO (2002) *Active Ageing. A Policy Framework.* World Health Organization.
- WILSON, I. B. & CLEARLY, P. D. (1995) Linking clinical variables with health-related quality of life. A conceptual model of patient outcomes. *Jama*, 273, 59-65.
- YUSUF, H., GHERUNPONG, S., SHEIHAM, A. & TSAKOS, G. (2006) Validation of an English version of the Child-OIDP index, an oral health-related quality of life measure for children. *Health Qual Life Outcomes*, 4, 38.
- ZARB, G. & SCHMITT, A. (1997) Clinical decision-making in implant prosthodontics. *Ont Dent*, 74, 21-3.

Original papers I – III

Paper I

Research article

Open Access

Clinical and socio-behavioral correlates of tooth loss: a study of older adults in Tanzania

Irene A Kida*^{1,2}, Anne N Åstrøm^{1,3}, Gunhild V Strand⁴ and Joyce R Masalu²

Address: ¹Centre for international health, UoB, Bergen, Norway, ²Muhimbili University College of Health Sciences, Dar es Salaam, Tanzania, ³Department of Odontology-Community Dentistry, UoB, Bergen, Norway and ⁴Department of Odontology-Gerodontology, UoB, Bergen, Norway

Email: Irene A Kida* - irene.kida@student.uib.no; Anne N Åstrøm - anne.aastrom@cih.uib.no; Gunhild V Strand - gunhild.strand@odont.uib.no; Joyce R Masalu - jmasalu@muchs.ac.tz

* Corresponding author

Published: 15 March 2006

Received: 17 January 2006

BMC Oral Health 2006, 6:5 doi:10.1186/1472-6831-6-5

Accepted: 15 March 2006

This article is available from: <http://www.biomedcentral.com/1472-6831/6/5>

© 2006 Kida et al; licensee BioMed Central Ltd.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/2.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

Background: Focusing 50 year olds and above, this study assessed the frequency, extent and correlates of tooth loss due to various reasons. Frequency and correlates of posterior occluding support was also investigated.

Method: A cross-sectional household survey was conducted in Pwani region and in Dar es Salaam in 2004/2005. One thousand and thirty-one subjects, mean age 62.9 years participated in a clinical examination and completed interviews.

Results: The prevalence of tooth loss due to any reason was 83.5 %, due to caries 63.4% and due to other reasons than caries, 32.5%. A total of 74.9% had reduced number of posterior occluding units. Compared to subjects having less than 5 teeth lost due to caries, those with 5 or more lost teeth were more likely to be females, having decayed teeth, confirming dental attendance and to be among the least poor residents. Compared to subjects who had lost less than 5 teeth due to reasons other than caries, those who had lost 5 or more teeth were more likely to be of higher age, having mobile teeth, being males, being very poor and to disconfirm dental attendance when having problems. Predictors of prevalence of tooth loss (1 or more lost tooth) due to various reasons and reduced number of occluding units followed similar patterns of relationships.

Conclusion: The results are consistent with prevalence and extent of tooth loss due to caries and due to reasons other than caries being differently related to disease- and socio- behavioral risk indicators. Caries was the principle cause of tooth loss and molar teeth were the teeth most commonly lost.

Background

The proportion of older people is growing faster than any other age groups throughout the world. By 2050, 2 billion people will be aged 60 years and above of whom 80% will be residents of developing countries [1]. Globally, poor oral health in older people is seen particularly as a high level of tooth loss, which in turn influences general health

in terms of weight loss, eating problems and social handicaps related to appearance and communication [1].

Loss of permanent teeth can result from various events, either teeth are extracted by oral care providers or they are lost spontaneously due to progression of periodontal diseases or other events such as dental trauma [1]. Whilst

dental caries and periodontal disease are the main reasons for tooth extractions, socio-economic-, behavioral- and attitudinal characteristics tend to influence the tooth retention profile of populations [2-7]. Epidemiological studies have shown that subjects of low income and education are more likely to be edentulous than their counterparts of higher income and education [8]. Tobacco use is a risk factor in tooth loss particularly in people having a high consumption over several years [1]. Recent surveys have shown higher frequency of tooth loss among adults in the industrialized countries than among their counterparts in developing countries, where access to dental care is limited [9-14]. Within many developing countries, urban dwellers and people of higher socio-economic status have easier access to dental care than their poor rural counterparts [15,16]. In Tanzania, since the government's health facilities are known to have shortage of essential equipments, many seek private facilities where charges for services are high and where no exemption of user fee system for the elderly is implemented [17]. Thus, one might expect affluent urban and poorer rural people to have the highest frequency of tooth loss and the highest rates of untreated oral diseases, respectively. Whereas industrialized countries spend 5-10% of their national public resources (GNP) on dental care each year, no budget is allocated to control for oral diseases in many developing countries [18]. This is noteworthy, considering that the burden of oral diseases is likely to grow in many developing countries because of transitions into unhealthy diets rich in sugar and increased consumption of tobacco products [19].

In Tanzania, information about the oral health status of the population is sketchy and mainly concerns children and adolescents. Reported epidemiological studies on tooth loss among older residents of mainland Tanzania, especially those living in rural areas, are very few [11,20]. A survey conducted as part of the NDHS (National Dental Health Survey) in the early 1980's, estimated frequencies of tooth loss of 83% (mean number of teeth missing 7.0) and 24% (mean number of teeth missing 0.8) due to caries and periodontal disease, respectively in adults 50 years and above [11]. In a more recent study of Tanzanian adults, Sarita [21] reported an average number of retained teeth ranging from 27 teeth in the youngest (20-29 years) to 20 teeth in the oldest age group (above 60 years). Evaluating the function of the dentition, Sarita [12] reported a prevalence of shortened dental arches (SDA) (reduced number of posterior occluding units) of 15% in the adult population. In neighboring Kenya, Manji et al [9] reported that the majority of rural people retained most of their dentition up to the age of 65 years, whereas above 90% of > 55 year-olds had lost at least one tooth. Studies from other developing countries have reported a relatively high extent of tooth loss. A study of older individuals in

Sri Lanka revealed a mean tooth loss of 20.7 SD10.7 among 60 year olds and above [10]. Susin et al [22] provided evidence of a mean tooth loss of 20 in Brazilian urban adults 60 years and older.

Since the independence in Tanzania in 1961, life expectancy at birth has been 50 years which places adults 35-40 yr and above in the elderly group of citizens [23]. Little is known with respect to the socio-demographic and behavioral correlates of the prevalence and extent of tooth loss among older adults and whether the rates of tooth loss in this age group have changed during the last two decades. Focusing community dwellers 50-years-old and above in urban and rural districts of Tanzania, this study aimed at assessing the frequency, extent and correlates of tooth loss due to dental caries and reasons other than dental caries. The frequency, correlates and functional consequences of having reduced premolar and molar occluding support were also investigated.

Methods

Study area

A cross sectional survey was conducted in Pwani region, Eastern Tanzania and in the capital city of Dar es Salaam from November 2004 to June 2005. According to the 2002 population and housing survey in Tanzania, Pwani region has the highest number of older people 65 years and above in the country (7%). Dar es Salaam and Pwani region have a total population size of 2.5 million and 889,154, respectively. The corresponding figures for population densities are 1,793 and 27 persons per square km. The districts have drinking water with fluoride content of about 1 mg F/L.

Sampling and procedure

A stratified (disproportionate) two-stage cluster sample design with villages as the primary sampling unit was utilized. Villages were selected from two rural districts (Kibaha and Bagamoyo) and one urban (Kinondoni) district in Pwani and Dar es Salaam, respectively. To obtain a sample of older adults of mixed socio-economic background, 107 pure urban (N= 59688) villages and 96 pure rural villages (N = 26520) were listed in Kinondoni and in Kibaha/Bagamoyo, respectively. A sample size of 1200 adults in the defined age group was calculated assuming a prevalence rate of tooth loss (≥ 1 missing tooth) of 50%, a precision of 4% and a design effect of 2 [24]. At the first stage, 10 pure urban villages (n = 6290) and 10 pure rural villages (n = 3729) were selected by systematic random sampling from the district village population lists. At the second stage, a total of 60 households were selected by systematic random sampling from each village selected at the first stage. This involved randomly selecting the first household by spinning a bottle at the presumed center of each village to obtain a starting direction, listing on papers

all household heads in the selected direction up to the boarder of the village, folding the paper and randomly picking one name. The next household would be one whose front door was nearest to the previous one. A household was defined as a group of people living, cooking and eating together. One person 50 years and above was enrolled per household. In case the household had several people in the targeted age group, one man and one woman were selected randomly. Over sampling of rural villages were implemented to achieve a sample size that was big enough to conduct stratified analyses. A village leader followed the data collectors through the village and traditional village protocol was observed ensuring a high response rate. A total of 511 (participation rate 85.2%) urban and 520 (participation rate 86.7%) rural subjects between 50 and 100 years (mean age: 62.9, SD = 10.6, men: 46.4%, no education: 44.7%), completed an extensive personal interview followed by a clinical examination. Only consenting subjects were included in the study. Exclusion criteria were presence of disease/conditions that might pose a health risk to the participant or that may interfere with the interview and clinical examination. Reasons for non-participation were refusals (n = 45), absence from household on the day of the interview (n = 88). Subjects were excluded if they were ill or had a history of psychiatric problems (n = 23), were intoxicated with alcohol (n = 2), were too old (n = 7) or had beliefs in witchcraft (n = 4). Permission to carry out the study was approved by the Research and Publication Committee at Muhimbili University College of Health Sciences, regional and district administration authorities, village leaders and from the ethical research committee in Norway (REK VEST). Informed consent was obtained from all participating subjects.

Interview

A structured interview schedule was constructed in English and translated into Swahili before being administered in the field by two trained research assistants. Oral health professionals reviewed the interview schedule for semantic, experiential and conceptual equivalence. Sensitivity to culture and selection of appropriate words were considered. The interview schedule was piloted before administration. *Socio-demographics* were assessed in terms of place of residence, gender and age. *Level of education* was coded on a scale from (1) no education to (6) college/university. A dummy variable was constructed for analysis into (1) no education, (2) at least primary school education. *Family wealth* was assessed as an indicator of socio-economic status in accordance with a standard approach in equity analyses [25]. Household durable assets indicative of family wealth (e.g. bicycle, television, car, motor cycle) assessed as (1) available/in working condition, (2) not available/available but not in working condition, were included in a principle component analysis. The first com-

ponent resulting from the analysis was used to divide households into four approximate quartiles of wealth status ranging from 1st quartile (least poor) to 4th quartile (most poor). *Frequency of dental attendance* during the previous 2 years – was coded (1) less than once and (2) once or more. *Reason for dental attendance* the previous 2 years was coded (1) when in problems (2) other reasons (including never go/go whether of not in problems). *Tobacco use* was assessed as (1) yes (2) no. A number of general health problems (e.g. high blood pressure) were assessed as (1) yes (2) no.

Clinical examination

One trained and calibrated dentist (IK) conducted all clinical examinations in a shaded area with natural daylight as the source of illumination and with an assistant recording the observations. Research assistants for recording were trained and calibrated before the main survey. Participants identified with problems that needed treatment were referred or advised to seek treatment from a nearest health care facility. Oral health education sessions were provided for all the participating subjects. *Plaque* was recorded initially using the mucosal – plaque index (MPS) [26] with the categories (1) no easily visible plaque (2) hardly visible plaque (3) moderate amount of plaque and (4) abundant amounts of confluent plaque. After cleaning of teeth by use of gauze, the dentition was inspected using disposable dental mirrors and probes, whereas cotton roles were used to control saliva. A full mouth clinical examination, including 3rd molars was conducted. *Caries experience* was assessed in accordance with the criteria described by the World Health Organization, WHO [27]. A decayed tooth was recorded as present when a carious cavity was apparent on visual inspection supplemented by probing if required. Root tips were recorded as present and decayed tooth, if there was a caries lesion, while, they were scored other options, e.g. trauma, erosion, accordingly, when the tips had no caries lesion. If in doubt, no caries was recorded. A tooth was considered *missing due to caries* if there was a history of extraction because of pain and or the presence of cavity prior to extraction. *Teeth lost due to other reasons* were recorded separately and not included in the calculation of the DMFT score. *Prevalence of tooth loss due to any reason* was calculated with inclusion of edentulous people and defined as the percentage of individuals with ≥ 1 lost tooth. *Prevalence of tooth loss due any reason, due to caries and due to other reasons than caries* were recorded as (0) no teeth lost and (1) ≥ 1 tooth lost. *Extent of tooth loss due to caries and due to other reasons* were recorded as (1) ≥ 5 teeth lost (0) less than 5 teeth lost. *Tooth mobility* was assessed using a modified Miller's index [28] whereby the ends of two instruments were placed on either sides of the tooth and forces applied in bucco-lingual/palatal direction and scored as present or absent. An individual tooth mobility scores was defined as (1) 2 or

more mobile teeth (0) less than 2 mobile teeth. *Functional premolar and molar occluding units* were counted based on existing natural tooth contacts between maxilla and mandible in the bilateral regions. The number of occluding pairs (with or without intact anterior region) was categorized into (1) complete posterior occluding support/10 functional occluding units, (2) reduced posterior occluding support/1–9 occluding units and (3) absence of bilateral occluding support. For analysis, a dummy variable was constructed yielding, (1) reduced occluding support (0–9 units) (0) and complete occluding support (10 units). The distribution of the POU variable supported this cut off point.

Reproducibility

Duplicate clinical examinations were carried out on a random sub-sample of the study subjects throughout the survey. Analysis performed on the duplicate examination recordings gave kappa statistics of 1.00 for missing teeth due to caries, decayed teeth and occluding support. Kappa statistics of 0.77, 0.79 and 0.51 were provided with respect to mobile teeth, tooth loss due to other reasons and plaque scores, respectively. These figures indicate a very good intra-examiner reliability (except for plaque) according to WHO [27].

Statistical analyses

Data were analyzed using SPSS version 13.0. Cross tabulation and chi-square statistics were used to assess bivariate relationships. Risk indicators for tooth loss frequency, extent of tooth loss and frequency of reduced premolar/

molar support were estimated by stepwise logistic regression using the logit-model with 95% CI (confidence interval) given for the odds ratios indicating statistically significant relationship if both values were above or below 1. To adjust for the effect of the cluster design, re-analyses were conducted with STATA 9.0 using the svylogit command.

Results

Table 1 gives the percentage distribution of participants' socio-demographic-, clinical-, and behavioral characteristics in urban Kinondoni and rural Kibaha/Bagamoyo districts. In addition to the data presented in Table 1, it was found that decayed teeth and mobile teeth were more prevalent in lower- than in higher family wealth groups ($p < 0.001$). Dental attendance patterns were more frequent in higher than lower family wealth groups (88.2% versus 68.7%, $p < 0.001$). Having 2 or more decayed teeth and 2 and more mobile teeth were most prevalent in females and males, respectively. Missing teeth due to caries and other reasons did not vary with the educational level of the participants (not in Table 1).

The prevalence of tooth loss (≥ 1 tooth lost due to any reason) in the study population, calculated with the inclusion of edentulous subjects (0.6% in urban and rural area) was 85.5% (mean tooth loss 6.1, SD= 6.4, mean tooth loss in affected subjects 7.1, SD = 6.3) in urban areas and 82.1% (mean tooth loss 5.9, SD= 6.6, mean tooth loss in affected subjects 7.2, SD = 6.5) in rural areas. Direct age standardization did not alter the crude urban rural differ-

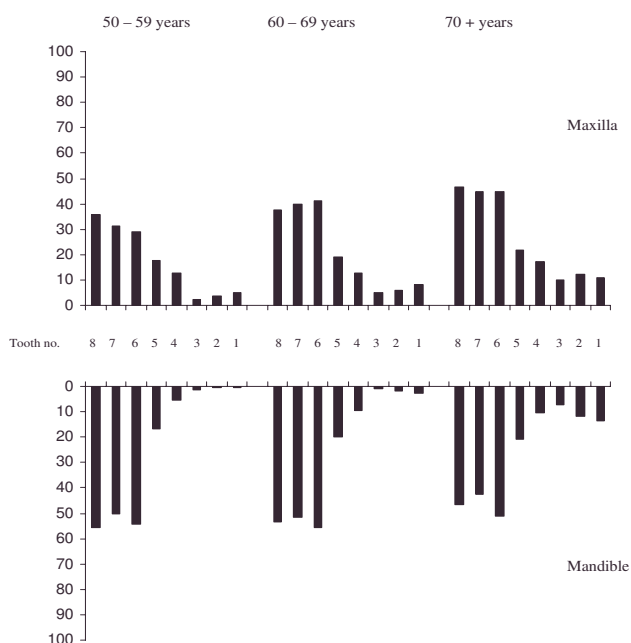
Table 1: Socio-demographic factors and oral health status indicators among older people in urban Kinondoni and rural Kibaha/Bagamoyo districts of Tanzania

	Kinondoni % (n)	Kibaha/Bagamoyo % (n)	p-value
Sex: Male	42.7 (218)	50.0 (260)	
Female	57.4 (292)	50.0 (260)	0.021
Age : 50–59 years	50.3 (257)	37.9 (197)	
60–69 years	28.8 (147)	30.0 (156)	
70+ years	20.9 (105)	32.1 (167)	0.001
Wealth index: 1st quartile- least poor	45.4 (232)	4.4 (23)	
2 nd quartile	40.1 (205)	8.8 (46)	
3rd quartile	11.2 (57)	35.0 (182)	
4th quartile- poorest	3.3 (17)	51.7 (269)	0.001
Education: none	36.1 (184)	53.4 (277)	
: at least primary school	63.9 (325)	46.6 (242)	0.001
Tobacco use: yes	15.1 (77)	30.6 (159)	0.001
Reason dental attendance: when problem	87.3 (446)	71.4 (370)	0.001
Dental attendance: \geq one time	21.1 (108)	24.2 (126)	0.231
High blood pressure: yes	26.2 (134)	6.7 (35)	0.506
Decayed teeth: \geq 2 teeth	46.0 (235)	55.4 (288)	0.050
Tooth mobility: \geq 2 teeth	16.2(83)	22.7 (118)	0.050
Brushing: daily	71.8 (367)	71.5 (372)	0.920
Plaque: moderate/abundant	44.1 (224)	47.2 (244)	0.175
Chewing: only soft foods	25.0 (129)	36.2 (189)	0.001

ence in prevalence of tooth loss and there was no statistically significant difference by gender. The weighted prevalence and mean tooth loss in the total population of Dar es Salaam/Pwani region was 83.5 % and 5.8 teeth (SD = 6.4). Adults in the age groups 50–59 years, 60–69 years and 70+ years had lost on average 5.5, 5.9 and 6.7 teeth due to any reason. The corresponding prevalence of tooth loss was 78.0%, 85.5% and 91.2%. A total of 63.4% (mean tooth loss 3.6) and 32.5% (mean tooth loss 2.4) had lost ≥ 1 tooth due to caries and due to other reasons, whereas 17.5%, 74.9% and 7.7% had respectively, 10-, 1- and 0 posterior occluding units.

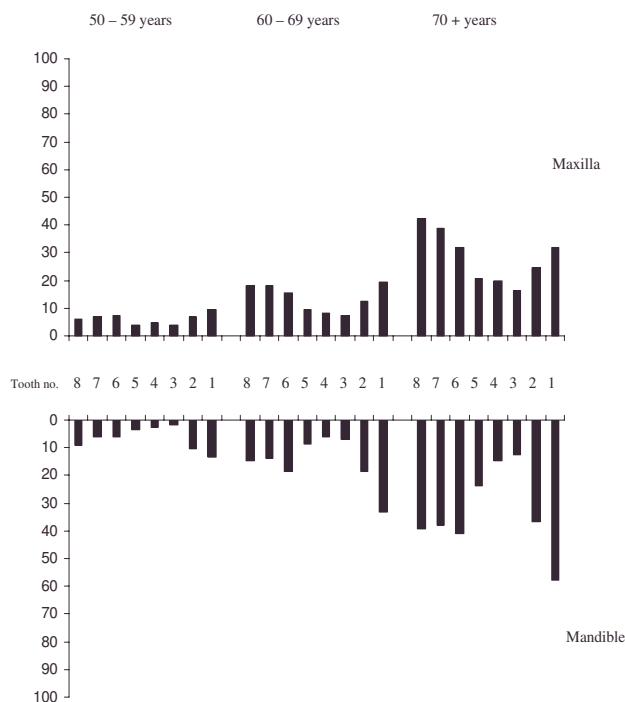
The distributions of tooth loss due to caries and due to other reasons according to tooth type and age groups are depicted in Figure 1 and Figure 2. Across all age groups, lower third and first molars were the teeth most frequently lost due to caries, whereas the lower central incisor was the tooth most frequently lost due to reasons other than caries. Table 2 shows the prevalence of subjects having lost ≥ 5 teeth and ≥ 1 tooth *due to caries* according to socio-

demographic, behavioral and clinical factors and the corresponding odds ratios (OR) from multiple logistic regression analysis. Compared to subjects having less than 5 lost teeth, those having lost ≥ 5 were more likely to be females, of higher age, having higher family wealth, having decayed teeth and confirming dental attendance, and were less likely not to have high blood pressure. When controlling for all other variables in the model, a significant direct relationship occurred between age and extent of tooth loss due to caries (≥ 5 teeth). As shown in Table 2, the predictors of prevalence of tooth loss (≥ 1 lost tooth) followed a similar pattern of relationship as that shown for extent of tooth loss. The multiple logistic regression models explained 19.8 % (Nagelkerke's R² = .198, Model chi-square 155.390, df 10, p < 0.001) of the variance in the extent of tooth loss and 28.1% (Nagelkerke's R² .281, Model chi-square 236.631, df 10, p < 0.001) of the variance in prevalence of tooth loss due to caries. A statistical significant two-way interaction occurred with respect to decayed teeth by age upon extent of tooth loss. Separate regression models revealed that



Tooth number illustration:
1: Central Incisors, 2: Lateral Incisor, 3: Canine, 4: 1st premolar, 5: 2nd premolar, 6: 1st molar, 7: 2nd molar, 8: 3rd molar

Figure 1
Percentage of tooth loss due to caries by tooth type and age group.



Tooth number illustration:
1: Central Incisors, 2: Lateral Incisor, 3: Canine, 4: 1st premolar, 5: 2nd premolar, 6: 1st molar, 7: 2nd molar, 8: 3rd molar

Figure 2
Percentage of tooth loss due to other reasons than caries by tooth type and age groups.

Table 2: Factors associated with having lost ≥ 5 teeth and ≥ 1 tooth due to caries. Chi square statistics, odds ratios (OR) and 95% Confidence limits (CL). Adjusted for use of tobacco (n = 1029).

	% (n) ≥ 5 teeth	OR (95% CL) (≥ 5 teeth)	% (n) ≥ 1 tooth	OR (95% CL) (≥ 1 tooth)
Age: 50–59 years	28.6 (130)	1	65.2 (296)	1
60–69 years	32.0 (97)*	1.4 (1.1–2.0)	63.7 (193)	1.1 (0.8–1.6)
70+years	32.5 (89) *	1.7 (1.2–2.4)	60.2 (165)	1.1 (0.7–1.6)
Sex: Male	24.7 (118)	1	55.2 (264)	1
Female	35.8 (198)*	1.5 (1.1–2.0)	70.5 (390)*	1.7 (1.2–2.2)
Residence: Urban	37.4 (191)	1	71.4 (365)	1
Rural	24.0 (125)	0.7 (0.5–1.1)	55.6 (289)*	0.5 (0.3–0.8)
Wealth index:				
4 th quart/poorest	20.6 (53)	1	52.1 (134)	1
3 rd quart	27.1 (70)*	1.6 (1.0–2.9)	60.9 (157)	1.1 (0.5–1.8)
2 nd quart	35.7 (97)*	1.8 (1.1–3.1)	70.2 (191)	1.3 (0.7–2.2)
1 st quart/least poor	38.8 (94)	1.3 (0.8–2.1)	70.2 (170)*	1.1 (0.7–1.6)
Decayed: 0–1 teeth	20.9 (106)	1	56.5 (287)	1
Decayed: 2–22 teeth	40.2 (210)*	2.8 (2.1–3.8)	70.2 (367)*	2.1 (1.6–2.7)
Dental attendance: Never	11.7 (25)	1	27.7 (59)	1
Dental attendance: When problems	35.7 (291)*	3.2 (2.0–5.2)	72.9 (595)*	5.3 (3.6–7.7)
Dental attendance: Never	27.2 (217)	1	57.3 (457)	1
Dental attendance: \geq once	42.3 (99)*	1.7 (1.2–2.3)	84.2 (197)*	2.8 (1.8–4.2)
High blood pressure: yes	46.2 (78)	1	78.1 (132)	1
High blood pressure: No	27.6 (238)*	0.6 (0.4–0.8)	60.6 (522)*	0.6 (0.3–0.9)

The total number in the different categories did not add up to 316 (≥ 5 teeth) and 654 (≥ 1 tooth) owing to missing values.

* $p \leq 0.05$

dental caries associated more strongly with tooth loss in younger than in older age groups. The odds ratios were 5.6 (95% CL 3.4–9.1), 2.2 (95% CL 1.2–3.9) and 1.6 (95% CL 0.9–2.8) in 50–59-, 60–69- and 70+year-olds, respectively

Compared to those having lost less than 5 teeth due to other reasons than caries, subjects who had lost 5 or more teeth were more likely to be of higher age and to have mobile teeth, whereas they were less likely to be females, of higher family wealth and to attend a dentist when having problems (Table 3). A similar pattern of relationships occurred for the predictors of prevalence of tooth loss (≥ 1 lost tooth) due to other reasons. The complete models accounted for 27.3% (Nagelkerke's $R^2 = .273$, Model chi-square 174.964, $df = 10$, $p < 0.001$) of the variance in extent of tooth loss due to other reasons and 28.8% (Nagelkerke's $R^2 = .288$, Model chi-square 237.490, $df = 10$, $p < 0.001$) of the variance in prevalence of tooth loss due to other reasons.

Table 4 depicts the adjusted ORs for reduced posterior occluding support. Number of decayed teeth, tooth mobility and age were the strongest predictors with odds ratios of 7.2, 3.0 and 2.7, respectively. Socio-demographics entered in the first step accounted for 8.1% (Nagelkerke's $R^2 = .081$, Model chi-square 51.4, $df 7$, $p < 0.001$). Entering behavioral and clinical variables raised the explained variance to 30% (Nagelkerke's $R^2 = .301$,

Model chi-square 205.1, $df = 12$, $p < 0.001$). In a separate regression analysis, the ability to eat only soft/mashed foods varied systematically with reduced posterior occluding support whilst controlling for socio-demographic factors. The adjusted OR for having reduced chewing ability was 4.5 (95% CL 2.7–7.4) for subjects with 0–9 occluding pairs compared to their counterparts with 10 occluding pairs.

Discussion

The subjects investigated in this study experienced tooth loss that is similar to what has been observed decades ago in Tanzania and neighboring country, Kenya. [9,11]. It contrasts markedly with findings of much more extensive tooth loss in Sri Lanka, USA and Brazil [10,13,22]. Compared to the mean tooth loss of 5.9 teeth estimated for Tanzanians 61–69 year olds, recent surveys of the US and Brazilian populations have reported means of 13.2 and 18.1 teeth lost in comparable age groups [13,22]. Findings of the present study showed that 94.5%, 88.1% and 72.3% of the 50–59-, 60–69- and 70+year olds had retained 20 teeth or more. It appears that in this community-based sample of adults, the FDI recommended goal of 50% of individuals 65 years and older having ≥ 20 teeth are within reach [29]. Contrary to many previous studies, the estimates presented here are not adjusted for teeth indicated for extraction. Although information on caries severity was not available, a substantial unmet treatment need was reflected in the DT component constituting

Table 3: Factors associated with having lost ≥ 5 teeth ≥ 1 tooth due to reasons other than caries. Chi square and adjusted odds ratios (OR) and 95% confidence limits (CL).

	% (n) ≥ 5 teeth	OR (95% CL) ≥ 5 teeth	% (n) ≥ 1 tooth	OR 95% CL ≥ 1 tooth
Age: 50–59 years	6.8 (31)	1	20.0 (91)	1
60–69 years	15.5 (47)*	1.7 (1.1–2.8)	33.7 (102)*	1.4 (1.1–2.1)
70+years	28.8 (79)*	3.7 (2.3–6.0)	51.8 (142)*	3.1 (2.1–4.4)
Sex: Male	19.2 (92)	1	40.2 (192)	1
Female	11.8 (65) *	0.6 (0.4–0.9)	25.9 (143)*	0.5 (0.4–0.8)
Residence: Urban	9.8 (50)	1	24.3 (124)	1
Rural	20.6 (107)	1.2 (0.7–1.9)	40.6 (211)	1.3 (0.8–1.9)
Wealth index:				
4 th quart/poorest	26.5 (68)	1	50.2 (129)	1
3 rd quart	16.3 (42)	0.6 (0.3–1.4)	29.8 (77)	0.7 (0.4–1.3)
2 nd quart	6.6 (18)*	0.3 (0.2–0.7)	22.4 (61)*	0.5 (0.3–0.9)
1 st quart/least poor	12.0 (29)	0.8 (0.5–1.3)	28.1 (68)*	0.6 (0.3–0.9)
Dental attendance: Never	26.3 (56)	1	48.4 (103)	1
Dental attendance: When problems	12.3 (100)*	0.5 (0.3–0.8)	28.3 (231)*	0.5 (0.3–0.7)
Tooth mobility: 0–1 teeth	9.5 (79)	1	24.5 (203)	1
Tooth mobility: ≥ 2 teeth	38.8 (78)*	5.3 (3.5–7.9)	65.7 (132)*	5.4 (3.8–7.8)
Decayed: 0–1 teeth	13.2 (67)	1	30.7 (156)	1
Decayed: 2–22 teeth	17.2 (90)	1.2 (0.8–1.7)	34.2 (179)	1.0 (0.7–1.4)
Tobacco: yes	26.3 (62)	1	50.0 (118)	1
Tobacco: no	11.9 (95)	0.6 (0.4–1.0)	27.3 (217)*	0.6 (0.4–0.8)

The total number in the different categories did not add up to 157 (≥ 5 teeth) and 335 (≥ 1 tooth) owing to missing values.

* $p \leq 0.05$

70.5% of the total DMFT score. Thus, it is uncertain whether the FDI goals had been within reach if teeth indicated for extraction were accounted for. A previous survey of the Tanzanian population with comparable demographics to the present study population, revealed a figure for tooth loss due to caries that was similar to the present rate of overall tooth loss (83%) and higher than the present rate of tooth loss due to dental caries (63%) [11]. Sarita et al [21] reported a higher frequency of tooth loss among Tanzanian adults than what was obtained in this study. Based on the present results, tooth loss due to caries seems to have declined since mid 1980's among people 50 years and above in Tanzania. However, the difference in rates of tooth loss observed in the present and previous studies of Tanzanian older adults might be attributed to differences in study design and the characteristics of the study populations involved.

Both the prevalence and extent of tooth loss due to reasons other than caries increased sharply with increasing age in multiple logistic regression analysis. The presence of a positive relationship between age and tooth loss is in agreement with some other investigations, but at variance with others [6]. Consistent with results from previous studies, the present one revealed that caries was the major cause of tooth loss across the age groups investigated [9,11,30]. After adjusting for covariates, females and males were most likely to experience tooth loss due to caries and due to other reasons, respectively. Greater tooth

loss in women than in men has been reported in many countries, although the reason for this gradient is still unclear [2,22]. In this study, women had experienced more decayed teeth but less tooth mobility than men and they attended dentists more frequently. Thus, the greater number of teeth lost due to caries in women appears to be related to dental caries experience and use of dental care services. Other studies have implicated periodontal disease as the leading cause of tooth loss as well as a higher prevalence of edentulous subjects in males compared to females [5].

It was documented for this sample that when compared to their less poor counterparts, the poorest subjects were more likely to experience dental caries, mobile teeth and teeth lost due to other reasons than caries. On the other hand, they were less likely to experience tooth loss due to caries and to seek dental care in response to oral problems. Findings from previous studies suggest that subjects of higher education and those who are wealthier in terms of economic status tend to have the lowest risk for tooth mortality [1,8,31,32]. It is probable that wealthy people afford preventive dental check-ups and conservative treatment that contribute to the retention of their teeth. In the present study, subjects who confirmed dental attendance frequently and when having problems had a higher frequency of tooth loss due to dental caries. This might be explained by a therapeutic rather than a preventive approach adopted by most dentists in Tanzania including

the emergency oral health care, with extraction of teeth being the treatment offered for dental caries almost on a routine basis [16]. The reason why tooth mortality due to other oral problems was less common among dental attendees than among non-attendees is unclear. Previous studies in Tanzania have reported on few teeth with increased mobility even in individuals with extensive loss of supporting bone and on a relatively low frequency of teeth lost due to periodontal breakdown [20].

More poor subjects, although having the highest level of disease, seemed to be at lower risk for tooth loss due to caries and at higher risk of tooth loss due to other reasons because they did not attend the dental care system. With all variables in the model adjusted for and although the relationship was not linear, poorer subjects were still less likely to loose their teeth due to dental caries and more likely to loose their teeth due to other reasons compared to their wealthier counterparts. This might reflect social differences in the actual treatment offered, in the treatment opted to be received as well as behaviors and beliefs regarding the dental health care system in general. Although elderly people 60 years and above are exempted from user fees in Tanzania [33], most often dental clinics run out of necessary facilities and patients are requested to buy gloves, anesthetics etc in order to receive dental care. It should be noted that the sensitivity of the multivariate models was relatively moderate, suggesting that important characteristics of individuals losing their teeth were not present in the analysis. Smoking status that was positively associated with tooth loss in this study most probably reflects other biological variables that were not included in the models [34].

It is evident that loss of occluding support not only associates with impaired chewing efficiency and inadequate nutrition [35,36] but also with other health problems such as lower extremity dynamic strength, agility and balance function in elderly adults [37]. Nevertheless, 10 occluding pairs from premolar to premolar have been recognized to satisfy function at a sub-optimal but acceptable level for older people [38]. The proportions of subjects with complete and reduced posterior occluding support in this study are not comparable to the figures pertaining to shortened dental arches reported by Sarita et al [12], due to different criteria. This study counted the number of posterior occluding pairs, an approach that has been used in some previous studies but not in many [2]. Consistent with earlier reports suggesting that difficulty with chewing food increases with decreasing number of occluding pairs, this study revealed that subjects with ≤ 9 occluding premolars/molars were about 4 times more likely to have chewing problems than their counterparts having complete posterior occluding support [2,12]. Locker [7] has argued for a need of information with respect to when

tooth loss becomes problematic as well as for whom. The present findings indicate that having reduced posterior occluding support occurred most frequently in older subjects, females, urban residents, those experiencing unrestored caries, mobile teeth and assessable plaque and also in subjects who visited the dentist most frequently (Table 4).

The self-report method employed in the assessment of the causes of tooth loss are associated with uncertainty since their validity could not be verified by reports from dental records or health care workers having performed the extractions. Examining the distribution of dental caries within the dentition revealed however, a closer resemblance with the distribution of tooth loss due to caries than with the distribution of tooth loss due to other reasons across all age groups investigated [11]. Moreover, the finding that the mean number of teeth with untreated dental caries far exceeded the mean number of mobile teeth tends to confirm the general picture obtained from the interviews. In a detailed analysis of the pattern of periodontal breakdown of Tanzanian adults, Baelum [39] reported mandibular incisors to be among the teeth most affected with loss of attachment. As shown in Fig 2 and consistently with what has been reported previously in

Table 4: Factors associated with reduced posterior occluding support. Multivariate analysis controlled for use of tobacco (n = 1023). Chi-square, odds ratios (OR) and 95% confidence limits (CL).

	% (n) 0-9 units	Adjusted OR (95% CL)
Age: 50-59 years	78.0 (354)	1
60-69 years	82.5 (250)	1.3 (0.8-2.0)
70+ years	90.0 (244) *	2.7 (1.6-4.6)
Sex: Male	79.3 (379)	1
Female	85.4 (472) *	1.4 (1.0-2.1)
Residence: Urban	87.9 (449)	1
Rural	77.3 (402)*	0.3 (0.1-0.5)
Wealth index:		
4 th quart/poorest	79.4 (227)	1
3 rd quart	78.7 (188)	1.0 (0.5-2.1)
2 nd quart	86.9 (218)	1.1 (0.6-2.1)
1 st quart/least poor	85.5 (218)	0.8 (0.5-1.3)
Decayed: 0-1 teeth	71.1 (361)	1
Decayed: 2-22 teeth	93.7 (490)*	7.2 (4.6-11.1)
Plaque: no visible	79.7 (444)	1
Plaque: moderate/abundant	85.7 (401) *	1.5 (1.0-2.2)
Tooth mobility: 0-1 teeth	81.1 (665)	1
Tooth mobility: ≥ 2 teeth	92.5 (186) *	3.0 (1.6-5.5)
Dental attendance: Never	71.4 (152)	1
Dental attendance: in problems	85.5 (694) *	2.3 (1.2-3.5)
Frequency attendance: Never	80.4 (644)	1
Frequency attendance: \geq once	89.7 (210) *	2.1 (1.2-3.5)

The total number in the different categories did not add up to 851 owing to missing values *
 $p \leq 0.05$

Tanzania and elsewhere, anterior teeth predominated among teeth lost due to other reasons, whereas posterior teeth predominated teeth lost due to caries [9,11,22]. A second limitation of this study was its cross-sectional design that might have weakened the association between dental disease and tooth loss. From this point of view, the interaction effect, with dental caries being a stronger predictor of tooth loss in younger rather than in older age group was not surprising.

Conclusion

The results of this study are consistent with tooth loss prevalence, extent of tooth loss and reduced occluding support being a consequence of disease-, behavior-, and social related risk indicators and their interactions. Caries was the principle cause of tooth loss and molar teeth were most commonly lost. This is in accordance with other studies recently conducted in sub-Saharan Africa [40,41]. Tooth loss due to caries and tooth loss due to other reasons was closely but differently related to disease- and socio-behavioral factors. Not going to a dentist was associated with retention of carious teeth and with tooth loss due to reasons other than caries, whereas loss of occluding support impacted on chewing ability. Efforts to preserve more natural teeth of the ageing population should focus on the prevention and treatment of caries and periodontal diseases. Outreach emergency oral health care in Tanzania should be strengthened through education of dental care providers to equip them with means to treat and retain teeth.

Competing interests

The author(s) declare that they have no competing interests.

Authors' contributions

IK: Principal investigator, conceived of the study, designed the study, collected data, statistical analysis and manuscript writing

AA: Main supervisor, designed study, statistical analysis, manuscript writing

GS: Participated in design of study and manuscript writing

JM: Participated in design of study, data collection and manuscript writing

Acknowledgements

This study was financially supported by the Faculty of Dentistry and the Centre for International Health, University of Bergen and Statens L naker, Norway. The authors would like to thank Professor Ola Haugejorden for valuable comments upon an earlier version of this article. The authors would like to acknowledge the Local administrative authorities, the College Research and Publication committee of the Muhimbili University College of

Health Sciences (MUCHS), Tanzania and REK VEST of Norway, for giving permission to conduct this study.

References

- Petersen PE, Yamamoto T: **Improving the oral health of older people: the approach of the WHO Global Oral Health Programme.** *Community Dent Oral Epidemiol* 2005, **33(2)**:81-92.
- Lin HC, Corbet EF, Lo EC, Zhang HG: **Tooth loss, occluding pairs, and prosthetic status of Chinese adults.** *J Dent Res* 2001, **80(5)**:1491-1495.
- Burt BA, Ismail AI, Morrison EC, Beltran ED: **Risk factors for tooth loss over a 28-year period.** *J Dent Res* 1990, **69(5)**:1126-1130.
- Gilbert GH, Duncan RP, Shelton BJ: **Social determinants of tooth loss.** *Health Serv Res* 2003, **38(6 Pt 2)**:1843-1862.
- Neely AL, Holford TR, Loe H, Anerud A, Boysen H: **The natural history of periodontal disease in humans: risk factors for tooth loss in caries-free subjects receiving no oral health care.** *J Clin Periodontol* 2005, **32(9)**:984-993.
- Treasure E, Kelly M, Nuttall N, Nunn J, Bradnock G, White D: **Factors associated with oral health: a multivariate analysis of results from the 1998 Adult Dental Health survey.** *Br Dent J* 2001, **190(2)**:60-68.
- Locker D, Ford J, Leake JL: **Incidence of and risk factors for tooth loss in a population of older Canadians.** *J Dent Res* 1996, **75(2)**:783-789.
- Public health and aging: retention of natural teeth among older adults - United states, 2002.** In *Morbidity and Mortality Weekly Report* Centers for Disease Control and Prevention; 2003:1226-1229.
- Manji F, Baelum V, Fejerskov O: **Tooth mortality in an adult rural population in Kenya.** *J Dent Res* 1988, **67(2)**:496-500.
- Ekanayake L, Perera I: **The association between clinical oral health status and oral impacts experienced by older individuals in Sri Lanka.** *J Oral Rehabil* 2004, **31(9)**:831-836.
- Baelum V, Fejerskov O: **Tooth loss as related to dental caries and periodontal breakdown in adult Tanzanians.** *Community Dent Oral Epidemiol* 1986, **14(6)**:353-357.
- Sarita PT, Witter DJ, Kreulen CM, Van't Hof MA, Creugers NH: **Chewing ability of subjects with shortened dental arches.** *Community Dent Oral Epidemiol* 2003, **31(5)**:328-334.
- Brown LJ: **Trends in tooth loss among U.S. employed adults from 1971 to 1985.** *J Am Dent Assoc* 1994, **125(5)**:533-540.
- Marcus SE, Drury TF, Brown LJ, Zion GR: **Tooth retention and tooth loss in the permanent dentition of adults: United States, 1988-1991.** *J Dent Res* 1996, **75 Spec No**:684-695.
- Naidoo S, Chikte UM, Moola H, Steyn K: **Perceptions of oral health: the South African Demographic and Health Survey of 1998.** *Sadj* 2001, **56(11)**:505-510.
- Ntabaye MK, Scheutz F, Poulsen S: **Household survey of access to and utilisation of emergency oral health care services in rural Tanzania.** *East Afr Med J* 1998, **75(11)**:649-653.
- Ministry of Health: Policy implications of adults' morbidity and mortality.** Dar es Salaam, Tanzania. ; 1997.
- Braine T: **More oral health care needed for ageing populations.** *Bull World Health Organ* 2005, **83(9)**:646-647.
- Petersen PE, Bourgeois D, Ogawa H, Estupinan-Day S, Ndiaye C: **The global burden of oral diseases and risks to oral health.** *Bull World Health Organ* 2005, **83(9)**:661-669.
- Muya RJ: **Changing and developing dental health services in Tanzania 1980-2000.** Dar Es Salaam, Tanzania, Ministry of Health; 1984:160 s..
- Sarita PT, Witter DJ, Kreulen CM, Matee MI, van't Hof MA, Creugers NH: **Decayed/missing/filled teeth and shortened dental arches in Tanzanian adults.** *Int J Prosthodont* 2004, **17(2)**:224-230.
- Susin C, Oppermann RV, Haugejorden O, Albandar JM: **Tooth loss and associated risk indicators in an adult urban population from south Brazil.** *Acta Odontol Scand* 2005, **63(2)**:85-93.
- Luhanga C, Ntabaye M: **Geriatric oral health issues in Africa: Tanzanian perspective.** *Int Dent J* 2001, **51(3 Suppl)**:219-227.
- Lwanga SKLS: **Sample size determinants in health studies. A practical manual.** World Health Organization; 1990.
- Victora CG, Fenn B, Bryce J, Kirkwood BR: **Co-coverage of preventive interventions and implications for child-survival strategies: evidence from national surveys.** *Lancet* 2005, **366(9495)**:1460-1466.

26. Henriksen BM, Ambjornsen E, Axell TE: **Evaluation of a mucosal-plaque index (MPS) designed to assess oral care in groups of elderly.** *Spec Care Dentist* 1999, **19(4)**:154-157.
27. **World Health Organization: Oral health survey: Basic methods.** Geneva ; 1997.
28. Laster L, Laudenbach KW, Stoller NH: **An evaluation of clinical tooth mobility measurements.** *J Periodontol* 1975, **46(10)**:603-607.
29. **Federation Dentaire Internationale: Global goals for oral health in the year 2000.** In *Int Dent J Volume 32*. FDI; 1982:74-77.
30. Fure S, Zickert I: **Incidence of tooth loss and dental caries in 60-, 70- and 80-year-old Swedish individuals.** *Community Dent Oral Epidemiol* 1997, **25(2)**:137-142.
31. Dolan TA, Gilbert GH, Duncan RP, Foerster U: **Risk indicators of edentulism, partial tooth loss and prosthetic status among black and white middle-aged and older adults.** *Community Dent Oral Epidemiol* 2001, **29(5)**:329-340.
32. Haugejorden O, Klock KS, Trovik TA: **Incidence and predictors of self-reported tooth loss in a representative sample of Norwegian adults.** *Community Dent Oral Epidemiol* 2003, **31(4)**:261-268.
33. Sahn DEYSDGG: **The demand for health care services in Rural Tanzania.** *Oxford Bulletin of Economics and Statistics* 2003, **65(2)**:241-259.
34. Albandar JM, Streckfus CF, Adesanya MR, Winn DM: **Cigar, pipe, and cigarette smoking as risk factors for periodontal disease and tooth loss.** *J Periodontol* 2000, **71(12)**:1874-1881.
35. Sheiham A, Steele JG, Marcenes W, Tsakos G, Finch S, Walls AW: **Prevalence of impacts of dental and oral disorders and their effects on eating among older people; a national survey in Great Britain.** *Community Dent Oral Epidemiol* 2001, **29(3)**:195-203.
36. Osterberg T, Steen B: **Relationship between dental state and dietary intake in 70-year-old males and females in Goteborg, Sweden: a population study.** *J Oral Rehabil* 1982, **9(6)**:509-521.
37. Yamaga T, Yoshihara A, Ando Y, Yoshitake Y, Kimura Y, Shimada M, Nishimuta M, Miyazaki H: **Relationship between dental occlusion and physical fitness in an elderly population.** *J Gerontol A Biol Sci Med Sci* 2002, **57(9)**:M616-20.
38. Witter DJ, van Palenstein Helderma WH, Creugers NH, Kayser AF: **The shortened dental arch concept and its implications for oral health care.** *Community Dent Oral Epidemiol* 1999, **27(4)**:249-258.
39. Baelum V: **Pattern of periodontal breakdown in adult Tanzanians.** *Scand J Dent Res* 1987, **95(3)**:221-228.
40. Sanya BO, Ng'ang'a PM, Ng'ang'a RN: **Causes and pattern of missing permanent teeth among Kenyans.** *East Afr Med J* 2004, **81(6)**:322-325.
41. Oginni FO: **Tooth loss in a sub-urban Nigerian population: causes and pattern of mortality revisited.** *Int Dent J* 2005, **55(1)**:17-23.

Pre-publication history

The pre-publication history for this paper can be accessed here:

<http://www.biomedcentral.com/1472-6831/6/5/prepub>

Publish with **BioMed Central** and every scientist can read your work free of charge

"BioMed Central will be the most significant development for disseminating the results of biomedical research in our lifetime."

Sir Paul Nurse, Cancer Research UK

Your research papers will be:

- available free of charge to the entire biomedical community
- peer reviewed and published immediately upon acceptance
- cited in PubMed and archived on PubMed Central
- yours — you keep the copyright

Submit your manuscript here:
http://www.biomedcentral.com/info/publishing_adv.asp



Paper II

European Journal of Oral Sciences 115, Kida, I. A.; Åstrøm, A. N.; Strand, G. V.; Masalu, J. R., Chewing problems and dissatisfaction with chewing ability: a survey of older Tanzanians, pp. 265-274. Copyright 2007 Blackwell Publishing Ltd.
<http://dx.doi.org/10.1111/j.1600-0722.2007.00459.x>

Abstract only. Full-text not available due to publisher restrictions.

Chewing problems and dissatisfaction with chewing ability: a survey of older Tanzanians

Irene A. Kida, Anne N. Åstrøm, Gunhild V. Strand, Joyce R. Masalu

Abstract

This study assessed the prevalence and correlates of reported chewing problems and dissatisfaction with chewing ability. Discrepancy between reported chewing problems and satisfaction/dissatisfaction with chewing ability was examined. A household survey was conducted in Tanzania in 2004/2005. A total of 1,031 adults (mean age 62.9 yr) underwent clinical examination and a personal interview. Forty per cent [95% confidence interval (CI): 37–43] reported problems with chewing at least one food item, and 25% (95% CI: 22–28) were dissatisfied with their chewing ability. Adjusted odds ratios (OR) for reporting problems with chewing any food were 1.6, 1.2, and 4.2 if having intact anterior/reduced posterior, reduced anterior/intact posterior, and reduced anterior/posterior occluding units, respectively. Subjects dissatisfied with their chewing ability were less likely to be female (OR $\frac{1}{4}$ 0.6) and more likely to have reduced anterior/posterior occluding units (OR $\frac{1}{4}$ 3.4), to report dental pain (OR $\frac{1}{4}$ 2.5), chewing problems (OR $\frac{1}{4}$ 4.7), and oral impacts on daily performances (OIDP) (OR $\frac{1}{4}$ 3.2). The OIDP scores discriminated between satisfied and dissatisfied groups, irrespective of confirmed chewing problems. Chewing problems and dissatisfaction with chewing ability was prevalent among older Tanzanians. Clinical measures of dentition status, together with reported functional and psychosocial impact scores, determined the subjects' evaluation of their chewing ability and should be taken into account when estimating treatment needs.

Key words: dental occlusion; mastication; older adults; satisfaction; Tanzania

Paper III

Research

Open Access

Psychometric properties and the prevalence, intensity and causes of oral impacts on daily performance (OIDP) in a population of older Tanzanians

IA Kida*^{1,2}, AN Åstrøm^{1,3}, GV Strand⁴, JR Masalu² and G Tsakos⁵

Address: ¹Centre for international health, UoB, Bergen, Norway, ²Muhimbili University College of Health Sciences, Dar es Salaam, Tanzania, ³Department of Odontology-Community Dentistry, UoB, Bergen, Norway, ⁴Department of Odontology-Gerodontology, UoB, Bergen, Norway and ⁵Department of Epidemiology and Public Health, University College of London Medical School, UK

Email: IA Kida* - irene.kida@student.uib.no; AN Åstrøm - anne.aastrom@cih.uib.no; GV Strand - Gunhild.strand@odont.uib.no; JR Masalu - jmasalu@muchs.ac.tz; G Tsakos - g.tsakos@ucl.ac.uk

* Corresponding author

Published: 27 August 2006

Received: 22 May 2006

Health and Quality of Life Outcomes 2006, **4**:56 doi:10.1186/1477-7525-4-56

Accepted: 27 August 2006

This article is available from: <http://www.hqlo.com/content/4/1/56>

© 2006 Kida et al; licensee BioMed Central Ltd.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/2.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

Background: The objective was to study whether a Kiswahili version of the OIDP (Oral Impacts on Daily Performance) inventory was valid and reliable for use in a population of older adults in urban and rural areas of Tanzania; and to assess the area specific prevalence, intensity and perceived causes of OIDP.

Method:

A cross-sectional survey was conducted in Pwani region and in Dar es Salaam in 2004/2005. A two-stage stratified cluster sample design was utilized. Information became available for 511 urban and 520 rural subjects (mean age 62.9 years) who were interviewed and participated in a full mouth clinical examination in their own homes.

Results: The Kiswahili version of the weighted OIDP inventory preserved the overall concept of the original English version. Cronbach's alpha was 0.83 and 0.90 in urban and rural areas, respectively, and the OIDP inventory varied systematically in the expected direction with self-reported oral health measures. The respective prevalence of oral impacts was 51.2% and 62.1% in urban and rural areas. Problems with eating was the performance reported most frequently (42.5% in urban, 55.1% in rural) followed by cleaning teeth (18.2% in urban, 30.6% in rural). More than half of the urban and rural residents with impacts had very little, little and moderate impact intensity. The most frequently reported causes of impacts were toothache and loose teeth.

Conclusion: The Kiswahili OIDP inventory had acceptable psychometric properties among non-institutionalized adults 50 years and above in Tanzania. The impacts affecting their performances were relatively common but not very severe.

Background

Clinical data are mouth centered and rely on dental professionals' judgments. They have traditionally been uti-

lized in assessing oral health in industrialized- and low income countries. Although informative, this clinical approach has been criticized because of its limited focus

in terms of failing to consider functional and psychosocial aspects of oral health [1,2]. In response to a concern that clinical measures alone may not be adequate for assessing the public's oral health needs, oral health related quality of life measures (OHRQoL) have been developed and tested in various populations and are increasingly being used to supplement clinical indicators [1]. Cross-cultural adaptation of existing measures is warranted and efforts are ongoing to translate and adapt OHRQoL measures for use in non-western cultural settings [1,3].

One promising OHRQoL measure is the Oral Impacts on Daily Performance (OIDP) scale [4,5]. The OIDP was developed to measure oral impacts that seriously affect a person's daily life. It is based on the conceptual framework of the World Health Organisation's International Classification of Impairments, Disabilities and Handicaps, ICDH [6], which has been amended for dentistry by LOCKER [7]. The OIDP concentrates only on the measurement of "ultimate" oral impacts, thus covering the fields of disability and handicap [4,5]. It consists of 8 items that assess the impact of oral conditions on basic activities and behaviours that cover the physical, psychological, and social dimensions of daily living [4,5]. Considering respondent burden, the OIDP is suitable for use in population surveys, not only in terms of being easier when measuring behaviours rather than feeling states, but also in being short. The scoring system quantifies (weigh) the impacts by using a score that reflects their frequency as well as a severity score that indicates the importance of the specific impact in the daily life of the person. Multiplying the frequency and severity scores provides different performance scores and the total score is expressed as a percentage of the sum of the performance scores divided by the maximum possible score multiplied by 100. In this sense the severity score provides a way of weighting the frequency of oral impacts with individually sensitive weights. Although, socio-dental indicators have been reported to perform satisfactorily as un-weighted rather than as weighted scores [8,9], the individually sensitive weighting system of the OIDP gives prominence and increased validity to the views of the respondents [10]. Moreover, it is evident that the OIDP weighted score is a better predictor than either the frequency or severity scores separately [1].

The OIDP has proved to be reliable and valid in cross-sectional population based studies. It has been shown to be applicable to older adult populations in Great Britain [11], Greece [10] and Thailand [12]. From Tanzania, Masalu et al [13] reported that the English OIDP frequency questionnaire fulfilled the psychometrical requirements underlying the scoring of the eight items and was applicable to adults attending higher education in Dar es Salaam.

Recently, it has been claimed that more oral health care is needed globally for the growing ageing populations [14]. In this context the OIDP index is worthy of consideration because of its adaptation for use in oral health needs assessment, thus making it useful for planning services [15,16]. This study aimed to assess the applicability of a Kiswahili version of the OIDP inventory for use in a population of older Tanzanian adults. First, internal reliability was assessed and discriminative and construct validity were determined by comparing OIDP scores of groups that differ regarding their demographic, socio-economic, clinical and behavioural characteristics. Secondly, the urban rural specific prevalence, severity and causes of oral impacts in older adults were assessed.

Methods

Study area

A cross sectional survey was conducted in Pwani region, Eastern Tanzania and in the capital city of Dar es Salaam from November 2004 to June 2005. According to the 2002 population and housing survey in Tanzania, Pwani region has the highest number of people 65 years and above in the country (7%). Dar es Salaam and Pwani region have a total population of 2.5 million and 889,154, respectively. The corresponding figures for population densities are 1,793 and 27 persons per square km. The districts have drinking water with fluoride content of about 1 mg fluoride/L (1 ppm)

Sampling and procedure

A sample size of 1200 was calculated assuming a prevalence rate of tooth loss (≥ 1 missing tooth) of 50%, a precision of 4% and a design effect of 2 [17]. The estimated sample size was satisfactory also for two sided tests, assuming prevalence of oral impacts of 0.60 and 0.50 in individuals with caries experience and without caries experience, a significance level of 5% and a power of 90% [17]. A stratified (disproportionate) two-stage cluster sample design with villages as the primary sampling unit was implemented. Villages were selected from two rural districts (Kibaha and Bagamoyo) and one urban (Kinondoni) district in Pwani and Dar es Salaam region, respectively (Fig 1). To obtain a sample of older adults of mixed socio-economic background, 107 pure urban ($N = 59688$) villages and 96 pure rural villages ($N = 26520$) were listed in Kinondoni and in Kibaha/Bagamoyo. At the first stage, 10 pure urban villages ($n = 6290$) and 10 pure rural villages ($n = 3729$) were selected by systematic random sampling from the district village population lists. At the second stage, a total of 60 households were selected by systematic random sampling from each village selected at the first stage. This involved randomly selecting the first household by spinning a bottle at the presumed center of each village to obtain a starting direction, listing on papers all household heads in the selected direction up to the

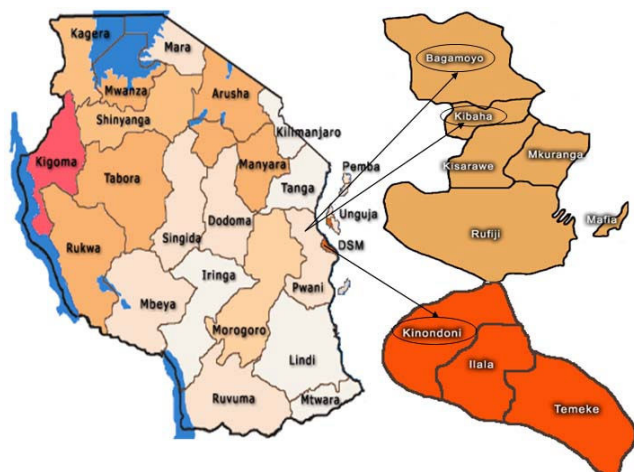


Figure 1
Tanzania: Kibaha and Bagamoyo districts (rural) in Pwani region and Kinondoni district (urban) in Dar es Salaam city.

border of the village, folding the paper and randomly picking one name. The next household would be one whose front door was nearest to the previous one. A household was defined as a group of people living, cooking and eating together. One person 50 years and above was enrolled per household. In case the household had several people in the targeted age group, one man and one woman were selected randomly. Over sampling of rural villages were implemented to achieve a sample size that was big enough to conduct stratified analyses. A village leader followed the data collectors through the village and traditional village customs were observed to ensure a high response rate. Only consenting subjects were included in the study. Reasons for non-participation were refusals ($n = 45$), absence from the household on the day of the interview ($n = 88$). Exclusion criteria were presence of disease/conditions that might pose a health risk to the participant or that may interfere with the interview and clinical examination. Subjects were excluded if they were ill or had a history of psychiatric problems ($n = 23$), were intoxicated with alcohol ($n = 2$), were too old ($n = 7$) or had beliefs in witchcraft ($n = 4$). Permission to carry out the study was approved by the Research and Publication Committee at Muhimbili University College of Health Sciences, MUCHS, regional and district administration authorities, village leaders and from the ethical research committee in Norway (REK VEST). Informed consent was obtained from all participating subjects.

Interview

For the OIDP inventory to be administered among older adults 50 years and above in Tanzania, translation into

Swahili language was mandatory (see additional file 1). Kiswahili is the national and official language in Tanzania and almost all (95%) Tanzanians speak the language proficiently. A structured interview schedule, including the OIDP inventory, questions on socio-demographic characteristics and other health-and oral health issues was constructed in English, translated into Kiswahili by two Tanzanian professionals fluent in Kiswahili and English and back translated into English by two independent translators. Project staff at the MUCHS reviewed the OIDP questionnaire for semantic, experiential and conceptual equivalence to the source version. Sensitivity to culture and selection of appropriate words were considered. After being reviewed for content and face validity by panels of Tanzanian academics, the Kiswahili version of the OIDP inventory was compared with a *de novo* development of oral impacts on daily performances generated through focused group interviews with a sub-group of the study participants. The interview schedule was piloted before administration to identify questions which were not clear. The interview was administered in the field by two trained research assistants before the participants were clinically examined.

The eight item OIDP index referred to difficulty carrying out the eight daily life activities during the past six months, (Table 1). Each frequency item (originally scored 0–5) was changed into 0–3 scores where (0) never, (1) less than once a month, (2) once or twice a month up to once or twice a week, (3) 3–4 times a week or more often [18]. The OIDP severity scores were assessed on a 4-point scale as follows; (0) not severe at all, (1) less severe, (2) severe, (3) very severe. Finally the participants were asked to identify the oral condition that caused the specific impacts by answering for each reported item (1) yes or (0) no to the following alternatives: "toothache, loose teeth, gum abscess, bad breath and bleeding gums".

Performance scores representing the weighted impact on each performance were calculated by multiplying frequency (0–3) and severity scores (0–3). The overall OIDP impact scores, OIDP-total, was the sum of all 8 weighted performances (range 0–72). For the purpose of cross-tabulation and logistic regression analyses, the OIDP-total scores were dichotomized using a score of 1 or more as cut-off. The distribution of the OIDP-total scores supported this cut-off point. Following the alternative scoring method described by Gherunpong et al. [18], each weighted performance score (range 0–9) was classified into 6 levels of intensity; none, very little, little, moderate, severe and very severe (Table 2). The overall intensity of oral impacts for a person follows the same classification and refers to the most severe impact on any of the 8 performances or the highest performance score. Finally, the extent of oral impacts, OIDP-extent, (range 0–8) was cal-

Table 1: The Oral Impacts on Daily Performances index (OIDP).

During the past 6 months – how often have problems with your mouth and teeth caused you any difficulty in:	
a.	Eating and enjoying food
b.	Speaking and pronouncing clearly
c.	Cleaning teeth
d.	Sleeping and relaxing
e.	Smiling, laughing and showing teeth without embarrassment
f.	Maintaining usual emotional state without being irritable
g.	Carrying out major work or socio role
h.	Enjoying contact with people

culated as a simple count score (OIDP SC); i.e. summing dichotomized frequency items in terms of (1) affected (including the original categories 1,2,3) and (0) not affected (including the original category 0). In order to demonstrate the relative burden of impacts among those affected, in this study we report on the intensity and extent of oral impacts among those participants with an impact, not on the whole sample. This means that for this purpose we do not consider subjects scored as zero respectively ("none" for intensity, "not affected" for extent), as this information is already provided by the prevalence figures. The correlation coefficient (Spearman's Rho) between the weighted OIDP-total on the one hand and OIDP SC sum scores on the other was 0.97.

The predictor variables used in the analyses, their coding and the number of subjects (%) according to categories are depicted in Table 3. *Socio-demographics* were assessed in terms of place of residence, gender and age. *Family wealth* was assessed as an indicator of socio-economic status in accordance with a standard approach in equity analyses [19]. Household durable assets indicative of family wealth (e.g. bicycle, television, car, motor cycle) assessed as (1) available/in working condition, (2) not available/available but not in working condition were analyzed in a principle component analysis. The first component resulting from the analysis was used to divide households into four approximate quartiles of wealth status ranging from 1st quartile (least poor) to 4th quartile (most poor). *Self*

reported oral health status was coded (1) very good, (2) good, (3) average, (4) bad, (5) very bad and further dichotomized into (1) good (original categories 1,2,3) and (2) bad.

Clinical examination

One trained and calibrated dentist (IK) conducted all clinical examinations in a shaded area with natural daylight as the source of illumination and with an assistant recording the observations. Research assistants for recording were trained and calibrated before the main survey. Participants identified with problems that needed treatment were referred or advised to seek treatment from the nearest health care facility. Oral health education sessions were provided for all the participating subjects. A full mouth clinical examination, including 3rd molars was conducted. *Caries experience* was assessed in accordance with the criteria described by the World Health Organization, WHO [20]. *Number of teeth lost due to any reason* was calculated with the inclusion of edentulous people (0.6%) and coded (1) 0–10, (2) 11–19 and (3) 20+. *Tooth mobility* was assessed using a modified Miller's index [21], whereby the ends of two instruments were placed on either sides of the tooth and forces applied in bucco-lingual/palatal direction and scored as present or absent. An individual tooth mobility score was defined as (1) 2 or more mobile teeth, (0) less than 2 mobile teeth. *Posterior premolar and molar occluding units, POU*, were counted based on existing natural tooth contacts between maxilla

Table 2: Classification of the intensity of oral impacts on a performance, after Gherunpong et al., 2004 [18].

Intensity	Severity score	Frequency score	Performance score
Very severe	(3)	×	(3)
Severe	(3)	×	(2)
	(2)	×	(3)
Moderate	(2)	×	(2)
	(3)	×	(1)
	(1)	×	(3)
Little	(2)	×	(1)
	(1)	×	(2)
Very little	(1)	×	(1)
No impacts	(0)	×	(0)

Table 3: Frequency distribution of participants in urban (Kinondoni) and rural (Kibaha/Bagamoyo) districts of Tanzania according to category on independent variables (n = 1031).

Variables	Categories (Code)	Urban	Rural
		% (n)	% (n)
Age (years)	50–59 (1)	50.3 (257)	37.9 (197)
	60–69 (2)	28.8 (147)	30.0 (156)
	70+ (3)	20.9 (107)	32.1 (167)*
Gender	Male (1)	42.7 (218)	50.0 (260)
	Female (2)	57.3 (293)	50.0 (260)*
Wealth index	1 st quartile-least poor	45.4 (232)	4.4 (23)
	2 nd quartile	40.1 (205)	8.8 (46)
	3 rd quartile	11.2 (57)	35.0 (182)
	4 th quartile – poorest	3.3 (17)	51.7 (269)*
Number of decayed teeth	0–1 (0)	54.0 (276)	44.6 (232)
	2–22 (1)	46.0 (235)	55.4 (288)*
Posterior occluding units,	10 POU (1)	12.1 (62)	22.7 (118)
	0–9 POU (2)	87.9 (449)	77.3 (402)*
Mobile teeth	0–1 (1)	83.8 (428)	77.3 (402)
	2–25 (2)	16.2 (83)	22.7 (118)*
Self-reported oral health status	Good (1)	74.4 (380)	54.4 (283)
	Bad (2)	25.6 (131)	45.6 (237)*
Chewing ability	All foods (1)	74.8 (382)	63.7 (331)
	Soft/mashed only (2)	25.2 (129)	36.3 (189)*
Number of missing teeth	0–10 (1)	83.2 (425)	82.2 (427)
	11–19 (2)	11.9 (61)	12.3 (64)
	20+ (3)	4.9 (25)	5.6 (29)

* $p \leq 0.05$.

The total number in the different categories did not add up to 1031 owing to missing values.

and mandible in the bilateral regions. The number of occluding units, POU, (with or without intact anterior region) was categorized into (1) complete posterior occluding support/10 functional occluding units, (2) reduced posterior occluding support/1–9 occluding units and (3) absence of bilateral occluding support. For analysis, a dummy variable was constructed yielding, (1) reduced occluding support (0–9 units) and (0) complete occluding support (10 units). The distribution of the originally scored POU variable supported this cut off point.

Reproducibility

Duplicate clinical examinations were carried out on a randomly selected sub-sample, considered to be representative of the study subjects. Analysis performed on the duplicate examination recordings gave kappa statistics of 1.00 for missing teeth due to caries, decayed teeth and occluding support. Kappa statistics of 0.77 and 0.79 were provided with respect to mobile teeth and tooth loss due to other reasons, respectively. These figures indicate a very good intra-examiner reliability according to WHO [20].

Statistical analyses

Data were analyzed using SPSS version 13.0. Due to the very low number of edentulous subjects in the material (six subjects), edentate subjects were included in the anal-

ysis. Limiting the analyses to the dentate participants did not change the results reported here. Cross tabulation and chi-square statistics were used to assess bivariate relationships. Internal consistency reliability was assessed using Spearman's correlation coefficient and Cronbach's alpha. To adjust for the effect of the survey design (strata and clustering), re-analyses were conducted with STATA 9.0 using the svylogit command.

Results

Characteristics of participants

A total of 511 (participation rate 85.2%) urban and 520 (participation rate 86.7%) rural subjects between 50 and 100 years (mean age: 62.9, SD = 10.6, men: 46.4%, no formal education: 44.7%), completed an extensive personal interview followed by a full mouth clinical examination. The prevalence of tooth loss (≥ 1 tooth due to any reason) was 85.5% (mean tooth loss 6.1, SD = 6.4) in urban areas and 82.1% (mean tooth loss 5.9, SD = 6.6) in rural areas [22]. Table 3 gives the percentage distribution of participants' socio-demographic-, clinical-, and behavioral characteristics in urban Kinondoni and rural Kibaha/Bagamoyo districts.

OIDP validity and reliability

One subject omitted one OIDP frequency item. This small number of missing responses adds support to the face validity of the Kiswahili OIDP inventory successfully addressed through focused group interviews and panel reviews. Construct and criterion validity was demonstrated in that the OIDP-total impact scores discriminated in the expected direction between subjects who rated their oral health status and chewing ability as good and bad (Table 4). Moreover, as depicted in Table 4, the mean OIDP total scores increased significantly with increasing number of decayed teeth, reduced number of posterior occluding units, increased number of mobile teeth (both urban and rural) and increased number of missing teeth (urban only). The association between the prevalence of oral impacts (OIDP total >0) and factors known to be associated with oral health; socio-demographic-, clinical and behavioral variables were assessed using unadjusted and adjusted logistic regression analysis (Table 5). There was a statistically significant relationship ($p < 0.001$) between the prevalence of oral impacts and place of residence, wealth index, self-reported oral health status, chewing ability and a number of clinical oral health indicators in the bivariate analysis. In the multiple logistic regression analysis, age, number of POU's, self-rated oral health and reported chewing ability remained statistically significant predictors. The ORs for experiencing any oral impact was 0.6, 1.7, 7.7 and 3.2 if being older, having reduced number of POU's, reporting bad oral health status and reporting chewing problems, respectively.

Test-retest reliability of the OIDP inventory was not performed due to ethical considerations, because oral health education sessions were provided for all participants after completion of the oral examination and because referrals for treatment were given to those with an acute oral problem. Internal consistency reliability analysis showed homogeneity of the OIDP-total items. In Kinondoni (urban), the corrected item - total correlation coefficient (i.e the correlation between each item and the total score after omitting the item) ranged between Spearman's rho 0.42 and 0.64 with a standardized Cronbach's alpha coefficient of 0.83. In Kibaha/Bagamoyo (rural) the corrected item total ranged from Spearman's rho 0.62 to 0.82 with a Cronbach's alpha of 0.90 (Table 6).

Prevalence, extent, intensity and causes of OIDP

A total of 43.2% and 44.5% had impact scores of zero (floor effect) using the OIDP ADD and the OIDP-total scoring method, respectively. The corresponding ceiling effects (proportions of adults who scored maximum) were 0.6% and 0.1%. As shown in Table 7 and 8, the prevalence of oral impacts (OIDP total >0) was high, amounting to 51.2% and 62.1% in Kinondoni (urban) and Kibaha/Bagamoyo (rural), respectively. In both areas, impacts on eating were most prevalent (42.5% in urban and 55.1% in rural) followed by cleaning teeth (18.2% in urban and 30.6% in rural), emotional stability (17.4% in urban and 30.4% in rural) and sleeping/relaxing (12.1% in urban and 27.0% in rural). Impacts on social contacts, work and smiling/showing teeth were the least prevalent impacts in both areas (Tables 7, 8). However, they were still quite

Table 4: Construct and criterion validity of the OIDP-total scores: mean values for each category of grouping variable and differences in mean rank (DMR). Mann Whitney U test and Kruskal Wallis test.

	Urban (n = 508)			Rural (n = 512)		
	Mean	p	DMR	Mean	p	DMR
<i>Oral health status</i>						
Good	2.1			3.6		
Bad	8.9	0.001	142.3	15.6	0.001	167.2
<i>Chewing foods</i>						
All kinds	2.5			5.3		
Soft and mashed only	7.7	0.001	100.0	15.7	0.001	136.2
<i>Decayed teeth</i>						
0-1	2.9			7.5		
2-22	4.9	0.002	37.8	10.4	0.002	38.8
<i>Occluding units</i>						
10 units	1.4			6.4		
0-9 units	4.2	0.001	67.1	9.9	0.001	51.9
<i>Number of missing teeth</i>						
0-10	3.6			8.3		
11-19	4.6			13.3		
20+	6.2	0.492	26.1	11.0	0.001	59.8
<i>Mobile teeth</i>						
0-1	3.5			8.2		
2 or more	5.3	0.034	35.0	12.1	0.001	57.2

Table 5: Odds ratios (ORs) and 95% Confidence Limits (CL) for having any oral impacts on daily performance (OIDP total >0) according to clinical and non-clinical variables.

	%(n)	Unadjusted		Adjusted	
		OR	95%CI	OR	95% CL
Age (years): 50–59	57.1 (257)				
60–69	50.7 (151)	0.8	0.5–1.1	0.6	0.4–0.8
70+	58.1 (158)	1.0	0.7–1.4	0.7	0.4–1.0
Sex: Male	54.8 (258)				
Female	56.1 (308)	1.0	0.8–1.3	0.9	0.6–1.2
Place: Urban	48.8 (248)				
Rural	62.1 (318)**	1.6	1.2–2.1	1.2	0.9–1.7
Wealth: 1 st least poor	50.2 (127)				
2 nd	48.0 (120)	0.9	0.6–1.2	0.5	0.5–1.1
3 rd	59.1 (139)	1.4	1.0–2.0	0.5	0.5–1.1
4 th most poor	63.8 (180)**	1.8	1.4–2.4	0.4	0.4–1.1
OHS: Good	38.0 (249)				
Bad	86.8 (317)**	10.6	7.5–15.0	7.7	5.4–11.1
Chewing food: all	44.3 (313)				
soft	80.6 (253)**	4.9	3.6–6.7	3.2	2.1–4.7
Decayed teeth: 0–1	49.5 (249)				
2–22	61.3 (317)**	1.6	1.3–2.1	0.9	0.7–1.3
Missing teeth: 0–10	53.4 (449)				
11–19	64.0 (80)	1.5	1.0–2.1	0.6	0.4–1.1
20+	68.5 (37)*	1.8	1.0–3.2	0.6	0.2–1.3
Posterior Occl Units:					
10	41.0 (73)				
0–9	58.6 (493)**	2.0	1.4–2.8	1.7	1.2–2.6
Mobile teeth: 0–1	52.1 (428)				
2 or more	69.3 (138)**	2.0	1.4–2.8	1.4	0.9–2.1

The total number in the different categories did not add up to 566 owing to missing values. ** p ≤ 0.001.

prevalent; 5.9% of urban and 21.7% of rural participants reported oral impacts in relation to social contacts, while the figures for oral impacts in relation to smiling were 8.4% and 15.6%.

In terms of the extent of oral impacts among subjects with impacts, in Kinondoni (urban) 47.3% had 1, 18.2% had 2 and 9.3% had 3 impacts. The corresponding figures in Kibaha/Bagamoyo (rural) were 32.7%, 13.0% and 11.4%. Few participants had 5 or more impacts.

In relation to the intensity of impacts, 6.0%, 14.0% and 4.3% of the participants in Kinondoni (urban) with impacts on respectively, eating, smiling and cleaning, had *very severe* impacts. Corresponding figures for eating, cleaning, emotion and smiling were 8.7%, 10.1%, 9.5% and 8.6% in Kibaha/Bagamoyo (rural). Mean scores of impacts (range 0–9) on each of the 8 performances ranged from 1.4 (eating) to 0.2 (working/social contact) in urban areas and from 2.1 (eating) to 0.6 (smiling) in rural areas. The distribution of the OIDP-total scores were skewed, mean 3.8 (sd = 6.5, range 0–40) and mean 9.1 (sd = 13.3, range 0–72) in urban and rural areas (Table 7, 8).

The oral problems perceived to cause the impacts on each of the 8 performances are shown separately for urban and rural residents in Fig. 2. In both areas, toothache and loose teeth were the most frequently perceived causes of impairments for almost all the performances. The majority of impacts on cleaning teeth were caused by bleeding gingiva and toothache in urban and rural areas, respectively. Bad breath was the third most frequently reported cause of impacts on speaking (among both urban and rural subjects) and enjoying contact with people (rural subjects), while bleeding gums was the third most frequently reported cause of impacts on enjoying contact with people in the urban areas.

Discussion

The present study applied for the first time a Kiswahili version of the OIDP weighted inventory to a population of older adults in urban and rural cultural settings of Tanzania. This necessitated reestablishment of the psychometrical properties and a further evaluation of the validity of the OIDP scale. When used in personal interviews, the Kiswahili OIDP was valid and reliable with psychometric properties similar to the original English version [10,11]

Table 6: Internal consistency reliability of the Kiswahili version of the Oral Impacts on daily Performances (OIDP) inventory among urban and rural participants: Corrected item total Spearman's correlation and Cronbach's alpha if item deleted

OIDP item	Urban (n = 508)		Rural (n = 512)	
	Corrected item total correlation	Alpha if item deleted	Corrected item total correlation	Alpha if item deleted
1. Eating	.46	.81	.62	.91
2. Speaking	.54	.77	.70	.89
3. Cleaning	.42	.78	.63	.91
4. Sleeping	.64	.75	.77	.89
5. Showing teeth	.56	.76	.63	.90
6. Emotion	.64	.75	.82	.89
7. Work	.51	.77	.78	.89
8. Social contact	.59	.77	.79	.89
Standardised Cronbach's Alpha		0.83		0.90

and to the English version shown to be applicable with Tanzanian students of higher education [13]. Internal consistency reliability in terms of Cronbach's alphas of 0.83 (urban) and 0.90 (rural) were satisfactory and well above the recommended levels of 0.70. Moreover, the corrected item-total correlation coefficients, ranging from Spearman's rho 0.42 to 0.64 in the urban area and from Spearman's rho 0.62 to 0.82 in the rural area, were above the minimum level of 0.20 for inclusion of an item into a scale [23]. Cultural issues, in particular language might give rise to problems with validity. Although no approach guarantees cross-cultural equivalence, the Kiswahili OIDP seemed to preserve the overall concepts of the English version and did not differ in terms of sequence of questions, the Likert scale and recall memory period used. Experience of the usability of the OIDP inventory across multi-cultural populations of Tanzania, first applied in English

as a self-administered questionnaire [13] and recently in Kiswahili as personal interviews provided further support for the cross-cultural equivalence of this inventory.

Hypotheses regarding the construct and criterion validity of the Kiswahili OIDP inventory were confirmed in that the weighted scores varied systematically and in the expected direction with self-reported oral health status and perceived chewing ability (Table 4, 5). The validity of the Kiswahili translation is supported by observations similar to those in the UK [11], Thailand [4,5], Greece [10] Norway[24] and among university students in Dar es Salaam [13]. In addition, the OIDP scores were significantly associated with various clinical measures (Table 4). In a study of Greek adults 65 years and above, Tsakos et al [2] reported significant associations between various clinical indicators and OIDP, after adjusting for socio-demo-

Table 7: Prevalence (% OIDP SC >0), mean OIDP total impact scores and intensity (% of adults with oral impacts) of older Tanzanians in urban areas (n = 508)

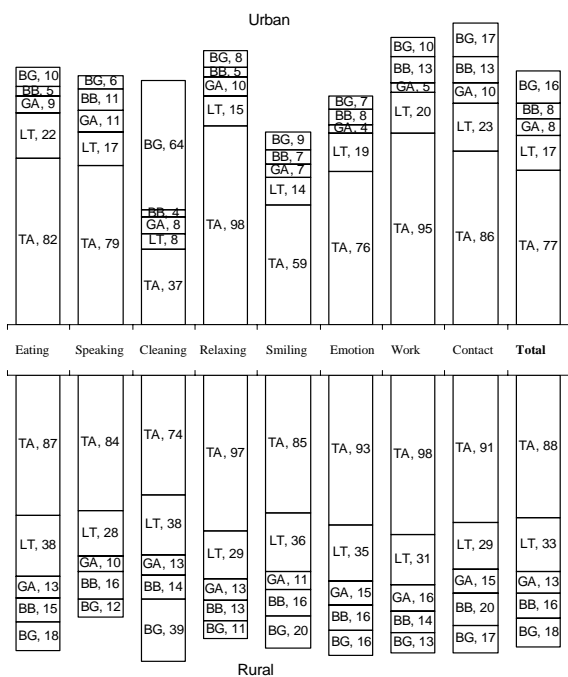
	Overall (n = 508)	Eating (n = 511)	Speaking (n = 508)	Cleaning (n = 511)	Sleeping (n = 511)	Smiling (n = 511)	Emotion (n = 511)	Work (n = 511)	Contact (n = 511)
OIDP prevalence %	51.2	42.5	9.1	18.2	12.1	8.4	17.4	7.6	5.9
OIDP impact score:									
Range	0-40	0-9	0-6	0-9	0-6	0-9	0-9	0-6	0-6
Mean (sd)	3.8 (6.5)	1.4 (2.1)	0.3 (1.0)	0.5 (1.4)	0.4 (1.1)	0.3 (1.3)	0.5 (1.3)	0.2 (0.9)	0.2 (0.8)
Impact intensity ^a									
Very little	11.2	11.5	8.7	30.1	11.3	14.0	14.6	12.8	26.7
Little	22.0	31.8	43.5	29.0	19.4	25.6	38.2	30.8	26.7
Moderate	58.4	38.7	37.0	30.1	62.9	39.5	38.2	53.8	36.7
Severe	8.4	12.0	10.9	6.5	6.5	7.0	7.9	2.6	10.0
Very severe	0.0	6.0	0.0	4.3	0.0	14.0	1.1	0.0	0.0

^a Impact intensity: % of adults with impact.

Table 8: Prevalence (% OIDP SC >0), mean OIDP-total impact score-, and impact intensity scores (% of adults with impacts) of older Tanzanians in rural areas (n = 512)

	Overall (n = 512)	Eating (n = 519)	Speaking (n = 514)	Cleaning (n = 520)	Sleeping (n = 519)	Smiling (n = 520)	Emotion (n = 520)	Work (n = 520)	Contact (n = 520)
OIDP prevalence %	62.1	55.1	20.8	30.6	27.0	15.6	30.4	22.5	21.7
OIDP impact score:									
Range	0–72	0–9	0–9	0–9	0–9	0–9	0–9	0–9	0–9
Mean (sd)	9.1 (13.3)	2.1 (2.6)	0.9 (1.9)	1.3 (2.3)	1.1 (2.1)	0.6 (1.7)	1.2 (2.2)	0.9 (1.9)	0.9 (1.9)
Impact intensity ^a									
Very little	11.9	18.1	11.2	12.6	7.9	11.1	14.6	7.7	7.1
Little	15.8	18.4	12.1	13.8	17.1	13.6	19.6	21.4	21.2
Moderate	60.7	32.6	40.2	35.8	50.0	50.6	36.7	47.9	43.4
Severe	11.8	22.2	29.9	27.7	18.6	16.0	19.6	15.4	22.1
Very severe	0.0	8.7	6.5	10.1	6.4	8.6	9.5	7.7	6.2

^a Impact intensity:% of adults with impact.



Abbreviations:
TA- Toothache; LT- Loose tooth; GA- Gum abscess; BB- Bad breath; BG- Bleeding gums

Figure 2
Percentage of the main oral problems causing an impact on the eight performances according to place of residence.

graphic variables. An important finding of this study was the relationship with number of POU, a clinical indicator reflecting both the number of posterior teeth present as well as their function. Similar results have been reported by Tsakos et al., [2], Srisilapanan and Sheiham [12], Locker and Slade [25], Gilbert et al. [26] and Sarita et al [27]. Clinical measures have traditionally been excluded from previous validations of the OIDP instrument [10,11]. The rationale behind the decision to omit clinical variables is derived from the conceptual distinction between health and disease [28,29]. Consistent with this reasoning and with findings reported previously [13], the self-rated oral health status and reported chewing ability associated more strongly with the OIDP impact score than did the measures of clinical indicators. According to the results depicted in Table 5, the ORs for having any oral impact was 7.7 if reporting bad oral health status, 3.3 if eating soft foods only and 1.7 if having reduced number of POU.

As shown in Table 5, rural- and poor participants scored higher on the OIDP inventory than their urban- and less poor counterparts. Accordingly, Srisilapanan [12] found older Thai adults with a high income to be more likely to have low OIDP scores while their counterparts with low income tended to have high OIDP scores. This finding is similar to those observed with other indicators, showing that reducedOHRQoL is most commonly recorded in socially and economically disadvantaged groups [29]. An inverse relationship between OIDP and age emerged in multivariate analysis when allowing for the effects of other variables (Table 5). Similar results have been observed in Norway, with a different age classification system and might reflect the changes in expectations occur-

ring with increasing age [30]. Recently, Locker and Gibson [31] found that half of the elderly subject investigated who described their oral health as poor, were still satisfied with their oral health status, a finding that was attributed to changes and adjustment of values and expectations in later life.

About one-half of the urban and rural subjects interviewed had experienced at least one oral impact during the past 6 months. The estimates obtained compares to the prevalence of impacts reported in Thai populations of younger (35–44 years) (73%) and older adults (52%) [5,12]. The present prevalence is higher, however, than that reported among older adults (67–79 years) in a national survey from Norway (18%) [24] as well as in Great Britain (12.3%) [11] and Greek (39.1%) [10] dentate older populations using the same socio-dental indicator. Further research is required to examine whether the differences in prevalence of OIDP between occidental and non-occidental societies are related to differences in dental status or in culture specific responses to dental impairments.

Consistent with previous studies and across age groups, eating was the most commonly reported aspect of OHR-QoL [13,30,32]. The percentage of impacts related to eating observed among younger and older Tanzanian adults were similar to those observed in comparable age groups of younger and older Thais, but much higher than the impacts of dentate adults from Greece (29.9%), UK (7.0%) and Norway (11.3%) [10,11,24]. More than half of the urban and rural adults with impacts reported having very little, little and moderate intensity, indicating that despite their relatively high prevalence, the reported impacts were not severe. In urban adults, impacts in relation to smiling and showing teeth were more severe than impacts on other performances, whereas in rural adults cleaning was the most severe impact followed by emotional stability and eating. Consistent with results obtained among Thai adults [4,5], toothache and loose teeth were the most frequently reported reasons for impacts from eating.

It should be noted that the accuracy of reporting perceived impairments and symptoms in population based studies might be limited. Another caveat might be the OIDP inventory using a recall period of 6 months and relying on self-reports which implies it can be prone to recall bias. Compared to shorter recall periods longer recalls might result in an underestimation of health consequences but might provide valid estimates for severe outcomes [33]. This might be the case with the OIDP covering ultimate impacts thus essentially measuring the disabilities and handicaps.

Conclusion

The Kiswahili OIDP inventory had acceptable psychometrical properties among non-institutionalized adults 50 years and above in urban and rural areas of Tanzania. The impacts affecting their performances were relatively common but not very severe. Numerous dental problems contribute to the overall impact assessed among elderly Tanzanians in this study. To increase the applicability of the OIDP inventory in need assessment approaches and dental service planning, condition specific impacts should be assessed to support clinical measures of standard treatment needs.

Competing interests

The author(s) declare that they have no competing interests.

Authors' contributions

IK: Principal investigator, conceived of the study, designed the study, collected data, statistical analysis and manuscript writing

ANÅ: Main supervisor, designed study, statistical analysis, manuscript writing

GS: Participated in design of study and manuscript writing

JM: Participated in design of study, data collection and manuscript writing

GT: Have commented on the paper and provided valuable guidance for the OIDP scoring system

All authors read and approved the final manuscript

Additional material

Additional File 1

OIDP – Toleo la Kiswahili. The file provided is the Kiswahili version of the oral impacts on daily performances (OIDP) index.

Click here for file

[<http://www.biomedcentral.com/content/supplementary/1477-7525-4-56-S1.doc>]

Acknowledgements

This study was financially supported by the Faculty of Dentistry and the Centre for International Health, University of Bergen and Statens L nekassen, Norway. The authors would like to thank Professor Ola Haugejorden for valuable comments upon an earlier version of this article. The authors would like to acknowledge the Local administrative authorities, the College Research and Publication committee of the Muhimbili University College of Health Sciences (MUCHS), Tanzania and REK VEST of Norway, for giving

permission to conduct this study. Thanks to the research assistants for their tireless work in the field.

References

- Slade GD, Strauss RP, Atchison KA, Kressin NR, Locker D, Reisine ST: **Conference summary: assessing oral health outcomes--measuring health status and quality of life.** *Community Dent Health* 1998, **15(1)**:3-7.
- Tsakos G, Marcenes W, Sheiham A: **The relationship between clinical dental status and oral impacts in an elderly population.** *Oral Health Prev Dent* 2004, **2(3)**:211-220.
- Locker D: **Oral health and quality of life.** *Oral Health Prev Dent* 2004, **2 Suppl 1**:247-253.
- Adulyanon S, Vourapukjaru A, Sheiham A: **Oral impacts on daily performances.** In *Measuring Oral Health and Quality of Life* Edited by: Slade GD. Chapel Hill, University of North Carolina, Dental Ecology; 1997:152-160.
- Adulyanon S, Vourapukjaru J, Sheiham A: **Oral impacts affecting daily performance in a low dental disease Thai population.** *Community Dent Oral Epidemiol* 1996, **24(6)**:385-389.
- Badley EM: **The ICDH: format, application in different settings, and distinction between disability and handicap. A critique of papers on the application of the International Classification of Impairments, Disabilities, and Handicaps.** *Int Disabil Stud* 1987, **9(3)**:122-125.
- Locker D: **Measuring oral health: a conceptual framework.** *Community Dent Health* 1988, **5(1)**:3-18.
- Allen PF, Locker D: **Do item weights matter? An assessment using the oral health impact profile.** *Community Dent Health* 1997, **14(3)**:133-138.
- McGrath C, Bedi R: **Why are we "weighting"? An assessment of a self-weighting approach to measuring oral health-related quality of life.** *Community Dent Oral Epidemiol* 2004, **32(1)**:19-24.
- Tsakos G, Marcenes W, Sheiham A: **Cross-cultural differences in oral impacts on daily performance between Greek and British older adults.** *Community Dent Health* 2001, **18(4)**:209-213.
- Sheiham A, Steele JG, Marcenes W, Tsakos G, Finch S, Walls AW: **Prevalence of impacts of dental and oral disorders and their effects on eating among older people; a national survey in Great Britain.** *Community Dent Oral Epidemiol* 2001, **29(3)**:195-203.
- Srisilapanan P, Sheiham A: **The prevalence of dental impacts on daily performances in older people in Northern Thailand.** *Gerodontology* 2001, **18(2)**:102-108.
- Masalu JR, Astrom AN: **Applicability of an abbreviated version of the oral impacts on daily performances (OIDP) scale for use among Tanzanian students.** *Community Dent Oral Epidemiol* 2003, **31(1)**:7-14.
- Braine T: **More oral health care needed for ageing populations.** *Bull World Health Organ* 2005, **83(9)**:646-647.
- Gherunpong S, Sheiham A, Tsakos G: **A sociodental approach to assessing children's oral health needs: integrating an oral health-related quality of life (OHRQoL) measure into oral health service planning.** *Bull World Health Organ* 2006, **84(1)**:36-42.
- Gherunpong S, Tsakos G, Sheiham A: **A sociodental approach to assessing dental needs of children: concept and models.** *Int J Paediatr Dent* 2006, **16(2)**:81-88.
- Lwanga SKLS: **Sample size determinants in health studies. A practical manual.** World Health Organization; 1990.
- Gherunpong S, Tsakos G, Sheiham A: **The prevalence and severity of oral impacts on daily performances in Thai primary school children.** *Health Qual Life Outcomes* 2004, **2**:57.
- Victora CG, Fenn B, Bryce J, Kirkwood BR: **Co-coverage of preventive interventions and implications for child-survival strategies: evidence from national surveys.** *Lancet* 2005, **366(9495)**:1460-1466.
- World Health Organization: Oral health survey: Basic methods.** Geneva; 1997.
- Laster L, Loudenbach KW, Stoller NH: **An evaluation of clinical tooth mobility measurements.** *J Periodontol* 1975, **46(10)**:603-607.
- Kida IA, Astrom AN, Strand GV, Masalu JR: **Clinical and socio-behavioral correlates of tooth loss: a study of older adults in Tanzania.** *BMC Oral Health* 2006, **6(1)**:5.
- Streiner DL, Norman GR: **Health measurement scales : a practical guide to their development and use.** In *Oxford medical publications* 2nd edition. Oxford, Oxford University Press; 1995:VIII, 231 s..
- Astrom AN, Haugejorden O, Skaret E, Trovik TA, Klock KS: **Oral Impacts on Daily Performance in Norwegian adults: validity, reliability and prevalence estimates.** *Eur J Oral Sci* 2005, **113(4)**:289-296.
- Locker D, Slade G: **Oral health and the quality of life among older adults: the oral health impact profile.** *J Can Dent Assoc* 1993, **59(10)**:830-3, 837-8, 844.
- Gilbert GH, Foerster U, Duncan RP: **Satisfaction with chewing ability in a diverse sample of dentate adults.** *J Oral Rehabil* 1998, **25(1)**:15-27.
- Sarita PT, Witter DJ, Kreulen CM, Van't Hof MA, Creugers NH: **Chewing ability of subjects with shortened dental arches.** *Community Dent Oral Epidemiol* 2003, **31(5)**:328-334.
- Locker D, Miller Y: **Subjectively reported oral health status in an adult population.** *Community Dent Oral Epidemiol* 1994, **22(6)**:425-430.
- Tsakos G, Marcenes W, Sheiham A: **Evaluation of a modified version of the index of Oral Impacts On Daily Performances (OIDP) in elderly populations in two European countries.** *Gerodontology* 2001, **18(2)**:121-130.
- Astrom AN, Haugejorden O, Skaret E, Trovik TA, Klock KS: **Oral Impacts on Daily Performance in Norwegian adults: the influence of age, number of missing teeth, and socio-demographic factors.** *Eur J Oral Sci* 2006, **114(2)**:115-121.
- Locker D, Gibson B: **Discrepancies between self-ratings of and satisfaction with oral health in two older adult populations.** *Community Dent Oral Epidemiol* 2005, **33(4)**:280-288.
- Astrom AN, Okullo I: **Validity and reliability of the Oral Impacts on Daily Performance (OIDP) frequency scale: a cross-sectional study of adolescents in Uganda.** *BMC Oral Health* 2003, **3(1)**:5.
- Moshiro C, Heuch I, Astrom AN, Setel P, Kvale G: **Effect of recall on estimation of non-fatal injury rates: a community based study in Tanzania.** *Inj Prev* 2005, **11(1)**:48-52.

Publish with **BioMed Central** and every scientist can read your work free of charge

"BioMed Central will be the most significant development for disseminating the results of biomedical research in our lifetime."

Sir Paul Nurse, Cancer Research UK

Your research papers will be:

- available free of charge to the entire biomedical community
- peer reviewed and published immediately upon acceptance
- cited in PubMed and archived on PubMed Central
- yours — you keep the copyright

Submit your manuscript here:
http://www.biomedcentral.com/info/publishing_adv.asp



Appendices I – VII

Appendix I

UNIVERSITETET I BERGEN

Det medisinske fakultet

Harald Hårfagresgt. 1, 5020 BERGEN

Tlf: 55 58 20 84/86

Fax: 55 58 96 82

E-post: Rek-3@iuh.no



UNIVERSITY OF BERGEN

Faculty of Medicine

Harald Hårfagresgt. 1, N-5020 BERGEN

Ph. +47 55 58 20 84/86

Fax: +47 55 58 96 82

E-mail: Rek-3@iuh.no

www.etikkom.no/REK/

*Regional komité for
medisinsk forskningsetikk
Vest-Norge (REK Vest)*

Bergen, 18.11.04

To whom it may concern

Confirmation (REK Vest no. 188.04)

We hereby confirm that the research protocol *Assessing the oral health status and the impacts of tooth loss on the quality of life in a rural and suburban elderly population of Tanzania*, by *Irene A Kida*, has been evaluated by The Regional Committee for Medical Research Ethics in Western Norway (REK Vest).

The protocol is now cleared.

Sincerely,

Arne Salbu
Secretary

Appendix II



MUHIMBILI UNIVERSITY COLLEGE
OF HEALTH SCIENCES

OFFICE OF THE DIRECTOR OF RESEARCH AND PUBLICATIONS

P. O. BOX 65001 ● DAR ES SALAAM ● TANZANIA

TELEPHONE: Direct: 255 22 2152489

Telegrams: UNIVMED

Telex: 41505 MUHMED TZ

Telefax: 255 22-150465

E-mail: drp@muchs.ac.tz

Ref.No.MU/RP/AEC/Vol.II/131

5th July, 2005

✓ Dr. Irene A. Kida,
School of Dentistry,
MUCHS.

RE: ETHICAL CLEARANCE FOR A STUDY TITLED, "ASSESSING THE ORAL HEALTH STATUS AND THE IMPACTS OF TOOTH LOSS ON THE QUALITY OF LIFE IN A RURAL AND URBAN POPULATION OF OLDER ADULTS IN TANZANIA"

Refer to your letter of 9th June, 2005 regarding the above subject.

I am pleased to inform you that the Chairman, has on behalf of the Academic Board, approved your request for ethical clearance.

You can now proceed with your work. However, if you propose any changes to the protocol, you must seek CRPC approval before implementing it.

Prof. M. Aboud

ASSOCIATE DIRECTOR, RESEARCH AND PUBLICATIONS

c.c. Principal,
MUCHS.

c.c. Registrar,
MUCHS.

c.c. Dean,
School of Dentistry,
MUCHS.

Appendix III

APPENDIX III

Request to participate in the Oral Quality of Life survey for elderly in Tanzania

Dear participant,

We hereby would like to ask you to participate in a study, entitled '***Assessing the oral health status and the impact of tooth loss on the quality of life in an older adult population of Tanzania***' considering your dental health, treatment needs and quality of life. Participation involves completion of a dental examination and a personal interview. Participation in the study is voluntary!. Through this study we want to gain information about the oral health status, treatment needs and oral health related quality of life in adult Tanzanians 50 years and above. Similar studies have been carried out in many countries worldwide but are scarce in Tanzania and other sub-Saharan African countries. All information gained through examination and interview will be treated confidentially. The present study is carried out by the University of Bergen and Muhimbili University College for health Sciences in Tanzania.

Serial number

Date

CONSENT FORM

(participating subject)

Title of the project: **Assessing the oral health status and the impacts of tooth loss on the quality of life in an older adult population of Tanzania**

Name of researchers:
Irene Anderson Kida

1. I confirm that I have been informed about the present study. I also confirm that I had the opportunity to ask questions and that I fully understand the information provided
2. I understand that my participation is voluntary and that I am free to withdraw at any time with out giving any reason.
3. I accept the invitation to participate in the above study.

Name of interviewer

Date

Signature

____/____/____

Appendix IV

APPENDIX IV

STRUCTURED PERSONAL INTERVIEW

(Household Survey Questionnaire)

A. Identification details

ID number _____

District _____

Village _____

Village leader _____

Urban/rural _____

Household code _____

Name of respondent _____

Date of interview _____

B. Socio-demographic details

1. Age (*age in completed years*) _____

2. Sex: Male Female

3. Marital status:

Single

Married

Separated

Divorced

Widow / widower

4. Relationship to head of household:

Head

Husband

Wife

Father

Mother

Uncle

Aunt

Other (specify) _____

5. Education:

No education

Not completed primary school

Completed primary school

Secondary school

Completed secondary education

College / university

Don't know

6. Number of people living in the household:

0 – 4

5-10

10 and above

7. The type of fuel the household use for lighting:

Electricity

Kerosene / paraffin

Gaslight

Candlelight

Other (specify) _____

8. Does the household have a working:

Radio yes

no

Television yes

no

Telephone yes

no

Refrigerator yes

no

Lantern (chemli) yes

no

Cupboard yes

no

9. Does any member of the household own:

A bicycle yes

no

A motor cycle /scooter yes

no

A car or truck yes

no

A boat yes

no

10. How many rooms in the house are used for sleeping:

One

Two

Three

Four

More than four

11. Main materials for the floor (*observe*):

Earth and dung

Cement

Other (specify)_____

12. Main material of the roof (*observe*):

Thatch

Iron sheets

Tiles

Concrete

Other (specify)_____

13. Main material of the wall (*observe*):

Thatch

Mad and pole

Unburnt bricks

Burnt bricks with mud

Burnt bricks with cement

Cement blocks

Other (specify)_____

14. How much land is available for cultivation / livestock for the household?

Number of acres: _____

(Probe for approximate number 1 acre = size of a football pitch)

15. Religion:

Christian

Muslim

Other: (specify)_____

16. Occupation:

Self employed

Employed

Retired

C. KISWAHILI version of the 8 item

OIDP

1) During the past 6 months – how often have problems with your mouth and teeth caused you any difficulty in eating and chewing food.

- Never
- Less than once a month
- Once or twice a month
- Once or twice a week
- 3-4 times a week
- Every or nearly every day

2) How severe was your difficulties with eating and chewing food

- Very severe
- Severe
- Less severe
- Not severe at all

3) What was the actual oral problem(s) that caused your difficulty with eating and chewing food?

Condition	Yes	No
<i>Toothache</i>		
<i>Loose tooth</i>		
<i>Gum abscess</i>		
<i>Bad breath</i>		
<i>Bleeding gums</i>		

Other, (specify) _____

4) During the past 6 months – how often have problems with your mouth and teeth caused you any difficulty in speaking and pronouncing clearly

- Never
- Less than once a month
- Once or twice a month
- Once or twice a week
- 3-4 times a week
- Every or nearly every day

5) How severe was your difficulties in speaking and pronouncing clearly

- Very severe
- Severe
- Less severe
- Not severe at all

6) What was the actual oral problem that caused your difficulty with speaking and pronouncing clearly?

Condition	Yes	No
<i>Toothache</i>		
<i>Loose tooth</i>		
<i>Gum abscess</i>		
<i>Bad breath</i>		
<i>Bleeding gums</i>		

Other, (specify) _____

7) During the past 6 months – how often have problems with your mouth and teeth caused you any difficulty with cleaning teeth

- Never
- Less than once a month
- Once or twice a month
- Once or twice a week
- 3-4 times a week
- Every or nearly every day

8) How (serious) severe was your difficulties with cleaning teeth

- Very severe
- Severe
- Less severe
- Not severe at all

9) What was the actual oral problem(s) that caused you the difficulty with cleaning teeth?

Condition	Yes	No
<i>Toothache</i>		
<i>Loose tooth</i>		
<i>Gum abscess</i>		
<i>Bad breath</i>		
<i>Bleeding gums</i>		

Other, (specify) _____

10) During the past 6 months – how often have problems with your mouth and teeth caused you any difficulty in sleeping and relaxing

- Never
- Less than once a month
- Once or twice a month
- Once or twice a week
- 3-4 times a week
- Every or nearly every day

11) How severe was your difficulties with sleeping and relaxing

- Very severe
- Severe
- Less severe
- Not severe at all

12) What was the oral problem (s) that caused your difficulty with sleeping and relaxing?

Condition	Yes	No
<i>Toothache</i>		
<i>Loose tooth</i>		
<i>Gum abscess</i>		
<i>Bad breath</i>		
<i>Bleeding gums</i>		

Other, (specify) _____

13) During the past 6 months – how often have problems with your mouth and teeth caused you any difficulty in smiling, laughing and showing teeth without embarrassment

- Never
- Less than once a month
- Once or twice a month
- Once or twice a week
- 3-4 times a week
- Every or nearly every day

14) How severe was your difficulties with smiling, laughing and showing teeth without embarrassment

- Very severe
- Severe
- Less severe
- Not severe at all

15) What was the actual oral problem (s) that caused your difficulty with smiling laughing and showing teeth without embarrassment?

Condition	Yes	No
<i>Toothache</i>		
<i>Loose tooth</i>		
<i>Gum abscess</i>		
<i>Bad breath</i>		

<i>Bleeding gums</i>		
-----------------------------	--	--

Other, (specify) _____

16) During the past 6 months – how often have problems with your mouth and teeth caused you any difficulty in maintaining usual emotional state without being irritable

- Never
- Less than once a month
- Once or twice a month
- Once or twice a week
- 3-4 times a week
- Every or nearly every day

17) How severe was your difficulties with maintaining usual emotional state without being irritable

- Very severe
- Severe
- Less severe
- Not severe at all

18) What was the actual oral problem(s) that caused your difficulty with maintaining usual emotional state without being irritable?

Condition	Yes	No
<i>Toothache</i>		
<i>Loose tooth</i>		

<i>Gum abscess</i>		
<i>Bad breath</i>		
<i>Bleeding gums</i>		

Other, (specify) _____

19) During the past 6 months – how often have problems with your mouth and teeth caused you any difficulty in carrying out major work or social role

- Never
- Less than once a month
- Once or twice a month
- Once or twice a week
- 3-4 times a week
- Every or nearly every day

20) How severe was your difficulties with carrying out major work and social role

- Very severe
- Severe
- Less severe
- Not severe at all

21) What was the actual oral problem (s) that caused your difficulty with carrying out major work and social role?

Condition	Yes	No
<i>Toothache</i>		
<i>Loose tooth</i>		

<i>Gum abscess</i>		
<i>Bad breath</i>		
<i>Bleeding gums</i>		

Other, (specify) _____

22) During the past 6 months – how often have problems with your mouth and teeth caused you any difficulty in enjoying contact with people

- Never
- Less than once a month
- Once or twice a month
- Once or twice a week
- 3-4 times a week
- Every or nearly every day

23) How severe was your difficulties with enjoying contact with people

- Very severe
- Severe
- Less severe
- Not severe at all

24) What was the actual oral problem (s) that caused your difficulty with enjoying contact with people,

Condition	Yes	No
<i>Toothache</i>		
<i>Loose tooth</i>		
<i>Gum abscess</i>		

<i>Bad breath</i>		
<i>Bleeding gums</i>		

Other, (specify) _____

C. Reported general health, oral health status/ perceived treatment needs, stated ability to eat certain foods/attitudes towards keeping teeth

1) How do you evaluate your general health status?

- Very good
- Good
- Neither good nor bad
- Bad
- Very Bad

2) How do you consider the present condition of your mouth and teeth

- Very good
- Good
- Average
- Bad
- Very bad

3) If you consider your oral condition as poor – what is the reason? _____

4) Are you satisfied with the appearance of your teeth ?

- Very satisfied
- Satisfied
- Neither satisfied nor dissatisfied
- Dissatisfied
- Very dissatisfied

5) If you are dissatisfied with the appearance of your teeth – what is the reason? _____

6) Do you think you need to see a dentist now or in the next few weeks?

- Yes
- No

7) If you think you need to see a dentist, what is the reason?

8) I need a routine dental check-up

- Yes
- No

9) I need help for a dental problem.

- Yes
- No

Specify the problem _____

10) If you perceive any dental treatment need at the moment, what kind of treatment do you need?

Pain release

Yes

No

11) Tooth extraction

Yes

No

12) Fillings

Yes

No

13) Partial dentures

Yes

No

14) Full dentures

Yes

No

15) How well can you chew food items?

(several food items assessed through
focused group)

Well

Less well

Badly

List of food items identified through
focused group discussions

16). Can you chew all kinds of food?

yes all food

Only soft food

only mashed foods

17) Do you have problems with
swallowing foods

No

Yes at food intake

Yes always

18) How often have you been prevented
to eat food that you would like to eat

All the time

Often

Seldom

Never

19). How often do you avoid eating with
other people?

All the time

Often

Seldom

Never

20) How often does it take you longer to
finish a meal compared to other people?

All the time

Often

Seldom

Never

21) How satisfied are you with your chewing ability?

Very satisfied

Satisfied

Neither satisfied nor dissatisfied

Dissatisfied

Very dissatisfied

22). During the previous 2 years did you experience

a) dental pain/toothache

b) Tooth abscess

c) dry mouth

d) infected sore gums

e) tooth decay

f) bleeding gums

g) broken tooth

C. Oral health related behaviours

1) Have you ever attended a dentist (dental therapist) for treatment?

Yes

No

2) Do you have a dentist (dental therapist) to go to if you need one ?

Yes

No

3) How easy or difficult is it for you to attend a dentist if you need one?

Very easy

Easy

Average

Difficult

Very difficult

4) Think back on the previous 2 years – how many times have you attended a dentist? _____

5) When do you usually go to the dentist (dental therapist)

Never go

Go only when I have problem

Go whether or not I have a problem.

6) How often do you brush your teeth?

Several times a day

Daily

Seldom

Never

7) What do you use when cleaning/brushing your teeth?

8) Do you use any kind of tobacco products?

Yes

No

9) If yes
(specify)_____

D) Oral health related knowledge

1) Do you know what causes tooth decay?

Yes

No

2) If yes, specify_____

3) Do you know what causes gum disease?

Yes

No

4) If yes specify_____

5) Do you know how to prevent tooth decay?

Yes

No

6) If yes , specify_____

7)Do you know how to prevent gum disease?

Yes

No

8) If yes, specify_____

E Self reported health problems

1) Have any of the following disorders been diagnosed by a physician during the previous 2 years

a) Obesity

b) Cancers

c) Heart disease

d) Respiratory disease

e) Trauma

f) Diabetes

g) Sight problems

Appendix V

(Kidadisi Cha Utafiti wa Kaya)

A. Maelezo ya Utambulisho

Namba ya Utambulisho _____

Wilaya _____

Kijiji _____

Kiongozi wa Kijiji _____

Mjini/ Vijijini _____

Namba ya Kaya _____

Jina la Mtafitiwa _____

Tarehe ya Usaili _____

B. Taarifa ya Kijamii na Kidemografia1. Umri (*Umri katika miaka kamili*) _____2. Jinsi: Mme Mke

3. Hali ya Ndoa:

- Sijaoa/ Sijaolewa
- Nimeoa/Nimeolewa
- Tumetengana
- Tumeachana
- Mjane/Mseja
- Nyingine (taja) _____

4. Uhusiano na Mkuu wa Kaya:

- Kiongozi/Mkuu
- Mume
- Mke
- Baba
- Mama
- Mjomba
- Shangazi
- Mwingine (taja) _____

5. Elimu:

- Sijaenda Shule
- Sijamaliza Shule ya Msingi
- Nimemaliza Shule ya Msingi
- Shule ya Sekondari
- Nimemaliza Elimu ya Sekondari
- Chuo / Chuo Kikuu
- Sifahamu

Nyingine, (taja) _____

6. Idadi ya watu wanaoishi kwenye Kaya:

- 0 – 4
- 5-10
- 10 na zaidi

7. Kaya inatumia nishati gani katika

kupata mwanga:

- Umeme
- Mafuta ya taa
- Mwanga wa gesi
- Mwanga wa Mshumaa
- Nyingine (taja) _____

8. Je, kaya ina vifaa hivi hapo chini na vinafanya kazi?

- | | |
|--------------|---------------------------------|
| Redio | <input type="checkbox"/> Ndiyo |
| | <input type="checkbox"/> Hapana |
| Televisheni | <input type="checkbox"/> Ndiyo |
| | <input type="checkbox"/> Hapana |
| Simu | <input type="checkbox"/> Ndiyo |
| | <input type="checkbox"/> hapana |
| Jokofu/Friji | <input type="checkbox"/> Ndiyo |
| | <input type="checkbox"/> hapana |
| Chemli | <input type="checkbox"/> Ndiyo |
| | <input type="checkbox"/> Hapana |
| Kabati | <input type="checkbox"/> Ndiyo |
| | <input type="checkbox"/> Hapana |

9. Je, kuna mtu katika kaya yenu anamiliki:

- | | |
|-----------------|---------------------------------|
| Baiskeli | <input type="checkbox"/> Ndiyo |
| | <input type="checkbox"/> Hapana |
| Pikipiki/ Skuta | <input type="checkbox"/> Ndiyo |
| | <input type="checkbox"/> Hapana |
| Gari/ Lori | <input type="checkbox"/> Ndiyo |
| | <input type="checkbox"/> Hapana |
| Boti | <input type="checkbox"/> Ndiyo |
| | <input type="checkbox"/> Hapana |

10. Nyumba yenu ina vyumba vingapi

vinavyotumika kwa kulala?:

- kimoja
- Viwili
- Vitatu
- Vinne
- Zaidi ya vinne

11. Sakafu imetengenezwa kwa vifaa gani?

(angalia):

- Udongo (na mavi ya ng'ombe)
- Simenti
- Vingine (taja) _____

12. Paa limetengenezwa na vifaa gani

(angalia):

- Manyasi
- Bati
- Vigae
- Zege
- Vingine (taja) _____

13. Ukuta umejengwa kwa vifaa gani? (angalia)

- Manyasi
- Fito na matope
- Matofali yasiyochomwa
- Matofali ya kuchoma na udongo
- Matofali ya kuchoma na simenti
- Matofali ya simenti
- Vingine (taja) _____

14. Kwa matumizi ya kaya yenu ni kiasi gani cha ardhi kipo kwa ajili ya kilimo/ malisho ya wanyama?

Idadi ya ekari: _____

(Ulizia ili kupata idadi kamili, ekari moja ni karibu sawa na ukubwa wa kiwanja cha mpira)

15. Dini:

- Mkristo
- Muislamu
- Nyingine: (taja) _____

16. Kazi:

- Ajira Binafsi
- Nimeajiriwa
- Nimestaafu
- Nyingineyo (taja) _____

C. (OIDP) Toleo la KISWAHILI

1) Katika kipindi cha miezi sita iliyopita ni mara ngapi umekuwa na tatizo katika mdomo wako na meno yaliyokuletea matatizo wakati wa kula au kutafuna chakula.

- Sijapata tatizo
- Chini ya mara moja kwa mwezi
- Mara moja au mbili kwa mwezi
- Mara moja au mbili kwa wiki
- Mara 3-4 kwa wiki
- Kila siku au karibu kila siku

2) Tatizo lako ni kubwa kiasi gani unapokula au kutafuna chakula?

- Kubwa sana
- Kubwa
- Siyo kubwa
- Siyo kubwa kabisa

3) Nini hasa tatizo lako la kinywa lililosababisha upate matatizo wakati wa kula au kutafuna chakula?

Hali	Ndiyo	Hapana
<i>Maumivu ya Jino</i>		
<i>Jino linalolegea</i>		
<i>Jipu la ufizi</i>		
<i>Harufu mbaya</i>		
<i>Fizi zinazotoa damu</i>		

Jingine: (taja) _____

4) Katika kipindi cha miezi sita iliyopita ni mara ngapi umekuwa na tatizo katika mdomo wako na meno yaliyokuletea matatizo katika kuzungumza na kutamka maneno vizuri.

- Sijapata tatizo
- Chini ya mara moja kwa mwezi
- Mara moja au mbili kwa mwezi
- Mara moja au mbili kwa wiki
- Mara 3-4 kwa wiki
- Kila siku au karibu kila siku

5) Tatizo lako ni kubwa kiasi gani la kuzungumza na kutamka maneno vizuri.

- Kubwa sana
- Kubwa

- Siyo kubwa
- Siyo kubwa kabisa

6) Kulikuwa na tatizo gani hasa la kinywa lililokufanya kupata taabu katika kuzungumza na kutamka maneno vizuri?

Hali	Ndiyo	Hapana
<i>Maumivu ya Jino</i>		
<i>Jino linalolegea</i>		
<i>Jipu la ufizi</i>		
<i>Harufu mbaya</i>		
<i>Fizi zinazotoa damu</i>		

Jingine, (taja) _____

7) Katika kipindi cha miezi sita iliyopita ni mara ngapi umekuwa na tatizo katika mdomo wako na meno lililokufanya kupata taabu katika kusafisha meno yako?

- Sijapata tatizo
- Chini ya mara moja kwa mwezi
- Mara moja au mbili kwa mwezi
- Mara moja au mbili kwa wiki
- Mara 3-4 kwa wiki
- Kila siku au karibu kila siku

8) Tatizo lako ni kubwa kiasi gani unaposafisha meno yako?

- Kubwa sana
- Kubwa
- Siyo kubwa
- Siyo kubwa kabisa

9) Kulikuwa na tatizo gani hasa la kinywa lililokufanya kupata taabu katika kusafisha meno yako?

Hali	Ndiyo	Hapana
<i>Maumivu ya Jino</i>		
<i>Jino linalolegea</i>		
<i>Jipu la ufizi</i>		
<i>Harufu mbaya</i>		
<i>Fizi zinazotoa damu</i>		

Jingine, (taja) _____

10) Katika kipindi cha miezi sita iliyopita ni mara ngapi umekuwa na tatizo katika mdomo wako na meno lililokufanya kupata taabu katika kulala na kupumzika?

- Sijapata tatizo
- Chini ya mara moja kwa mwezi
- Mara moja au mbili kwa mwezi
- Mara moja au mbili kwa wiki
- Mara 3-4 kwa wiki
- Kila siku au karibu kila siku

11) Tatizo lako ni kubwa kiasi gani unapolala na kupumzika?

- Kubwa sana
- Kubwa
- Siyo kubwa
- Siyo kubwa kabisa

12) Ulikuwa na tatizo gani la kinywa lililokupa taabu ya kulala au kupumzika?

Hali	Ndiyo	Hapana
<i>Maumivu ya jino</i>		
<i>Jino linalolegea</i>		
<i>Jipu la ufizi</i>		
<i>Harufu mbaya</i>		
<i>Fizi zinazotoa damu</i>		

Jingine, (taja) _____

13) Katika kipindi cha miezi sita iliyopita ni mara ngapi umekuwa na tatizo katika mdomo wako na meno lililokufanya kupata taabu katika kutabasamu, kucheka na kuonyesha meno yako bila kuona aibu?

- Sijapata tatizo
- Chini ya mara moja kwa mwezi
- Mara moja au mbili kwa mwezi
- Mara moja au mbili kwa wiki
- Mara 3-4 kwa wiki
- Kila siku au karibu kila siku

14) Tatizo lako ni kubwa kiasi gani katika kutabasamu, kucheka na kuonyesha meno bila kuona aibu.

- Kubwa sana
- Kubwa
- Siyo kubwa
- Siyo kubwa kabisa

15) Ulikuwa na tatizo gani hasa la kinywa lililokupa taabu ya kutabasamu, kucheka na kuonyesha meno bila kuo aibu?

Hali	Ndiyo	Hapana
<i>Maumivu ya jino</i>		
<i>Jino linalolegea</i>		
<i>Jipu la ufizi</i>		
<i>Harufu mbaya</i>		
<i>Fizi zinazotoa damu</i>		

Jingine, (taja) _____

16) Katika kipindi cha miezi sita iliyopita ni mara ngapi umekuwa na tatizo katika mdomo wako na meno lililokufanya kupata taabu katika kuwa katika hali yako ya kawaida (ya mhemko) bila kukereka.

- Sijapata tatizo
- Chini ya mara moja kwa mwezi
- Mara moja au mbili kwa mwezi
- Mara moja au mbili kwa wiki
- Mara 3-4 kwa wiki
- Kila siku au karibu kila siku

17) Tatizo lako ni kubwa kiasi gani katika kuwa na hali ya mhemko wa kawaida bila kukereka

- Kubwa sana
- Kubwa
- Siyo kubwa
- Siyo kubwa kabisa

18) Ulikuwa na tatizo gani hasa la kinywa lililokupa taabu kuweza kuwa katika hali ya kawaida ya mhemko bila kukereka?

Hali	Ndiyo	Hapana
<i>Maumivu ya jino</i>		
<i>Jino linalolegea</i>		
<i>Jipu la ufizi</i>		
<i>Harufu mbaya</i>		
<i>Fizi zinazotoa damu</i>		

Jingine, (taja) _____

19) Katika kipindi cha miezi sita iliyopita ni mara ngapi umekuwa na tatizo katika mdomo wako na meno linakupa taabu ya kufanya kazi kubwa au majukumu ya kijamii

- Sijapata tatizo
- Chini ya mara moja kwa mwezi
- Mara moja au mbili kwa mwezi
- Mara moja au mbili kwa wiki
- Mara 3-4 kwa wiki
- Kila siku au karibu kila siku

20) Tatizo lako ni kubwa kiasi gani katika kufanya kazi kubwa na majukumu ya kijamii

- Kubwa sana
- Kubwa
- Siyo kubwa
- Siyo kubwa kabisa

21 Ulikuwa na tatizo gani hasa la kinywa lililokupa taabu kuweza kufanya kazi kubwa na majukumu ya kijamii?

Hali	Ndiyo	Hapana
<i>Maumivu ya jino</i>		
<i>Jino linalolegea</i>		
<i>Jipu la ufizi</i>		
<i>Harufu mbaya</i>		
<i>Fizi zinazotoa damu</i>		

Jingine, (taja) _____

22) Katika kipindi cha miezi sita iliyopita ni mara ngapi umekuwa na tatizo katika mdomo wako na meno lililokupa taabu katika kufurahia pamoja na watu wengine

- Sijapata tatizo
- Chini ya mara moja kwa mwezi
- Mara moja au mbili kwa mwezi
- Mara moja au mbili kwa wiki
- Mara 3-4 kwa wiki
- Kila siku au karibu kila siku

23) Tatizo lako ni kubwa kiasi gani katika kufurahia pamoja na watu wengine

- Kubwa sana
- Kubwa
- Siyo kubwa
- Siyo kubwa kabisa

24) Ulikuwa na tatizo gani hasa la kinywa lililokupa taabu katika kuweza kufurahia pamoja na watu wengine.

Hali	Ndiyo	Hapana
<i>Maumivu ya jino</i>		
<i>Jino linalolegea</i>		
<i>Jipu la ufizi</i>		
<i>Harufu mbaya</i>		
<i>Fizi zinazotoa damu</i>		

Jingine, (taja)

C. Taarifa ya afya kwa ujumla, Hali ya afya ya kinywa/mahitaji ya matibabu, Uwezo uliotajwa wa kula vyakula Fulani/tabia katika kutunza meno

1) Unatathmini vipi afya yako kwa ujumla?

- Nzuri sana
- Nzuri
- Si nzuri wala si mbaya
- Mbaya
- Mbaya sana

2) Unaionaje hali yako ya sasa ya mdomo na meno yako.

- Nzuri sana
- Nzuri
- Si nzuri wala si mbaya
- Mbaya
- Mbaya sana

3) Kama unafikiria hali yako ya kinywa kuwa siyo nzuri sababu yake ni nini? _____

4) Unaridhika na mwonekano wa meno yako?

- Ninaridhika sana
- Naridhika
- Sina uhakika
- Siridhiki
- Siridhiki kabisa

5) Kama huridhiki na mwonekano wa meno yako sababu yake ni nini?

6) Je unafikiri unahitaji kumwona daktari wa meno sasa au katika wiki chache zijazo?

- Ndiyo
- Hapana

7) Kama unafikiri unataka kumwona daktari wa meno ni kwa sababu gani? _____

8) Ninahitaji kufanya uchunguzi wa kawaida wa meno.

- Ndiyo
- Hapana

9) Ninahitaji msaada kwa tatizo langu la meno.

- Ndiyo
- Hapana

Taja tatizo _____

10) Kama unafikiri unahitaji matibabu ya meno kwa sasa ni aina gani ya matibabu unayohitaji?

- 10) Kuondoa maumivu Ndiyo
 Hapana

- 11) Kung'oa jino Ndiyo
 Hapana

- 12) Kujaza jino Ndiyo
 Hapana

- 13) Meno ya bandia kwa meno machache Ndiyo
 Hapana

- 14) Meno ya bandia kwa kinywa kizima Ndiyo
 Hapana

15) Unaweza kutafuna vyakula vifuatavyo vizuri namna gani? Nyama Vizuri

- Vizuri kidogo
- Vibaya

- Ndizi za kupikwa Vizuri
 Vizuri kidogo
 Vibaya

- Makande Vizuri
 Vizuri kidogo
 Vibaya

- Mihogo Vizuri
 Vizuri kidogo
 Vibaya

- Embe mbichi Vizuri
 Vizuri kidogo
 Vibaya

Nyingineyo _____

16). Unaweza kutafuna aina zote za chakula?

- Ndiyo vyakula vyote
- Vyakula laini tu
- Vyakula vilivyopondwa

17) Una tatizo la kumeza chakula?

- Hapana
- Ndiyo ninapokula
- Ndiyo kila mara

18) Ni mara ngapi umezuiwa kula vyakula unavyopenda kula

- Mara zote
- Mara kwa mara
- Mara chache
- Sijawahi kuzuiwa

19). Mara ngapi unakwepa kula na watu wengine?

- Mara zote
- Mara kwa mara
- Mara chache
- Sijawahi kukwepa

20) Mara ngapi imekuchua muda mrefu kumaliza chakula ukilinganisha na watu wengine?

- Mara zote
- Mara kwa mara
- Mara chache
- Sijawahi

21) Unaridhika kwa kiasi gani na uwezo wako wa utafunaji chakula?

- Ninaridhika sana
- Ninaridhika
- Sina uhakika
- Siridhiki
- Siridhiki kabisa

22).Katika miaka miwili iliyopita umewahi kupata matatizo gani kati ya yafuatayo:

- | | |
|-------------------------|---------------------------------|
| a) Maumivu ya meno/jino | <input type="checkbox"/> Ndiyo |
| | <input type="checkbox"/> Hapana |
| b) Jipu la meno | <input type="checkbox"/> Ndiyo |
| | <input type="checkbox"/> Hapana |
| c) Mdomo kukauka | <input type="checkbox"/> Ndiyo |
| | <input type="checkbox"/> Hapana |
| d) vidonda vya fizi | <input type="checkbox"/> Ndiyo |
| | <input type="checkbox"/> Hapana |
| e) jino kuoza | <input type="checkbox"/> Ndiyo |
| | <input type="checkbox"/> Hapana |
| f) fizi zinazotoa damu | <input type="checkbox"/> Ndiyo |
| | <input type="checkbox"/> Hapana |
| g) jino kuvunjika | <input type="checkbox"/> Ndiyo |
| | <input type="checkbox"/> Hapana |

C. Tabia zinazohusiana na afya ya kinywa

1) Umewahi kwenda kwa daktari wa meno (Tabibu wa meno) kupata matibabu?

- Ndiyo
- Hapana

2) Unaye daktari wa meno (Tabibu wa meno) ambaye unaweza kumwona kama una tatizo?

- Ndiyo
- Hapana

3) Ni rahisi kiasi gani au ni vigumu kiasi gani kwako kumwona daktari wa meno kama una matatizo ya meno?

- Rahisi sana
- Rahisi
- Wastani
- Vigumu
- Vigumu sana

4) Fikiria miaka miwili nyuma ni mara ngapi umewahi kwenda kwa daktari wa meno? _____

5) Kwa kawaida ni wakati gani unakwenda kwa daktari wa meno (Tabibu wa meno)

- Siendi
- Ninaenda ninapokuwa na tatizo
- Ninaenda nikiwa au hata nisipokuwa na tatizo

6) Unapiga meno yako mswaki mara ngapi?

- Mara kadhaa kwa siku
- Mara moja kwa siku
- mara chache
- Sipigi mswaki

7) Unatumia nini unaposafisha/ kupiga mswaki meno yako? _____

8) Unatumia aina yote ya tumbaku?

- Ndiyo
- Hapana

9) Kama ndiyo (Taja) _____

D) Maarifa yanayohusiana na Afya ya Kinywa na meno.

1) Unafahamu nini kinasababisha meno kuoza?

- Ndiyo
- Hapana

2) Kama ndiyo, taja, _____

3) Unafahamu nini kinasababisha ugonjwa wa fizi? Ndiyo

- Hapana

4) Kama ndiyo, taja _____

5) Unafahamu namna ya kuzuia meno kuoza?

- Ndiyo
- Hapana

6) Kama ndiyo, taja _____

7) Unafahamu namna ya kuzuia ugonjwa wa fizi?

- Ndiyo
- Hapana

8) Kama ndiyo, taja _____

E Matatizo ya Afya yaliyojiripoti

1) Je, umewahi kugunduliwa na daktari kama una matatizo yafuatayo, katika kipindi cha miaka miwili iliyopita?

- a) Unene kupita kiasi Ndiyo Hapana
- b) Saratani (cancer) Ndiyo Hapana
- c) Ugonjwa wa moyo Ndiyo Hapana
- d) Ugonjwa wa kupumua Ndiyo Hapana
- e) Jeraha Ndiyo Hapana
- f) Kisukari Ndiyo Hapana
- g) Matatizo ya kuona Ndiyo Hapana
- h) Shinikizo la damu Ndiyo Hapana
- i) Matatizo ya mifupa na viungo Ndiyo Hapana

Appendix VI

APPENDIX VI

ID NO -----

Male

Female

DATE OF BIRTH: ___ / ___ / _____

Village-----

I) DENTITION STATUS

Upper right

Upper left

18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28

Lower right

Lower left

48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38

TOOTH CODES		NOTES
Sound tooth	0	
Decayed	1	
Filled with decay	2	
Filled no decay	3	
Missing due to caries	4	
Missing any other reason	5	
Fissure sealant	6	
Bridge abutment, special crown veneer	7	
Un-erupted crown	8	
Not recorded	9	
Trauma/fracture	T	

II) TOOTH MOBILITY SCORE:

Upper right

Upper left

18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28

Lower right

Lower left

48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38

0 = No detectable movement or physiological movement

1 = Detectable movement

III) OCCLUSAL STATUS - EICHNER INDEX:

- A = Contact in all four occlusal zones
- B = Contact in 1 –3 occlusal zones
- C = Absence of tooth contact

IV) PROSTHETIC STATUS

Upper	Lower
<input type="text"/>	<input type="text"/>

- 0= No prosthesis
- 1= Bridge
- 2= More than one bridge
- 3= Partial denture
- 4= Both bridge(s) and partial denture(s)
- 5= Full removable denture
- 9= not recorded

V) PROSTHETIC NEED

Upper	Lower
<input type="text"/>	<input type="text"/>

- 0= No prosthesis needed
- 1= Need for one unit prosthesis
- 2= Need for multiunit prosthesis
- 3= need for a combination of one- and or multi-unit prostheses
- 4= Need for full prosthesis (replacement of all teeth)
- 9= not recorded

VI) MUCOSAL AND PLAQUE STATUS:

Plaque Score (PS)

- 1 = No easily visible plaque
- 2 = Small amounts of hardly visible plaque
- 3 = Moderate amounts of plaque
- 4 = Abundant amounts of confluent plaque

Mucosal Score (MS)

- 1 = Normal appearance of gingival and mucosa
- 2 = Mild inflammation
- 3 = Moderate inflammation
- 4 = Severe inflammation

Mucosal-Plaque Score

- PS + MS:
- 2 – 4 = Good or acceptable
 - 5 – 6 = Un acceptable
 - 7 – 8 = Poor

Appendix VII

APPENDIX VII

ERRATA

We regret that some errors occurred in the following papers.

Paper I

Reference

1. Reference number (1) is World Health Organization. Active Ageing: a policy framework. Geneva, Switzerland: WHO; 2002.

Paper II

Typing errors.

1. Table 7: the percentage overall impact intensities are 5.5, 10.8, 22.9, 5.7 and 4.1 for very little, little, moderate, severe and very severe, respectively.
2. Table 8: the percentage overall impact intensities are respectively 7.3, 9.8, 21.9, 15.8 and 7.3 for very little, little, moderate, severe and very severe.
3. Reference No. 17: the author names are Lwanga, S and Lameshow, S.