

# Knowledge, beliefs and behavior related to oral health among Tanzanian and Ugandan teacher trainees

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This study was designed to assess levels of oral health knowledge, beliefs and self-reported behavior among teacher trainees in Uganda and Tanzania. Anonymous questionnaire data were collected from trainees attending the final year at teacher training colleges in Rungwe district, Tanzania, in 1997, and in Mbale and Kampala districts of Uganda, in 1998. A total of 195 trainees from Tanzania and 225 trainees from Uganda participated. Results from Pearson's  $\chi^2$  test and independent sample *t* tests indicated that Tanzanian students had less experience with oral impairments, were more resolutely prepared to teach about the importance of personal habits for oral health maintenance, and had higher levels of oral health knowledge than Ugandan students. Ugandan students endorsed frequent consumption of sugar products more often than their Tanzanian counterparts, but they were more diligent in visiting dentists. Most of the Tanzanian (97.4%) and Ugandan (95.6%) students reported daily toothbrushing. In both countries, beliefs about the importance of preventive behaviors for oral health were closely related to the frequency with which such habits occurred. This cross-cultural consistency highlights the importance of cognitive factors. The implications for oral health educational programs among teacher trainees across East African countries are discussed. □ *Adult behavior; cross-cultural; East Africa; oral health*

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Marked improvements in young people's oral health have been observed in the industrialized countries during the past decades (1,2). In East Africa, oral health is deteriorating or is anticipated to take a turn for the worse, particularly among younger age groups, and more seriously in affluent urban than in poor rural populations (3–6). Oral diseases are not life-threatening, but are worthy of attention because they draw on economic resources and incur high costs in terms of pain, suffering, and discomfort.

Although the World Health Organization (7) has stressed the importance of initiating and maintaining preventive oral health programs, East African countries are without national policies on water fluoridation and handling of social and economic aspects of sugar production, promotion, and consumption (8). Nevertheless, Tanzania has adopted a strategy of involving teachers in educating children about oral health (Ministry of Health and Welfare, 1988). In other East African countries, for instance, Uganda, where the economy is constrained and dental personnel particularly scarce, schoolteachers provide oral health education more sporadically (9).

By virtue of their training and opportunity to influence large numbers of children and their parents, teachers form a group of particular interest in the planning and implementation of oral health preventive programs. However, previous studies in western countries have showed marked deficiency in oral health behavior and gaps in knowledge of current preventive methods among both teacher trainees and working elementary school-

teachers (10–13). Consistent findings have been reported in studies from Zanzibar, Romania, and Kuwait (5, 14, 15), although positive attitudes and relatively high levels of oral health knowledge have been reported (16, 17). With few exceptions, the existing evidence suggests that working teachers who have not received formal training are poorly informed about oral health, but still perceive themselves to be prepared for the task of teaching oral health to schoolchildren.

In a study of Tanzanian mainland primary schoolteachers, Nyandindi et al. (18) found poor knowledge of oral health and a general reluctance to give dietary counseling as part of school oral health education. Although oral health educational issues have been integrated into the general syllabus of Tanzanian teachers' training colleges, a moderate proportion of in-service teachers remembered having received training on dental topics (18). Considering the oral health situation of Tanzanian school-aged children, studies indicate a high prevalence of reported toothbrushing, but poor oral hygiene. In addition, the consumption of sugared products is relatively low, but highly preferred by school-aged children (19–21). A similar picture is provided by earlier reports on the oral health of Ugandan schoolchildren (3, 4). Thus, existing evidence raises doubt about the quality of current oral health education, and points to a need for improved preventive oral health programs in different regions of East Africa (5).

Results of a recent study in Tanzania have shown that extensive training and counseling of working teachers can

foster communication on oral health issues and assist in developing teaching proficiency (22). One might argue that early intervention with teacher trainees should be implemented as well. Many will become important role models and opinion leaders in the future and, as such, will play an influential role in social and political change. Patterns of their health behaviors and attitudes toward prevention are of great interest and are vital to the planning and implementation of oral health promotion programs. So far, no empirical data exist on oral health knowledge, attitudes, and behaviors among teacher trainees in Tanzania and Uganda.

As part of an effort to provide information for the planning and implementation of integrated health and oral health educational programs among teacher trainees, this paper presents results from baseline surveys conducted in Tanzania and Uganda. The primary aim was to describe the level of preparedness to teach about the importance of personal behavior to oral health maintenance, oral health knowledge, perceived oral impairments, and oral health-related behaviors. On the assumption that there is an underlying consistency across countries, cultures, and population subgroups, and that oral health behaviors are not totally independent, a second aim was to assess the multidimensionality of oral health behaviors and to identify behavioral correlates in terms of health cognitions.

## Material and methods

### *Sample*

The data presented here stem from 2 cross-sectional surveys. One study was performed in the district of Rungwe, Tanzania, during August and September 1997. The second study was carried out 1 year later during May and July 1998 in the Mbale and Kampala districts of Uganda. All students attending the second (final) year at Mpuguso (rural;  $n = 82$ ) and Tukuyu (urban;  $n = 192$ ), teachers' training colleges (TTC) in the Rungwe district were invited to participate in a questionnaire survey. A total of 195 Tanzanian students (made up of 131 trainees from Tukuyu and 64 from Mpuguso), of whom 56% were women, participated. The response rate was 71%. In the Kampala and Mbale districts of Uganda, all students attending the final year at Shimoni (urban;  $n = 160$ ) and Nyondo (rural;  $n = 150$ ) TTC constituted the eligible sample of Ugandan teacher trainees. A total of 225 students (98 from Shimoni and 127 from Nyondo) participated in the survey. Of these, 48% were women. The response rate was 72%. Not having returned from vacation and being busy with examinations explain why some students did not respond to the Tanzanian and Ugandan surveys, respectively. The Tanzanian and Ugandan TTCs selected for this study were among the largest in each country, and admit students from all over the country. Thus, no weighting was performed with

respect to unequal proportions of participants attending urban and rural colleges.

Structured, self-administered questionnaires were employed in both surveys. Whereas the Tanzanian students completed the questionnaires in a class setting under the supervision of a research assistant, the Ugandan students were allowed to bring the questionnaires home and return the completed forms in a sealed envelope the following morning. Ethical clearance was obtained from the National Council of Science and Technology through the Ministry of Health and the Principal Secretary for the Ministry of Health in Kampala and Dar es Salaam, respectively. Strict procedures were followed to protect the participants, to ensure confidentiality, and to minimize response bias. Uniform detailed explanations were provided to all respondents both verbally and in writing. For the Tanzanian participants, the questionnaire originally constructed in English was translated into Kiswahili, translated back by a language expert and pre-tested before use in the field. In the Ugandan survey, the original English version was employed. The questionnaires covered a range of socio-demographic factors and questions concerning health and oral health. In both countries, the questionnaires were reviewed by experienced local researchers, dental academicians, and administrators from the respective health systems.

### *Statistical analyses*

Data were analyzed using the Statistical Package for Social Sciences (version 8.0).

Gender differences and differences between the Tanzanian and Ugandan groups were analyzed using Pearson's chi-squared test ( $\chi^2$ ) and independent sample *t* tests. Principle component analysis (PCA) (23) was conducted separately with the Tanzanian and Ugandan participants to facilitate study of the dimensionality of oral health-related behaviors. PCA is a multivariate method that is used to examine the relationship among a set of correlated and difficult-to-interpret factors. The goal is to identify several latent or underlying variables that can be used to explain the relationships. Extracted factors were rotated orthogonally by the Varimax procedure and validated by internal consistency analysis (24), as recommended by Bentler (25). Spearman's rank order and phi correlation coefficients were used to assess the bivariate relationships among self-reported oral health behaviors, knowledge of oral health, perceived oral impairments, preparedness to teach about the importance of personal habits to oral health, and country association. Finally, multiple linear regression analyses were performed using *t* tests and *F* statistics to evaluate the regression coefficients and model fit, respectively.

### *Measures*

Perceived oral impairments were assessed using 4 questions that asked respondents how often they had

Table 1. Percentage distribution by gender, college (urban/rural), education, and age among teacher trainees in Rungwe, Tanzania ( $n = 195$ ) and Mbale/Kampala ( $n = 225$ ) districts of Uganda

	Female	Male	Urban college	Rural college	O-level	Adv. level	20–29 years
Rungwe	55.9	44.1	67.2	32.8	98.4	1.6	98.0
Mbale/Kampala	48.4	51.6	43.6	56.4	79.5	20.5	90.0

Ordinary level = O-level; advanced level = adv. level.

experienced 'toothache, bleeding gums, bad breath, and difficulties with chewing food'. Each question had 4 response categories: 1 = 'often', 2 = 'sometimes', 3 = 'seldom', or 4 = 'never'. For the cross-tabulation analyses, the responses to each variable were dichotomized into 1 = 'often/sometimes' and 2 = 'seldom/never'. For multivariate analyses of the pooled sample, the 4 categorical variables were added in order to construct a sum score index (overall mean = 12.7, SD = 2.5, range = 5–16, Cronbach's alpha = 0.72). The lower the score on this additive index, the more frequent the experience with oral impairments.

For assessment of preparedness to teach about the importance of personal behavior in the maintenance of oral health, the students were provided with 3 statements, e.g. 'I feel prepared to teach about the relationship between diet and oral health'. Responses were given on a scale ranging from 1 = 'strongly agree' to 5 = 'strongly disagree'. The 3 items were added into a sum score index (overall mean = 4.3, SD = 1.8, range = 3–12, Cronbach's alpha = 0.82). The lower the score on this sum index, the higher the perceived preparedness to teach about the importance of personal habits in the maintenance of oral health.

Seven statements were used to assess knowledge of oral health (e.g., 'Gum disease can be progressive, leading to loss of bone that supports teeth' and 'Gum disease is caused by the presence of dental plaque'). The students rated each statement as 1 = 'correct' or 2 = 'false'. For the multiple regression analyses, these statements were combined into a sum index (overall mean = 9.0, SD = 1.5, range = 7–14, Cronbach's alpha = 0.46). The lower the score on this index, the higher the level of knowledge of oral health.

In order to assess oral health behaviors, students were asked how often (during the last 3 months) they had consumed soda, sugared tea/coffee, cakes and biscuits, chocolate, and sweets. They were further asked how often they had used a plastic toothbrush or a mwsaki (chewing stick). The response categories for each question ranged from 1 = 'several times a day' to 6 = 'never'. For cross-tabulation analyses, each item was re-coded into 1 = 'at least once a day' and 2 = 'seldom/never'.

The students were further asked how often they had visited a dentist, with answers given on a scale ranging from 1 = 'twice a year or more' to 4 = 'never'. This item was re-coded into 1 = 'visit a dentist at least sometimes' and 2 = 'never visit a dentist'. Students' intention to

behave preventively was assessed using 2 questions: 'How likely or unlikely is it that you will avoid frequent between-meal intake of sugared snacks and drinks in the future?' and 'I intend to avoid daily intake of sugared snacks and drinks in the future'. The responses were ticked on scales ranging from 1 = 'very likely' to 5 = 'very unlikely' and from 1 = 'strongly agree' to 5 = 'strongly disagree', respectively. The 2 items were combined into a sum index. Spearman's rank order correlation coefficient between the scale items was  $r_s = 0.67$ ,  $P < 0.001$ . The lower the score on the additive scale, the stronger the respondents' intentions to avoid frequent between-meal intake of sugared snacks and drinks in the future.

#### *Socio-demographic features*

Gender was coded as 1 = 'female', 2 = 'male'. Age was coded as 1 = '< 20 years', 2 = '20–29 years', 3 = '30–39 years', 4 = '40 years and older'. Respondents' educational status when entering TTC was coded as 1 = 'ordinary level' (i.e., primary education certificate and ordinary level secondary education certificate) and 2 = 'advanced level' (i.e., advanced level secondary education certificate and grade 2 teacher certificate).

## Results

Table 1 shows the distribution according to gender, age, college region, and educational level. More women (51.9%) than men participated. There was no significant difference among the participants from the 2 countries in gender, age, or educational level. A higher proportion of Tanzanian than Ugandan participants ( $P < 0.05$ ) attended an urban college, but no significant urban/rural differences occurred on the main variables investigated in this study.

#### *Perceived oral impairments*

According to Table 2, the proportion of respondents that confirmed experience with oral impairments varied considerably according to the type of impairment. Although there were few gender differences in each country, there was an overall substantial difference between students from Uganda and Tanzania with respect to experienced toothache (41.8% versus 16.9%;  $P < 0.001$ ). Similar inter-country differences were ob-

Table 2. The distribution of oral impairments, preparedness to teach about oral health, oral health-related knowledge, and behavior among female and male teacher trainees in Rungwe district ( $n = 195$ ), Tanzania and the districts of Kampala and Mbale ( $n = 225$ ), Uganda. Pearson's  $\chi^2$  and independent sample  $t$  tests

	Tanzania		Uganda	
	Female	Male	Female	Male
Oral impairments (%)				
Toothache	20	12	39	44
Bleeding gums	4	9	23	37*
Bad breath	3	4	17	25
Difficulties chewing	21	16	25	32
Knowledge (%)				
Gum disease destroying	84	79	72	70
Bleeding a sign of gum disease	91	82*	68	76
Gum disease caused by plaque	83	82	58	52
Tooth decay/toothbrushing	28	21	79	72
Tooth decay/intake of sugar	79	73	83	73*
Regularly dental attendance	61	51*	79	77
Tooth decay/fluoride	75	78	79	76
Preparedness to teach (mean)				
Relation of diet to oral health	1.4	1.3	1.6	1.4
Habits to prevent gum disease	1.5	1.4	1.6	1.4
Habits of importance to avoid tooth decay	1.3	1.2	1.7	1.3*
Intention to avoid frequent sugar intake (mean)	5.4	6.1*	5.3	5.3
Oral health behavior (%)				
Sugared tea and coffee	75	68	69	61
Cakes and biscuits	5	7	27	14*
Chocolate/sweets	14	14	23	13*
Soda	6	5	26	14*
Toothbrushing	96	98	96	94
Visit a dentist or not	39	35	64	48*

\* $P < 0.05$ , \*\* $P < 0.001$  (within country samples).

served regarding bleeding gums (30.7% versus 7.0%;  $P < 0.001$ ), bad smell in mouth (21.5% versus 3.7%;  $P < 0.001$ ), and difficulties with chewing (28.7% versus 18.9%;  $P < 0.05$ ).

#### Knowledge of oral health

As depicted in Table 2, almost the entire Tanzanian sample was aware that gum disease might destroy oral tissues, bleeding might be a sign of gum disease, and gum disease is caused by plaque. A sizable proportion of the Ugandan students also answered many items correctly, although knowledge gaps were observed regarding the relationship between dental plaque and gum disease. Few statistically significant gender differences were observed (Table 2). Whereas 82.2% of the students from Tanzania answered correctly that gum disease can be progressive and can destroy the supporting tissues of teeth, this was the case for only 71.6% of the Ugandan participants ( $P < 0.001$ ). Furthermore, Tanzanian students agreed more often than did their Ugandan counterparts that slight bleeding upon brushing may be an early sign of gum disease (87.4% versus 72.9%;  $P < 0.001$ ) and that gum disease is caused by dental plaque (82.8% versus 55.6%;  $P < 0.001$ ). On the other hand, Ugandan students agreed more often than did their Tanzanian counterparts that tooth decay might be a consequence of irregular tooth

brushing (76.0% versus 25.1%;  $P < 0.001$ ) and that dentists should be visited on a regular basis (78.2% versus 57.1%;  $P < 0.001$ ).

*Preparedness to teach about the relevance of personal behavior to oral health maintenance.* The mean distribution for preparedness to teach about the relevance of personal habits to oral health among Tanzanian and Ugandan students of both gender is depicted in Table 2. As a general impression, students from both countries were well prepared to teach about the oral health benefits accruing from personal habits, although the Ugandan female students were less prepared than their male counterparts to teach about personal habits of importance to avoid tooth decay. There was an inter-country difference in that the Tanzanian students were more strongly prepared to teach about the importance of dietary behaviors in the maintenance of oral health (1.3 versus 1.5;  $P < 0.05$ ). The same country-based difference emerged with respect to the preparedness to teach about the importance of oral hygiene habits for avoidance of tooth decay (1.3 versus 1.5;  $P < 0.05$ ).

*Oral health-related behavior.* As shown in Table 2, with the exception of intake of sugared tea or coffee, moderate numbers of Tanzanian and Ugandan students reported daily intake of soda, cakes, biscuits, chocolates, and sweets. In contrast, almost the entire sample of Tanzanian (97.4%) and Ugandan (95.6%) students reported brushing their

Table 3. The rotated (Varimax) factor structure of 7 oral health behaviors and explained variance. Tanzanian ( $n = 195$ ) and Ugandan ( $n = 225$ ) teacher trainees

Oral health behaviors	Tanzania		Uganda	
	Factor 1	Factor 2	Factor 1	Factor 2
Soda	0.646	— <sup>a</sup>	0.735	— <sup>a</sup>
Sugared coffee/tea	0.668	— <sup>a</sup>	0.523	-0.290
Cakes	0.617	— <sup>a</sup>	0.767	— <sup>a</sup>
Chocolate/sweets	0.703	-0.370	0.760	— <sup>a</sup>
Tooth-brushing	— <sup>a</sup>	0.630	0.250	0.567
Dental attendance	0.376	0.380	0.424	0.450
Avoiding sugared snacks	— <sup>a</sup>	0.741	-0.290	0.760
Percentage total variance	26.9	15.8	33.9	16.6
Mean (sd)	16.2 (3.4)	10.5 (2.5)	14.5 (4.3)	9.7 (2.8)

<sup>a</sup> Factor loading equal to or below 0.25.

teeth at least once a day. As opposed to the Ugandan survey group, self-reported oral health behavioral patterns of the Tanzanian participants did not differ significantly according to sex (Table 2). Tanzanian students endorsed oral health-enhancing behavior more frequently than did Ugandan students in terms of daily intake of soda (6.2% versus 20.1%;  $P < 0.001$ ) and cakes and biscuits (6.3% versus 20.9%;  $P < 0.001$ ). On the other hand, the Tanzanian students were less likely to visit a dentist as compared to their Ugandan counterparts (37.5% versus 56.0%;  $P < 0.001$ ) and to decide to avoid frequent intake of sugared products (5.7 versus 5.3;  $P < 0.05$ ).

*Dimensions of oral health behavior*

In a rotated (Varimax) solution of 7 oral health-related behaviors, PCA gave 2 components with eigenvalue greater than 1. Furthermore, the elbow criterion of the scree test clearly indicated the existence of 2 factors in both survey groups. Table 3 presents the rotated factor matrix and the variance explained by the factors. The 2 factors accounted for 42.7% and 50.5% of the variance among the variables in the Tanzanian and Ugandan materials, respectively. When rotating the components, the results were surprisingly consistent across the countries. Factor 1 was defined by the items assessing intake of soda, sugared coffee and tea, cakes and biscuits, and chocolates and sweets. Items assessing toothbrushing frequency, dental attendance, and the intention to avoid sugared snacks were

defined as factor 2. Most items loaded meaningfully (loadings greater than 0.25) on only 1 factor, except dental attendance, which had a factor complexity  $> 1$  by loading highly on several factors. The behaviors included in factor 1 are all considered deleterious to oral health and may be denoted ‘oral health detrimental behavior’. Moreover, toothbrushing, dental attendance, and intention to avoid sugared snacks were included in the definition of factor 2 in both groups, since most items (i.e. toothbrushing and avoidance of sugared snacks) loaded highly on this factor. Factor 2 may be labeled ‘oral health-enhancing behavior’, because engagement in these behaviors is considered conducive to oral health.

The oral health behaviors included in the 2 factors as specified above were added into 2 sum scores: ‘Oral health-enhancing behavior’ (Cronbach’s alpha = 0.48 and 0.49 in the Tanzanian and Ugandan groups, respectively) and ‘oral health detrimental behavior’ (Cronbach’s alpha = 0.59 among Tanzanians and 0.69 among Ugandans). The lower the scores on these sum indexes, the more frequent the engagement in ‘oral health-enhancing’ and ‘oral health detrimental behaviors’.

*Correlates of oral health enhancing and oral health detrimental behaviors.* ‘Oral health-enhancing’ behavior correlated significantly with oral health knowledge ( $r_s = 0.15$ ,  $P < 0.001$ ), preparedness to teach ( $r_s = 0.18$ ,  $P < 0.001$ ), and country ( $\phi = 0.19$ ,  $P < 0.05$ ). ‘Oral health detrimental’ behavior was significantly correlated with country ( $\phi = 0.32$ ,  $P < 0.001$ ), preparedness to teach ( $r_s = -0.17$ ,

Table 4. Oral health detrimental behavior regressed on country, knowledge, and preparedness to teach the importance of personal behavior to oral health. Multiple linear regression (minimum  $n = 395$ )

Step predictor	Regression coefficient B	Standard error (B)	P	R <sup>2</sup>
Country association	-1.46	0.39	0.001	0.047
Knowledge	0.29	0.13	0.030	0.052
Preparedness to teach	0.43	0.12	0.001	0.085
Constant	16.90			

Table 5. Oral health-enhancing behavior regressed on country, knowledge, and preparedness to teach the importance of personal behavior to oral health. Multiple linear regression (minimum  $n = 388$ )

Step predictor	Regression coefficient B	Standard error (B)	P	R <sup>2</sup>
Country association	-0.74	0.25	0.004	0.017
Oral knowledge	0.18	0.09	0.034	0.038
Preparedness to teach	0.25	0.08	0.001	0.063
Constant	8.607			

$P < 0.05$ ), and oral health knowledge ( $r_s = 0.10$ ,  $P < 0.05$ ). Multiple linear regression analyses were performed with 'oral health detrimental' and 'oral health-enhancing' behavior as dependents and country, knowledge, and preparedness to teach as independent variables. With respect to 'oral health detrimental' behavior (Table 4), the total exploratory effect was only 8.5%. Country explained 4.7 percentage points on entering the equation, whereas preparedness to teach and knowledge significantly increased the explained variance by 3.8%. The model explained a significant but small part of the variance ( $F = 12.04$ ,  $P < 0.001$ ). With respect to 'oral health-enhancing' behavior (Table 5), the total exploratory effect was 6.3%. Whereas country explained 1.7% on entering the equation, preparedness to teach and knowledge increased the explained variance by 4.6%. This model explained a small but significant amount of the variance ( $F = 8.81$ ,  $P < 0.001$ ). Using the  $t$  values as a rough guide, preparedness to teach and knowledge both appeared to be useful predictors in the regression models.

## Discussion

The findings presented in this paper are believed to be representative for second-year teacher trainees in the district of Rungwe, Tanzania and in the Kampala and Mbale districts of Uganda. Due to the rich geographical and socio-cultural diversity within each country, it is not possible to generalize from the studied populations to any larger population of young adults inside or outside these districts. The question also arises whether the results are representative of Tanzanian and Ugandan teacher trainees in general, or are specific to the colleges under investigation. Commonly, universities vary in atmosphere and in the type of students they attract. Because there was no way of determining the strength of such influences, future work must establish whether the variability between teacher colleges across Tanzania and Uganda is greater than that within each country. This does not belittle the present observations provided it is borne in mind that the participants are not representative of each country, but are illustrative of oral health-related knowledge, attitude, and behavior of a selected, but important group. Since students are an easily identifiable, accessible, and homogenous group in the population, they are suitable for international comparisons. In that the samples targeted in this study represent a restricted range of respondents regarding education and status, the danger that social inequalities have contributed to the pattern of results is reduced.

The instrument used was a self-administered questionnaire and not an interview, which has commonly been used in non-occidental social surveys (26). Although it is generally assumed that data collected by interview will be more reliable, there is little direct evidence of greater reliability within health behavior research (27). It might even be argued that anonymous self-report information is more reliable than interview data in that the respondents

are not subject to the pressures of social demand emanating from conversation with research assistants. Nevertheless, with respect to oral health-enhancing behavior, knowledge, and attitudes, over-reporting has to be assumed, whereas the oral health detrimental behaviors have probably been under-reported. On the other hand, the questions employed were sufficiently simple and unambiguous to achieve a reasonable degree of validity on the different variables. In fact, previous research has shown such self-reports to be quite accurate (28). Although the applied sample techniques and instruments were identical across the surveys, there was a 1-year delay in data collection in Uganda relative to Tanzania. In spite of these limitations, the present results provide some interesting insights into differences between a student population that is obliged to teach oral health in primary school, and a population for whom school oral health education is occasionally addressed, but included in future plans.

As expected, students from Tanzania clearly had more knowledge of gum disease and associated risk factors, were more prepared to teach about the importance of personal habits to oral health maintenance, and had less experience with oral impairments than Ugandan students. Due to the high level of knowledge among Tanzanian students on symptoms and causes of gum disease, we would have expected knowledge on tooth decay to be high as well. However, gaps were observed on this issue, most apparently regarding the link between tooth decay and irregular toothbrushing. It is notable that despite the emphasis placed on oral hygiene measures in school-based oral health education (22), this consideration ranked relatively low in Table 2. However, knowledge about the involvement of particular behaviors in disease is seldom certain, and there is disagreement even among experts about the relative importance of various contributing factors (29). Such disagreements might explain why Tanzanian students were less knowledgeable about the effect on tooth decay of irregular toothbrushing than were their Ugandan counterparts. According to the oral health educational curriculum employed in Tanzanian schools, a low-sugar diet is recommended as the prime device to avoid tooth decay. Nevertheless, the number of respondents failing on several items suggests that important misconceptions exist, even in this privileged section of the Tanzanian and Ugandan populations. Thus, the present results confirm the general impression that training in teacher trainees programs need to be established to raise the skill levels for oral health promotion in primary schools (5, 18, 22).

As compared to men, women are generally less likely to smoke, pay more attention to their diet, take more vitamins, and engage in more oral care behaviors. This gender gradient is repeatedly observed in western studies, and has been interpreted as being consistent with the traditional norms for sex-role appropriate behavior (30, 31). In contrast, the Ugandan female students were more likely than the male students to endorse daily intake of sugared snacks and drinks. Notably, these behavior

patterns did not correspond with the picture of the female students being better informed than their male counterparts about the link between sugar consumption and tooth decay. Other responses might suggest a more conscious effort towards a healthier lifestyle on the part of the female students in that they were more likely than the male students to visit a dentist at least occasionally. Unfortunately, reasons for visiting a dentist were not ascertained in this study. In a previous report on South African schoolteachers, perceived symptoms of oral disease were recognized as the most common reason for their dental visiting (11). The cross-cultural absence of gender differences in reported toothbrushing and the high prevalence of this preventive practice are less surprising in light of East African surveys among schoolchildren (3, 19). In fact, the reported prevalence of toothbrushing in each survey group was nearly as high as that currently observed among comparable age groups in Norway (32).

For most of the oral health behaviors assessed, there are differences between Tanzanian and Ugandan students, and often these were rather substantial. Thus, among men more than 14% endorsed daily intake of soda and cakes in Uganda as compared to <6–7% in Tanzania. Among women, sugar consumption varied from 5–6% in Tanzania to 26–27% in Uganda. These figures indicate that concerted efforts should be made to maintain low sugar intake by teacher trainees in East Africa, thereby counteracting the anticipated future increase in consumption. Such efforts might be important, especially when considered from a role-modeling perspective. Although parents are children's primary socializing agents, schoolteachers also have great influential potential because of their natural authority. Moreover, they spend a lot of time with the children at a stage of their lives when oral health habits are being formed. It should be noted that the differences between Tanzanian and Ugandan teacher trainees were not uniform across oral health behaviors. As shown in Table 2, Tanzanian students were less likely than their Ugandan counterparts to visit a dentist. This could reflect more conscious efforts towards a healthier lifestyle on the part of the Ugandan students. Alternatively, if dental attendance is determined more by situational than by individual forces, this finding might reflect inter-country differences with respect to the availability of dental care as well as variations in personal decisions.

Teachers' preparedness to teach about the link between personal habits and health outcomes reflects their beliefs about the oral health benefits accruing from carrying out these activities. As can be seen from Tables 4 and 5, those teachers who were strongly prepared to teach about health benefits were more and less likely to engage in oral health-enhancing and oral health detrimental behavior, respectively. This accords with theoretical expectations and previous empirical evidence of associations between health beliefs and performance of protective health behavior (31). The fact that this relationship was consistent across different cultural settings bolsters confidence in its importance. Moreover, the presence of 2 behavioral

dimensions denoted 'oral health detrimental' and 'oral health-enhancing' behavior supports the hypothesis of bi-dimensionality in health behavior as well as corroborating previous empirical findings (33). The cross-cultural consistency in oral health behavioral dimensions is notable taking into account the variation in prevalence of single behaviors between Tanzania and Uganda. From a practical point of view, such homogeneity might be useful in the planning and implementation of oral health training programs with teacher trainees, indicating that successful programs developed for use in Tanzania could easily be translated for use in Uganda or vice versa, with expectations of similar results. However, further studies are needed, as the present results provide no conclusive answer to the question about dimensionality of oral health-related behaviors, and the behaviors in question were only moderately correlated.

In summary, the present results show that although the level of preparedness to teach and the awareness of oral health-related issues seem to be high, the construction of an oral health promotion program among teacher trainees in Tanzania and Uganda is important. Specific misconceptions still exist, which need to be addressed in future training of teacher trainees. Generally, the consumption of sugared snacks and drinks is low, and steps should be taken to maintain a low-sugar diet to counteract an expected increase in the future. Strengthening health beliefs in the presence of correct knowledge might successfully promote the adoption and maintenance of oral health-enhancing behavior among teacher trainees across East African countries, thereby improving their status as role models for primary schoolchildren.

## References

1. Marthaler TM, O'Mullane DM, Vrbic V. The prevalence of dental caries in Europe 1990–1995. ORCA Saturday afternoon symposium 1995. *Caries Res* 1996;30:237–55.
2. Von de Fehr FR. Caries prevalence in the Nordic countries. *Int Dent J* 1994;44:371–8.
3. Jensen K, Kizito EK, Langbæk J, Nyika TA. Dental caries, gingivitis and oral hygiene among school children in Kampala, Uganda. *Community Dent Oral Epidemiol* 1973;1:74–83.
4. Tiromwe F, Ekoku Y, Manji F, Baclum V, Fejerskov O. Oral health in Uganda. Results of the National Survey 1987. Ministry of Health Uganda/Kenya Medical Research Institute; 1988.
5. Petersen PE, Mzee OM. Oral health profile of school children, mothers and school teachers in Zanzibar. *Community Dent Health* 1998;15:256–62.
6. Moshá HJ, Nglishiso LA, Nkwera H, Scheutz F, Poulsen S. Oral health status and treatment needs in different age groups in two regions of Tanzania. *Community Dent Oral Epidemiol* 1994;22:307–10.
7. World Health Organisation Prevention methods and program for oral diseases. Technical Report series 713. Geneva: WHO; 1984.
8. Tapsoba H, Deschamps JP. Promotion of orodental health in adolescents in Africa. *Promot Educ* 1997;4:26–8.
9. Tirwornwe JF. Rural dental health project in Uganda. In: Sheiham S, Mautsch W, editors. Promoting oral health in

- deprived communities. Berlin: German Foundation for International Development; 1995. p. 465–8.
10. Loupe MJ, Frazier J. Knowledge and attitudes of school teachers toward oral health programs and preventive dentistry. *J Am Dent Assoc* 1983;107:229–34.
  11. Chikte UME, Brand AA, Gilbert L. The suitability of teachers as oral health educators. *J Dent Assoc South Africa* 1990;45:429–32.
  12. Glasrud PH, Frazier PJ. Future elementary school teachers' knowledge and opinions about oral health and community programs. *J Public Health Dent* 1988;48:74–80.
  13. Lang P, Woolfolk MW, Faja BW. Oral health knowledge and attitudes of elementary school-teachers in Michigan. *J Public Health Dent* 1989;49:44–50.
  14. Petersen PE, Danila I, Samoila A. Oral health behaviour, knowledge and attitudes of children, mothers and school teachers in Romania in 1993. *Acta Odontol Scand* 1995;53:363–8.
  15. Petersen PE, Hadi R, Al-Zaabi FS, Hussein JM, Behbehani JM, Skougard MR, et al. Dental knowledge, attitudes and behavior among Kuwaiti mothers and school teachers. *J Pedodont* 1990;14:158–64.
  16. Suliman A-T, Madina SA, Petersen PE. Oral health situation of schoolchildren, mothers and schoolteachers in Saudi Arabia. *Int Dent J* 1998;48:180–6.
  17. Petersen PE, Poulsen VJ, Ramahaleo J, Ratsifaritara C. Dental caries and dental health behaviour situation among 6- and 12-year-old urban schoolchildren in Madagascar. *African Dent J* 1991;5:1–7.
  18. Nyandindi U, Palin-Palokas T, Milen A, Robinson V, Kombe N, Mwakasagule S. Participation, willingness and abilities of school teachers in oral health education in Tanzania. *Community Dent Health* 1994;11:101–4.
  19. Nyandindi U, Palin-Palokas T, Milen A, Robinson V, Kombe N. Oral health knowledge, attitudes, behaviour and skills of children entering school in urban and rural areas in Tanzania. *Public Health* 1994;108:35–40.
  20. Nørmark S, Mosha HJ. Knowledge, practices and dental health among Tanzanian children. *Afr Dent J* 1989;3:24–33.
  21. Mazango CM, Tenovou J, Hausen H. Dental caries in relation to diet, saliva and cariogenic micro-organisms in Tanzanians of selected age groups. *Community Dent Oral Epidemiol* 1996;24:169–74.
  22. Nyandindi U, Milen A, Pali-Palokas T, Robinson V. Impact of oral health education on primary school children before and after teachers' training in Tanzania. *Health Promotion International* 1996;11:193–200.
  23. Kim JO, Mueller CW. Factor analysis: statistical methods and practical issues. Sage University Paper Series on Quantitative Applications in Social Sciences, 07–014. Beverly Hills: Sage; 1978.
  24. Cronbach LJ. Coefficient alpha and the internal structures of tests. *Psychometrika* 1957;16:7–334.
  25. Bentler PM. Factor analysis. In: Bentler PM, Lettieri SJ, Austin GA, editors. Data analysis strategies and designs for substance abuse research. Research issue no. 13. DHEW publication (ADM). Rockville, MD: National Institute on Drug Abuse; 1976.
  26. Kapiga SH, Nachtigal G, Hunter DJ. Knowledge of AIDS among secondary school pupils in Bagamoyo and Dar es Salaam, Tanzania. *AIDS* 1991;5:325–8.
  27. Surgeon General. The health benefits of smoking cessation. DHHS publication (CDC) 90–8416. Washington, DC: US Department of Health and Human Services; 1990.
  28. Hirschman RS, Leventhal H, Glynn K. The development of smoking behaviour: conceptualisation and supportive cross sectional survey data. *J Appl Soc Psychol* 1984;14:184–206.
  29. Bratthall D, Hansel-Petersson G, Sundberg H. Reasons for the caries decline: what do the experts believe? *Eur J Oral Sci* 1996;104:416–22.
  30. Waldron I. Gender and health related behaviour. In: Gochman DS, editor. Health behaviour: emerging perspectives. New York: Plenum Press; 1988. p. 193–208.
  31. Conner M, Norman P. The role of social cognitions in health behaviours. In: Conner M, Norman P, editors. Predicting health behaviour. Buckingham: Open University Press; 1995. p. 1–23.
  32. Åström AN, Jakobsen R. Stability of dental health behaviour: a 3-year prospective cohort study of 15-, 16-, and 18-year-old Norwegian adolescents. *Community Dent Oral Epidemiol* 1998;26:129–38.
  33. Aarø LE, Laberg JC, Wold B. Health behaviours among adolescents: towards a hypothesis of two dimensions. *Health Educ Res* 1995;10:83–93.

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