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Full Length Research Paper

Dental care practices and caries experiences among teenagers in Hhohho sub-region, Swaziland

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Increased figures in tooth extractions among the youth population in the Northern Hhohho region of Swaziland prompted the researchers to investigate these development, with the purpose of assessing and describing dental healthcare practices and caries experiences among school going teenagers. The study engaged a randomized-survey design through a self-administered questionnaire. The population sample comprised 562 secondary school-going pupils (13 to 18 years). On self-reported caries experiences, about 43.3% reported to have had one or more decayed-teeth; 21.9% were found to be consuming foods comprising refined-carbohydrates daily; and about 30.3% often go to bed chewing sweets. About 98.8% brush their teeth at least once a day, and about 77.8% knew other unconventional tooth brushing methods. Logistic regression results suggest that pupils who were within 10 km of a dental clinic were 30% less likely to be found with decayed-teeth (e^B=0.719; p-value=0.082). Surprisingly, pupils who knew the cause of caries were almost twice likely to be found with decayed-teeth (e^B=1.866; p-value=0.003). Those who took soft-drinks for their daily refreshments increased their chances of being found with decayed-teeth by three-folds (e^B=3.33; p-value=0.008). Pupils who knew the difference between tooth-decay and gum disease were twice likely to be found with decayed-teeth (e^B=1.918; p-value=0.003). It can therefore be concluded that whilst caries affect teenagers uniformly (whether boys/girls); most of the known caries causal factors do not seem to influence the probability of having caries in this region.

Key words: Dental caries experiences, oral hygiene, dietary habits, tooth-brushing, teenagers.

INTRODUCTION

Some personal oral healthcare practices and perceptions that often have a direct influence on caries development such as frequency of tooth-brushing and certain dietary habits continue to occupy a central role in the field of oral health research today. For instance, it is important to understand the role played by even a simple fruit juice in caries development. That is why caries has now been considered to be the major oral health problems throughout the world (Evans et al., 2013; Ministry of Health and Social Welfare, 2005; Marthaler et al., 1996; Petersen, 2003). With gum-diseases on its side, caries has been noted as significant in societies by the World Health Organization (WHO), because almost everybody has experienced one or more of these two conditions at some point in time (WHO, 2001). Caries is related to one's lifestyle, and behavioural factors under a person's control are clearly implicated. These factors include poor oral hygiene; poor dietary habits, that is, frequent consumption of refined carbohydrates, frequent use of oral medications that contain sugar, and inappropriate methods of feeding infants (Selwitz et al., 2007).

There is strong evidence to the effect that certain foodstuff is the main cause of dental caries in most people (Rugg-Gunn and Nunn, 1999; WHO, 2006; Rees, 1992).

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Rees (1992) claims that adolescent individuals often choose foods high in fat and sugar that consist of fast-foods and ready-to-eat snack foods which are know causes of caries on teeth. Further, while Sheiham (2001) concurs with the aforementioned argument of a strong association between sugar and dental caries, he argues that there is no such relation between starch and caries. He claims that individuals who eat low sugar diets, but high starch would normally experience low caries levels. Above all arguments, the bottom line is that children are the most vulnerable group to dental caries. The vulnerability of teenagers to caries also varies with socio-economic groupings and geographical locations. For instance, Gugushe and du Plessis (1998) in a study to understand the regional and countrywide urban-rural distribution of dental caries in Swaziland concluded that in developing countries, children from higher socio-economic groups often residing in the urban areas have more dental decay than children from lower socio-economic groups residing in rural areas. Although Radford et al. (2000) conducted their study on infants, the socio-economic background of their subjects suggest that individuals living in areas of highest deprivation had higher frequencies of caries compared to those from more affluent areas. This is another example of how some individuals are more vulnerable to caries compared to others.

The Swaziland government through the Ministry of Health and Social Welfare (1994) noted that there was no significant increase in the experience of dental caries in 12-year old children. However, there was a big difference in caries experiences in the same age cohort between rural and urban areas with a 'decayed-missing-filled-teeth' (DMFT) of 0.64 for the rural and 1.23 for the urban areas. For periodontal diseases, the prevalence of gingivitis was 100% whilst that of calculus was also discovered to be very high for an age cohort of a 15 year old (Ministry of Health and Social Welfare, 1994). Four years later, Gugushe and du Plessis (1998) investigated the regional urban-rural distribution of dental caries in Swaziland amongst 6 to 44 years old. The two researchers discovered that in the Lubombo region, the dental caries experience of 6 and 12 years children was significantly higher in the urban areas than in rural areas. For the Shiselweni region, only the 12 years old had a significant difference $p=0.0018$ in the urban-rural caries experience. There was no significant difference $p>0.05$ observed in the urban-rural dental caries experience of all the other age groups and the regions (Gugushe and du Plessis, 1998). Due to insufficient empirical data on oral health in Swaziland, the worse in oral health conditions is likely to have occurred in the years.

In addition to the oral hygiene and diet, there are other social and geographical factors that put teenagers at risk to dental caries. This was noted by Höllund (1990) and the International Food Information Council (1998). A study by Höllund (1990) whose purpose was to examine the structure of attitudes towards healthy food in a group of adolescents, and evaluate the impact of a health education programme on these attitudes; she concluded that the change in attitudes can be explained by two mechanisms: (1) dissonance arousal and discrepancy between personal attitudes and group norms; (2) and that future programmes should emphasise affection rather than cognition (Höllund, 1990). Similarly, the International Food Information Council (1998) argues that lack of good rules on oral health by individuals as well as good nutrition would normally put their oral health at high risk. In some instances, both social and geographical factors may either provide unfavourable or favourable conditions in the form of accessibility to efficient health care services. The aim and purpose of this cross-sectional study was therefore, to assess and describe the dental care practices and caries experiences of teenagers in the Northern Hhohho region of Swaziland. The key focus was on their personal oral hygiene practices, dietary habits, distances and visits to the dental clinic, oral healthcare perceptions, which allsomehow informed their caries experiences.

MATERIALS AND METHODS

This study engaged a randomised survey design. The University of South Africa Ethics Committee approved the study. Permission was also sort from the Regional Education Office and from the governing bodies of the selected schools. Following a pre-test of the tool to improve validity and reliability, some minor adjustments were made on certain questions for clear understanding. A total of 527 schools going teenagers (13 to 18 years) were targeted in the Northern Hhohho region of Swaziland through a two-stage random sampling. At first, we selected the specific schools which were distributed between rural and urban areas, and then went on to select the actual classes within these schools through a simple random sampling method. This resulted to a total of 10 schools (5-rural and 5-urban schools) being selected. In each selected class, all consented pupils participated in the study as their age limit did qualify them by law to give their own consent for participating in the study. Data collection was through self-administered questionnaires as (in the case of caries) the study did not aim to measure the actual DMFT prevalence of the pupils, but reference was on caries occurrences through self-reported caries experiences. Prior arrangements were made with the schools such that within a period of two weeks all the schools would have been completed.The main categories per the structuring of the assessment tool were: caries occurrence, oral hygiene practices, dietary intake, and visits to the dental clinic which were all assessed using the self-administered questionnaire. The last question comprised of an open-ended statement on their views on how to prevent caries among teenagers. In each class, after a brief description of the study purpose and how to go about in filling the questionnaire, consented pupils were given the questionnaire to fill. When all had finished, all questionnaires were collected and placed in the respective envelops.

Data analysis

Following data cleaning, we were then left with a total of 508 usable responses for data analysis. Data were captured and analysed using

Table 1. Respondents' dietary habits.

Variable	Frequency	Proportion (%)
Eat sweetened foods		
Always	18	3.5
Sometimes	402	79.1
Never	88	17.2
Total	508	100
Snacking with		
Sweets	57	11.2
Fruits	308	60.6
Chips	111	21.9
Other	31	6.3
Total	508	100
Lunch-box pack		
Bread and juice	295	58.1
Cookies and juice	34	6.7
Fruits and juice	88	17.3
Other	91	17.9
Total	508	100

the Statistical Package for the Social Sciences (SPSS-16.0). The t test, odds ratio calculations and the chi-square test (at a level of significance of p=0.05) were used during the preliminary analysis. Logistic regression analysis was also conducted to assess the bivariate relationship between the presence or absence of self-reported decayed-teeth by the pupils (the response variable) and each of the nineteen explanatory variables which included: sex/gender of the pupil, the age, whether they were boarders or day scholars, whether they lived with at least one of their parents, whether they had a tooth brush or not, whether the pupil's gums bled when brushing teeth or not, whether the pupil brushed teeth two times or more per day, whether they knew of other (traditional) methods of cleaning teeth, whether the pupil could list all carbohydrates foods found in the community and could tell which ones were known for causing tooth decay, whether the pupil was in the habit of eating sweetened food during spare time after lunch, whether their daily snack consisted of sweets or not; whether their daily drink consisted of soft drinks or not, whether the pupil sometimes went to bed chewing a sweet or a "*chappies*", whether it was easy to buy sweets from the school tuck-shop or not, whether their lunch box normally consisted of cookies and juice, whether the pupil could tell the difference between tooth decay and gum disease, whether the distance to the nearest dental clinic was more than 10 km or not, and whether the pupil ever visited the dental clinic to check their teeth at least once a year. At the first stage of the binary logistic regression, all the 19 independent variables in the model were included, and then an automatic forward-selection method was employed in which variables with the greatest significance were added one at a time. Lastly, an automatic back-ward selection procedure was employed. The logistic regression equation that was employed was of the form:

$\log_e(P/(1-P)) = \text{Const} + B_1X_1 + B_2X_2 + ... + B_kX_k + u]$.

RESULTS

Descriptive differentiations

Based on the target and the final total of 508 usable responses for analysis, 96.3% response rate was discovered. A proportion of 66.3% of the respondents were within the stipulated age-cohort of 13 to 18 years as some were 12 years and others were 19 years. In terms of gender, 55.1% were boys whilst 44.9% were girls. On whether a respondent was a boarder or a day-scholar, it was found that 8.3% were boarders whilst 91.7% were day-scholars. In terms of owing tooth brushes, 94.1% of the respondents claimed to have toothbrushes. Out of those who owned toothbrushes, 98.8% brushed their teeth at least once a day; whilst a proportion of about 77.8% knew other unconventional tooth brushing methods. On the overall, it was found that about 23.3% of the respondents do regular dental checkups at least once a year. About 28.3% of the pupils reported bleeding gums during tooth brushing. A proportion of about 63.8% claimed to know the difference between gum diseases and caries. About 11.2% of the respondents claimed to be snacking with sweets, whilst 59.6% snacked with fruits. It was also found that about 6.7% of the respondents often pack their school lunch-boxes with sweet-cookies, whilst 17.3% use fruits and juices. A proportion of about 30.3% of the pupils often go to bed chewing sweets. Further, a proportion of about 87.4% of the respondents claimed they could list carbohydrates foods that cause caries as demonstrated in Table 1. In the case of tooth decay experiences, as many as 43.3% of the respondents indicated through their responses to have been currently living with one or more decayed teeth, whilst 71.9% knew how a tooth starts to decay. This figure is only based on reported present-caries, not filled or removed teeth. Only 23.2% of the respondents mentioned that they undertook dental check-ups at least once a year.

Test for level of significance

Although some of the resultant p-values were not significant at p=0.05 following the binary logistic regression analysis on the number of self-reported decayed-teeth and most of the 19 explanatory variables; the following relationships were noted as demonstrated in Tables 2 and 3: (1) the relationship between the response variable (number of self-reported decayed-teeth) and tooth-brushing frequency was such that $0.05<p<0.10$; (2) the relationship between the number of self-reported decayed-teeth and the respondent's gender was such that $0.10<p<0.25$; (3) the relationship between the number of self-reported decayed-teeth and going to bed chewing sweets was such that $0.10<p<0.25$; (4) the relationship between the number of self-reported decayed-teeth and the use of friends and tuck-shops as key sources of sweets at school was such that $0.25<p<0.75$; (5) the relationship between the number of self-reported decayed-teeth and distances away from the dental-clinic was such that $0.25<p<0.75$; (6) finally, the relationship between the number of self-reported

Table 2. Squared differences between the observed and the expected values on having decayed teeth against some of the explanatory variables.

Variable	Number of carious teeth					
	3 or more	2 Teeth	1 Tooth	None	Not sure	T/T
Squared differences between the observed and the expected values on number of carious teeth per mouth based on the frequency of tooth brushing, divided by (E) expected						
3 times daily	4.94	1.04	0.00	3.05	0.00	9.03
2 times daily	2.36	0.97	0.00	1.01	0.15	4.49
Once daily	0.17	0.40	0.02	0.00	0.37	0.96
Totals	7.47	2.41	0.02	4.06	0.52	14.48
Squared differences between the observed and the expected values on number of carious teeth per mouth based on sex, divided by (E) expected						
Males	0.00	1.14	0.04	0.96	0.63	2.77
Females	0.00	1.40	0.05	1.18	0.37	3.00
Totals	0.00	2.54	0.09	2.14	1.00	5.77
Squared differences between the observed and the expected values on number of carious teeth per mouth based on going to bed chewing sweets, divided by (E) expected						
Chew-sweets (yes)	0.70	0.06	1.57	0.04	0.50	2.87
Chew-sweets (no)	0.30	0.03	0.68	0.02	0.21	1.24
Totals	1.00	0.09	2.25	0.06	0.71	4.11
Squared differences between the observed and the expected values number of carious teeth per mouth against whether a child is a boarder or a day-scholar, divided by (E) expected						
Boarder	0.22	0.38	1.64	0.50	1.28	4.02
Day-scholar	0.02	0.03	0.14	0.04	0.11	0.34
Totals	0.24	0.41	1.78	0.54	1.39	4.36

Table 3. Squared differences between the observed and the expected values on having decayed teeth against some of the explanatory variables.

Variable	Having decayed teeth		
	Yes	No	Totals
Squared differences between the observed and the expected values on having decayed teeth against sources of sweets within the school environment, divided by (E) expected			
Friends	0.17	0.22	0.39
Teachers/Vendors	0.00	0.00	0.00
Tuck-shops	0.31	0.40	0.71
Totals	0.48	0.62	1.10

Table 3. Contd.

Squared differences between the observed and the expected values on having decayed teeth against distances from the dental clinic, divided by (E) expected:			
>50 km away	0.01	0.01	0.02
10-49 km away	0.24	0.32	0.56
<10 km away	0.06	0.08	0.14
Totals	0.31	0.41	0.72

decayed-teeth and whether a pupil was a day-scholar or boarder at the school was such that $0.25<p<0.75$. These findings imply that all hypothetical beliefs in regard to these relationships may be confirmed as such, as per the fact that the resultant p-values were not statistically significant at $p=0.05$.

Model diagnostics results

The examination of each of the nineteen independent variables gave an indication of how it is likely to be associated with the response variable (the presence or absence of dental caries) in a binary regression model. The results from the analysis as demonstrated in Tables 4 and 5 seemed to suggest the following: (1) more than a half of respondents had at least one tooth missing or decayed or filled (54.9%) as against 45.1%; (2) most of the 19 independent variables were not significantly associated with the absence or presence of dental carries, and this was shown by the test z-statistics and their corresponding p-values (the z-statistics were used to test the equality of two proportions in two independent samples – and a normal approximation was used because of large samples); (3) the only variables that showed statistical significance were: taking soft drinks (p-value = 0.009) and having knowledge of traditional methods of cleaning teeth (p-value=0.006). However, knowing the causes of dental caries was associated with the presence or absence of dental caries in a totally unexpected direction, in that the respondents who had this knowledge had a significantly higher proportion of individuals with dental caries (as compared to those who did not claim any such knowledge). Therefore, from the earlier results, it would be expected that the binary logistic model would not yield many statistically significant regression coefficients.

DISCUSSION

Dental caries experiences amongst teenagers

This study results confirm previous research findings in respect to the strong correlation between certain dietary habits and the occurrence of caries among the youth population group within the HHohho region. The results are consistent with the caries status as indicated in the hospital statistics, as per the revelations that more than half of the respondents had at least one tooth decayed or missing or filled (54.9% as against 45.1%), and this demonstrated the fact that dental problems among school-going children in Northern Hhohho region of Swaziland were very serious. Whilst the study did not aim to determine the DMFT prevalence in the 13 to 18 years old group within the mentioned region; previous studies (Ministry of Health and Social Welfare Report, 1994) noted that there was no significant increase in the experience of dental caries in 12 years old children in Swaziland. In the current study, emphasis is on caries occurrences as a result of self-reported caries experiences by the respondents including their dietary habits and oral hygiene practices. For dental caries to develop on the tooth you have to have certain types of bacteria present in the oral cavity, and the individual has to consume refined sugars frequently (WHO, 2001; van der Hoeven and van Palenstein Helderman, 1998; van Palenstein Helderman et al., 1996; Chestnutt and Gibson, 2002). So a continuous interaction over time between these factors would lead to caries development resulting from an ecological imbalance in the physiological equilibrium between tooth minerals and oral microbial biofilms (Selwitz et al., 2007).

A proportion of 56.9% of the pupils were found to be getting sweets from friends within the school premises, whilst 34.6% bought sweets from tuck-shops at school. However, on the issue of having decayed teeth against these key sources of sweets (friends, vendors, tuck-shops) within the school environment, the significance test proved that such sources do not have a strong association with caries, as the χ^2 value of 1.10 was such that $0.25<p<0.75$. Implying that there is no specific source of sweets within the school environment that can be attached to caries development among the pupils, rather than the continuous interactions between bacteria and other host in the mouth factors. Here, we need to focus on the risk factors of developing caries. For instance, if we are saying about 21.9% of the pupils consume cakes or cookies almost daily (as per the findings), based on the frequency and amount, this dietary habit exposes them to high risk of caries development. Support of this claim was derived from a study conducted amongst 11 to 14 years old English pupils investigating the correlation

Table 4. Relationships between the 19 explanatory variables and having a decayed tooth.

Explanatory variable	Values of the explanatory variable	Dental caries? (dependent variable)		Total	Percent "Yes"	z-statistic and p-value for testing equality in % "yes"
		No	Yes			
Sex	Female=0	95	129	224	57.6	z=1.118, p=0.264^{ns}
	Male=1	131	146	277	52.7	
Type of scholar	Day scholar=0	202	257	459	56.0	z=1.633, p=0.102^{ns}
	Border=1	24	18	42	42.9	
Living with whom	No parents=0	78	110	188	58.5	z=1.263, p=0.207^{ns}
	With at least one parent=1	148	165	313	52.7	
Having tooth brush	No=0	14	15	29	51.7	z=-0.368, p=0.713^{ns}
	Yes=1	211	260	471	55.2	
Bleed in gums when brushing	No=0	161	195	356	54.8	z=-0.242, p=0.809^{ns}
	Yes=1	62	79	141	56.0	
Know traditional methods	No=0	49	64	113	56.6	z=0.414, p=0.679^{ns}
	Yes=1	177	211	388	54.4	
Can list carbohydrates	No=0	65	71	136	52.2	z=-0.74, p=0.459^{ns}
	Yes=1	160	203	363	55.9	
Know decay-causing foods	No=0	26	37	63	58.7	z=0.656, p=0.512^{ns}
	Yes=1	200	238	438	54.3	
Take sweet food > lunch	No=0	44	43	87	49.4	z=-1.107, p=0.268^{ns}
	Yes=1	182	231	413	55.9	
My daily snacks=sweets	No=0	201	243	444	54.7	z=-0.099, p=0.921^{ns}
	Yes=1	25	31	56	55.4	
Cookies or cakes daily	No=0	183	208	391	53.2	z=-1.434, p=0.152^{ns}
	Yes=1	43	67	110	60.9	
My daily drink is soft drinks	No=0	219	251	470	53.4	z=-2.601, p=0.0093****
	Yes=1	7	24	31	77.4	

Table 4. Contd.

Gone to bed chewing sweets?	Never=0 Sometimes=1	151 75	198 77	349 152	56.7 50.7	z=1.241, p=0.215^{ns}
Tuckshop is easiest source of sweets	No=0 Yes=1	143 83	185 90	328 173	56.5 52.0	z=0.941, p=0.347^{ns}
Cookies/juice lunch box	No=0 Yes=1	212 14	256 19	468 33	54.7 57.6	z=-0.324, p=0.746^{ns}
Know how t-decay starts?	No=0 Yes=1	77 149	63 211	140 360	45.0 58.6	z=-2.744, p=0.006***
Can tell t-decay from gum disease?	No=0 Yes=1	83 141	95 180	178 321	53.4 56.1	z=-0.581, p=0.561^{ns}
Nearest dental clinic	>10k (=0) ≤10k (=1)	128 98	172 103	300 201	57.3 51.2	z=1.345, p=0.179^{ns}
Visit to dental clinic	Never=0 At least once=1	174 52	209 65	383 117	54.6 55.6	z=-0.190, p=0.849

correlation between the frequency/weight of intake of dietary items high in sugars. The conclusions drawn from the earlier study was that foods such as: sugared-tea, sweet hot drinks, sweet pudding, soft drinks, chocolate, biscuits, and cakes have a high correlation-coefficient(*r*) of +0.80 to +0.98 (Sheiham, 2001). Similarly, for those pupils who either take soft-drinks or eat sweets regularly (11.4 and 11.2%, respectively); the correlation-coefficient between the frequency and weight for tea is believed to be +0.98, whilst for sweets, it is believed to be +0.74 (Sheiham, 2001). This again may suggest that about 11.4% of the pupils in the current study may be at a high risk of developing caries. Even the results that followed the binary regression revealed similar chances in that those who took soft-drinks for their daily refreshments were three times likely (e^B=3.33; p=0.008) to being found with dental caries when compared with those who chose other types of drink such as water and juice. Of note, there seemed to have had a negative regression coefficient which pointed to the wrong direction on going to bed eating sweets, which seemed to have reduced the odds of getting dental caries to 40% (e^B=0.647; p=0.045). Also, knowing what causes tooth decay seemed to double the likelihood of getting dental caries (e^B=1.918; p=0.003), although this one seemed to be a contrast.

Some of the schools in Swaziland have enrolled both day-scholars and boarders. This situation cannot be overlooked when looking at dental care practices and caries experiences amongst teen-agers. In the case of caries occurrences between day-scholars and borders, the resultant p-value was found to be not statistically significant in that the χ^2 value of 4.36 was such that 0.25<p<0.75, implying that the number of carious teeth per individual cannot be determined by whe-ther a pupil is a boarder or day-scholar, thereby confir-ming any hypothetical belief in this regard. On another note, pupils having decayed teeth against distances away from the dental clinic, the findings were that the χ^2 value of 0.72 was such that 0.25<p<0.75, this implies that being far-away or closer to the clinic has no effect on caries expe-riences. However, the logistic regression results suggest the opposite in that pupils who were within

Table 5. Results of the three variable-selection procedures.

Method 1: All 19 variables included	B	p-value[1]	e^B
Constant	1.452	0.234	4.272
Sex	-0.188	0.349	0.828
Type of scholar (day or boarding)	-0.479	0.185	0.619
Whether pupil was staying with parents	-0.181	0.360	0.834
Ownership of toothbrush	0.121	0.771	1.128
Bleeding of gums when brushing teeth	0.166	0.451	1.181
Knowledge of other traditional methods	-0.220	0.341	0.802
Knowing all carbohydrate foods	0.133	0.556	1.142
Knowing which foods cause tooth decay	-0.490	0.111	0.613
Taking sweetened food after lunch	0.231	0.361	1.260
Carrying snacks of sweets daily	-0.020	0.947	0.980
Daily drink being soft drinks	1.189	0.012**	3.283
Sometimes going to bed with sweets	-0.435	0.045**	0.647
School tuckshop gives easy access to sweets	-0.214	0.342	0.807
Lunch box is made up of cookies/juices	-0.157	0.697	0.855
Eating cookies or cakes everyday	0.240	0.323	1.271
Knowledge of what causes tooth decay	0.651	0.003***	1.918
Can tell difference between tooth decay and gum disease	0.058	0.784	1.060
Distance to nearest dental clinic being within 10 km	-0.295	0.134	0.744
Visiting the dental clinic at least once a year	0.054	0.821	1.056
Method 2: Forward selection method			
Constant	-0.294	0.098*	0.745
Daily drink being soft drinks	1.122	0.013**	3.071
Knowledge of what causes tooth decay	0.619	0.003***	1.857
Method 3: Backward selection method			
Constant	-0.168	0.381	0.845
Daily drink being soft drinks	1.205	0.008***	3.338
Knowledge of what causes tooth decay	0.624	0.003***	1.866
Distance to nearest dental clinic being within 10 km	-0.330	0.082*	0.719

[1]One star *Indicates significance at the 10% level, **Indicate significance at the 5% level, *** Indicate significance at the 1% level.

pupils who were within 10 km of a dental clinic significantly reduced the odds by 30% of being found with caries (e^B=0.719; p=0.082) compared to pupils who lived more than 10 km away. The findings suggest that there is a need for health authorities to design oral health services that are universal, and that do not differentiate between pupils in terms of type of schooling (boarders or day-scholars), race, color, or creed.

It can therefore be concluded that, whilst all the other suggested explanatory variables were not statistically significant, it indicates to a large extent that the high caries occurrences found in the Northern region of Swaziland affects children alike. The study suggests that caries affect pupils uniformly, whether they are young or older; whether they are boarders or day-scholars; whether their gums bleed while brushing their teeth or not; whether they have knowledge of carbohydrates foods that that cause teeth to decay or not; whether they retire to bed chewing sweets or not; whether they snack with cookies or sweets; whether they visit the dental clinic at least once a year or not. In other words, these mentioned factors did not seem to affect the pupil's probability of having dental caries.

Influence on oral hygiene practices among teenagers

A proportion (78.7%) of the pupils claims to have been brushing their teeth either once or twice daily. This points to the fact that during most part of the day, they are at school, suggesting that there are currently serious limitations or unavailability of school dental health programs in most schools in the country. School dental health programs are the key in motivating children towards regular

tooth brushing both during school hours and at home. The primary measures in preventing dental diseases involve the maintenance of a good oral hygiene (Oregon Health and Science University, 2006; American Dental Association, 2004; International Food Information Council, 1998). Amongst boys, there was a consistent decrease in the proportion of pupils brushing their teeth frequently; whilst there was a concomitant increase in the proportion of girls brushing their teeth. In addition, the fact that the frequency of bleeding gums decreased with increased frequency of toothbrush possession does suggest regular use of a toothbrush to confirm ownership. Although when we ran the significance test on the number of carious teeth/mouth against the frequency of tooth brushing, the value was not statistically significant in that the χ^2 value (14.48) was such that $0.05<p<0.10$, thereby confirming any hypothetical belief in this regard. The test was only statistically significant at 10%, implying that the frequency of tooth brushing by individuals does have an effect on the number of carious teeth/mouth/an individual. These revelation calls for better strategies in the promotion of tooth brushing programs at all school levels.

Some schools in Swaziland are predominately rural, hence it is by no surprise that a proportion of 77.8% of the pupils claimed that they knew unconventional tooth cleansing devices. These may include certain types of traditional tooth brushing devices such as the use of certain chewing-sticks, roots of certain plants, and char-coal amongst others. Although this behaviour could not influence much of the caries experiences amongst many individuals as has been revealed through the statistical test. For instance when we tested the significance level on having decayed teeth (number) against knowledge of unconventional tooth brushing devices such as chewing-sticks and in others, it was found to be statistically not significant in that the χ^2 value of 4.58 was such that $0.25<p<0.75$. This suggests that having knowledge of some traditional tooth brushing devices or methods does not determine the number of carious teeth in an individual. However, further statistical analysis through the use of the binary regression, revealed that having knowledge of these traditional methods against having or not having decayed teeth was statistically significant ($p=0.006$). Although traditional tooth cleansing were the best alternatives in the past; nowadays, most people seem not interested in these methods. They consider chewing-sticks as too primitive.

The primary strengths of this study were the diverse differences between rural and urban locations of the selected schools which brought with it diversities in terms of frequencies and types of food consumptions, cultural inert beliefs, socio-economic status, etc. In addition, this approach enabled the youth to have freely expressed themselves through the use of the self-administered questionnaires without any intimidation form the researchers on their personal oral healthcare choices.

However, the sample used during the study represented an approximately 0.84% of the estimated total teenage population for generalization purposes. Another limitation is that a section of teenagers who were out of school during the exercise could not participate in the study. Further, the subjects did not undergo any clinical oral examination to detect their actual dental care status; hence, the reason why results do not make reference to any DMFT/dmft prevalence. Instead as highlighted, data were derived through self-administered questionnaires, a situation which has a likelihood of bringing in confounding variables.

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