STUDIES IN SPORT, PHYSICAL EDUCATION AND HEALTH

38

Ursuline S. Nyandindi

Evaluation of a School Oral Health Education Programme in Tanzania

UNIVERSITY OF JYVÄSKYLÄ

JYVÄSKYLÄ 1995

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An Ecological Perspective

Esitetään Jyväskylän yliopiston liikuntatieteellisen tiedekunnan suostumuksella
julkisesti tarkastettavaksi yliopiston vanhassa juhlasalissa (S212)
toukokuun 13. päivänä 1995 kello 12.

Academic dissertation to be publicly discussed, by permission of
the Faculty of Sport and Health Sciences of the University of Jyväskylä,
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UNIVERSITY OF JYVÄSKYLÄ

JYVÄSKYLÄ 1995

Evaluation of a School Oral Health Education Programme in Tanzania

An Ecological Perspective

Joint work at

the Department of Health Sciences,
Faculty of Sport and Health Sciences, University of Jyväskylä
and
the Department of Preventive Dentistry and Cariology,
Faculty of Dentistry, University of Kuopio.

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URN:ISBN:978-951-39-8872-2
ISBN 978-951-39-8872-2 (PDF)
ISSN 0356-1070

ISBN 951-34-0527-3
ISSN 0356-1070

Jyväskylä University Printing House
and Sisäsuomi Oy, Jyväskylä 1995

To my children and family

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ABSTRACT

Ursuline Nyandindi
Evaluation of a school oral health education programme in Tanzania: An ecological perspective. Jyväskylä: University of Jyväskylä, 1995 - 87 p. (Studies in Sport, Physical Education and Health,
ISSN 0356-1070; 38)
ISBN 951-34-0527-3
Diss.

This study evaluated the primary school oral health education programme in Tanzania, which is being implemented by teachers. The oral health education needs of pupils, environmental support for the programme, the preparedness of teachers for the oral health education task, the delivery process of conventional oral health education, and the impact among pupils were assessed in terms of the CIPP (context, input, process, product) evaluation model. The study was carried out in a selected district. The pupils and their teachers were studied by interviews, questionnaires and clinical observations, while the environments and the educational process were observed. Children not yet given oral health education at school (reference group, n=200) were found to have poor oral health knowledge, attitudes, practices and skills. The children's environments appeared less supportive of oral health education messages. The teachers who conducted oral health education generally had no training in it and seemed to have inadequate knowledge, skills and motivation for this task. The oral health education sessions were poor in content and methods. The impact on pupils attending these sessions (conventional session group, n=200) was poor. On the basis of these findings, a modified oral health education manual was produced. Using the manual as a framework, teacher training was provided in workshops to all teachers responsible for school oral health education in the study district, while in an adjacent district a sample of teachers were issued the teaching manual only. These measures were carried out with the dental personnel and school administrators of the study area. The teachers trained in workshops, but not those given the manual only, were able to improve both the content and methods of their oral health education sessions, and the impact on pupils who participated in these sessions (modified session group, n=200) improved.

Keywords: Schools, Oral Health Education, Evaluation, Tanzania

ACKNOWLEDGEMENTS

This work was carried out at the Department of Preventive Dentistry and Cariology, Faculty of Dentistry, University of Kuopio, and part of it was carried out at the Department of Health Sciences, Faculty of Sport and Health Sciences, University of Jyväskylä, Finland.

I wish to express my sincere gratitude to my supervisor Docent Anneli Milén, DDS, PhD, Health and Development Cooperation Group, National Agency for Welfare and Health in Finland, Helsinki. I am also very deeply thankful to my supervisor Doctor Tuija Palin-Palokas, DDS, PhD, Department of Preventive Dentistry and Cariology, Faculty of Dentistry, University of Kuopio. Their outstanding leadership, scientific guidance, friendliness and special dedication to this work, have been of greatest value.

I am very grateful to the official referees of this thesis, Professor Poul Erick Petersen, DDS, Dr Odont, BA, MSc, Department for Community Dentistry and Graduate Studies, Faculty of Health Sciences, Copenhagen, and Docent Sirpa Shemeikka, PhD, Department of Community Health and General Practice, Faculty of Medicine, University of Kuopio, for their constructive criticisms and suggestions for improving the manuscript.

I wish to convey my sincere thanks to Dr. Heikki Tuutti, the manager of the Muhimbili Dental School Development Project, for providing me the opportunity to undertake this work under the project. I also thank all the Finnish and Tanzanian members of the project for their cooperation.

I thank my other co-authors Drs. Valerie Robison, Nahanson Kombe, Sylvia Mwakasagule, and Fidelia Mbiru for their contributions.

I owe my sincere thanks to Professor Heikki Luoma and Professor Jukka Meurman, the former and present heads of the Department of Preventive Dentistry and Cariology, and all the staff members, in the Faculty of Dentistry at Kuopio University, for their support.

I am very thankful to Associate professor Lasse Kannas, PhD, MEd, the Head of the Department of Health Sciences in the Faculty of Sport and Health Sciences and the Vice Rector of the University of Jyväskylä, for his leadership and supervision of my training in Health Education and Health Promotion at the University of Jyväskylä. I also thank all the staff members of the Department and Faculty for their cooperation.

I am deeply indebted to the former and present leadership; Dr. B. Lembariti, Dr. E. Kikwilu, Dr. L. Mabelya, Dr. P. Rugarabamu, and to all my colleagues, in the Department of Preventive and Community Dentistry and the Faculty of Dentistry at the Muhimbili University College of Health Sciences of the University of Dar es Salaam, for providing permission and support for this work.

I wish to acknowledge the officials in the Central Oral Health Unit, Ministry of Health (MOH) in Tanzania, for their approval and advises for the study. I also appreciate the collaboration achieved with the representatives of the Health Education Unit, MOH, and of the Curriculum Development Institute, Ministry of Education, in Tanzania.

I also thank the pupils and teachers who participated in the study.

I extend my acknowledgements to Mr. Vivian Paganuzzi, MA, Language Centre, Kuopio University, for revising the English language of the original and the final manuscript of the thesis.

My thanks also go to Mr. Juha Rantakari for his guidance on scholarly matters, Dr. Terttu Parkatti, PhD for her assistance in practical matters, and Ms. Pirjo Koikkalainen for the final layout of the manuscript, and Dr. Harri Suominen, PhD, for his role in the publication of the thesis, at the University of Jyväskylä.

I offer my special thanks to Professor Aulikki Nissinen, the head of the Department of Community Health and General Practice at Kuopio University, for her support to my family and my studies.

I warmly thank the families of Anneli Milén, Tuija Palin-Palokas, Riitta Myllykangas, Riitta Wetterstrand, Jaana Niemi, Jaana Kusnetsov, Jaana Vainio, Helena Jauhiainen, Aruna Hanski, Kirsti Niskanen, Veronica Lindgren, Veli Koistinen, Pirjo Ruuskanen, Coleen Ferguson, and all other friends, for their support during my stay in Finland.

I am very deeply indebted to the staff of the kindergarten and the elementary school at Särkiniemi in Kuopio, Finland, for their loving and excellent care and teaching of my children.

Many individuals and families in Tanzania have greatly assisted and encouraged me in this work, I offer them my gratitude.

Finally, I owe my most sincere respect and thanks to my children, Barakha, Namweta and Stanley, my husband and colleague Dr. Geoffrey Kiangi, my parents Stanislaus and Romana, and other members of my family, for their patience and assistance during my studies.

This work has been financially supported by FINNIDA and the Academy of Finland through the Muhimbili Dental School Development Project of the University of Kuopio, which I acknowledge with gratitude.

Jyväskylä, 15th April 1995

Dr. Ursuline S. Nyandindi

LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following original articles referred to in the text by the Roman numerals I - V:

(I) Nyandindi, U., Palin-Palokas, T., Milén, A., Robison, V., Kombe, N. 1994. Oral health knowledge, attitudes, behaviour and skills of children entering school in urban and rural areas in Tanzania. Public Health 108, 35-41.

(II) Nyandindi, U., Palin-Palokas, T., Milén, A. 1994. The importance of supportive environments for oral health promotion in school-aged children in Tanzania. Health Promotion International 9, 21-26.

(III) Nyandindi, U., Palin-Palokas, T., Milén, A., Robison, V., Kombe, N., Mwakasagule, S. 1994. Participation, willingness and abilities of schoolteachers in oral health education in Tanzania. Community Dental Health 11, 101-104.

(IV) Nyandindi U., Milén, A., Palin-Palokas, T., Mwakasagule, S., Mbiru, F.A. Training teachers to implement a school oral health education programme in Tanzania. Health Promotion International 10, 93-100, 1995.

(V) Nyandindi, U., Milén, A., Palin-Palokas, T., Robison, V. Impact of oral health education among primary school children before and after teachers' training in Tanzania. (Submitted for publication).

1 INTRODUCTION

1.1 Tanzania today

This study was carried out in Tanzania Mainland, the largest part of the United Republic of Tanzania, to which also belong the islands of Zanzibar and Pemba. Tanzania Mainland has a land area of 878,829 sq. km. The latest (1988) census showed a population of 22.5 million with a sex ratio of 1:1, growing fast at a rate of 3% annually (Ministry of Finance, Economic Affairs and Planning 1988). Almost half of the population is younger than 15 years. Administratively, Tanzania Mainland is divided into 20 regions, 103 districts, 500 divisions, about 2,200 wards each comprising 2-5 villages, and at the smallest level into units of ten households. Most people (82%) live in rural areas. There are 120 tribes with different customs, languages and dialects, but the official language, Swahili, is spoken by most people. The majority of people are Christian or Moslem (Gish 1983, Goetz 1985). Since its independence in 1961, Tanzania Mainland has been politically stable under one-party rule. By 1991 the political system in the country has been changing towards a multi-party democracy.

Economically, Tanzania is among the poor countries of the world. The economy, which mainly depends on agriculture, grew modestly until the mid-1970s, but has declined ever since despite several economic adjustment programmes implemented primarily according to the policies of the World Bank. Tanzania's GNP per capita decreased between 1978 and 1991 from USD 230 to USD 100, while the average GNP per capita for 1991 in more developed countries (MDCs = e.g. European countries, North America, Australia, Japan and New Zealand) was USD 16,900 (The World Bank 1980, Population Reference Bureau 1991). The country has a growing export-import trade deficit. The dependence on foreign funding is high. Commodity import support for the government budget increased from 6% to 24% between 1981 and 1991.

Tanzania's external debt in 1991 was USD 6 billion, which was about 9 times higher than the value of its exports of 1990 (Wagao 1993).

The basic infrastructure of the country is not developed, especially in the rural areas. The 1988 census revealed that about 80% of urban households, compared to only 20% of rural households, had access to tap water. Moreover, every one in four urban households, compared to one in a thousand rural households, had electricity (Planning Commission 1992). Towns have road networks but in rural areas roads are few and mostly impassable during the rainy season. However, basic education and health care facilities exist both in urban and in rural areas.

Primary education is available for every child in Tanzania. According to 1991 statistics (Ministry of Education and Culture 1992), there are 10,437 public primary schools (grades 1 to 7) in the country. However, there are only 158 public and 247 privately-owned secondary schools (grades 9 to 12 or 14) and two universities. The official age for child enrolment in school is seven years, but the majority of children start school later. The primary schools are attended annually by about 3.5 million children (approximately 15% of the total population) aged from about 7 to 17 years. The average number of primary school pupils per teacher in 1991 was 36. Basic facilities for learning are lacking in many schools. Of pupils who complete primary school, only 11% continue to secondary schools. The universities' total annual intake is limited to about 1,000 students. Some people enrol in adult literacy classes and the adult literacy rate was 90% in 1986 (Ministry of Education and Culture 1992) but this has been shown to be lower (55%) in 1992 (UNDP 1994).

Basic health indicators reveal a poor health situation in Tanzania compared with the more developed countries (MDCs) (Population Reference Bureau 1991). The Tanzanian Fertility Rate per 1,000 women is 7.1 (versus 1.9 in MDCs), the Crude Birth Rate is 50 per 1,000 population (versus 14 in MDCs), the Maternal Mortality Rate per 100,000 live births is 340 (versus 17 in MDCs), the Infant Mortality rate per 1,000 babies born alive is 102 (versus 14 in MDCs) and the Crude Death Rate per 1,000 population is 13 (versus 9 in MDCs). Average life expectancy at birth is 52 years for males and 55 years for females (versus 71 years for males and 78 years for females in MDCs).

The main health problems in Tanzania are communicable diseases like malaria, pneumonia and diarrhoea, and delivery problems are also common. These diseases and conditions accounted for 70% of hospital visits in 1988 (Kilama 1990, Mwaluko et al. 1991). HIV infection has become a serious health threat in the country, currently affecting about 7% of adolescents and 10% of adults, especially women and urban dwellers (Kilewo et al. 1994, Ndeki et al. 1994). Non-communicable diseases like cancer are also on the increase (Mwaluko et al. 1991).

The public health infrastructure in Tanzania Mainland comprises a referral system with about 8,500 village health posts, 3,000 maternal and child health (MCH) clinics, 2,644 dispensaries, 260 health centers, 98 district hospitals, 17 regional hospitals, and 4 consultant hospitals. The health units operate under government supervision. However, almost half of them are operated by non-governmental organizations, many of which are religious groups (FINNIDA

1992). Financial resources for the health sector are scarce and have been declining, e.g. the health budget decreased from 7% to 4% of the government's annual budget between 1976 and 1987 (Chiduo 1991). The real health expenditure per capita is very low. It rose from Tanzanian shillings (Tshs) 31 to Tshs 48 in 1971 to 1978, then declined to Tshs 26 (less than one USD) in 1987 (Andersson-Brolin et al. 1991). Government health services were provided 'free of charge' until 1992, when a patient fee system was introduced. There is a shortage of trained health personnel in the country, e.g. there is one doctor per 24,400 persons and one trained nurse per 5,365 persons. In government health units, equipment and essential drugs are often in short supply, and staff motivation is low (Chiduo 1991). Besides government services, a few parastatals have health care units for employees. Privately-owned health care units are becoming increasingly common. Traditional therapies co-exist with modern medical practices.

The current national health policy aims at improving the health and well-being of all Tanzanians, with a focus on people most at risk (Ministry of Health and DANIDA 1992). To cope with the health and economic problems, the nation has committed itself to the Primary Health Care (PHC) approach, with an emphasis on health education (through primary schools and MCH clinics), food and nutrition, mother and child health, water and sanitation, immunization, disease control and treatment, and essential drugs. Included in the national PHC strategy is promotion of oral health (Ministry of Health and DANIDA 1992).

1.2 Oral health problems and care in Tanzania

As compared with the prevailing fatal diseases, oral diseases are not a major health problem in Tanzania. Oral tumours and injuries affected only 1% of dental patients nationwide in 1985. However, the majority of adults and school-age children in Tanzania are affected by gum disease, and everyone in three or four have dental caries (Ministry of Health and Social Welfare 1988, Axell and Johansson 1993, Mosha et al. 1994). Caries also affects one-quarter to two-thirds of children aged 3 to 7 years (Mosha and Robison 1989, Rugarabamu 1990, Kerosuo and Honkala 1991, Mosha et al. 1994), and between 2% and 13% of children aged 1 to 4 years in different parts of the country (Matee et al. 1994).

Oral health services in Tanzania Mainland are administered as part of the overall health care system. However, oral health care facilities are limited. Currently, government dental clinics are integrated with district and higher level hospitals, but the goal is to provide basic dental services at dispensaries (Ministry of Health and Social Welfare 1988). Privately-owned dental clinics also exist, mainly in towns. Traditional healers play some role in dental treatment (Ngilisho et al. 1994). The public dental sector is poorly funded: in 1983/84, for example, the dental health budget was Tshs 0.40 per capita (Muya et al. 1984). There are very few dental personnel in the public sector. In 1990 there was one dentist (i.e. dental officer, with a 5-year university training) per 300,000 persons,

and one dental assistant or assistant dental officer (secondary school education and training for 2 years with or without a 2-year upgrading course) per 200,000 persons (Mumghamba 1990). Dental care has usually been sought and provided for acute ailments rather than for comprehensive care or prevention (Mosha and Scheutz 1993).

Since 1982 the national oral health policy has recommended prevention rather than curative care, and emphasizes PHC with the focus on health education. Oral health education has been integrated into general health education programmes existing in MCH clinics and in primary schools. These programmes are implemented by the MCH personnel and primary school teachers (Ministry of Health 1979, Ministry of Health and Social Welfare 1988).

Oral health education can enhance people's adoption of appropriate oral health behaviours (Blinkhorn 1981, Burt 1983, Horowitz 1983, Craft 1984, Ashley 1989). To maximize its effectiveness, oral health education should be available to people early in life and should be integrated with other health services (Steffensen 1990, Kupietzky 1993). Provision of oral health education to mothers through existing MCH units, with the aim of influencing their own and their children's oral health, is recommended (Baker 1990, Frazier and Horowitz 1990, Gaupp 1990, Steffensen 1990). School-based oral health education programmes are also recommended, and have been introduced in many countries (Frazier et al. 1983, Dhillon and Philip 1992).

Schools provide an opportunity for direct and equitable education for health (WHO 1988, 1989, Dhillon 1992, Dhillon and Philip 1992). Schools also permit the integration of health education with children's total learning. The effects of well-organized school oral health education can spread to the whole family (Croucher et al. 1985). Having a school oral health education programme in operation, however, does not guarantee its proper implementation or desired outcomes. The success of the programme depends on the actual input of the implementors and on support from the health care administrators. The implementors may lack abilities or motivation for the task, or the programme goals may not coincide with the needs of the target population. Besides what children are taught at school, their environments also greatly influence their everyday lives, and hence their eventual health behaviour. For these reasons, the expectations of the programme planners may sometimes not be met.

Monitoring and evaluation of health education is necessary for feedback and further development of the programmes (Green and Lewis 1986, Ewles and Simnett 1987, Nutbeam et al. 1990, Tones et al. 1990, Sarvela and McDermott 1992). Assessing health education activities within an ecological perspective, which means focusing on the individuals involved as well as environmental factors, is often emphasized (McLeroy et al. 1988, Kickbusch 1989, Rudd and Walsh 1993). However, such evaluative studies on health education in developing countries are scarce (Hubley 1988, Loevinsohn 1990).

Involving Tanzanian primary schools in oral health education is important as these schools are attended by the majority of school-age children all over the country. Ideally, the strategy will improve the oral health of children and thus of the whole Tanzanian population. Nonetheless, prior to the present evaluation, no assessment of the Tanzanian programme for primary school oral health education had been made.

2 REVIEW OF THE LITERATURE

2.1 Oral health education needs of Tanzanian school-age children

Knowledge of the health education needs of the target population is a prerequisite for proper planning and implementation of any health education or health promotion programme (Ewles and Simnett 1987, Gilmore et al. 1989, Haglund et al. 1990, Green and Kreuter 1991). The oral health education needs of different populations usually differ. However, lack of adequate needs assessment has characterized many oral health education programmes even in the developed countries (Brown 1994). Tanzanian schoolchildren's oral health status is rather well documented but their oral health knowledge, attitudes and practices are less well known.

Tooth decay affects about one-third of primary school-age children in Tanzania but the average number of decayed, missing and filled teeth per person (mean DMFT index) is low. The DMFT index for 12 year-olds is within the global goal of 3 or less by the year 2000 (Frencken et al. 1986 a,b, 1990, 1991a, Kerosuo et al. 1986, Mandari 1988, Nyerere 1988, Bloch et al. 1989, Rugarabamu et al. 1990, Mosha and Scheutz 1992, Axell and Johansson 1993, Mosha et al. 1994). However, over 80% of Tanzanian school-age children have dental plaque, calculus or gingivitis (Frencken et al. 1986a, 1991b, Kerosuo et al. 1986, Mandari 1988, Nørmark and Mosha 1989a, Mumghamba 1990).

The oral health knowledge of Tanzanian school-age children has been described only once, in a study carried out in 1982 among second-grade children in rural schools. The pupils, who had not received oral health education at school, were found to have poor knowledge about both tooth decay and gum disease (Nørmark and Mosha 1989a). Similar findings have been reported from

Kenya (Kaimenyi et al. 1993) and among black pupils in South Africa (Luk and Pillary 1982).

Preference for sugary over non-sugary foods is a common phenomenon. A decade ago (1982) such a preference was found to be still rather rare (25%) among rural Tanzanian children (Nørmark and Mosha 1989a). Sugar consumption has been reported to have increased by 200-300% in various developing countries between 1939 and 1970 (Enwonwu 1981). Frequent sugar consumption has been found among 6- and 12-year old urban schoolchildren in Madagascar (Petersen et al. 1991). For urban and rural Tanzanian school-age children, self-reported sugar consumption still seems to be rather infrequent (Nyandindi 1988, Nørmark and Mosha 1989a). Among some 7- to 15-year-olds interviewed in 1987, more children in urban areas (59%) than in rural areas (43%) reported eating sugary snacks at least once a day (Nyandindi 1988).

Most of the school-age Tanzanian children studied claim to brush their teeth once or twice a day (Nyandindi 1988, Nørmark and Mosha 1989a). Factory-made toothbrushes are commonly (72%) used among urban children (Nyandindi 1988), and in rural areas their use seems to be increasing. Factory-made toothbrushes were used by 10% of a group of rural school-aged children in 1982 (Nørmark and Mosha 1989a) but by 45% of rural children studied in 1987 (Nyandindi 1988). The same trend has been observed among urban children (Frencken et al. 1991b). It has also been found that factory-made brushes are used by the majority of the groups of urban adolescents studied in other parts of Africa, in Ghana (Addo-Yobo et al. 1990), Sierra Leone (Nørmark 1991) and Kenya (Kaimenyi et al. 1993). Although self-made toothbrushes (chewing-sticks) have been traditionally recommended and used in the developing world (Olsson 1978, Butt and Dunning 1986, Jeboda and Ericksen 1988, Danielsen et al. 1989, Al-Khateeb et al. 1991), it has also been reported that they are avoided because they are considered primitive (Nørmark 1991). Use of toothpaste among Tanzanians has not been reported. Use of charcoal, ash and sand for tooth-cleaning has been found to be common in a rural Tanzanian community, especially among youths (Sarita and Tuominen 1992).

The majority of Tanzanian school-age children have been found to have poor oral hygiene despite habitual daily toothbrushing (Kerosuo et al. 1986, Frencken et al. 1986a, 1991b, Nyandindi 1988, Nørmark and Mosha 1989a, Mumghamba 1990). Similar findings have been reported from groups in other African countries (Danielsen et al. 1989, Guile et al. 1990, Ng'ang'a and Valderhaug 1991, Petersen et al. 1991).

2.2 The Tanzanian school oral health education programme

2.2.1 Initiation of the programme

Health services for schoolchildren in Tanzania were introduced during colonial rule, in 1921. In the following year MCH services were started. Initially, the school health and MCH services were mainly curative and operated in only a

few towns. In 1923, health education was added to the primary school curriculum. However, after independence (1961) both school health and MCH services lacked funds and had ended by 1970. Later, in 1978, the Tanzanian government, with donor support, began to revive and expand the services. The school health activities began to operate again in 1982 (Berger and Ngaliwa 1983). Guidelines for the implementation of the national school health programme were published later by the School Health Services Unit in the Ministry of Health ('Wizara ya Afya' 1988). The programme activities were to include annual medical checkups, curative care, school lunch, sanitation, and health education for pupils.

Dental services in the country first started in 1920. Only after independence (1961) were school dental services started, also only curative, as part of mobile school health services, but due to economic constraints they ended a few years later. In 1979 a Ministry of Health Committee chaired by the chief dental officer prepared the first five-year (1982-1987) National Plan for Oral Health (Ministry of Health 1979). This marked a turning point: the focus was changed from curative services to preventive services. Oral health education and periodic dental screening of children at primary schools and at MCH clinics were included in the plan. These principles are also emphasized in the second National Plan for Oral Health for the years 1988-2002 (Ministry of Health and Social Welfare 1988).

2.2.2 Guidelines for operation

The current National Plan For Oral Health 1988-2002 (Ministry of Health and Social Welfare 1988) states broadly that the goal of the school oral health education programme is to promote individual and community awareness and lifestyles conducive to oral health. The school-based programme is targeted to all children attending primary schools, and teachers are the implementors. Schoolteachers have been chosen to carry out this task due to their regular contact with pupils, their professional skills, their established role as health educators in school, and also because of the scarcity of dental personnel in the country (Mosha and Nørmark 1984, Muya et al. 1984, Ministry of Health and Social Welfare 1988, Mosha 1990).

The dental personnel at district and regional levels are required to train pre-service and in-service teachers in oral health education. The Central Oral Health Unit in the Ministry of Health is to guide dental personnel in training the teachers. However, due to lack of transport and other resources for reaching all the 10,437 primary schools and 42 teacher training colleges in the country, dental personnel are currently required to reach and train at least those teachers who teach at schools located near the dental units (Ministry of Health and Social Welfare 1988). In practice, dental personnel, who work in towns only, cannot train the majority of the teachers, as most of these teach in rural schools.

Two teaching guides have been prepared for guiding oral health education at Tanzanian primary schools. The Institute of Curriculum

Development of the Ministry of Education, which is responsible for designing the national school curriculum, has published guidelines for oral health education for teachers, and so has the Central Oral Health Unit of the Ministry of Health. Both guides focus on achieving behavioural changes in pupils but their target pupils, teaching objectives and contents differ in some respects.

The Ministry of Education has scheduled oral health education as a part of the health subject for first grade ('Wizara ya Elimu' 1988). Classroom teachers should conduct two weekly health sessions of 30-minutes each. A health lesson curriculum guide for teachers ('Taasisi ya Elimu' 1987a) and a corresponding health booklet for pupils ('Taasisi ya Elimu' 1987b) have been distributed to the primary schools. The health topics included are personal hygiene, sanitation in classrooms and toilets, water safety, health hazards of flies and mosquitoes, road safety and good personal conduct. The oral health topic is covered in a 10-page chapter. The content is oral hygiene, but no dietary matters related to oral health are included. The teaching objectives are to acquaint pupils with the functions of teeth, the reasons and items needed for cleaning teeth, how to make and use a 'mswaki' (chewing-stick), how to make toothpaste powder (by mixing salt and sodium bicarbonate), and to enable pupils to keep their teeth clean. Use of lectures, songs, demonstrations and practicals are recommended for teaching.

The other publication, by the Ministry of Health, Central Oral Health Unit, has been delivered to some teachers, and is intended to guide primary school health coordinators (teachers trained in primary health care) and other classroom teachers in dental health activities, and for use in teacher training colleges (Nørmark et al. 1986). This 43-page book has sections on the importance of oral health, ways of maintaining oral health, oral anatomy, oral diseases and their causes and prevention. The manual outlines sessions on oral hygiene and diet to be taught for 1-3 hours per year in every grade level (first to seventh).

The teaching objectives are to ensure that pupils brush their teeth every day at school during lunch break, and to teach them to make their own toothbrushes ('miswaki') and racks for storage, identify the parts, kinds and functions of teeth, identify local foods affecting teeth, explain the causes and signs of tooth decay and gum disease, and to enable older pupils to assist younger ones in brushing their teeth. Lectures, discussions, demonstrations, supervised practicals and role plays are the suggested teaching methods. The guide requires school health coordinators to cooperate with classroom teachers in leading the sessions, and in particular to examine pupils' teeth monthly and refer those pupils with problems to hospitals.

2.2.3 Training and preparedness of implementors

Implementors greatly affect the process and outcomes of any health education strategy, depending on their proficiency, motivation and credibility. Most school oral health education programmes have been planned by dentists, and implemented by dental personnel or schoolteachers, or sometimes by nurses or pupils (Masters 1972, Plamping et al. 1980, Frazier et al. 1983). Elementary

school teachers worldwide have been given the task of providing health education in schools (WHO/UNESCO/UNICEF 1992b), but they have not universally accepted this duty, or been able to teach this subject (Bartlett 1981, Futrell 1992, Kolbe et al. 1992). Training for and motivation of the teachers providing health education is needed (Krishnamurthy and Samuel 1987, Futrell 1992, WHO/UNESCO/UNICEF 1992a).

Teachers' preparedness for the oral health education task has been studied mostly in developed countries. It has been concluded that teachers without training in oral health education have insufficient dental knowledge and skills but, nevertheless, feel competent for the task (Mullins and Sprouse 1973, Loupe and Frazier 1983, Glasrud and Frazier 1988, Lang et al. 1989). Groups of teachers studied in South Africa (Chikte et al. 1990), Kuwait and Madagascar (Petersen et al. 1990a, 1991) have been reported to have relatively high dental knowledge for this task.

Dental personnel in Tanzania are expected to train teachers for their oral health education task in schools, but the attempts have so far been only sporadic. By 1993 only some teachers in Tanga, Mbeya and Morogoro regions (out of the 20 regions) had been provided with training seminars, financed mainly by donors (member of staff of the Central Oral Health Unit, personal communication). Primary school teachers' knowledge of and skills in carrying out oral health education has not been studied in Tanzania.

Some teachers in both developed and developing countries have been willing (Loupe and Frazier 1983, Lang et al. 1989, Petersen et al. 1990a, 1991, Abellard 1994) but others reluctant to teach oral health education in schools (Boyer 1976, Chikte et al. 1990). Teachers' reluctance to give oral health instruction in schools has also been observed in Tanzania in a school dental health project during the 1970s (Mosha 1981). However, in connection with the national programme, teachers' willingness in implementing this task has not been assessed.

2.2.4 Implementation of activities

Reaching the target population is naturally fundamental for the success of any health education programme. The Tanzanian national oral health education activities, initiated in 1982, were reported to be active in 1987 at about half of the MCH clinics but only at about 2% of the primary schools (Mosha 1989). The delay in the implementation of the school-based oral health education may have been partly caused by the late issuing of the teachers' guidelines for the programme. By 1990, the guidelines published by the Ministry of Education ('Taasisi ya Elimu' 1987a,b) were said to be available and in use in the primary schools (member of staff of the Institute of Curriculum Development, personal communication).

The content of oral health education has to match the needs of the target group. The need for school oral health education in Tanzania to properly address both gum disease and tooth decay is evident, considering their common

occurrence and the insufficiency of the knowledge, attitudes and skills to prevent them among schoolchildren. However, the actual content of the oral health education carried out by teachers in primary schools in Tanzania has not been studied.

The methods used in providing oral health education can enhance or inhibit learning and create either an active or a passive audience. Traditionally, oral health education had been conducted with the assumption that providing people with correct information would improve their knowledge, attitudes and practices. Consequently, one-way communication, in particular lecturing, had been the most common teaching style in oral health education (Davis 1974, Stoll 1977, Johnson 1981). More recently, group or one-to-one instruction, printed materials, use of audio-visual material, demonstration, practicals, mass media, films and computer-assisted learning have been used in school oral health education (Gold and Duncan 1980, Frazier 1980, Frazier et al. 1983, Horst and Hoogstraten 1989). Case studies, games, songs, projects, and role plays, which encourage active participation, have also replaced one-way communication (WHO 1988).

Very little information exists on approaches to school oral health education in developing countries (WHO 1989). The studies which exist, mostly experiments, have reported the impact or outcomes but rarely the oral health education processes. The studies indicate two main methods: instruction followed by practice sessions, and instruction only. Sessions including lectures with posters or written materials have been tried by some elementary school teachers in South Africa (Evian et al. 1978). The effects of instruction in toothbrushing by a hospital auxiliary, followed by daily practice at school, have been studied in Ethiopia (Olsson 1978). Similar sessions led by a teacher have been studied in South Africa (Hartshorne et al. 1989). A demonstration project on oral health education through instruction, a film and toothbrushing supervised by a dental hygienist or nurse at school has been reported from Syria (Burhani 1986). In Nigeria, sessions with films, posters, comic books, disclosing tablets and toothbrushing practice were organized by dentists at a primary school with children of well-off families (Doherty 1983).

In Tanzania, a study was conducted on fourth-grade pupils who were first instructed and then practised toothbrushing weekly under the supervision of instructed teachers in eight urban primary schools (van Palenstein et al. 1992). In another study done at two secondary schools, ninth-graders received lectures and oral hygiene instruction, and some also received dental treatment from dental students (Frencken et al. 1993). The teachers' guides for the Tanzanian primary school oral health education programme recommend practice sessions (Nørmark et al. 1986, 'Taasisi ya Elimu' 1987a), but there has been no follow-up on the actual practice.

2.2.5 Acceptance by target population

Health education, including that for oral health, is usually a compulsory subject at schools. Schools in developed countries have traditionally included oral health education and service programmes in their activities (Frazier et al. 1983, Silversin and Konarcki 1985). It has been emphasized that health education or health promotion planners must take the views of the recipients into account (WHO 1983, Nutbeam et al. 1990). However, the degree of acceptance and other views of recipients of school oral health education have not been investigated in Tanzania or in other developing countries.

2.3 Environmental support for children's oral health practices in Tanzania

Their environments can facilitate or hinder people's adoption and maintenance of oral health behaviours (Silversin and Konarcki 1985, Jacob and Plamping 1989). Although health education can contribute to behavioural change, the changes are made possible and maintained only if the individuals are enabled by their environments to do so (Green and Simons-Morton 1991). A call for actions to create supportive environments for health has been made (WHO 1986, 1991, WHO, Nordic Countries and UNEP 1991).

Formerly, health educators rarely took the environmental factors related to healthy lifestyle into account (WHO 1983, Tones et al. 1990, Ritchie 1991). Since the 1970s, several school health education programmes have tried to focus on environments through comprehensive approaches (Bartlett 1981, Trichopoulos and Petridou 1988). However, it appears that many oral health education programmes still try to alter behaviour without paying attention to environmental forces, resources or barriers (Rubinson 1982, Frazier 1992).

2.3.1 Social, physical and economic environments

Empirical evidence shows that parents have the strongest influence on the oral health behaviour and ideas of their children (Rayner and Cohen 1974, Blinkhorn 1978, Silversin and Kornacki 1985, Woolfolk et al. 1989). Besides parents, conformity to peer group norms also influences adolescents' dental behaviours such as sugar consumption (Rise and Holund 1990) and toothbrushing (Hodge et al. 1982), and increases in importance as children grow older (Silversin and Kornacki 1985). The role of parents and the influence of peers on the oral health behaviour of school-age children have not been studied in Tanzania.

Physical environments influence the availability of people's day-to-day requirements for oral health practices. While a variety of foods and instruments

for tooth-cleaning are usually obtainable in developed countries, they are not always available in Third World countries. In Tanzania, the daily per capita availability of sugar was only 50 grams or less during the early 1970s (Screebny 1982). During the early 1980s, sweets were available in every town (Muya et al. 1984). Schools, where adolescents spend a large part of their day, have often served as centres for sales of sugary foods (Roder 1973, Addo-Yobo et al. 1991). In Tanzania, sweets and biscuits were commonly sold in the urban primary schools studied (Mosha 1981). For tooth-cleaning, tree-twigs suitable for making toothbrushes ('miswaki') ought to be easily available, especially in rural areas. A shortage of manufactured toothbrushes and toothpaste has been pointed out (Muya et al. 1984), but the availability of indigenous and factory-made tooth-cleaning materials has not been thoroughly assessed in Tanzania.

The link between oral health and economic factors is well known (Beal 1989), and poverty is a barrier to the development of appropriate oral health services in developing countries (Hobdell and Sheiham 1981). Tanzania is among the world's low-incomed countries, and most of its people cannot afford to pay even for their basic health services (Abel-Smith and Rawal 1992, Gilson et al. 1994).

Among Tanzanian school-age children, poverty seems to affect oral health both negatively and positively. Tooth decay is more common among the affluent than the poorer people, but the reverse is true for gum disease (Mandari 1988). Children in the urban areas eat more sugary foods than do their rural counterparts (Nyandindi 1988). Poverty and other socioeconomic factors also seem to limit peoples' choice of toothcleaning equipment. Indigenous items like the 'miswaki', charcoal and sand are used more often in rural areas and by low socioeconomic groups, while manufactured toothbrushes are used more commonly by urban or higher socioeconomic groups in Tanzania (Nyandindi 1988, Sarita and Tuominen 1992) and other African societies (Addo-Yobo et al. 1990). Knowledge of the cost of foodstuffs and of tooth-cleaning equipment, relative to parents' abilities to provide their children with these items, is needed in the planning of children's oral health education. The affordability of such items has not yet been studied in Tanzania.

2.3.2 Public policy and measures

Oral health care in any population is considerably influenced by policy issues (Petersen and Holst 1992). Oral health has improved greatly in most developed countries mainly as a result of preventive policies that stress optimum use of fluorides and periodic dental screening, in addition to proper oral hygiene and healthy eating habits (Nakajima 1994, Marthaler 1994). Water fluoridation at community level is the most effective means of caries prevention (Marthaler 1994), but in Tanzania the majority of people, especially in rural settings, have no access to piped water systems (Planning Commission 1992). Of the alternatives, toothpaste seems to be commonly available but is too costly for many people. Dental screening of pupils at primary schools is among the

objectives of the national school dental programme, but is currently hindered by shortage of resources, particularly transport of dental personnel to the schools (Ministry of Health and Social Welfare 1988). There is also a national policy requiring school authorities jointly with local community leaders to organize school lunches ('Wizara ya Afya' 1988), but it seems that this is not being implemented. There is no policy on or attempts to limit the availability of sugary foodstuffs at schools or in society in general.

2.4 Effects of oral health education among schoolchildren

The effects of school oral health education, like those of school health education in general, have been reported mainly from developed countries (Brown 1994). It is generally acknowledged that health education has succeeded in many ways, but not always (Green et al. 1980, Ewles and Simnett 1987, Tones et al. 1990).

Many of the school oral health education trials conducted by either dental personnel or schoolteachers in developed countries have brought about a significant increase in pupils' knowledge (Craft et al. 1984, Walsh 1985, Hodge et al. 1987, Søgaard and Holst 1988, Horst and Hoogstraten 1989). Sometimes the sessions have resulted in favourable dental attitudes (Craft et al. 1984, Walsh 1985) or have improved pupils' oral hygiene (Anaise and Zilkah 1976, Kolehmainen 1983, Craft et al. 1984, Schou 1985, Walsh 1985, Hodge et al. 1987, Søgaard et al. 1987). At other times the sessions have been ineffective (Russell et al. 1989). Short-lived programmes, opposing values of families or communities, and other environmental obstacles have reduced the impact of school oral health education programmes (Frazier 1992, Brown 1994).

In the developing countries several school-based strategies have attempted to improve dental health, but in most cases neither their failures or successes have been reported (WHO 1989). Only a few evaluative studies of school oral health education in these countries are available.

A South African study done 6 months after a teacher-led poster, reading and slide/tape dental session, although it was not stated whether the sessions included toothbrushing practicals, reported slightly better knowledge and significantly better oral hygiene in fourth-grade pupils in comparison with the controls (Evian et al. 1978). In Ethiopia, Olsson (1978) found third-graders to have improved oral hygiene after professional instruction followed by supervised daily brushing sessions for three months. Evaluation after one year of a Nigerian school dental health programme organized by a dental team who provided information and skills training showed significant reduction in the occurrence of caries in a group of fourth-graders (Doherty 1983). A South African study done 3 months following an information session and daily toothbrushing by instructed teachers showed significant improvement in oral hygiene and dental knowledge of first-grade pupils (Hartshorne et al. 1989).

In Tanzania, Mosha (1981) evaluated a 4-year dental project covering all pupils in seven primary schools. Dental screening, treatment and health

education for pupils were conducted by dental staff and then health education was continued by dental auxiliaries and instructed teachers. The study did not describe the content or methods of the oral health education. It concluded that caries status and toothbrushing frequency and efficiency improved among the pupils during the project. Another study in Tanzania showed improved oral hygiene in a group of fourth-graders exposed to instruction and weekly brushing supervised by instructed teachers for three months compared with a control group not exposed to the sessions (van Palenstein et al. 1992). Another study conducted 22 months after ninth-graders got oral health information, brushing sessions and after some had got dental treatment from dental students, found no significant difference in caries experience between the participants and non-participant pupils (Frencken et al. 1993).

These studies on school oral health education implemented by dental personnel, nurses or schoolteachers in developing countries generally show more elements of success than of failure. The studies have usually focused on short-term effects, and seldom describe the implementation processes or the environmental factors presumably affecting the children's cognitive, affective or behavioural aspects of oral health. Thus, interpretation of the findings is difficult, and such evaluations offer little guidance to programme improvements (Green and Lewis 1986). Moreover, the school oral health education activities evaluated have mostly been experiments conducted beyond existing school curricula, and sometimes not even by schoolteachers, leaving the question of their applicability in more realistic situations unanswered.

No evaluation of the effects of the national school oral health education activities in Tanzania has been undertaken.

2.5 Summary of the literature

The literature from various parts of the world generally reveals that school-age children are in need of oral health education and that primary schools provide an important opportunity for it. Schoolteachers are recognized as potential oral health educators, but they require training and motivation for the task. The traditional model of school oral health education, which was instructional and focused on individuals, is gradually changing to practice-oriented sessions which also take into account environmental factors. The effects of school oral health education have often been reported to be favourable, but not always.

The literature from Tanzania is scarce but indicates a need for oral health education at primary schools, and for teachers' involvement and training for the task. It provides hardly any information on the teachers' preparedness for school oral health education, quality of the sessions planned and given, support from or conflict with environments, or impact or outcomes among schoolchildren. Evaluation of the school oral health education activities in Tanzania, particularly conducted within an ecological perspective, is needed.

2.6 Evaluation in health education

Evaluation (evaluative research) in health education or health promotion activities has been defined in many ways, but is generally a process of systematic gathering of information and making judgement on the worth of the activity (Borus et al. 1984, Green and Lewis 1986, Ewles and Simnett 1987, Schalock and Thornton 1988, Greenberg 1989, Hawe et al. 1991, Sarvela and McDermott 1992).

Evaluating a health education programme usually involves observing and collecting data about how a programme operates and the effects it appears to have on the participants (Hawe et al. 1991). Thus, evaluation can relate to the impact or outcomes (impact or outcome evaluation) or to the processes leading to the effects (process/formative evaluation). Impact (or short-term outcomes) generally refers to the effects of a programme on intermediate variables like knowledge, attitudes, skills and behaviours, while outcomes refer to the changes in health status, but some evaluators use these terms in the opposite way (Green and Lewis 1986). The results of an evaluation can provide feedback for the programme planners and implementors, and a basis for designing and testing necessary adjustments to the programme.

As there is no one correct way to evaluate health education programmes, the approach chosen has to be appropriate to the type of information needed about the programme (Hawe et al. 1991). Both quantitative methods (especially used in impact evaluation) and qualitative methods (especially used in process evaluation) are important (Green and Lewis 1986). There have been various frameworks for evaluation in health education, some of which, for example the CIPP model, encourage assessing the health education programmes in a holistic or ecological perspective. This model focuses on assessment of the pre-existing conditions, programme components, intervening events and programme impact and outcomes (Green and Lewis 1986).

The CIPP model, advanced by Stufflebeam in the early 1970s and later described by Green and Lewis (1986), is a framework advocating evaluation of the context, input, process and product of health education programmes. In essence, context evaluation defines the environment in which the programme operates. Input evaluation identifies the capabilities of the agencies involved, the strategies planned, and the resources available. Process evaluation examines the implementation of the programme. Product evaluation measures the attainments during or on completion of the programme, and interprets them in relation to the programme context, input and process. This comprehensive type of evaluation enhances our understanding of a programme, and is especially useful in assessing developing health education programmes (Green and Lewis 1986).

3 AIMS OF THE STUDY

The primary aim of this study was to evaluate the performance of the school oral health education programme in Tanzania, with reference to the CIPP model. On the basis of the findings, an intervention, including designing modified school oral health education and training teachers for it, was carried out and evaluated.

The specific aims were to examine the:

1. Oral health education needs of the target population (schoolchildren), by assessing oral health knowledge, attitudes, practices and skills of children entering school.

2. Context in which the programme operates, by examining environmental (social, physical, economic) factors supporting or conflicting with proper oral health behaviours in schoolchildren.

3. Input of the programme implementors (schoolteachers), by assessing their participation, abilities and willingness in carrying out school oral health education.

4. Process (content and methods) of conventional school oral health education and its impact on oral health knowledge, attitudes, practices and skills of schoolchildren.

5. Process of modified school oral health education and its impact on oral health knowledge, attitudes, practices and skills of schoolchildren.

4 STUDY DESIGN, POPULATION AND METHODS

4.1 Study design

The present study represents applied research with the aim of evaluating the performance of a school oral health education (OHE) programme in Tanzania with the ultimate goal of finding ways of further improving the programme. The study consisted of a series of initial cross-sectional studies done during 1990 to assess the pupils' oral health education needs, environmental support for the programme, the teachers' input and preparedness for oral health education, the quality of the conventional oral health education sessions, and the impact among the pupils. There then followed an intervention in the form of designing modified oral health education sessions and a teaching manual, and a teacher training programme conducted in November 1990. Subsequently, cross-sectional evaluative studies of the quality and contents of modified oral health education sessions given by the recently trained teachers and of the impact of the modified sessions among pupils were done during 1991 (Figure 1).

In the initial studies, the prevailing oral health education needs of the pupils were assessed by examining the oral health knowledge, attitudes, behaviour and skills of the children (the reference group) when they first entered school (study I). The environmental (social, physical and economic) factors which may support or hinder the success of the school oral health education programme were examined. The messages about oral health received by the pupils and the availability and prices of snack foodstuffs and tooth-cleaning equipment were registered (study II). To determine the input and preparedness of the teachers for implementing oral health education, their participation, abilities and willingness for this task were assessed (study III). The process of oral health education at the schools was examined by assessing the content and

methods of conventional sessions carried out by the teachers in first-grade classes (study IV). The impact of the conventional oral health education among pupils was assessed four months after the pupils attended the sessions. This was done by studying the pupils' oral health knowledge, attitudes, skills and practices, and the results from this group were compared to those of the reference group who had not been exposed to oral health education at school (study V).

The intervention (designing improved oral health education sessions, and the training of teachers for their health education task) was the result of the initial findings from the pupils, the teachers, the environments, and the conventional oral health education sessions' contents, methods and impact. Teacher training was designed and carried out in workshops, and for comparison, one group of teachers studied and practised with a manual on their own (study IV).

Evaluation of the effectiveness of the teacher training was carried out at two levels. First, the process (content and methods) of modified oral health education sessions at schools was assessed two months after the training (study IV). Secondly, the impact of the modified sessions as regards the oral health knowledge, attitudes, practices and skills of pupils were studied four months after they attended the sessions, and the findings from this group were compared with those from the conventional session group and with those from the reference group (study V).

PHASE 1: INITIAL ASSESSMENTS OF THE OHE PROGRAMME

Samples	Methods
Pupils entering school, without OHE (Reference group) (n=200)	Interviews & clinical checkups
Environments (n=10)	Observation
Teachers responsible for OHE at school (n=46)	Questionnaire, interviews & clinical checkups
Conventional OHE sessions (n=10)	Observation
Pupils given conventional OHE (Conventional session group) (n=200)	Interviews & clinical checkups

PHASE 2: INTERVENTION

a) Planning: Designing a new OHE manual and teacher training based on initial assessments

b) Implementation: Training teachers in OHE, using two methods

Samples	Methods
All 125 teachers of OHE in the study district	Workshops based on the manual
Sample of 10 teachers of OHE in another district	Studying the manual alone

PHASE 3: EVALUATIVE STUDIES AFTER INTERVENTION

Samples	Methods
OHE sessions after teacher training with workshops (Modified sessions) (n=10)	Observation
OHE sessions after teachers studied the manual (n=10)	Observation
Pupils who received modified OHE (Modified session group) (n=200)	Interviews & clinical checkups

FIGURE 1 Study design and samples

4.2 Study population

4.2.1 Settings

The Ilala district, where the study was conducted, is located in the Dar es Salaam region (Figure 2). This district is about 210 square kilometres in area, and a small portion of it lies within the limits of the City of Dar es Salaam.

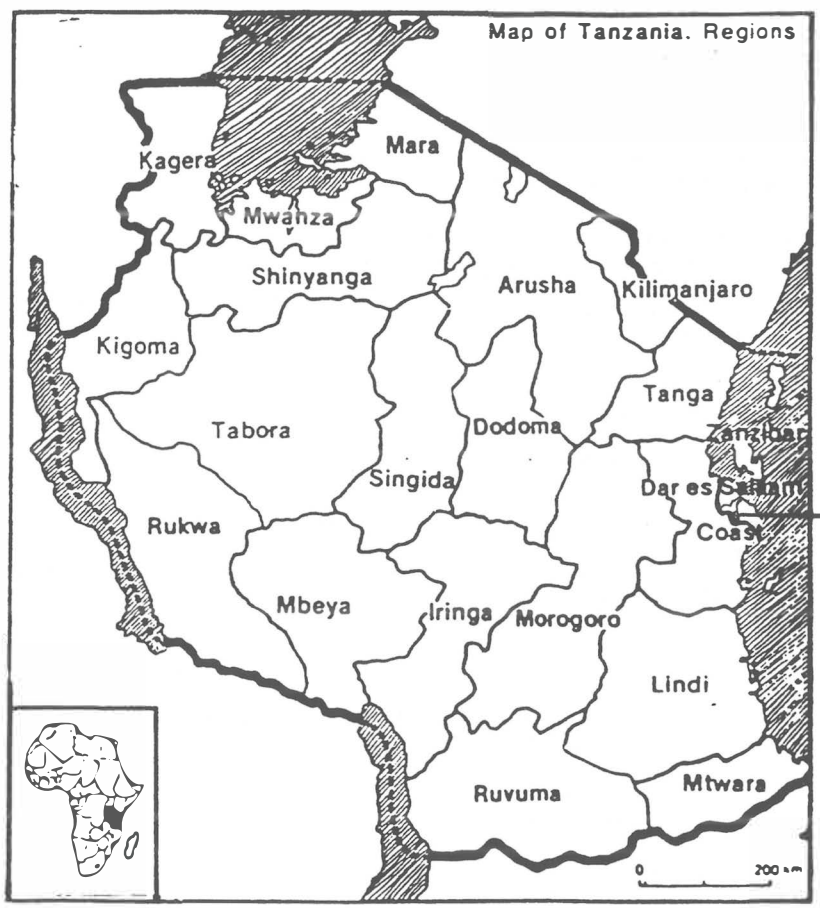

FIGURE 2 Location of the Ilala district in Tanzania

According to the 1988 Census the Ilala district has about 350,000 inhabitants (Planning Commission 1990). Although the district largely consists of rural areas, most people (92%) live in urban (Dar es Salaam City) areas. This community consists of several Tanzanian tribes, mostly Christians and Moslems (Kikwilu et al. 1987). The urban inhabitants depend mainly on employment and petty trades for their livelihood, while rural dwellers are mainly peasants. Both urban and rural dwellers have limited incomes. Of all households in 1987, 20% owned a proper house, 87% had latrines (pit latrines), 18% had tap water, 15% had electricity, 7% had a refrigerator, 52% had a radio, 2% had television, 12% had bicycles and 4% had a car (Mandari 1988).

The public health infrastructure in the Ilala district includes one hospital, two health centres, 37 dispensaries and 16 MCH clinics (Kikwilu et al. 1987). The Muhimbili Medical Centre, which includes the only medical and dental faculties in the country, is also situated in the Ilala district. This centre basically deals with training and consultancy at national level, but it also serves its neighbourhoods. There is a public dental clinic in the district hospital. Its dental personnel consisted of three assistant dental officers and two dental assistants in 1990. Both curative and preventive dental services are limited, as dental materials are often in short supply, and reaching outstations, e.g. schools, is difficult. Prior to this study, the dental personnel in Ilala had carried out dental screenings in pupils at a few schools, but teacher training in oral health education had hardly been attempted.

Primary schools are the most common educational institutions in the Ilala district. There are 44, of which 35 are located in the urban areas and 9 in the rural areas. The schools are financed by the Dar es Salaam City Council, and their activities are planned and monitored by the Ministry of Education. According to 1990 records at the district education office, 42,663 pupils (about 8% of the districts' population), with almost equal gender ratios, attended the 44 primary schools. There were 1,231 teachers in these schools. The number of first-grade classes, for whom oral health education is scheduled, ranged between 2 and 9 in urban schools and were usually 2 in rural schools. The classes were large (37 to 184 pupils), particularly at urban schools. Permission to implement the present study was granted by the Dar es Salaam City Council and the Ilala District Education Office.

4.2.2 Samples

Subjects in study I (Reference group) were from five (out of 35) urban schools and from five (out of nine) rural schools randomly selected among urban and rural schools in the Ilala district. At each of the ten selected schools, a school-entering class was randomly chosen. The pupils in each class were stratified by gender, and ten boys and ten girls were randomly selected from both strata. The sample consisted of children (n=200) aged 5 to 14 years (mean=9 years, SD=1.8 years) newly enrolled at school, who had not yet received any oral health education at school.

The evaluation of the environments (Study II) was made at the premises and surroundings of the same five urban and five rural primary schools where pupils were studied. The food items and tooth-cleaning equipment and their prices were recorded within the school premises and at 15 shops, located near the 10 schools, which pupils might visit during breaks. The presence of trees suitable for making toothbrushes ('miswaki') in the surroundings was also determined.

The sample in Study III consisted of first-grade classroom teachers (n=46). All first-grade classroom teachers at eight urban and eight rural primary schools were studied. These included the teachers in those five urban and five rural schools where the pupils were sampled for study I. To increase the size of the sample, teachers in three urban schools randomly selected from the remaining 30 urban schools and in three rural schools (the one remaining rural school was involved in another dental project) were studied.

In study IV, the quality and content of conventional oral health education sessions (n=10) was assessed at the 10 primary schools where pupils had taken part in study I. At each school, a session given to a class of newly-enrolled first grade pupils who were not involved in study I and who had not yet received oral health education at school was examined.

The assessment of the impact of the conventional sessions among pupils (study V) took place at the same 10 primary schools where pupils in the reference group had been studied and the conventional sessions had been observed. Each of the 10 first-grade classes which four months earlier had attended the sessions was first stratified by gender. Then, 10 boys and 10 girls were randomly selected from each class, and their participation in the sessions was confirmed from records. This was the conventional session sample of 200 children. The findings among them were compared with those among the referents.

The teacher training in oral health education was provided to two samples of teachers (study IV). Workshops were organized for all 125 teachers of first-grade classes, i.e. those responsible for teaching oral health education at the 44 primary schools in the Ilala district. For comparison, 10 first-grade teachers, including one teacher randomly selected from each of the 5 (out of 28) urban primary schools and from 5 (out of 21) rural schools in an adjacent district, Temeke, were given a manual to study and practice by themselves. A team formed by the study group, the Ilala district's dental personnel and the school administrators collaboratively organized the teacher training.

The ten modified oral health education sessions studied (study IV), were taught by the ten teachers who had taught the conventional sessions, but now they taught the sessions two months after they had attended the training workshops. The teachers taught the modified sessions to their newly-enrolled first-grade classes, who had not received any oral health education at school before. The teachers were given three days' notice before teaching the sessions and were asked to try to follow the guidance they had been given earlier. Ten sessions given by the teachers who had only studied the manual alone were also assessed (study IV).

The evaluation of the impact of the modified oral health education among pupils (study V) involved comparison of three samples of first-grade children. The modified session group (n=200) was selected from the first-grade classes who attended the modified sessions in the 10 primary schools, where the reference group and conventional oral health education session group were also studied. Each of the 10 classes given the modified sessions was stratified by gender and 10 boys and 10 girls were randomly selected. The findings among pupils who participated in the modified sessions were compared with findings among those pupils who did not receive oral health education and with findings among those who attended the conventional sessions.

4.3 Methods

4.3.1 Interviews, questionnaires, observations and clinical examinations

Interviews with the children were used for assessing oral health knowledge, attitudes and behaviour, and sources and content of oral health messages previously received (studies I and V). The interviews at each school were carried out individually in the children's own classroom. Interviewing was done by two persons, a schoolteacher and a health education worker, who had been trained for the task. The questions had been structured with optional responses to ease recording of replies (Appendix 1), but were asked in an open manner, using the Swahili language. For further clarification, the interviewers displayed to each pupil the items under question, including dietary items and tooth-cleaning equipment. With the 21 questions, the interview took about 15 minutes with each child.

After the interviews, the children's oral hygiene was clinically examined to assess their tooth-cleaning skills. The examinations were conducted by a dentist in the school yard at a site with good daylight and the child placed in an ordinary chair. In each child, the buccal and lingual surfaces of twelve teeth (first permanent molars, second deciduous molars and permanent central incisors) were examined using a dental mirror. Visible dental plaque was registered using a modified Visible Plaque Index (Ainamo and Bay 1975). Plaque was recorded as present (code 1) when clearly seen on the surface, otherwise it was considered absent (code 0). It took about two hours to examine 20 children in each school. The children's skills in making traditional toothbrushes ('miswaki'), were then studied. The 20 children simultaneously but independently made a 'mswaki' from a tree-twig using a knife provided, and this exercise was accomplished within half an hour. The dentist then evaluated each 'mswaki' and categorized it as suitable if it had soft bristles and a length of about 18 cm, which is considered adequate for reaching posterior teeth.

The interview and clinical examination procedures had previously been tested in a pilot sample of 20 school entrants from a non-participating primary school. Repeated interviews and clinical examinations conducted blindly among

the pupils revealed inter-interviewer agreement of 92%, intra-interviewer agreement of 96% and 94%, and intra-examiner agreement of 95%. Repeated checks on oral hygiene in 20 pupils (10%) in each study sample (reference, conventional session and modified session groups) still showed high intra-rater reliability; mean kappa values of 0.93, 0.95 and 0.93, respectively. The instruments for the whole study had been developed in consensus among the study team with advice from school administrators.

Data regarding the environment (study II) were obtained by two means. While information about the social environment was collected as part of the pupil interviews, information on the physical and economic environments was gathered by means of observations, and by visiting the school premises and surroundings, and nearby shops and kiosks. With the aid of a check-list (Appendix 2), the food items and tooth-cleaning materials available were recorded and their prices were listed. This was done by the author, accompanied by a teacher from each school who helped to seek the cooperation of the food vendors and shopkeepers.

Questionnaires, interviews, and clinical examinations were used for getting information about the teachers (study III). A questionnaire with 10 questions assessed the teachers' knowledge of oral health, and an interview form with 17 questions explored their participation and willingness as oral health educators (Appendices 3a and 3b). The teachers were studied at their respective schools. They took about 30 minutes to fill in the questionnaire individually, and were interviewed for about 30 minutes each. The same two persons who had interviewed the pupils also supervised the questionnaire procedures and conducted the interviews among the teachers.

The teachers' abilities to teach toothbrushing to the pupils were assessed by observing their own skills in making a 'mswaki', and in brushing. These assessments were performed by the same dentist who examined the pupils. The methods and criteria used to detect and record plaque among the teachers were similar to those used for the pupils, but the teeth examined in each teacher were first and second molars and first incisors. The quality of the 'miswaki' made by the teachers was also assessed and a length of about 20 cm was considered suitable for adults.

Observation was used for evaluating the quality of oral health education sessions studied prior to and after the teacher training (study IV). The author attended each session at the schools and, seated at the back of the classroom, recorded the number of pupils in attendance, the physical environment, the concepts and the skills taught, the teaching methods, the materials used for learning, the pupils' involvement, and the time used. A check-list (Appendix 4) was used to guide the recording.

4.3.2 Oral health education manual and teacher training workshops

A need for improvements in the functioning of the programme was apparent from the initial findings. The pupils' oral health knowledge and behaviours

required much improvement. The teachers' knowledge, skills and motivation for providing oral health education were low, and their conventional sessions were poor in both content and quality as well as ineffective among pupils.

The objective of the intervention was to train the teachers in proper content and methods of oral health education, since they had not received any such training. The training was oriented towards the necessary knowledge and skills for teachers and appropriate methods in oral health education. The training was planned and implemented as a joint effort by the author and other members of the study team and the dental personnel and school administrators of the Ilala district, with the approval of the authorities for school currica and for oral health matters at national level.

To begin with, a new manual for oral health education lessons in first grade was designed by the team on the basis of the pupils' established oral health education needs. The curriculum guide currently used by the classroom teachers includes toothbrushing, but no dietary matters ('Taasisi ya Elimu' 1987a). The new manual has an easy structure for teachers to follow, includes both oral hygiene and dietary matters, and emphasizes methods that encourage interactive communication, teaching of dental skills and pupil involvement in the learning process. The manual also served as a framework for the teacher training in order to make the training applicable to the teachers' oral health education task at schools and to support them in their future oral health education work.

The training of the teachers was undertaken in two ways. 1) Workshops, centred on the manual, were arranged for the 125 teachers in the Ilala district to allow the teachers and dental personnel to discuss and practice the desired school oral health education; and 2) for comparison, the manual was issued for self-study to the other group of teachers (n=10) working in the Temeke district. The training process was pre-tested at a pilot workshop delivered to teachers (n=35) working in a primary school of the adjacent Kinondoni district.

Teacher training was preceded by visits made by the dental team to each of the 44 primary schools in the Ilala district. This was done to invite the 125 first-grade teachers to the workshops and to provide them with the new manual and other teaching aids for orientation about two weeks in advance. At the same time, the teaching manual and other materials were issued to the 10 first-grade teachers sampled from the Temeke district, and they were asked to study the manual well and practice with it.

The workshops that followed in the Ilala district were carried out in two urban and two rural schools, the teachers allocated to the workshop sites nearest to them. All invited teachers attended. The training at each location lasted for one day, from 8 a.m to 2 p.m. The dental personnel taught as a team, each teaching a sub-topic. The training particularly tried to provide teachers with experience in the skills for teaching dietary choices and toothbrushing, which they initially lacked, by organizing an opportunity for learning, experimenting and discussion. The teachers actively discussed the concepts and showed particular interest in learning the practical skills for themselves and for teaching their pupils. The district's dental personnel reported their satisfaction with the knowledge and experience they gained in the training process, in view of their

task to update teachers' dental knowledge and skills in the future. They were also pleased with the intervention's wide coverage of schools.

4.3.3 Analysis of the data

Data on the pupils' dental knowledge, attitudes, practices and social support, and on the teachers' participation, willingness and abilities in oral health education, (studies I, III, V), were analyzed using the SPSS/PC+ 4.0 software package (Norusis 1990a,b). To evaluate differences statistically within and between groups, the Chi-square test was used for proportions and Student's t-test (two-tailed) for means. Data describing the physical and economic environmental factors connected to school oral health education, and the content and methods of school oral health education sessions, (studies II, IV), were analyzed qualitatively and quantitatively from the records.

5 RESULTS

5.1 Oral health education needs of pupils

The needs assessment (study I) was done among children entering first grade and who had not received oral health education at school. Their oral health knowledge was found to be scant and they had inconsistent ideas (Table 1). Over 70% were not aware that tooth decay and gum disease are common in their society. Only 37% knew that tooth decay is caused by sugary foods, and fewer than every third knew that reducing sugar consumption can prevent decay. Only 26% knew both the cause and prevention of decay, including 40% in the urban areas but only 11% in the rural areas ($p=0.000$). Half (52%) of the children knew that gum disease can be prevented by proper toothbrushing, but 42% did not know its cause or prevention. However, 58% said they primarily brushed to avoid decay and 38% brushed to keep their teeth white.

TABLE 1 Distribution (%) of the children (n=200) according to their replies on causes and prevention of dental diseases.

Replies on cause of tooth decay	Replies on prevention of tooth decay			
	Low sugar consumption	Proper brushing	Some other way /did not know	Total %
Eating sugary foodstuffs	26	7	4	37
Poor toothbrushing	0	29	2	31
Other cause/did not know	1	13	18	32
Total	27	49	24	100
Replies on cause of gum disease	**Replies on prevention of gum disease**			
	Proper brushing	Low sugar consumption	Some other way or did not know	Total %
Poor toothbrushing	36	0	2	38
Other cause/did not know	16	4	42	62
Total	52	4	44	100

Dietary practices and attitudes reported by the children showed that many (74%) had eaten sugary foods once or twice during the previous day. The five most commonly eaten sugary foodstuffs were sugar-sweetened tea, sweets, ice-cream, sodas and biscuits. There was a common preference for sugary over non-sugary foods. When the five most commonly eaten sugary and five non-sugary foods were displayed for each child to choose the favourite one, every one in two boys or girls chose a sugary item. Sodas and biscuits were generally regarded as harmless for teeth. Every third child also regarded sweets as harmless for teeth. More urban than rural children ate sugary foods, and more girls than boys ate sugary foods and regarded them as harmless for teeth (Table 2).

TABLE 2 Practices and beliefs about sugar in diet among children (n=200) according to location and gender.

Behaviour		Tea with sugar %	Sweets %	Ice-cream %	Soda %	Biscuits %
Had consumed sugary items (once or twice) the previous day:	Urban	78***	27***	26***	22***	19***
	Rural	51	6	1	4	3
	Boys	65	10*	12	9	6*
	Girls	64	23	15	17	16
Regarded sugary items as harmless for teeth:						
	Urban	27	32	9	60	45
	Rural	20	30	4	65	65
	Boys	27	22**	4	57	35**
	Girls	20	40	9	68	55

Differences between groups (urban vs. rural; boys vs. girls) evaluated by Chi-square statistics (df=1, * = $p \leq 0.05$, ** =$p \leq 0.01$, *** = $p \leq 0.001$)

Toothbrushing was prevalent among the studied children. Every child claimed that he/she brushed teeth at least once a day. Most children (95%) said they preferred factory-made toothbrushes to self-made 'miswaki'. The tooth-cleaning items used by the children, however, depended on location. Most urban children (95%) but not as many rural children (64%) used factory-made toothbrushes, and the rest used the 'miswaki'. Only every fifth urban child and every second rural child had the skill for making a proper 'mswaki'. The majority (76%) considered toothpaste essential for tooth-cleaning, and most urban children (86%) but fewer rural children (28%) used it. Brushing with charcoal was more common among the rural children (37%) than among the urban ones (8%), and some rural pupils (16%) brushed with ash.

The clinical dental examinations revealed that many children had visible plaque (mean=12, SD 4.4) on the studied 24 index tooth surfaces. Oral hygiene was slightly better among girls (mean 11.4, SD 4.1) than among boys (mean 12.7, SD 4.7) ($t=2.05$, $p=0.041$). No significant difference was observed in the oral hygiene standard between habitual users of factory-made toothbrushes and 'miswaki'.

The age of the children studied was not associated with their level of oral health knowledge, attitudes, practices or skills.

5.2 Environmental support for pupils' oral health practices

The context (environmental) evaluation (study II) revealed parental support through reinforcement of positive oral health behaviours among children, but less so in terms of provision of basic equipment. Parents were the main source of dental advice to the children interviewed on entering primary school. About half (55%) of the children recalled they had been told by their parents to avoid sugary foods and 54% had been told to brush their teeth daily. The other source of dental information were siblings in the case of a few children (11%). It was found that many children did not eat before going to school. Every second urban child and three-quarters of the rural children studied said they usually went to school without breakfast and also did not get a packed meal for school.

Neither the urban nor the rural school environments provided healthy dietary alternatives for the children. The primary schools studied did not provide any meals to pupils. Instead, sugary snacks were sold to pupils by vendors in school buildings or compounds, at urban schools in particular. In the shops located near the urban and the rural schools, only snacks with sugar were available. Urban areas were generally more supportive than rural areas as regards oral hygiene equipment. Toothbrushes were available in most urban shops but only in half of the rural community shops studied. Toothpaste was available in two-thirds of the urban shops as compared to one-third of the rural shops. However, tree-twigs suitable for making 'miswaki' were plentiful in the rural areas and were sold at town markets, too.

The food items and tooth-cleaning equipment appeared to be costly for parents or children themselves to buy regularly. The sugary snacks available at school premises and from shops cost from Tshs 2 to Tshs 180. The price of a toothbrush ranged from Tshs 35 to Tshs 120, and was higher for a good quality toothbrush.

Toothpaste was even more expensive, Tshs 75 to Tshs 500 per pack. However, the majority of Tanzanian employees had a monthly salary of only Tshs 3,500, which was equivalent to USD 18 in 1990 when the data were collected. Currently, they earn about the same in US dollars. Most Tanzanians live in rural areas and depend on subsistence farming, and the incomes of these people are even lower.

5.3 Participation and preparedness of schoolteachers in oral health education

In the interviews (study III), the primary school teachers who were supposed to implement the school oral health education programme ranked the health subject only as moderately important among the subjects they taught. They considered the time (one hour per week) allocated for the subject of health insufficient. They

complained of inadequate teaching materials for the subject, and of having to teach too big classes. Besides teaching a first-grade class in the morning, most teachers (65%) also taught a second-grade class in the afternoon. One-third of the teachers reported that school inspectors had visited them and inquired into their health education activities in the past year.

The majority (74%) of the teachers had taught the oral health topic during the previous school year. They had taught about toothbrushing, but had suggested that parents should take over the task, as children normally brush at home. They had not taught about the relationship of diet to oral health. When asked why, they replied that dietary issues were not in their current oral health education guide ('Taasisi ya Elimu' 1987a). The teachers also held the opinion that children cannot follow dietary instruction given at school since they depend on their parents' preferences for food. Most of the teachers (74%) said they checked pupils' teeth as part of hygiene control at the morning pupil assemblies obligatory in Tanzania. The teachers said they needed teaching aids, but only one in ten raised the need for special training for their oral health education task.

The teachers' dental knowledge was inadequate. Only half of them were aware that both tooth decay and gum disease are common in their society. Although many teachers knew that tooth decay is caused by frequent sugar consumption, nearly all regarded toothbrushing as the best way to prevent it. Half of them related gum disease to Vitamin C deficiency (nutritional disorder associated with inflamed gums), yet almost all of them considered toothbrushing the best preventive measure (Table 3).

The clinical dental examinations revealed that, except for two teachers, the respondents had visible plaque on at least half of their 20 examined index tooth surfaces. Only half (46%) had the skills necessary for making a proper traditional toothbrush, which they were expected to teach their pupils to make. When brushing with their self-made 'miswaki' most teachers were able to get the buccal tooth surfaces clean but the cleanliness of the inner tooth surfaces did not improve.

TABLE 3 Distribution (%) of the teachers (n=46) according to their replies on causes and prevention of dental diseases.

Replies on cause of tooth decay	Replies on prevention of tooth decay		
	Low sugar consumption	Proper brushing	Total %
Eating sugary foodstuffs	6	62	68
Poor toothbrushing	3	29	32
Total	9	91	100
Replies on cause of gum disease	**Replies on prevention of gum disease**		
	Proper brushing	Taking vitamin C	Total %
Poor toothbrushing	33	1	34
Vitamin C deficiency	49	4	53
Eating sugary foodstuffs	13	0	13
Total	95	5	100

5.4 Process and impact of conventional oral health education

To assess the process of the school oral health education programme, some sessions provided to first-grade children by the classroom teachers were observed (study IV). The sessions were held entirely inside the classrooms. A large number of pupils (range 37-184; mean 65 pupils, SD 27) participated in each session. The classrooms had very few benches and thus many pupils sat on the floor. Every teacher brought along the guide book issued by the Ministry of Education, but no other materials for teaching. Each session lasted one school period (about 30 minutes), addressed oral hygiene only and was taught by lecturing. The teachers emphasized daily use of either factory-made toothbrushes or chewing-sticks for preventing bad breath or tooth decay, but taught no skills. They encouraged pupils to use toothpaste, but also recommended use of charcoal or ash as alternative inexpensive 'toothpastes'. There were no discussions, demonstrations or practice exercises.

The impact of these conventional oral health education sessions was very poor. The children investigated after receiving such oral health education were

found to have almost equally poor knowledge about tooth decay as the children not yet exposed to oral education at school (referents). However, a larger proportion of the children in the conventional session group than in the reference group knew about the cause and prevention of gum disease (Table 4). The children in the conventional session group also reported more frequent brushing than the referent children. They frequently brushed with tooth-erosive substances (Table 6). Otherwise, the children who had received the conventional sessions did not show improved practices or attitudes regarding sugary snacks or improved toothbrushing skills in comparison with the referents (Tables 5 and 7).

5.5 Process and impact of modified oral health education

The modified oral health education sessions given by the workshop-trained teachers were observed and found to be more satisfactory than the conventional sessions. These modified sessions were taught to as large a number of pupils at a time as before, but were partly carried out outside the classrooms. The sessions addressed both tooth decay and gum disease. Pupils were actively involved in the learning. The teachers used the new manual and other teaching aids like buckets for fetching water and trays for displaying food items provided, and the pupils brought with them tree-twigs and knives for making toothbrushes. In accordance with instructions given during the teacher training, two sessions of 30 and 60 minutes each were taught. The first session contained discussion on tooth decay and gum disease and practice of diet selection, and the second concentrated on toothbrushing practice. Following demonstrations by the teachers, every pupil participated in an exercise of making a 'mswaki' and brushing their teeth under their teachers' guidance. The teachers emphasized regular renewal of factory-made brushes or 'miswaki', recommended the use of toothpaste, and discouraged use of charcoal or ash. They also instructed pupils to spread their newly gained oral health knowledge and skills to their families.

The sessions taught by the ten teachers who had studied the manual without attending the workshops were almost no better than the conventional sessions. The teachers brought the new manual to class and the other teaching aids provided, and eight out of the ten teachers had asked pupils to bring their toothbrushes from home. The teachers taught about oral hygiene, mainly by lecturing, but usually omitted dietary issues. They held one session in a classroom for half an hour. Toothbrushing was emphasized for reasons other than gingival health, but no advice on the renewal of toothbrushes was given. Brushing with toothpaste was encouraged, but use of charcoal or ash were not challenged. Some teachers mentioned the two common dental diseases, tooth decay and gum disease. Only two teachers got pupils to try to identify non-sugary food items. The eight teachers whose pupils had brought toothbrushes told pupils to go outside to brush. Only two teachers demonstrated the brushing technique and supervised the pupils' brushing. The rest stayed inside while pupils were brushing outside.

Only the impact of the modified oral health education sessions given by the workshop-trained teachers was evaluated. In view of their observed content and methods, the sessions taught by the teachers given the manual only were not expected to yield much better results than the conventional sessions.

In the modified session group the knowledge of the causes and prevention of tooth decay was better in comparison with the conventional session and reference groups. Half the children in the modified session group, but only a quarter of those in the other groups, knew about the cause and prevention of tooth decay. Nearly three-quarters of the children in the modified session and nearly two-thirds in the conventional session group, compared to only one-third of the referent children, knew about the cause and prevention of gum disease (Table 4). Most pupils in both session groups said they brushed to prevent tooth decay. Only in the modified session group were there some children (13%) who said they brushed to prevent gum disease.

TABLE 4 Oral health knowledge compared between the conventional (C) and modified (M) session groups, and between each session group and the referents (R).

	Referents	Pupils who received oral heath education				
		Conventional		Modified		
	(n=200)	(n=200)		(n=200)		
	%	%	C vs R	%	M vs R	C vs M
Knew about tooth decay;						
Occurrence (common)	28	35		63	***	***
Cause (sugary snacks)	39	46		84	***	***
Prevention (avoid sugar)	27	24		50	***	***
Both cause and prevention	26	22		48	***	***
Knew about gum disease;						
Occurrence (common)	11	10		56	***	***
Cause (poor toothbrushing)	38	65	***	78	***	**
Prevention (toothbrushing)	52	83	***	80	***	
Both cause and prevention	35	62	***	70	***	
Motive for toothbrushing;						
To avoid tooth decay	58	73	***	81	***	
To make teeth white	36	18	***	6	***	***
To avoid gum disease	0	1	na	13	na	na
No reason	6	8		0	na	na

Differences between groups evaluated by Chi-square statistics (df = 1, * = $p \leq 0.05$, ** = $p \leq 0.01$, *** = $p \leq 0.001$, na = not applicable).

Self-reported practices and attitudes on sugary snacks were most promising among the children who had participated in the modified sessions (Table 5). Sugar consumption was the least frequent among these children. The

proportions who had eaten any sugary item on the previous day were significantly ($p<0.001$) lower among the rural than urban children in all three groups; 56% versus 92% in reference group, 47% versus 87% in the conventional session group, and 39% versus 85% in the modified session group. Preference for sugary snacks was less common (31%) in the modified session group than in the conventional session (40%) and reference groups (48%). Moreover, children in the modified session group considered sugary foods, particularly sweets and soda drinks, harmful to teeth more often than the others. As in the other groups, more girls (49%) than boys (27%) in the modified session group held the opinion that soda drinks are harmless to teeth.

TABLE 5 Self-reported practices and beliefs about sugary foods compared between the conventional (C) and modified (M) session groups, and between each session group and the referents (R).

	Referents	Pupils who received oral heath education				
	(n=200)	Conventional (n=200)		Modified (n=200)		
	%	%	C vs R	%	M vs R	C vs M
Pupils who had consumed sugary items (once or twice) the previous day;						
Tea with sugar	65	60		44	***	**
Sweets	17	11		9	*	
Ice-cream	14	12		14		
Soda drinks	13	10		10		
Biscuits	11	10		13		
Pupils who regarded sugary items as harmful to teeth;						
Tea with sugar	76	73		80		
Sweets	69	80	*	89	***	*
Ice-cream	93	96		84	**	***
Soda drinks	37	38		62	***	***
Biscuits	55	54		68	**	**

Differences between groups evaluated by Chi-square statistics (df = 1, * = $p \leq 0.05$, ** = $p \leq 0.01$, *** = $p \leq 0.001$)

Judging from the children's own statements, toothbrushing was more common in the modified session group than among the other children. Oral health education had no influence on the type of toothbrushes the children used or preferred. The use of factory-made toothbrushes remained popular across groups. A significantly ($p<0.001$) higher proportion (86%) of children in the modified session group than in the conventional session group (37%) or in the

reference group (35%) had learned to make a proper 'mswaki'. Three-quarters of the children in each group reported that they valued toothpaste, but only about every second child in each group used it. Children in the conventional session group brushed with charcoal more often than the other pupils (Table 6).

TABLE 6 Self-reported oral hygiene practices and attitudes compared between the conventional (C) and modified (M) session groups, and between each session group and the referents (R).

	Referents	Pupils who received oral heath education				
		Conventional		Modified		
	(n=200)	(n=200)		(n=200)		
	%	%	C vs R	%	M vs R	C vs M
Toothbrushing frequency;						
Once a day	78	57	***	23	***	***
At least twice a day	22	43	***	77	***	***
Items used for toothbrushing;						
Industrial toothbrush	80	80		78		
Chewing-sticks ('miswaki')	20	20		22		
Toothpaste	57	55		57		
Charcoal	23	38	**	26		**
Ash	9	5		1	na	na
Skilled in making 'mswaki'	35	37		86	***	***
Type of toothbrush preferred;						
Industrial	95	92		90		
'mswaki'	5	8		10		
Regarded toothpaste essential	76	74		75		

Differences between groups evaluated by Chi-square statistics (df = 1, * = $p \leq 0.05$, ** = $p \leq 0.01$, *** = $p \leq 0.001$, na = not applicable).

Oral hygiene was slightly better among the children in the modified sessions than among the other children. The mean number of tooth surfaces with visible plaque (24 surfaces examined in each pupil) was smaller in the modified session group (mean 10.5, SD 4.7) than in the conventional session group (mean 11.7, SD 4.9) or the referents (mean 12.0, SD 4.9). The difference was statistically significant only between the modified session group and the referents ($t=3.28$, $p=0.001$). Unlike among the referents, in the modified session group the level of oral hygiene was similar among boys and girls, but it was slightly better in the urban children (mean 9.1, SD 4.1) than in rural ones (mean 12, SD 4.8) ($t=4.49$, $p<0.001$). In all groups, children were more able to clean the inner than the outer

sides of upper teeth, the outer than the inner sides of lower teeth, and the front than the back teeth (Table 7).

Nearly all the children, irrespective of their oral health education exposure, stated that they would like to participate in school oral health education.

TABLE 7 Pupils with no visible plaque on the index teeth compared between the conventional (C) and modified (M) session groups, and between each session group and the referents (R).

		Referents	Pupils who received oral heath education				
			Conventional		Modified		
		(n=200)	(n=200)		(n=200)		
		%	%	C vs R	%	M vs R	C vs M
UPPER TEETH							
Right first	Outer	3	9		18	*	**
permanent molar	Inner	48	53		51		
Right second	Outer	1930	**	38	***		
deciduous molar	Inner	70	67		74		
Right permanent	Outer	83	83		87		
central incisor	Inner	87	83		83		
Left permanent	Outer	83	82		90		*
central incisor	Inner	88	82		82		
Left second	Outer	23	26		30		
deciduous molar	Inner	77	70		73		
Left first	Outer	7	14	*	14	*	
permanent molar	Inner	54	60		57		
LOWER TEETH							
Left first	Outer	49	52		61	*	
permanent molar	Inner	4	6		5		
Left second	Outer	73	73		76		
deciduous molar	Inner	19	16		22		
Left permanent	Outer	57	61		69	*	
central incisor	Inner	69	68		78	*	*
Right permanent	Outer	56	61		76	***	**
central incisor	Inner	67	69		77	*	
Right second	Outer	7677		77			
deciduous molar	Inner	18	15		21		
Right first	Outer	49	52		55		
permanent molar	Inner	2	3	na	5		

Differences between groups evaluated by Chi-square statistics (df = 1, * = $p \leq 0.05$, ** = $p \leq 0.01$, *** = $p \leq 0.001$, na = not applicable).

6 DISCUSSION

6.1 Study design, samples and methods

This evaluation of the national school oral health education programme in Tanzania was undertaken, with reference to the CIPP model (Green and Lewis 1986), at the levels of the programme's operational context, the input of the planners and implementors, the delivery process, and the impact produced. The findings were interpreted mainly with reference to the demonstrated contemporary oral health education needs of the target population, in addition to the pre-outlined programme goal. This comprehensive type of evaluation generates wide-ranging information which can help to improve a health education programme rather than simply demonstrate its functioning (WHO 1983, Flay 1986, Green and Lewis 1986, Nutbeam 1990, Hawe et al. 1991, Sarvela and McDermott 1992).

Three cluster samples of schoolchildren were included in the study: the reference group, the conventional session group and the modified session group. The samples were randomly chosen and heterogenous, with similar age, gender and area distributions, which would also increase the samples' comparability at baseline and the external validity of the results. The between-group study design (Adams and Schvaneveldt 1985) used here increases internal validity of the evaluation design because it prevents within-group carry-over of the session or interview effects, as each study group got only one type of oral health education. Each subject was studied only once, which also may help avoid replies given because they are considered desirable. Spill-over of the interview or session contents between the samples was not very likely as the children were from different classes. The modified session group only started school a year after the conventional oral health education sessions took place at each school.

The wide age range (5 to 16 years) among the first graders studied is common in Tanzania, although the national policy requires children to begin school at seven (Ministry of Education and Culture 1992). Prior to school oral health education (in the reference group) there were no age-related differences in dental knowledge, attitudes, practices and skills. Tanzanian children of any age have little opportunity to learn about oral health before starting school, as Tanzanian mothers have limited knowledge of dental health matters (Kabalo and Mosha 1988). This investigation studied first-grade pupils, for whom dental lessons are scheduled, regardless of their ages.

The collection of information on the schoolchildren's oral health knowledge, attitudes and practices was based on interviews, as the children could not read or write, while their dental skills were observed and their oral hygiene examined. Self-reported health practices may not always be the true practices (Ross and Vaughan 1986, Sarvela and McDermott 1992). To reduce this problem, each subject was interviewed only once to avoid prior exposure to the questions, and a teacher and a health education worker were trained to interview the children on the basis of their familiarity with and skills in communicating with schoolchildren. To increase the children's comprehension, each child was shown the various materials, such as tooth-cleaning equipment and foods, or pictures of the items in question.

The training of the interviewers, the structure of the interviews and the clarity of examination criteria would increase the reliability of the results. The children understood the questions well and there were no missing answers. To avoid the problem of recall, only the previous days' dietary patterns and toothbrushing frequencies were asked about. All the measurements for the whole evaluative study were designed in co-operation with local dental personnel and school teachers to ensure the measurements' validity.

The social, physical and economic conditions differ greatly between urban and rural areas of Tanzania (Planning Commission 1992). Studying both urban and rural environments is necessary for an understanding of children's everyday realities related to oral health in the country. The Ilala district which was selected for this study has people of mixed socioeconomic and cultural backgrounds, mainly due to its partial location in the country's capital city. Most people live in the urban area, but the district is largely rural (Kikwilu et al. 1987, Planning Commission 1990), permitting comparison of the functioning of the programme in both settings.

The schoolteachers studied were first-grade classroom teachers, who, according to the school curriculum ('Taasisi ya Elimu' 1987a,b, 'Wizara ya Elimu' 1988), should implement the oral health education sessions. Their oral health knowledge was assessed by questionnaires and their skills by clinical examination, and they were individually interviewed. Particularly on questions pertaining to their participation and willingness in giving school oral health education, interviews provided contact, cooperation, and a chance to clarify questions. The teacher training in oral health education was also provided to the first-grade teachers normally responsible for the task.

If subjects know they are being observed, they may behave in a more socially desirable manner (Sarvela and McDermott 1992). Therefore, in the

evaluation of the oral health education sessions, the observer's presence could have motivated the teachers to teach as well as they could. This, however, would have affected all the observed teachers alike. An attempt to make the teachers feel at ease was made by assuring them that their personal performance would not be disclosed.

All the sampled pupils and teachers participated in the survey and interventions. This was probably due to the cooperation with local teachers and school authorities, and to the personal invitations and preliminary orientation for the teachers.

6.2 Oral health education needs of schoolchildren

Oral health behaviour and attitudes usually start at home as part of the socialization process, in which mothers are the most important role models (Blinkhorn 1978, 1981, Beal 1983, Silversin and Konarcki 1985). Children seem to acquire dietary and tooth-cleaning behaviours at a very early age (Gordon and Reddy 1985). However, studies in different parts of the world have found mothers to have insufficient oral health knowledge and skills (Jeboda et al. 1984, Petersen et al. 1990a, b, 1991, Davies and Croucher 1992, Esa et al. 1992). In Tanzania, mothers of young children have poor dental knowledge even though many of them visit MCH clinics where oral health education is one of the services (Kabalo and Mosha 1988). Mothers alone may not be capable of teaching their children oral health matters. Oral health education of children at school is one way of providing them with oral health knowledge and skills for their future lives.

This study shows that the school-entering children in Tanzania have insufficient knowledge and conflicting views about oral health matters. As reported in previous studies in Tanzania (Nyandindi 1988, Nørmark and Mosha 1989a), children still seem to have low daily frequency of sugar consumption, especially boys and rural children. However, the children (girls particularly) regard sugary items as harmless for teeth, and their preference for sugary foods is high. This preference seems to have increased since it was last surveyed in Tanzania in 1982 (Nørmark and Mosha 1989a). This suggests that with improved access to sugary foods in the country, sugar consumption will tend to increase. It is therefore essential that the role of diet in dental health be taught in the school oral health education sessions in Tanzania.

Daily toothbrushing appears to be prevalent among Tanzanian school-age children, although the rationale for brushing is not clear to them. In Tanzania (Nyandindi 1988) and other parts of Africa (Addo-Yobo et al. 1991, Kaimenyi et al. 1993), factory-made toothbrushes are commonly used among urban school-age children. Even in rural areas such toothbrushes are far more common now than a decade ago (Nørmark and Mosha 1989a). Children have previously been reported to have negative attitudes to brushing with chewing-sticks (Nørmark 1991). This should be taken into account when

advising children about toothbrushes. Toothpaste is valued and used commonly by urban children. Rural children rarely use toothpaste, but commonly brush with abrasive substances like charcoal or ash. This seems to be due to the poor availability and costliness of toothpaste.

Despite their self-reported regular toothbrushing habits, the children's oral hygiene was poor, particularly among boys. This has been reported previously in children (Frencken et al. 1986a, Kerosuo et al. 1986, Mandari 1988, Nyandindi 1988, Nørmark and Mosha 1989b, Mumghamba 1990) and in adults in Tanzania (Lembariti et al. 1988, Mumghamba 1990). In addition to lacking the proper toothbrushing skills, the children probably use worn-out or ineffective toothbrushes. School oral health education in Tanzania is needed to further reinforce the children's brushing behaviour, but it is evidently more important to teach them the proper and applicable techniques and skills.

6.3 Factors supporting or undermining school oral health education

Social support is important for adherence to behaviours conducive to oral health (Blinkhorn 1978, Jacob and Plamping 1989). It is claimed that mothers try to clean their young children's teeth in Tanzania (Kabalo and Mosha 1988). Parental reinforcement for toothbrushing in school-age children was found in this study. Some parents also seem to advise their children against eating sugar too often. However, the children's access to proper tooth-cleaning equipment is limited. Their dietary regimen seems less harmful to oral health, but still rather poor from the point of view of general health. This is especially true of rural children.

The necessity for health-promoting schools is uncontestable (Tones et al. 1990). However, this study found that urban schools harbour vendors of sugary snacks, and such snacks dominate the selection in shops near schools, both urban and rural. The foods sold by vendors at schools or at shops that could serve as a small meal appeared too costly for pupils from average-income families. A policy to provide lunch for pupils at primary schools exists in Tanzania ('Wizara ya Afya' 1988) but it does not function. School authorities and parents will have to try to find the means and ways of putting this essential policy into practice.

In urban areas, factory-made toothbrushes and toothpaste, which school-age children prefer, are commonly available. This is less so in rural areas, where children commonly brush with chewing-sticks and charcoal or ash (Nyandindi 1988, Nørmark and Mosha 1989a). The costliness of the industrial toothbrushes and toothpaste is also a problem here. School-age children may not be able to afford to renew their toothbrushes regularly and, consequently, may brush with worn-out, ineffective brushes. Many people in Tanzania cannot even afford to pay for basic health services (Abel-Smith and Rawal 1992, Gilson et al.

1994). Public measures to increase supply in rural areas and perhaps subsidize costs may increase people's access to appropriate tooth-cleaning equipment.

6.4 Schoolteachers and the oral health education task

The participation and willingness of elementary school teachers as implementors of school oral health education are well known (Frazier et al. 1983, Loupe and Frazier 1983, Lang et al. 1989), but teachers have also been found to be reluctant to demonstrate toothbrushing to pupils (Boyer 1976). Tanzanian primary school teachers have the task of teaching oral health education, but they do not value the health subject in general very highly compared to other school subjects. The little time allocated for the health subject, considering the large number of health topics to be covered, and the infrequent follow-up by school administrators, further reflect the topic's low priority in the school curriculum. The findings indicate the need for inspiration and support from health personnel and from school authorities for the teachers in their health education role.

Teachers' own knowledge and skills are prerequisites for providing good quality oral health education. As in many other countries (Mullins and Sprouse 1973, Loupe and Frazier 1983, Glasrud and Frazier 1988, Lang et al. 1989), the Tanzanian primary school teachers implementing oral health education seem to have insufficient oral health knowledge and skills, and very few teachers perceive the need for specific training for this task. In this study, the teachers' level of knowledge about oral health matters was inadequate for oral health education. So far, attempts to train teachers for oral health education have been rare, reportedly due to economic limitations. Unless Tanzanian teachers are trained in oral health education, as required by the Ministry of Health and Social Welfare (1988), they cannot be expected to carry out their oral health education task effectively.

6.5 Conventional school oral health education

For the implementation of school oral health education in Tanzania, there are co-existing guides from the school authorities ('Taasisi ya Elimu' 1987a) and from the oral health sector (Nørmark et al. 1986), which are inconsistent with respect to their content and their selection of target pupils. The teachers studied reported following the former guide, which has deficient content and limits dental sessions to first-graders only. A national framework to guide the programme is essential, but to meet local needs, specific, tailor-made guides should also be available. The needs of pupils, principles of learning and the

environments should be taken into account in school health education (Nutbeam 1992, Walker and Wright 1992).

The content and the methods of oral health education given in the Tanzanian primary schools do not seem to coincide with the prevailing needs of the pupils. As has been common in school oral health education programmes (Frazier et al. 1983), the conventional oral health education sessions observed in Tanzanian primary schools have toothbrushing as their only or dominant content. Brushing technique, which clearly needs much improvement, is, however, not taught or practised. The role of diet in dental health is not taught. The state of the art emphasizes interactive learning and practice of the proper dental skills (Jacob and Plamping 1989). Yet, as in traditional approaches (Frazier et al. 1983), lecturing appears to be the dominant method of oral health education in Tanzanian primary schools.

The present results reveal that the conventional oral health education in Tanzanian primary schools have little impact on the children's poor dental knowledge, attitudes, practices and skills. For example, the pupils' understanding of caries and its relationship to sugary diet does not improve, as these matters are not taught during the sessions. Moreover, their use of tooth-erosive items as a substitute for toothpaste is encouraged during the sessions, and therefore tends to increase. The children seem to gain motivation for toothbrushing, but do not gain the skills for making the 'mswaki' and their poor oral hygiene does not improve during the lecture-oriented sessions.

The inappropriateness of the sessions may be influenced by the teachers' attending in their teaching only to the content of the curriculum guide ('Taasisi ya Elimu' 1987a) issued by the Ministry of Education. The guide lacks information on some important elements of oral health education such as diet. It suggests teaching of toothbrushing in practice sessions, but the teachers' inadequate abilities and motivation are a hindrance. Teachers' basic training, which focuses on cognitive subjects, has also been linked with their lecture-oriented health sessions (Bartlett 1981). The large classes found in developing countries (Hurskainen 1994) also encourage lecture-oriented sessions. The mismatch between the oral health education needs of pupils in Tanzania and the sessions that they currently receive may be solved by organizing proper training, guidance and support for the schoolteachers implementing this task.

6.6 The intervention

The teacher training was designed to meet the needs of both the pupils and the teachers, and to be feasible in the existing circumstances. The workshops also enabled the teachers to practice with the dental personnel with whom they are supposed to collaborate. The teachers showed enthusiasm in learning throughout the workshops. Long-lasting motivation could be expected since they found the training beneficial not just for their school oral health education task but personally as well.

The local dental personnel who implemented the workshops were content with the training, including the procedure, the wide coverage at low costs, and the realistic settings, which is important for the training's feasibility in Tanzanian conditions. They gained from this training a practical experience for undertaking their duty to update and support the teachers in their district. The teachers' self-study using the oral health education manual was a way of comparing the impact of the workshops with the impact of a less costly way of educating the teachers.

6.7 School oral health education after modifications

In developed countries, various evaluative studies on school oral health education have found significant increases in pupils' knowledge (Craft et al. 1984, Walsh 1985, Hodge et al. 1987, Søgaard and Holst 1988, Horst and Hoogstraten 1989), and sometimes in their attitudes (Craft et al. 1984, Walsh 1985) or in their oral hygiene (Anaise and Zilkah 1976, Kolehmainen 1983, Craft et al. 1984, Schou 1985, Walsh 1985, Hodge et al. 1987, Søgaard et al. 1987). In developing countries, oral health education in schools has also been shown to improve oral health knowledge (Evian et al. 1978, Hartshorne et al. 1989), oral hygiene (Evian et al. 1978, Olsson 1978, Hartshorne et al. 1989, van Palenstein et al. 1992) or pupils' caries status (Mosha 1981, Doherty 1983).

The content of the modified oral health education sessions was specified from the surveyed needs of the pupils. The focus was on the skills of toothbrushing and making dietary choices, through demonstration and practice oriented sessions. Despite the large classes, pupils were activated by questions and invited to discuss the concepts of oral health. It has been shown that active learning can facilitate informed health choices among the audience (Beall and Hurley 1982, Kannas 1991). However, these adjustments in the content and methods of the school oral health education could not be achieved simply by supplying teachers with a written guide.

In the interviews, the pupils showed good acceptance of oral health education lessons, suggesting that future cooperation from pupils can be expected. The children participating in the modified sessions gained dental knowledge, attitudes, practices and skills. Their improved knowledge about both gum disease and tooth decay can be ascribed to the clarifications and discussions about the occurrence, causes and prevention of these dental problems that went on between the teachers and pupils during the modified sessions. However, the sessions were not able to influence the differences between urban and rural children's diet or tooth-cleaning equipment; these do not depend so much on the children but mainly on their providers and their environments.

Environment rather than personal choices limits sugar consumption in Tanzanian school-aged children even without oral health education exposure, as found in the reference group. General malnutrition is a common problem among children in Tanzania, particularly among those with lower socio-economic status

(Kavishe and Yambi 1991). With improved economic conditions, sugar consumption may also increase. Education on healthy dietary choices is necessary for future generations of children as well as for children of today. Self-reported consumption of sugary foodstuffs fell among the children who attended the modified sessions. This may have been partly due to the children's improved knowledge about tooth decay and attitudes towards sugar in food. To some extent, the result may reflect the children's newly gained knowledge about healthy food choices rather than actual behaviour. Only a follow-up study can assess how lasting this change is.

Toothbrushing was more frequent among the children who participated in the modified sessions than among the other children. For economic reasons, the sessions emphasized, and the pupils practised, making and using 'miswaki'. The children, however, continued to use and prefer factory-made toothbrushes. The attempt to promote toothpaste, which the pupils valued, and abolish the use of charcoal, did not succeed. The costliness of toothpaste seems to limit its use and encourages use of charcoal as a substitute, particularly in poorer rural areas of Tanzania.

Oral hygiene was slightly better among the children in the modified session group than among the other children. This can be credited to the supervised toothbrushing sessions, where the technique was demonstrated, tried and corrected individually. Practice sessions in toothbrushing have improved pupils' oral hygiene in other studies in Africa, too (Olsson 1978, Hartshorne et al. 1989, van Palenstein et al. 1992). In the present study, however, after only one supervised session the improvement in oral hygiene was evident but could not be expected to be very large. Booster sessions, as has been shown (Emler et al. 1980, Houle 1982), would possibly have further improved the impact. Such sessions could not be arranged prior to the evaluation due to teachers' lack of time, as the time allocated for school health education in the Tanzanian primary schools is limited.

As has been found previously among some school-age children in Tanzania (Nørmark and Mosha 1989b) and Ethiopia (Olsson 1978), there was no difference in oral hygiene between the users of factory-made toothbrushes and 'miswaki'. In a previous study in Tanzania (van Palenstein et al. 1992) higher plaque scores were found in users of 'miswaki' than users of manufactured toothbrushes, but three months after weekly supervised brushing there was no difference between the groups. However, it is unclear whether both types of brushes are equally effective, as these studies did not examine the quality of the pupils' brushes. Costliness may limit regular renewal of industrial toothbrushes among many Tanzanians.

The favourable impact that was observed after the modifications in the current school oral health education in Tanzania suggests a possibility and a means of improving the functioning of the national programme.

7 CONCLUSIONS AND RECOMMENDATIONS

Children entering the primary schools in Tanzania need oral health education at school, as their oral health knowledge, attitudes, practices and skills are poor.

Tanzanian environmental conditions are not very supportive of the recommended oral health behaviours in school-age children. There is some social support, such as parental reinforcing of behaviours conducive to oral health in children, but the physical and economic situation, especially in the rural areas, do not always enable such behaviours.

The current input into the existing school oral health education programme requires improvement. The guidelines for implementation are inconsistent and deficient in some basic elements, and preparation and support of teachers for oral health education are inadequate. Teachers try to implement the programme in accordance with the school curriculum, but have inadequate abilities and motivation for this task.

The ongoing process of oral health education at school is inadequate, as the content and methods of the conventional sessions are inappropriate for the pupils' needs. The impact among the pupils receiving the conventional oral health education is also poor, as the pupils do not gain the necessary oral health knowledge, attitudes, practices or skills.

The present results demonstrate that both the process and the impact of the school oral health education can be improved. This was accomplished by designing modified oral health education based on pupils' actual oral health education needs and training teachers through workshops organized by dental personnel jointly with school authorities. Issuing an oral health education manual only did not bring about the desired changes in the teachers' performance.

For further improvements to the programme, the schoolchildren's oral health education needs require to be assessed regularly and should form the basis for the programme objectives. The environments have also to be continuously examined, improved and considered with regard to their support for the children's oral health education. There is a need to improve the

guidelines, and to invest in teacher training workshops and teacher motivation in school oral health education. As emphasized in the national oral health care policy, and exemplified in this study, district dental staff must try to train and support the programme implementors.

The teachers conducting oral health education should try to include relevant content and use methods encouraging interactive learning and the mastery of skills. Booster sessions on oral health at the primary school level would be beneficial. Involving parents in school oral health education activities is important and needs to be studied.

Reorientation of the activities towards a school oral health promotion strategy is essential. Ideally, these measures require cooperation from all parties, the oral health providers, the school personnel, and children and their parents. Continued evaluation of the activities is essential for feedback to the parties involved, and for necessary improvements. The evaluation results can also generate school oral health education model(s) suitable for the Tanzanian settings.

8 TIIVISTELMÄ

Tutkimuksessa arvioitiin opettajien toteuttamaa suun ja hampaiden hoidon terveyskasvatusohjelmaa tansanialaisissa kouluissa. Oppilaiden tarvetta suun ja hampaiden hoidon opetukseen, ympäristön tukea ohjelmalle, opettajien valmiutta antaa kyseistä opetusta, tavanomaisen opetuksen toteuttamisprosessia sekä sen vaikutusta oppilaisiin arvioitiin tutkimuksessa CIPP-arvioitimallin (konteksti, panos, prosessi, tuotos) avulla. Tutkimus suoritettiin maantieteellisesti rajatulla alueella. Tiedonhankintamenetelminä käytettiin haastatteluja, kyselykaavakkeita sekä kliinisiä havaintoja, kun taas ympäristöä ja opetusprosessia tutkittiin observoinnin avulla. Lasten, jotka eivät saaneet suun ja hampaiden hoidon opetusta koulussa (vertailuryhmä, n = 200), suun ja hampaiden hoitoa koskevat tiedot, asenteet, käytännöt ja taidot havaittiin puutteellisiksi. Lasten ympäristö ei suhtautunut suun ja hampaiden hoidon opetukseen kovinkaan suotuisasti. Opetusta antavilla opettajilla ei yleensä ollut tehtävään koulutusta eikä siihen tarvittavaa tietoutta, taitoja tai motivaatiota. Opetustuokiot olivat sekä sisällöllisesti että menetelmiltään vaatimattomia. Opetustuokioiden vaikutus niihin osallistuneisiin oppilaisiin (tavanomaisen opetuksen ryhmä, n = 200) oli huono. Tutkimustulosten perusteella suun ja hampaiden hoidon opetusta varten valmistettiin modifioitu ohjekirja. Tutkimusalueella suun ja hampaiden hoidon kouluopetuksesta vastuussa olevia opettajia koulutettiin ohjekirjan mukaisesti, kun taas läheisellä alueella ohjekirja ainoastaan jaettiin opettajaryhmälle. Toimenpiteistä vastasivat tutkimusalueen hammashoitohenkilöstö sekä koulujen hallinnosta vastaavat. Koulutusta saaneiden opettajien suun ja hampaiden hoidon opetustuokiot paranivat sekä sisällöllisesti että menetelmiltään, myös opetuksen vaikutus opetustuokioihin osallistuneisiin oppilaisiin (modifioidun opetuksen ryhmä, n = 200) parani. Vastaavaa edistymistä ei tapahtunut ainoastaan ohjekirjan saaneiden opettajien kohdalla.

9 REFERENCES

Abellard, J. 1994. Oral health in Mali's schools. World Health, 47th Year, No. 1, 12-14.

Abel-Smith, B., Rawal, P. 1992. Can the poor afford 'free' health services? A case study of Tanzania. Health Policy and Planning 7, 329-341.

Adams, G.R., Schvaneveldt, J.D. 1985. Understanding research methods. New York: Longman, 135-147.

Addo-Yobo, C., Williams, S.A., Curzon, M.E.J. 1990. Oral hygiene practices, oral cleanliness and periodontal treatment needs in 12-year old urban and rural school children in Ghana. Community Dental Health 8, 155-162.

Addo-Yobo, C., Williams, S.A., Curzon, M.E.J. 1991. Dental caries experience in Ghana among 12-Year-Old urban and rural schoolchildren. Caries Research 25, 311-314.

Ainamo, J., Bay, I. 1975. Problems and proposals for recording gingivitis and plaque. International Dental Journal 25, 229- 235.

Al-Khateeb, T.L., O'Mullane, D.M., Whelton, H., Sulaiman, M.I. 1991. Periodontal treatment needs among Saudi Arabian adults and their relationship with the use of the Miswak. Community Dental Health 8, 323-328.

Anaise, J.Z., Zilkah, E. 1976. Effectiveness of a dental education program on oral cleanliness of schoolchildren in Israel. Community Dentistry and Oral Epidemiology 4, 186-189.

Andersson-Brolin, L., Lorentzson, B., Michanek, E., Ndagala, D. 1991. The Art of Survival. A study on sustainability in health projects. Stockholm: SIDA, 39-44.

Ashley, F.P. 1989. Role of dental health education in preventive dentistry. In J.J. Murray (Ed.) The prevention of dental disease. Oxford: Oxford University Press, 406-414.

Axell, T., Johansson, K. 1993. Oral health in a Tanzanian village. Tropical Dental Journal 16, 14-20.

Baker, G.H. 1990. Integration of oral and general health in maternal and child populations. Journal of Public Health Dentistry 50, 402-405.

Bartlett, E.E. 1981. The contribution of school health education to community health promotion: What can we reasonably expect? American Journal of Public Health 71, 1384-1391.

Beal, J.F. 1989. Social factors and preventive dentistry. In J.J. Murray (Ed.) The prevention of dental disease. Oxford: Oxford University Press, 313-342.

Beall, S., Hurley, R.S. 1982. The humanistic approach: A model for dental health curriculums. The Journal of School Health 52, 29-32.

Berger, I.B., Ngaliwa, S. 1983. 'Mradi wa afya mashuleni': The Tanzania school health program. The Journal of School Health 53, 95-98.

Blinkhorn, A.S. 1978. Influence of social norms on toothbrushing behaviour of preschool children. Community Dentistry and Oral Epidemiology 6, 222-226.

Blinkhorn, A.S. 1981. Dental health education. In G.L. Slack & B.A. Burt (Eds.) Dental public health. An introduction to community dental health. Bristol: John Wright & Sons Ltd, 270-286.

Bloch, B., Malele, J., Tanner, M., Savigny, D. 1989. Prevalence of dental caries among children in a rural Tanzanian community. Tropical Dental Journal 12, 47-53.

Borus, M.E., Buntz, C.G., Tash, W.R. 1984. Evaluating the impact of health programs: A primer. Massachusetts: The MIT Press, 1-15.

Boyer, E.M. 1976. Classroom teachers' perceived role in dental health education. Journal of Public Health Dentistry 36, 237-243.

Brown, L. F. 1994. Research in dental health education and health promotion: A Review of the literature. Health Education Quarterly 21, 83-102.

Burhani, H. 1986. In Syria: Effective methods to teach health education in schools. International Journal of Health Education 5, 32-34.

Burt, B.A. 1983. The prevention connection: linking dental health education and prevention. International Dental Journal 33, 188-195.

Butt, M.H., Dunning, J.M. 1986. Reimplementation of chewing stick oral hygiene in Kenya. Tropical Dental Journal 9, 35-37.

Chiduo, A.D. 1991. Health services in Tanzania: future perspectives and policy options. In G.M.P. Mwaluko, W.L. Kilama, M.P. Mandara, M. Murru & C.N.L. Macpherson (Eds.) Health & diseases in Tanzania. London: Harper Collins Academic, 296-308.

Chikte, U.M.E., Brand, A.A., Gilbert, L. 1990. The suitability of teachers as oral health educators. Journal of the Dental Association of South Africa 45, 429-432.

Craft, M. 1984. Dental health education and periodontal disease: Health policies, disease trends, target groups and strategies. In A. Frandsen (Ed.) Public health aspects of periodontal disease. Chicago: Quintessence Publishing Co, 149-160.

Craft, M., Croucher, R., Dickinson, J., James, M., Clements, M., Rodgers, A. 1984. Natural Nashers: a programme of dental health education for adolescents in schools. International Dental Journal 34, 204-213.

Croucher, R., Rodgers, A.I., Humpherson, W.A., Crush, L. 1985. The 'spread of effect' of a school based dental health education project. Community Dentistry and Oral Epidemiology 13, 205-207.

Danielsen, B., Baelum, V., Manji, F., Fejerskov, O. 1989. Chewing sticks, toothpaste, and plaque removal. Acta Odontologica Scandinavica 47, 121-125.

Davies, S., Croucher, R. 1992. An investigation into the role of post-natal health clinics in oral health education. Community Dental Health 10, 83-88.

Davis, H.C. 1974. An approach to dental health education for schoolchildren. In G.L. Slack (Ed.) Dental public health: An introduction to community dentistry, Bristol: Wright, 274-283.

Dhillon, H.S. 1992. School health education at the crossroads. International Journal of Health Education 11, 29-31.

Dhillon, H.S., Philip, L. 1992. Health in education for all: Enabling school-age children and adults for healthy living. International Journal of Health Education 11, 17-27.

Doherty, A. 1983. A school-based caries-prevention programme in Nigeria. The Journal of Pedodontics 7, 150-158.

Durward, C.S., Wright, F.A.C. 1989. Dental knowledge, attitudes, and behaviours of Indo chinese and Australian-born adolescents. Community Dentistry and Oral Epidemiology 17, 14-18.

Emler, B.F., Windchy, A.M., Zaino, S.W. 1980. The value of repetition and reinforcement in improving oral hygiene performance. Journal of Periodontology 51, 228-235.

Enwonwu, C.O. 1981. Review of oral disease in Africa and influence of socio-economic factors. International Dental Journal 31, 29-38.

Esa, R., Razak, I.A., Jalalludin, R.L.R. 1992. Cross-cultural variations in dental knowledge among antenatal mothers. Tropical Dental Journal 15, 19-23.

Evian, C., Weinberg, B., Cleaton-Jones, P. 1978. What did schoolchildren gain from the second national dental health week? Journal of the Dental Association of South Africa 33, 369-372.

Ewles, L., Simnett, I. 1987. Promoting health. A practical guide to health education. Cambridge: John Wiley and Sons, 58-81.

FINNIDA. 1992. Belief in health. Evaluation of Finnish NGO health missions in Tanzania. FINNIDA, 1-22.

Flay, B.R. 1986. Efficacy and effectiveness trials (and other phases of research) in the development of health promotion programs. Preventive Medicine 15, 451-474.

Frazier, P.J. 1980. School-based instruction for improving oral health: closing the knowledge gap. International Dental Journal 30, 257-268.

Frazier, P.J. 1992. Research on oral health education and promotion and social epidemiology. Journal of Public Health Dentistry 52, 18-22.

Frazier, P.J., Johnson, B.G., Jenny, J. 1983. Health educational aspects of preventive dental programs for school-age children in 34 countries -final results of an FDI international survey. International Dental Journal 33, 133-170.

Frazier, P.J., Horowitz, A.M. 1990. Oral health education and promotion in maternity and child health: a position paper. Journal of Public Health Dentistry 50, 390-395.

Frencken, J.E.F.M., Truin, G-J., König, K.G., Ruiken, R.M.H.M., Elvers H.J.W. 1986a. Prevalence of caries, plaque and gingivitis in an urban and rural Tanzanian child population. Community Dentistry and Oral Epidemiology 14, 161-164.

Frencken, J.E., Mabelya, L., van Palenstein, H., Mulder, J. 1993. Effects of two oral health care programmes on the prevalence of dental caries amongst secondary school scholars in Tanzania after 22 months. Tropical Dental Journal 16, 11-14.

Frencken, J., Manji, F., Mosha, H. 1986b. Dental caries prevalence amongst 12-year-old urban children in East Africa. Community Dentistry and Oral Epidemiology 14, 94-98.

Frencken, J. E., Truin, G-J., van't Hof, M. A., König, K.G., Mabelya, L., Mulder, J., Ruiken, H.M.H.M. 1990. Prevalence of dental caries in 7-13-yr-old children in Morogoro District, Tanzania, in 1984, 1986, and 1988. Community Dentistry and Oral Epidemiology 18, 2-8.

Frencken, J.E., Truin, G-J., van't Hof, M.A., König, K.G., Kahabuka F.K.A., Mulder, J., Kalsbeek, H. 1991a. Fluoride in drinking water and caries progression in a Tanzanian child population. Community Dentistry and Oral Epidemiology 19, 180- 181.

Frencken, J.E., Truin, G-J., van't Hof, M.A., König, K.G., Lembariti, B.S., Mulder, J., Kalsbeek, H. 1991b. Plaque, calculus, gingival bleeding and type of tooth cleaning device in a Tanzanian child population in 1984, 1986 and 1988. Journal of Clinical Periodontology 18, 592-597.

Futrell, M. H. 1992. Teacher support for comprehensive school health education. International Journal of Health Education 11, 37-39.

Gaupp, P.G. 1990. New initiatives for advocacy in national maternal and child oral health. Journal of Public Health Dentistry 50, 396-401.

Gilmore, G.D., Campbell, M.D., Becker, B.L. 1989. Needs assessment strategies for health education and health promotion. Indianapolis: Benchmark Press, Inc, 3-23.

Gilson, L., Alilio, M., Heggenhougen, K. 1994. Community satisfaction with primary health care services: An evaluation undertaken in the Morogoro Region of Tanzania. Social Science and Medicine 39, 767-780.

Gish, O. 1983. Some observations about health development in three African socialist countries: Ethiopia, Mozambique and Tanzania. Social Science and Medicine 17, 1961-1969.

Glasrud, P.H., Frazier, P.J. 1988. Future elementary schoolteachers' knowledge and opinions about oral health and community programs. Journal of Public Health Dentistry 48, 74-80.

Goetz, P.W. (Ed.) 1985. The New Encyclopaedia Britannica. Volume II. Chicago: Encyclopaedia Britannica, Inc, 548-550.

Gold, R.S., Duncan, D.F. 1980. Computers and health education. The Journal of School Health 50, 503-505.

Gordon, Y., Reddy, J. 1985. Prevalence of dental caries, patterns of sugar consumption and oral hygiene practices in infancy in S. Africa. Community Dentistry and Oral Epidemiology 13, 310-314.

Green, L.W., Kreuter, M.W., Deeds, S.G., Partridge, K.B. 1980. Health education planning. A diagnostic approach. Palo Alto: Mayfield Publishing Company, xiii, 68-85.

Green. L. W., Kreuter, M. W. 1991. Health promotion planning: An educational and environmental approach. Mountain View: Mayfield Publishing Company, 44-214.

Green, L.W., Lewis, F.M. 1986. Measurement and evaluation in health education and health promotion. Palo Alto: Mayfield Publishing Company, 1-53, 147-222.

Green, L.W., Simons-Morton, D. G. 1991. Education and life-style determinants of health and disease. In W.W. Holland, R. Detels & G. Knox (Eds.) Oxford textbook of public health. Influences of public health. Oxford: Oxford Medical Publications, 181-195.

Greenberg, J.S. 1989. Health education: Learner-centered instructional strategies. Dubuque: Wm. C. Brown Publishers, 27-40.

Guile, E.E., al-Shammary, A., el-Backly, M. 1990. Prevalence and severity of periodontal diseases in Saudi Arabian schoolchildren aged 6, 9 and 12 years. Community Dental Health 7, 429-432.

Haglund, B.O., Weisbrod, R.R., Bracht, N. 1990. Assessing the community: Its services, needs, leadership, and readiliness. In N. Bracht (Ed.) Health promotion at the community level. Newbury Park: SAGE Publications, 91-108.

Hartshorne, J.E., Carstens, I.L., Beilinsohn, B., Potgieter, G. 1989. The effectiveness of a school-based oral health education program - A pilot study. Journal of the Dental Association of South Africa 44, 409-514.

Hawe, P., Degeling, D., Hall, J. 1991. Evaluating health promotion. Sydney: MacLennan & Petty, 1-127.

Hobdell, M.H., Sheiham, A. 1981. Barriers to the promotion of dental health in developing countries. Social Science and Medicine 15A, 817-823.

Hodge, H., Buchanan, M., O'donnell, P., Topping, B., Banks, I. 1987. The evaluation of the junior dental health education programme developed in Sefton, England. Community Dental Health 4, 223-229.

Hodge, H.C., Holloway, P.J., Bell, C.R. 1982. Factors associated with toothbrushing behaviour in adolescents. British Dental Journal 152, 49-51.

Horowitz, A.M. 1983. Effective oral health education and promotion programs to prevent dental caries. International Dental Journal 33, 171-181.

Horst, G., Hoogstraten, J. 1989. Immediate and delayed effects of a dental health film on periodontal knowledge, attitudes and reported behaviour of Dutch adolescents. Community Dentistry and Oral Epidemiology 17, 183-186.

Houle, B.A. 1982. The impact of long-term dental health education on oral hygiene behaviour. The Journal of School Health 52, 256-261.

Hubley, J. 1988. Health education in developing countries – the need for an appropriate technology. Health Education Research 3, 387-392.

Hurskainen, A. 1994. The neglected education. In K.S. Lankinen, S. Rergström, P.H. Mäkelä, M. Peltomaa (Eds.) Health and disease in developing countries. London: The Macmillan Press Limited, 59-66.

Jacob, M. C., Plamping, D. 1989. The practice of primary dental care. London: Wright, 81-146.

Jeboda, S.O., Salako, N.O., Bamgboye, P.O. 1984. Dental health awareness among Nigerian mothers. Tropical Dental Journal **7**, 185-194.

Jeboda, S.O., Ericksen, H.M. 1988. Primary oral health care. The concept and suggestions for practical approach. Tropical Dental Journal 4, 121-126.

Johnson, V. 1981. Health education in primary schools. In J. Cowley, K. David & W. Trefor (Eds.) Health education in schools. London: Harper & Row Publishers, 75-107.

Kabalo, J.M., Mosha, H.J. 1988. Dental awareness amongst mothers attending MCH clinics in Bagamoyo District, Coast Region, Tanzania. African Dental Journal 2, 65-68.

Kaimenyi, J.T., Ndungu, F.L., Maina, S.W., Chindia, M. 1993. Oral hygiene habits and dental health awareness of Kenyan children aged 9-15 years in a peri-urban and urban school. East African Medical Journal 70, 67-70.

Kannas, L. 1991. Health education models and exercise promotion. In P. Oja & R. Telama (Eds.) Sport for All. Amsterdam: Elsevier Science Publishers B.V. (Biomedical Division), 165-173.

Kavishe, F.P., Yambi, O. 1991. Malnutrition. In G.M.P. Mwaluko, W.L. Kilama, M.P. Mandara, M. Murru & C.N.L. Macpherson (Eds.) Health & diseases in Tanzania. London: Harper Collins Academic, 261-272.

Kerosuo, H., Honkala, E. 1991. Caries experience in the primary dentition of Tanzanian and Finnish 3-7-year-old children. Community Dentistry and Oral Epidemiology 19, 272-276.

Kerosuo, E., Kerosuo, H., Kallio, P., Nyandindi, U. 1986. Oral health status among teenage schoolchildren in Dar es Salaam, Tanzania. Community Dentistry and Oral Epidemiology 14, 338-340.

Kickbusch, I. 1989. Approaches to an ecological base for public health. Health Promotion International 4, 265-268.

Kikwilu, E., Mandari, G., Mugonzibwa, E., Mumghamba, E., Nyandindi, U., Nyerere, J., Rugarabamu, P. 1987. Ilala oral health survey: Study design and methods. Kuopio: Publications of the University of Kuopio, 13-16.

Kilama, W.L. 1990. Health research priorities, opportunities and challenges of the 1990s. Paper presented at the 9th annual scientific conference of the Tanzania Public Health Association, Dar es Salaam 19-23 November 1990, 1-26.

Kilewo, J., Dahlgren, L., Sandström, A. 1994. Socio-geographical patterns of HIV-I transmission in Kagera Region, Tanzania. Social Science and Medicine 38, 129-134.

Kolbe, L., Tolsma, H.S., Dhillon, H.S., O'Byrne, D. Jones, J. 1992. School health education: Challenge for national and international agencies. International Journal of Health Education 11, 72-76.

Kolehmainen, L. 1983. Effect of systematic oral hygiene instruction on oral health among 13 year old schoolchildren. Proceedings of Finnish Dental Society 79, 211-217.

Krishnamurthy, P., Samwel, M. 1987. School health – Preparation of teacher for health education. International Journal of Health Education 6, 19-23.

Kupietzky, A. 1993. Teaching kindergarten and elementary school children dental health: A practical presentation. The Journal of Clinical Pediatric Dentistry 17, 255-259.

Lang, P., Woolfolk, M.W., Faja, B.W. 1989. Oral health knowledge and attitudes of elementary schoolteachers in Michigan. Journal of Public Health Dentistry 49, 44-50.

Lembariti, B.S., Frencken J.E., Pilot, T. 1988. Prevalence and severity of periodontal conditions among adults in urban and rural Morogoro, Tanzania. Community Dentistry and Oral Epidemiology 16, 240-243.

Loevinsohn, B.P. 1990. Health education interventions in developing countries: A methodological review of published articles. International Journal of Epidemiology 19, 788-794.

Loupe, M.J., Frazier, P.J. 1983. Knowledge and attitudes of schoolteachers toward oral health programs and preventive dentistry. Journal of the American Dental Association 107, 228-234.

Luk, K.M., Pillary, R. 1982. Dental health attitudes and practices among Black, Coloured and White children in South Africa. Diasterma, 20th Anniversary Issue 51-54.

Mandari, G. J. 1988. Oral health in relation to socio-economic status in Ilala District, Tanzania. Masters Dissertation. Dar es Salaam: Publications of the Division of Dentistry, University of Dar es Salaam, Oral Health 3, 47-67.

Marthaler, T.M. 1994. Fluoridation at community level. World Health, 47th Year, No. 1, 7-9.

Masters, D.H. 1972. The classroom teacher....Effective dental health educator. The Journal of School Health 42, 257-261.

Matee, M.I.N., van't Hof, M.A., Maselle, S.Y., Mikx, F.H.M., van Palenstein, H.W.H. 1994. Nursing caries, linear hypoplasia, and nursing and weaning habits in Tanzanian infants. Community Dentistry and Oral Epidemiology 22, 289-293.

McLeroy, K.R., Bibeau, D., Steckler, A., Glanz, K. 1988. An ecological perspective on health promotion programs. Health Education Quarterly 15, 351-377.

Ministry of Education and Culture. The United Republic of Tanzania. 1992. Basic education statistics in Tanzania 1991 – Regional data. Dar es Salaam: Ministry of Education and Culture, 1-52.

Ministry of Finance, Economic Affairs and Planning, The United Republic of Tanzania. 1988. 1988 Population Census: Preliminary Report. Dar es Salaam: Bureau of Statistics, 5-6.

Ministry of Health and DANIDA, The United Republic of Tanzania. 1992. Primary Health Care Strategy. Dar es Salaam: Ministry of Health, 1-31.

Ministry of Health and Social Welfare, The United Republic of Tanzania. 1988. The National Plan for Oral Health 1988-2002. Dar es Salaam: Central Dental Unit, 1-44.

Ministry of Health, The United Republic of Tanzania. 1979. First National Plan for Dental Health Services 1979-1990. Dar es Salaam: Central Dental Unit, 1-43.

Mosha, H.J. 1981. A school dental health education program in municipality of Arusha. The Dar es Salaam Medical Journal 8, 106-108.

Mosha, H. 1989. Situation analysis and intervention programmes for oral health promotion in Tanzania. PhD Thesis. Kuopio: Publications of the University of Kuopio, 46-67.

Mosha, H.J. 1990. Primary oral health care – The Tanzanian experience. Tropical Dental Journal 13, 55-59.

Mosha, H.J., Ngilisho, L.A.F, Nkwera, H., Scheutz, F., Poulsen, S. 1994. Oral health status and treatment needs in different age groups in two regions of Tanzania. Community Dentistry and Oral Epidemiology 22, 307-310.

Mosha, H.J., Nørmark. S. 1984. Involvement of school teachers and MCH aides in establishing oral health education care programmes in Tanzania. Tropical Dental Journal 7, 199-203.

Mosha, H.J., Robison, V.A. 1989. Caries experience of the primary dentition among groups of Tanzanian urban preschool-children. Community Dentistry and Oral Epidemiology 17, 34-37.

Mosha, H. J., Scheutz, F. 1992. Dental caries in the permanent dentition of schoolchildren in Dar es Salaam in 1979, 1983 and 1989. Community Dentistry and Oral Epidemiology 20, 381-382.

Mosha, H.J., Scheutz, F. 1993. Perceived need and use of oral health services among adolescents and adults in Tanzania. Community Dentistry and Oral Epidemiology 21, 129-132.

Mullins, R., Sprouse, W. 1973. Dental health knowledge of elementary school teachers in Bowling Green, Kentucky, 1972. Journal of the American Society of Preventive Dentistry 3, 60-65.

Mumghamba, E.G.S. 1990. Periodontal conditions and treatment needs in Ilala District, Tanzania. Masters Dissertation. Dar es Salaam: Publications of the Division of Dentistry, University of Dar es Salaam. Oral Health 7, 75-77, 106-144.

Muya, R.J., Rambusch, E., Fejerskov, O., Hobdell, M.H., Nørmark, S. 1984. Changing and developing dental health services in Tanzania 1980-2000. Dar es Salaam: Central Dental Unit, Ministry of Health, 18-72.

Mwaluko, C.M.P., Swai, A.B.M, McLarty, D.G. 1991. Non-communicable diseases. In C.M.P. Mwaluko, W.L. Kilama, M.P. Mandara, M. Murru & C.N.L. Macpherson (Eds.) Health & diseases in Tanzania. London: Harper Collins Academic, 219-236.

Nakajima, H. 1994. Oral health for a healthy life. World Health, 47th Year, No. 1, 3.

Ndeki, S.S., Klepp, K.I., Mliga, G.R.Z. 1994. Knowledge, perceived risk of AIDS and sexual behavior among primary school children in two areas of Tanzania. Health Education Research 9, 133-138.

Ng'ang'a, P.M., Valderhaug, J. 1991. Oral hygiene practices and periodontal health in primary school children in Nairobi, Kenya. Acta Odontologica Scandinavica 49, 303-309.

Ngilisho, L.A.F., Mosha, H.J., Poulsen, S. 1994. The role of traditional healers in the treatment of toothache in Tanga Region, Tanzania. Community Dental Health 11, 240-242.

Nørmark, S. 1991. Oral health among 15- and 35-44-year-olds in Sierra Leone. Tandlagebladet 95, 132-138.

Nørmark, S., Mosha, H. J. 1989a. Knowledge, practices and dental health among rural Tanzanian children. African Dental Journal 3, 24-33.

Nørmark, S., Mosha, H.J. 1989b. Relationship between habits and dental health among rural Tanzanian children. Community Dentistry and Oral Epidemiology 17, 317-321.

Nørmark, S., Mosha, H.J., Jensen, K. 1986. Dental health. Guide for teachers in primary schools. Dar es Salaam: DANIDA/Central Dental Unit, 1-43.

Norusis, M.J. 1990a. SPSS/PC+™ 4.0 Base Manual for the IBM PC/XT/AT and PS/2. Chicago: SPSS Inc, B-115 - B-135.

Norusis, M.J. 1990b. SPSS/PC+™ Statistics 4.0 for the IBM PC/XT/AT and PS/2. Chicago: SPSS Inc, B-1 - B-12.

Nutbeam, D. 1992. The health promoting school: closing the gap between theory and practice. Health Promotion International 7, 151-153.

Nutbeam, D., Smith, C., Catford, J. 1990. Evaluation in health education. A review of progress, possibilities, and problems. Journal of Epidemiology and Community Health 44, 83-89.

Nyandindi, U. S. 1988. Oral health habits in the District of Ilala, Tanzania. Masters Dissertation. Dar es Salaam: Publications of the Division of Dentistry, University of Dar es Salaam, Oral Health 4, 65-76.

Nyerere, J. 1988. Caries treatment need in Ilala District, Tanzania. Masters Dissertation. Dar es Salaam: Publications of the Division of Dentistry, University of Dar es Salaam, Oral Health 5, 33-48.

Olsson, B. 1978. Efficiency of traditional chewing sticks in oral hygiene programs among Ethiopian schoolchildren. Community Dentistry and Oral Epidemiology 6, 105-109.

Petersen, P.E., Hadi, R., Al-Zaabi, F.S., Hussein, J.M., Behbehani, J.M., Skougaard, M.R., Vigild, M. 1990a. Dental knowledge, attitudes and behaviour among Kuwaiti mothers and school teachers. The Journal of Pedodontics 14, 158-164.

Petersen, P.E., Holst, D. 1992. Policy and research in oral health care. Scandinavian Journal of Dental Research 100, 74-76.

Petersen, P.E., Poulsen, V.J., Ramahaleo, J., Ratsifaritara. 1991. Dental caries and dental health behaviour situation among 6- and 12-year-old urban schoolchildren in Madagascar. African Dental Journal 5, 1-7.

Petersen, P.E., Skougaard, M., Vigild, M. 1990b. A cross-cultural perspective of the dental health situation among Kuwaiti schoolchildren and mothers. Danish Dental Journal 94, 83-86.

Plamping, D., Thorne, S., Gelbier, S. 1980. Children as teachers of dental health education. British Dental Journal 149, 113-115.

Planning Commission, President's Office, The United Republic of Tanzania. 1990. 1988 Population Census: Dar es Salaam Regional Profile. Dar es Salaam: Bureau of Statistics, 8-9, 78-82, 161-165.

Planning Commission, President's Office, The United Republic of Tanzania. 1992. 1988 Population Census, Basic Demographic and Socio-Economic Characteristics. Dar es Salaam: Bureau of Statistics, 65-142.

Population Reference Bureau, Inc. 1991. 1991 World Population Data Sheet. Washington: Population Reference Bureau, Inc, 1-2.

Rayner, J.F., Cohen, L.K. 1974. A position on school dental health education. Journal of Preventive Dentistry 1, 11-23.

Rise, J., Holund, U. 1990. Prediction of sugar behaviour. Community Dental Health 7, 267-272.

Ritchie, J.E. 1991. From health education to education for health in Australia: a historical perspective. Health Promotion International 6, 157-163.

Roder, D.M. 1973. The association between dental caries and the availability of sweets in South Australian school canteens. Australian Dental Journal 18, 174-182.

Ross, D.A., Vaughan, J.P. 1986. Health interview surveys in developing countries: A methodological review. Studies in Family Planning 17, 78-94.

Rubinson, L. 1982. Evaluating school dental health education programs. The Journal of School Health 52, 26-27.

Rudd, R.E, Walsh, D.C. 1993. Schools as healthful environments: Prerequisite to comprehensive school health? Preventive Medicine 22, 499-506.

Rugarabamu, P.G.N. 1990. Caries Status of deciduous teeth among children in Ilala District, Dar es Salaam. Masters Dissertation. Dar es Salaam: Publications of the Division of Dentistry, University of Dar es Salaam, Oral Health 6, 33-61.

Rugarabamu, P., Frencken, J.E., Amuli, J.A.D, Lihepa, A. 1990. Caries experience amongst 12- and 15-year-old Tanzanian children residing on a sugar estate. Community Dental Health 7, 53-58.

Russell, B.A., Horowitz, A.M., Frazier, P.J. 1989. School-based preventive regimens and oral health knowledge and practices of sixth graders. Journal of Public Health Dentistry 49, 192-200.

Sarita, P.T.N., Tuominen, R. 1992. Tooth cleaning methods and their effectiveness among adults in rural Tanzania. Proceedings of the Finnish Dental Society 88, 139-145.

Sarvela, P.D., McDermott, R.J. 1992. Health education evaluation and measurement: A practitioner's perspective. Melbourne: Brown & Benchmark Publishers, 1-14, 83-108.

Schalock, R.L., Thornton, C.V.D. 1988. Program evaluation: A field guide for administrators. New York: Plenum Press, 23-27, 135-179.

Schou, L. 1985. Active-involvement principle in dental health education. Community Dentistry and Oral Epidemiology 13, 128-132.

Screebny, L.M. 1982. Sugar availability, sugar consumption and dental caries. Community Dentistry and Oral Epidemiology 10, 1-7.

Silversin, J.B., Konarcki, M.J. 1985. Controlling dental diseases through prevention: Individual, institutional and community dimensions. In L.K. Cohen, P.S. Bryant (Eds.) Social Sciences and Dentistry. London: Quintessence Publishing Company Ltd, 145-201.

Søgaard, A.J., Holst, D. 1988. The effect of different school based dental health education programmes in Norway. Community Dental Health 5, 169-184

Søgaard, A.J., Tuominen, R., Holst, D., Gjermo, P. 1987. The effect of 2 teaching programs on gingival health of 15-year-old schoolchildren. Journal of Clinical Periodontology 14,165-170.

Stoll, F.A. 1977. Dental health education. Philadelphia: Lea & Febiger, 149-162.

Steffensen, J.E. 1990. Literature and concept review: issues in maternal and child oral health. Journal of Public Health Dentistry 50, 358-369.

'Taasisi ya Elimu'. 1987a. 'Afya ni uhai kwa shule za msingi, Kiongozi cha mwalimu kwa kitabu cha kwanza na cha pili, Shule za msingi'. Dar es Salaam: 'Taasisi ya Ukuzaji Mitaala', 18-26.

'Taasisi ya Elimu'. 1987b. 'Afya ni uhai, Kitabu cha kwanza na cha pili, Shule za msingi'. Dar es Salaam: 'Taasisi ya Ukuzaji Mitaala', 4.

The World Bank. 1980. Health problems and policies in the developing countries. World Bank Staff Working Paper No. 412, Washington: The World Bank, 1-17.

Tones, K., Tilford, S., Robinson, Y. 1990. Health education: Effectiveness and efficiency. London: Chapman and Hall, 1-14, 83-117.

Trichopoulos, D., Petridou, E. 1988. Promoting health among school age children. Scandinavian Journal of Social Medicine 16, 251-255.

UNDP. 1994. Human Development Report 1994. Oxford: Oxford University Press, 129-131.

Van Palenstein, H.W.H., Munck, L., Mushendwa, S., Mrema, F.G 1992. Cleaning effectiveness of chewing sticks among Tanzanian schoolchildren. Journal of Clinical Periodontology 19, 460-463.

Wagao, J.H. 1993. Tanzanian economy: Retrospect and prospects. The Tanzania Magazine of Business Politics and Economics 1, 21-27.

Walker, B.R., Wright, S.M. 1992. Whole people: putting personal and social issues into school health curricula – a case study from Australia. Health Promotion International 7, 99-107.

Walsh, M.M. 1985. Effects of school-based dental health education on knowledge, attitudes and behaviour of adolescents in San Francisco. Community Dentistry and Oral Epidemiology 13, 143-149.

WHO. 1983. New approaches to health education in primary health care. Report of a WHO Expert Committee. Geneva: WHO Technical Report Series 690, 1-44.

WHO. 1986. Ottawa Charter. The first international conference on health promotion held in Ottawa 17-21st November 1986. Canadian Journal of Public Health 77, 426-427.

WHO. 1988. Education for health. A manual on health education in primary health care. Geneva: WHO, 134-140.

WHO. 1989. Research and action for the promotion of oral health within primary health care. Geneva: WHO, 1-45.

WHO. 1991. A call for action: promoting health in developing countries. Health Education Quarterly 18, 5-15.

WHO, Nordic Countries, ENEP. 1991. Supportive environments for health: The Sundsvall Statement. Health Promotion International 6, 297-300.

WHO/UNESCO/UNICEF. 1992a. Comprehensive school health education: Suggested guidelines for action. International Journal of Health Education 11, 8-15.

WHO/UNESCO/UNICEF. 1992b. Country reports presented at the consultation on strategies for implementing comprehensive school health education/promotion, November 25-29, 1991 in Geneva. International Journal of Health Education 11, 53-64.

'Wizara ya Afya'. 1988. 'Mwongozo wa huduma za afya shuleni'. Dar es Salaam: 'Kitengo cha huduma za afya shuleni', 1-46.

'Wizara ya Elimu'. 1988. 'Uhai na maendeleo ya mtoto: Kiongozi cha mwalimu'. Dar es Salaam: 'Wizara ya Elimu', 26-33.

Woolfolk, M.W., Lang, W.P., Faja, B.W. 1989. Oral health knowledge and sources of information among elementary schoolchildren. Journal of Public Health Dentistry 49, 39-43.

APPENDIX 1: INTERVIEW AND CLINICAL OBSERVATIONS IN PUPILS

Registration number ☐☐☐

Date of interview ☐☐☐☐☐☐

Name of primary school _____

School location (1 = urban, 2 = rural) ☐

Names of pupil (first and surname) _____

Sex of pupil (1 = Male, 2 = Female) ☐

Age of pupil (in years) ☐

BEHAVIOUR

1. a) Did you brush your teeth yesterday?
   1. Yes 2. No

   IF YES;

   b) How many times did you brush? ☐

   c) When did you brush? 1. Morning 2. Daytime 3. Evening

2. Do you usually use a 'mswaki' (chewing-stick) or a factory-made toothbrush (SHOW BOTH TYPES OF TOOTHBRUSHES TO PUPIL)?

   1. Using a factory-made toothbrush
   2. Using a chewing-stick (wooden) toothbrush

3. Do you usually use toothpaste (SHOW TOOTHPASTE TO PUPIL)?

   1. Yes 2. No

4. a) Do you often use something else for cleaning your teeth?
   1. Yes 2. No

   IF YES;

   b) What item(s) do you use? _____

5. Which food item(s) did you take yesterday, and how often?

	Food Item	Frequency of taking
1.	Rice	☐
2.	Tea with sugar	☐
3.	Vegetables	☐
4.	Ice-cream	☐
5	Meat	☐
6.	Sweets	☐
7.	Cassava	☐
8.	Soda	☐
9.	'Ugali' (hard porridge)	☐
10.	Biscuits	☐
11	Others (specify _____)	☐

KNOWLEDGE AND ATTITUDES

6. What problems does someone who has lost many teeth get?

1. Cannot chew food properly
2. Cannot speak properly
3. Cannot have good appearance
4. Others (specify _____)
5. I don't know

7. Many people get problems with their teeth or gums. What are those problems?

1. Tooth decay 2. Gum disease 3. Other 4. I don't know

8. What causes tooth decay? (SHOW SAMPLE DECAYED TOOTH TO PUPIL)

1. Sugary foods 2. Poor brushing 3. Other 4. I don't know

9. In order to prevent your teeth from decaying, what will you do?

1. Avoid sugary foods 2. Proper brushing 3. Other/no opinion

10. Why is it important for you to brush your teeth?

1. To prevent gum disease
2. To prevent tooth decay
3. To keep teeth white
4. Other reason

11. When your gums bleed slightly on brushing, or are swollen, it may be a sign of gum disease (SHOW A PICTURE OF INFLAMED GUMS TO PUPIL). What usually causes this problem?

    1. Poor brushing 2. Sugary foods 3. Other 4. I don't know

12. What can you do to keep your gums healthy?

    1. Proper brushing 2. Avoid sugar foods 3. Other/No opinion

13. Do you think that using a factory-made toothbrush (SHOW PUPIL A FACTORY-MADE TOOTHBRUSH) can clean your teeth properly?

    1. Yes 2. No 3. I don't know

14. Do you think that using a 'mswaki' (chewing-stick) (SHOW A MSWAKI' TO PUPIL) can clean your teeth properly?

    1. Yes 2. No 3. I don't know

15. From the two types of toothbrushes presented (SHOW BOTH A FACTORY-MADE TOOTHBRUSH AND A 'MSWAKI'), select one which

    you prefer to use 1. Prefers a factory-made toothbrush
    2. Prefers a 'mswaki' (chewing-stick)

16. Do you think that you must use toothpaste (SHOW TOOTHPASTE TO PUPIL) when you brush your teeth?

    1. Yes 2. No 3. I don't know

17. Would you like to be taught more about oral health matters?

    1. Yes 2. No 3. I am not certain

18. Among the ten foods and drinks presented (DISPLAY THE SAMPLE FOODS AND DRINKS ON A TRAY), select three which you like most

    (Codes: 1 = First choice, 2 = Second choice, 3 = Third choice)

1. Rice	☐	6. Sweets	☐
2. Tea with sugar	☐	7. Cassava	☐
3. Vegetables	☐	8. Soda	☐
4. Ice-cream	☐	9. Hard porridge ('ugali')	☐
5. Meat	☐	10. Biscuits	☐

19. For each of the ten foods and drinks (DISPLAYED ON THE TRAY), say if it is harmless (code 1) or harmful (code 2) for teeth.

1. Rice	☐	6. Sweets	☐
2. Tea with sugar	☐	7. Cassava	☐
3. Vegetables	☐	8. Soda	☐
4. Ice-cream	☐	9. Hard porridge ('ugali')	☐
5. Meat	☐	10. Biscuits	☐

SOCIAL SUPPORT

20. a) Is there anyone who usually reminds you to brush your teeth?

1. Yes 2. No

IF YES;

b) Who are the persons who remind you to brush your teeth?

1. Parents 2. Siblings 3. Friends 4. Teachers 5. Others

21. a) Is there anyone who usually advises you not to eat sweets or other sugary foodstuffs frequently?

1. Yes 2. No

IF YES;

b) Who are the persons who advise you against sugary foods ?

1. Parents 2. Siblings 3. Friends 4. Teachers 5. Others

SKILLS

22. Quality of a wooden toothbrush ('mswaki') made by pupil

a) Brushing end 1. Soft enough 2. Not soft enough

b) Shaft length 1. 18 cm. or more 2. Less than 18 cm.

23. Prevalence of visible plaque on index tooth surfaces examined in pupils
(Scores: 1 = Plaque visible, 0 = No plaque visible)

Index tooth	Visible plaque scores	
	Outer surface	Inner surface
UPPER TEETH		
Right first permanent molar	☐	☐
Right second deciduous molar	☐	☐
Right permanent central incisor	☐	☐
Left permanent central incisor	☐	☐
Left second deciduous molar	☐	☐
Left first permanent molar	☐	☐
LOWER TEETH		
Left first permanent molar	☐	☐
Left second deciduous molar	☐	☐
Left permanent central incisor	☐	☐
Right permanent central incisor	☐	☐
Right second deciduous molar	☐	☐
Right first permanent molar	☐	☐

APPENDIX 2: CHECK-LIST FOR OBSERVATION OF ENVIRONMENTS

Registration number ☐☐☐

Date of interview ☐☐☐☐☐☐

Name of primary school _____

School location (1 = urban, 2 = rural) ☐

a) Packed meals brought by pupils to school from home

FOOD ITEMS	Present	Storage place	Absent

b) Food items provided 'free' to pupils at school

FOOD ITEMS PROVIDED	How often per week	Time for eating	Place for eating	
			Canteen	Compound

c) Food items sold in school canteen or at school compound

FOOD ITEMS SOLD	Place for selling		Price in Tanzanian shillings
	Canteen	Compound	

d) Facilities for pupils' tooth-cleaning at school

FACTORS	Present	Type	Absent
Water supply within or outside			
Place for washing e.g. wash-basin			
Special place for toothbrushing			
Possible place for toothbrushing			
Place for keeping toothbrushes			
Toothbrushes kept by pupils			

e) Food items and tooth-cleaning items sold at shops visited

FIRST SHOP			SECOND SHOP		
FOOD ITEMS		Price in Tshs	FOOD ITEMS		Price in Tshs
TOOTH-CLEANING ITEMS	Brand	Price in Tshs	TOOTH-CLEANING ITEMS	Brand	Price in Tshs

e) Availability of trees (or tree-twigs) for making toothbrushes

FACTOR	Yes	No
Are trees suitable for making 'miswaki' present in the surroundings near school or near homes?		
Are tree-twigs for making 'miswaki' sold at the market place near school of near homes?		
IF YES; a tree-twig for making a toothbrush costs	____	Tshs

APPENDIX 3 a: QUESTIONNAIRE FOR TEACHERS

Registration number ☐☐☐

Date of filling questionnaire ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐

Name of primary school _____

School location (1 = urban, 2 = rural) ☐

Names of teacher (first and surname) _____

Gender of teacher (1 = Male, 2 = Female) ☐

Age in years ☐☐

Years in service as a teacher ☐☐

Teacher Training College (TTC) attended _____

PLEASE: 1. ANSWER ALL THE QUESTIONS & FOLLOW THE INSTRUCTIONS
2. YOUR ANSWERS WILL BE KEPT CONFIDENTIAL

KNOWLEDGE

1. List 3 main functions of teeth
   1. _____
   2. _____
   3. _____

2. The two diseases that usually occur in the mouth are:
   1. _____ 2. _____

3. Do you think that you can, by yourself, keep your teeth healthy?
   1. Yes 2. No 3. I don't know

4. Do you think that you can, by yourself, keep you gums healthy?
   1. Yes 2. No 3. I don't know

5. What causes tooth decay (dental caries)?

_____

6. The best way of preventing your teeth from decaying is:

_____

_____

7. Gum disease is usually caused by:
(CHOOSE ONE ANSWER)

1. Malaria
2. Poor toothbrushing
3. AIDS
4. Decay of teeth
5. High blood pressure
6. Vitamin C deficiency
7. I don't know

8. What is the best way of keeping your gums healthy?

_____

9. Why is it important to brush teeth?

_____

10. a) Did you get any training for oral health education?

1. Yes
2. No

IF YES;

b) Where did you get such training?

_____

APPENDIX 3 b: INTERVIEW AND CLINICAL OBSERVATIONS IN TEACHERS

Registration number ☐☐☐

Date of filling questionnaire ☐☐☐☐☐☐

Name of primary school _____

School location (1 = urban, 2 = rural) ☐

Names of teacher (first and surname) _____

Gender of teacher (1 = Male, 2 = Female) ☐

Age (in years) ☐☐

Years in service as a teacher ☐☐

Teacher Training College (TTC) attended _____

PARTICIPATION IN GENERAL AND HEALTH EDUCATION

1. Which grade levels do you teach in this school?

   1. Grade I 2. Grade II 3. Both grades I & II

2. How many streams (classes) in total do you teach in this school? ☐

3. How many pupils are there in your first-grade class? ☐☐

4. Which subject(s) do you teach in your first-grade class?

   1. Mathematics
   2. Reading
   3. Health
   4. Writing
   5. Language
   6. Arts
   7. Physical education
   8. Religion

5. Some subjects may be of more important to pupils' education than other subjects. Please, give your opinion by ranking the subjects in the order of their importance (Rank 1 to 8).

☐	Mathematics	☐	Language
☐	Reading	☐	Arts
☐	Health	☐	Physical education
☐	Writing	☐	Religion

6. Did you teach the health subject in first grade last year?

   1. Yes 2. No

7. There are several health problems here in Tanzania. Do you think the time for teaching the health subject is enough ?

   1. Enough 2. Not enough

8. a) Do you usually conduct hygiene checkups in your pupils during routine morning pupil assemblies ?

   1. Yes 2. No

   IF YES;

   b) How many days per week do you conduct the hygiene checkups?

   ☐☐

   c) During the checkups, what things in pupils do you inspect?

   _____

   d) What do you do if a pupil has persistent poor body hygiene?

   _____

9. a) What materials guide(s) (directives, syllabus, books, other aids) do you use for teaching the health subject in first-grade ?

   _____

10. What further assistance would like for your health education task?

    _____

11. a) Do the health lessons given at school actually help the pupils?

    1. Yes 2. No

    IF YES;

    b) Have the health lessons improved pupils' body hygiene?

    1. Yes 2. No

    c) Have the health lessons improved pupils' diets ?

    1. Yes 2. No

12. Who were the persons (officials) who visited you during the last year concerning teaching of the health subject?

_____

PARTICIPATION IN ORAL HEALTH EDUCATION

13. a) There are different topics to teach in health lessons. Did you in last year teach about oral health in first-grade ?

1. Yes 2. No

IF YES;

b) What dental matters did you teach?

_____

IF DID NOT TEACH ABOUT DIET OR TOOTHCLEANING;

c) Why not?

_____

d) What guidelines (syllabus, directive, books etc.) do you use for teaching the oral health education lessons?

Name of guideline	Where obtained?
_____	_____
_____	_____

14. a) Whom do you think should teach pupils about toothbrushing?

_____

b) Why should it be (or not be) schoolteachers?

_____

15. Do you think that first-grade children can easily learn to brush their teeth properly?

1. Yes 2. No

16. Do you think that first-grade children can easily learn to avoid eating unhealthy foods and to select healthy foods?

_____

17. Since you have the task to teach pupils about oral health, what support do you need for facilitating your task; e.g. do you feel having enough knowledge, teaching materials, and so forth ?

_____

SKILLS

19. Quality of a wooden toothbrush ('mswaki') made by teacher

a) Brushing end 1. Soft enough 2. Not soft enough

b) Shaft length 1. 20 cm. or more 2. Less than 20 cm.

20. Prevalence of visible plaque on index tooth surfaces examined in teachers before and after brushing with self-made 'miswaki'
(Scores: 1 = Plaque visible, 0 = No plaque visible)

Index tooth	Visible plaque scores			
	Outer surface		Inner surface	
	Before brushing	After brushing	Before brushing	After brushing
UPPER INDEX TEETH				
Right second molar	☐	☐	☐	☐
Right first molar	☐	☐	☐	☐
Left central incisor	☐	☐	☐	☐
Left first molar	☐	☐	☐	☐
Left second molar	☐	☐	☐	☐
LOWER INDEX TEETH				
Left second molar	☐	☐	☐	☐
Left first molar	☐	☐	☐	☐
Right central incisor	☐	☐	☐	☐
Right first molar	☐	☐	☐	☐
Right second molar	☐	☐	☐	☐

APPENDIX 4: CHECK-LIST FOR OBSERVATION OF ORAL HEALTH EDUCATION SESSIONS

Registration number ☐☐☐

Date of filling observation ☐☐☐☐☐☐

Name of primary school _____

Location of school (1 = urban, 2 = rural) ☐

Stream (class) of first-grade pupils taught ☐

Teacher' s name _____

a) Pupils participating in the sessions

Names of boys and girls in attendance (write on a separate sheet)

BOYS	GIRLS
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Total number of pupils in attendance at the session ☐☐☐

b) Teaching and learning environment

Number of pupils sitting in desks ☐☐

Number of pupils sitting on floor ☐☐

	Present	Absent
Teachers' desk		
Blackboard		
Chalk for writing		

c) Preparations made by teacher and pupils

Teaching materials brought by teacher	Yes	The items	No

Teaching materials brought by pupils	Yes	The items	No

d) General presentation of the session

Time of starting the session ⌊__⌋⌊__⌋⌊__⌋⌊__⌋

Time of ending the session ⌊__⌋⌊__⌋⌊__⌋⌊__⌋

	Yes	No
Teacher introducing topic of learning?		
Teacher asking pupils questions?		
Pupils answering questions?		
Pupils can hear what teacher says?		
Pupils can see what teacher writes or does?		
Teacher using simple language?		
Teacher giving feedback to pupils?		

e) Use of teaching and learning materials

Teaching materials used by teacher	Yes	The items	None

Learning materials used by pupils	Yes	The items	None

f) Content and methods of the session

CONTENT TAUGHT	YES	METHOD(S)	NO
i) ON GUM DISEASE AND ORAL HYGIENE			
Basic functions of teeth			
Basic morphology of teeth			
Regularity of toothbrushing			
Type of toothbrushes for use			
Renewal of toothbrushes			
Recommendation for toothpaste			
Advice not to brush with charcoal/ash			
Dental plaque			
Gum Disease:			
Its occurrence in the society (common)			
Its cause (poor toothbrushing)			
Its prevention (proper toothbrushing)			
How to make a toothbrush ('mswaki')			
How to brush teeth properly			

ii) ON TOOTH DECAY AND DIET

Tooth decay:

Its occurrence in the society (common)			
Its cause (frequent sugar consumption)			
Its prevention (low sugar consumption)			
Foods (non-sugary) harmless for teeth			
Foods (sugary) harmful for teeth			
iii) ANY OTHER MATTERS TAUGHT _____	___	_____	___