

Caries experience in grades 1 and 6 children attending elementary schools at King Abdul-aziz Military City, Tabuk, Saudi Arabia

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لقد تمت دراسة مدى الإصابة بنخر الأسنان لدى طلاب الصفين الأول والسادس الابتدائي بمدارس مدينة الملك عبد العزيز العسكرية - تبوك - المملكة العربية السعودية وذلك من أجل :

أ - تحديد الوضع الحالي للمشكلة و ذلك لتقييم فاعلية البرامج الوقائية مستقبلا بمستشفيات القوات المسلحة بالشمال الغربية .

ب - دراسة الحاجة لاستبدال الاهتمام الحالي بالبرامج العلاجية بأخرى وقائية .

ج - المساعدة في تحديد الموارد المطلوبة لتطبيق برامج وقائية لصحة الأسنان بمستشفيات القوات المسلحة بالشمال الغربية .

د - تحديد الخط البياني الأساسي والذي يمكن عن طريقه قياس مدى فعالية البرامج الوقائية المستقبلية بمستشفيات القوات المسلحة بالشمال الغربية .

وباستخدام طريقة منظمة الصحة العالمية (W.H.O.) في المسح الخاص بصحة الفم والأسنان فقد وجد أن متوسط عدد الأسنان اللبسية المصابة بالنخر أو المفقودة أو الخشونة (dmft) بين طلاب الصف الأول (mean age = 6.02 ± 0.36 years) بمقدار ٧,٧٧ بينما متوسط عدد الأسنان الدائمة المصابة بالنخر أو المفقودة أو الخشونة (DMFT) بين طلاب الصف السادس (mean age = 11.12 ± 0.76 years) قد قدر بـ ٢,٩١ حيث لم يلاحظ أي اختلاف إحصائي بين الذكور والإناث في كلتا المجموعتين ، والجدير بالذكر أنه قد تبين أن نسبة الأسنان غير المعالجة (مصابة بالنسوس) في كلتا المجموعتين عالية جدا وقد بلغت ٨٣% . ولقد أظهرت النتائج المشتركة للاستبيان الخاص بالوالدين في كلتا المجموعتين أن ٢٤% من الذكور و ١٩% من الإناث نادرا ما يستخدمون فرشاة الأسنان أو لا يستخدمونها على الإطلاق مع ملاحظة أن عددا قليلا منهم قد استخدم معجون الأسنان قبل سن الثالثة مع انخفاض ملحوظ في نسبة الإناث عن نسبة الذكور في استخدام معجون الأسنان حيث تراوحت النسبة بينهم من ٧% - ١٩% على الترتيب . وقد أحاب غالبية من شملهم الاستبيان أن أطفالهم يتناولون الحلويات والمرطبات بانتظام بين الوجبات ، فقد أشار ٧١% من الذكور و ٦٧% من الإناث بأنهم يتناولونها مرتين أو أكثر في يوميا . ولقد تم تحديد نسبة الفلورايد في مياه الصنابير المتزلية بالمدينة العسكرية ووجد أنها تتراوح بين ٠,١٦ - ٠,٣٩ ملجم/لتر وهي تعتبر أقل بكثير من النسبة المثلى وهي ٠,٧ ملجم/لتر . وقد أوضح الاستبيان أن حوالي ثلث أطفال المدينة العسكرية يشربون من مياه الصنابير ، وأن عددا قليلا منهم يستخدم مياه الشرب المعساة تجاريا والتي تحتوي على ٠,٧ ملجم/لتر فلورايد . أما النصف الآخر من الأطفال فيستخدمون مياه الشرب من محطات التحلية ، والجدير بالذكر أن نسب الفلورايد في تلك المحطات غير معروفة وهي بحاجة للتجديد . وقد طرحت أيضا العقبات المتوقعة والتي ستواجه تطبيق برنامج وقائي لصحة الفم والأسنان في المستشفيات العسكرية بالمملكة العربية السعودية والتي تحتاج للتعريف بها والتأييد للحلول المقترحة وهذه الدراسة الحالية قد ساعدت في إلقاء الضوء مع وضع الحلول للعقبات الأساسية في برنامج مستشفيات القوات المسلحة بالشمال الغربية . وقد تمت الموافقة على المقترحات والتسهيلات وتسخير الموارد البشرية ، وتضمنت هذه التسهيلات إقامة مركز لصحة أسنان الطفل والذي يعتبر الأول من نوعه على مستوى المملكة . وفي النهاية فإن معرفة الحاجة المناسبة للحالات العلاجية والتي تعتبر إحدى العقبات لتطبيق سياسة وقائية ببرنامج مستشفيات القوات المسلحة بالشمال الغربية فإن تطبيق البرامج الوقائية قد أقرح كوسيلة من وسائل تقليل المعدل المرتفع حاليا للنسوس .

Caries experience in grades 1 and 6 children attending the elementary schools at King Abdul-Aziz Military City, Tabuk, Saudi Arabia was investigated In order to (a) highlight the extent of dental disease in the community, (b) assess the need to change emphasis from restorative-oriented to preventive-oriented dental services, (c) assist in determining the required resources to implement a preventive oral health program and (d) determine base line data to monitor the effectiveness of future preventive programs at Northwest Armed Forces Hospitals (NWAFFH). Using the World Health Organization basic methodology for oral health surveys, mean primary dmft for children in grade 1 (mean age = 6.02+0.36 years) was found to be 7.77 and permanent DMFT In grade 6 (mean age -11.12±0.76 years) was 2.91 with no statistical difference between gender in both groups. The untreated (decayed) component in both groups was very high at 83 percent. The combined results of a survey questionnaire for parents of children in both groups revealed that 24 percent of boys and 19 percent of girls rarely or never brush their teeth, and that few used toothpaste before three years of age with females significantly less than males (7 and 19.5 percent, respectively). The majority of respondents said that their children regularly consume sweet foods and beverages between meals, 71 percent of boys and 67 percent of girls indicating they indulge twice or more each day. The fluoride ion levels In domestic tap drinking water on the military cantonment were determined and found to be below optimum

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levels, ranging from 0.16 to 0.39 mg/l. The survey questionnaire revealed, however, that only about one third of children obtain drinking water from the cantonment, with a relatively small number from commercially bottled water (0.70 mg/l fluoride ion) and about half from private water treatment stations. The

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levels of fluoride ion of the latter are unknown and need to be determined. Possible barriers to the implementation of preventive oral health programs in military hospitals in the Kingdom of Saudi Arabia were presented and the need for their identification and resolution advocated. Thus the present study has helped to highlight and resolve the major barriers at NWAFFH, so that proposals for new facilities and human resources have been approved. These include establishment of a Child Dental Health Centre, which is thought to be the first government facility of its kind in the Kingdom. Finally, recognizing the currently high demand for restorative services as one of the barriers to the implementation of a preventive policy at NWAFFH, employment of the atraumatic restorative technique (ART) was suggested as a means of reducing the current high level of untreated caries.

Introduction

References abound in the literature to marked reductions in caries prevalence in industrialized countries over the past two decades.¹⁴ This has been widely attributed to water fluoridation and use of fluoride tooth pastes, as well as application of fissure sealants and professional application of topical fluoride medicaments. In contrast, however, there have been reports of high and/or increasing caries prevalence, especially in primary teeth, in some developing nations including Saudi Arabia⁵⁹ and other Middle East countries.^{10,12}

Despite these trends in patterns of dental caries, the current database profiles of military hospitals in Saudi Arabia servicing military personnel and their dependants appear to sustain a major emphasis on traditional restorative services. The dentist to eligible patient ratio at Northwest Armed Forces Hospitals (NWAFFH) is currently around 1:8,000 and the Department of Dental Services is overwhelmed with the demand for comprehensive restorative treatment. Prior to the present survey there was no specialist/consultant position in public health dentistry, and the three hygienists in post were mainly employed in scaling and cleaning teeth in adults. There were no positions dedicated to dental health education, and individual dentists and hygienists exercised "prevention" on a one-to-one basis during normal daily practice. Based on anecdotal evidence, a similar situation has prevailed in other military hospitals.

Clearly a change in emphasis in dental services at NWAFFH was deemed necessary in order to reduce the seemingly high prevalence of dental caries. It was considered appropriate to determine the extent of the problem by means of a survey of dentition status, commencing with Grades 1 and 6 children attending schools at King Abdul-Aziz Military City (KAAMC). These two cohorts were judged important from the point of view of future introduction and monitoring of preventive strategies, and opportunistic for observing eruption of permanent molars with a view to the application of fissure sealants.

Burt¹³ has argued that the principal benefits of surveys of dental caries are in (a) monitoring trends in oral disease when the surveys are repeated periodically; and (b) giving dental health a visibility it might otherwise not get among policy-makers. Thus the aims of the present survey were to: a) highlight the extent of dental disease in the NWAFFH community, b) assess the need to change emphasis from restorative-oriented to preventive-oriented dental services, c) assist in determining the required resources to implement a preventive oral health program and, d) determine baseline data to monitor the effectiveness of future preventive programs at NWAFFH.

Materials and Methods

Following approval by the NWAFFH Medical Research Committee, 503 Grades 1 and 6 children (263 females and 240 males) were randomly selected by proportional representation from 95 class lists in 16 KAAMC schools consisting of 1417 grade 1 and 1314 grade 6 children (male and female). The number of children invited from each class ranged from 3 to 7 with an average of 5.3 per class. Invitations were sent to respective parents, including the offer of preferential treatment for their children's current dental needs in return for participation in the survey.

A team of 10 calibrated examiners recorded the dentition status using the DMFT indices based on the World Health Organization (WHO) methodology for oral health surveys.¹⁴ Instrumentation included blunt sickle probe, mouth mirror and lighting from identical dental units in the NWAFFH Department of Dental Services.

Two members of the team were appointed Chief Calibration Examiners and given the responsibility of training the team according to the WHO criteria. They independently examined five children of various ages and compared their respective recordings. Any differences were discussed with reference to the WHO criteria. Following an initial training lecture, the other eight members of the team each examined a minimum

of five children with their recordings independently checked by the Chief Calibration Examiners. Any differences were discussed with reference to the WHO criteria.

All examiners attended a follow-up lecture, including discussion on any issues requiring clarification, and a summary of the key points distributed for ready reference during the survey. The survey took place over a period of two weeks with the majority of children examined in the first week. On the first day of the survey, there were four examiners, including the two Chief, Calibration Examiners. Each of the latter was paired with one of the other examiners and independently examined the first ten children. Any differences were discussed and agreement reached after reference to the WHO criteria. After examining the first ten subjects, the pairs were changed for the following ten subjects.

On the proceeding days of the survey, the two Chief Calibration Examiners teamed up with each new examiner in turn for the first five examinations. Thereafter, all examiners recorded data independently. The two Chief Calibration Examiners, however, acted as consultants throughout the period of the survey. Any questions or doubts were referred to them for adjudication.

Clinical data were recorded on optical scan forms designed by The University of Melbourne, Australia. The examination recorded tooth status as falling into one of the following categories: Sound; Decayed; Filled & Decayed; Filled; Satisfactory; Missing; Caries; Missing; Not Caries; Trauma; Crown/Bridge; Unerupted.

Completed scan forms were forwarded to The University of Melbourne and data scanned onto computer using a Century 3000 optical scanner. The data was imported into SPSS/PC+ version 4.0 (Statistical Package for Social Sciences) for statistical analysis of both groups of cohorts.

A standard t-test was applied to determine whether there was any difference in dmft (cohort 1) and DMFT (cohort 2) between males and females. Additional statistical analyses were undertaken for the 6 year-olds in cohort 1 and 12 year-olds or more in cohort 2. The fluoride levels of tap water at all domestic locations in the military area were determined by the SPADNS method.¹⁵

Finally, a questionnaire was given to each parent and child for completion* prior to examination. Interpreters provided assistance where necessary. Questions were related to length of time the child had lived in Tabuk, frequency of brushing, use of toothpaste, use of miswak, frequency of consumption of sucrose-

containing foods and beverages between meals, parent's perception of child's dental health status, and source of drinking water consumed in the home. The data from the questionnaire were entered directly into Microsoft Excel version of Office 97 Standard Edition and the chi square test was applied to determine whether there were any statistical differences in response between gender.

Results

Parents representing 314 children (175 females and 139 males) from 15 schools agreed to include their children in the study. One school for females did not cooperate with the return of parent responses.

Of the 314 children offered appointments through the respective schools, only 257 (136 females and 121 males) actually presented for examination, that is 51 percent of the 503 originally invited. Of these 86 (90 percent) out of a total of 95 classes were represented by at least one child, and 75 (78 percent) had 2 or more representatives from the same class.

The representation from Grade 1 (Cohort 1) was 124 (64 female and 60 male) and Grade 6 (Cohort 2) was 133 (72 female and 61 male). The number of valid forms, however, were 123 (63 females and 60 males) and 131 (70 female and 61 male) respectively. The distributions by gender in relation to the total number of children attending Grade 1 were 8.6 percent for females and 8.8 percent for males, and 10.3 percent for females and 9.6 percent for males attending Grade 6. Mean ages and frequencies are shown in Tables 1 and 2.

Table 1. Cohort 1: Age distribution.

Age	Frequency	Percent
5	7	5.7
6	107	87.0
7	9	7.3
Total	123	100.00

Mean age: 6.02±0.36 years

Mean primary (dmft) for cohort 1, mean primary (dmft) for 6 year-olds, dmft by categories (6 year-olds), mean permanent (DMFT) for cohort 2, DMFT by categories (cohort 2), and mean permanent DMFT for age 12 years and over from

Table 2. Cohort 2: Age distribution.

Age	Frequency	Percent
10	18	13.7
11	89	67.9
12	18	13.7
13	4	3.1
14	1	0.8
15	1	0.8
Total	131	100.00

Mean age: 11.12±0.76 years

Table 3. Cohort 1: Mean primary dmft (n=123).

	Decayed	Missing	Filled	dmft
Mean	6.46	0.69	0.63	7.77
Std. Deviation	4.56	1.27	1.19	4.88

Table 4. 6 year-olds: Mean primary dmft (n=107).

	Decayed	Missing	Filled	dmft
Mean	6.37	0.67	0.62	7.66
Std. Deviation	4.60	1.28	1.17	4.95

Table 5. 6 year-olds: Severity of caries experience (dmft) by category.

dmft	Number	Percent
0	8	7.5
1-4	23	21.5
5-9	39	36.4
^10	37	34.6
Total	107	100.00

Table 6. Cohort 2: Mean permanent DMFT (n=131).

	Decayed	Missing	Filled	dmft
Mean	2.42	0.11	0.38	2.91
Std. Deviation	2.16	0.36	0.79	2.24

cohort 2 are shown in Tables 3 to 8, respectively.

There were no significant differences in dmft or DMFT between males and females in cohorts 1

Table 7. Cohort 2: Severity of caries experience (DMFT) by category.

DMFT	Number	Percent
0	31	23.7
1-4	82	62.6
>5	18	13.7
Total	131	100.00

Table 8. 12 years and over: Mean permanent DMFT (n=24)

	Age	Decayed	Missing	Filled	dmft
Mean	12.38	3.17	0.17	0.17	3.50
Std. Deviation	0.77	2.44	0.48	0.38	2.74

or 2, respectively.

The fluoride ion levels in domestic tap drinking water under military jurisdiction ranged from 0.16 to 0.39mg/l.

Due to a misunderstanding by the recording clerks in the allocation of patient codes on the questionnaire forms, the results could not be correlated to the individual caries scores. A differentiation between male and female could, however, be obtained. A total of 253 valid forms (137 females and 116 males) were received and collectively analyzed according to gender. The responses to questions are tabulated in Table 9.

Discussion

Because of the low dentist/population ratio at NWAFFH, high caries experience and demand for dental services, it has not been possible to organize a school dental service, including a recall/monitoring system. Therefore, the method described above was the only way of selecting the participants in the survey. Nevertheless, the proportions of males and females in both cohorts were similar and, apart from one school (female), the sample contained a balanced representation.

The numbers of children examined also exceeded the recommended sample sizes for a population with high caries prevalence.¹⁴ On the other hand, since the actual sample was based on parental acceptance of invitations (51 percent of the original random selection), it must be considered that the offer of preferential treatment could have been a source of bias.

The NWAFFH program is a service facility and the research project was planned to focus on two

Table 9. Cohorts 1 and 2: Responses to questionnaire.

	Mal (%)	Female (%)
1) Has your son/daughter lived all their lives in this area?		
a) Yes	83	81
b) No	17	19
2) How often does your son/daughter brush his/her teeth?		
a) Two or more times a day	43	49
b) Once a day	26	21
c) Rarely	24	19
d) Never	07	11
3) When did your son/daughter first start using toothpaste?		
a) Before three years of age	19.5	07*
b) About three years of age	26	28
c) When he/she started school	35	28
d) Other (Responses below)		
i) Never	10	07
ii) Don't know	2.5	11
iii) Various	07	19
4) How often does your son/daughter use the Miswak?		
a) Two or more times a day	15	08
b) Once a day	08	05
c) Rarely	53	23§
d) Never	24	64+
5) How often does your son/daughter eat sweet foods or drinks (such as biscuits, cakes, sweets, coca-cola, pepsi,7up, etc) between normal meals?		
a) Never	03	06
b) Rarely	23	24
c) Once a day	30	35
d) Two to three times a day	26	26
e) Four or more times a day	09	06
f) Don't know	09	03
6) How do you think your child's teeth are at the moment?		
a) Healthy, no visit to the dentist needed	03	15f
b) Healthy, but his/her teeth need to be checked	25	22
c) Has decayed teeth/tooth but no pain	46	36
d) Has broken teeth/tooth but no pain	05	04
e) My child has toothache sometimes	12	12
f) My child has toothache often	04	06
g) Don't know	04	04
h) Other	01	01
7) The drinking water in your home comes through		
a) Tap	28	38
b) Bottle	17	09
c) Private water treatment stations	45	50
d) All the above	10	03
* (x ² = 4.00, P<.05)		
§ (x ² = 7.15, P<.008)		
t (x ² = 11.18, P<.0008)		
t (x ² = 5.14, P<.02)		

specific target groups. Grades 1 and 6, rather than on specific age groups. In any case, it was not possible to identify ages of children from the class

lists provided and dates of birth registered in some parts of Saudi Arabia are often only approximate. A variation was therefore to be expected due to differences in age at the date of admission to school (Tables 1 & 2).

Nevertheless, the majority of children in cohort 1 were registered as 6 year-olds (87 percent) and a separate analysis was undertaken of this group for the purpose of comparison with other studies. Whether referring to the dmft of cohort 1 (Table 3) or 6 year-olds (Table 4) makes little difference to the discussion. The percentage of 6 year-olds caries free, 7.5 percent (Table 5), was well below the WHO recommended national goal of 60 percent by year 2000¹⁶ and an alarming number of children (34.6 percent) had dmft > 10. Of particular relevance was the very high, untreated component of the dmft index at 83 percent. Presumably, the conditions were left untreated either because of failure to seek treatment or because of non-availability of a dentist. Considering that the participants in this survey were offered preferential access to treatment, this suggests that they had not been able to readily obtain treatment in the past. Therefore, it appears that present resources are unable to cope with either the need or demand for dental services.

The percentage of fillings in primary dentition (df/index) was 9 percent compared to the national goal of 60 percent by year 2000.¹⁶

The mean DMFT for cohort 2 was 2.91 (Table 6). This is relatively high considering that the majority in this cohort were 11 year-olds or under (81.6 percent). The DMFT for this cohort already exceeds the WHO recommended national goals 2000 of not more than average 2.1 DMFT at age 12 year-old.¹⁶ As in the 6 year-olds, the highest proportion of the component was untreated caries (83 percent). The percentage of fillings in the DF index for this cohort was 14 percent, which contrasted with the national goals for 2000 that the percentage of fillings should be 80 percent or more in the permanent dentition.¹⁶ Only 23.7 percent of children in cohort 2 were caries-free (Table 7).

The mean permanent DMFT for 12 year-olds and over was also determined (Table 8), but the small number in the group (n=24, including 6 over 12 years) should be taken into account. The mean DMFT was 3.5 and the highest component of the index was untreated decay (91 percent). The proportion of filled teeth in the DF index was only 5 percent.

In the present study, there was no significant difference in dmft or DMFT between males and females in cohorts 1 and 2, respectively. This

concur with a study on caries experience (dmft) of 5 year-olds in AlKharj,⁹ (dmft and DMFT) in children residing in communities with differing levels of natural fluoride in drinking water,¹⁷ and another in 12-13 year-old children in Riyadh.¹⁸ Others have reported differences, some higher in females,^{19,20} another higher in males.⁵

One explanation²⁰ given for higher caries rate in females was the earlier tooth eruption dates. The same author also alluded to the possibility that caries prevalence was less in males due to higher frequency of using miswak, which may have contributed to prevention of caries. However, another study reported inconsistent observations amongst pre-school children from three different regions in Abu Dhabi.¹⁰ The variations, therefore, suggest that differences in lifestyle due to cultural practices in some areas may also be a plausible explanation.

A number of interesting findings were recorded in the answers to the questionnaire, although it must be borne in mind that the reliability of interview data has been brought into question, particularly in relation to recalling age at which infants' tooth cleaning begins.²¹

For example, the responses to frequency of brushing were similar in both genders and a relatively high percentage (31 percent males and 30 percent females) rarely or never brush their teeth. Few started using toothpaste before three years of age, with females significantly less than males (7 and 19.5 percent, respectively). The latter could be due to cultural preference for male children with the possibility of greater concern assigned for their welfare. Worthy of note was the number of responses indicating that the child had never used toothpaste (male 10 percent, female 7 percent).

There was a highly significant difference in gender with respect to some responses related to use of miswak. More males responded using it rarely compared to females (53 and 23 percent, respectively), and almost three times as many females than males (64 and 24 percent) indicated they never use it. On the other hand, miswak was claimed to be part of daily practice at least once a day in 23 percent males and 13 percent females, but the difference in gender was not significant. This difference compares to an earlier study in primary school children in Riyadh, which reported use of miswak in 33 percent boys and 10 percent in girls, although no evidence for any statistical difference was reported.²⁰

The majority of respondents said that their children regularly consume sweet foods and

beverages between normal meals, 35 percent of males and 32 percent of females indicating they indulge twice or more each day. This is of major concern as the detrimental effects of high sugar consumption on caries prevalence, particularly in an environment of low fluoride exposure and poor oral hygiene, are well known.

In the Middle East, average sugar use was reported to be higher than that of other developing countries,²² and it has been proposed that control of dietary sugar should be included as part of the management of caries in children.¹⁸ Unfortunately, it is very difficult to break such a habit established early in life.^{23,24}

Reservations regarding reduction of sugar consumption have also been raised because of the danger of increasing fat consumption,²⁵ and high sugar use in developed countries has been compensated by increased exposure to fluorides rather than by controlling consumption. Therefore, control of sugar consumption should be confined mainly to encouraging reduction in use between normal meals.

Significantly, more parents perceived that their daughters' teeth were healthy compared to their male counterparts, but no explanation is offered. Many parents (males 46 percent, females 36 percent) judged that their children had decayed teeth but no pain, and a relatively high percentage mentioned that their child had toothache "sometimes" (males and females 12 percent) or "often" (males 4 percent, females 6 percent).

With respect to the high, untreated component of the caries index in this study, similar findings have been reported in both primary and permanent dentitions in Saudi Arabia^{5,9,17,18} and other Middle East countries,^{10,12,19,26} thus highlighting the importance of prevention. The latter should, indeed, be the highest priority for governments and providers of dental services at all levels.

With permission from the Ministry of Defence, Medical Services Division, (MODA MSD) a survey of database profiles of the major military hospitals in the Kingdom revealed that the main emphasis of dental departments is currently directed towards restorative services, with few or no organized preventive services. Following a restorative dentistry track alone, however, will not prevent disease. Indeed, studies on the impact of dental treatment on the incidence of dental caries in children and adults^{27,28} have demonstrated that the effect is small. Furthermore, it has been pointed out that the role of dental services in reducing dental caries may rest in the non-

personal services for example, water fluoridation, fluoridated toothpaste, non-cariogenic snacks and drinks and oral health education in schools.²⁸

There appear to be several, plausible barriers, however, to implementation of preventive programs, including personal and non-personal health services, in military hospitals in Saudi Arabia. These barriers are postulated as follows:

i) Staff databases of dental services in military hospitals appear to remain locked in existing profiles with an emphasis on restorative services, and individuals with similar designations replace retiring professional staff members.

ii) There appears to be a scarcity of existing professional staff trained in community and preventive dentistry, and an apparent lack of interest in the specialty from Saudi graduates.

iii) Low dentist/population ratios and high demand for dental treatment may be overwhelming and consuming the focus of dental service facilities.

iv) Some departments may be too small and/or isolated to undertake any effective preventive activities. Also, it appears that dentists are often posted to isolated areas on temporary assignments.

v) There may be failure to communicate the problem to medical and hospital managers. The latter are usually medically or management oriented and may not fully understand the nature and extent of dental disease.

vi) Finally, lack of immediate and visible results of preventive programs could also be a barrier.

More research at a national and local level is required to address the high caries prevalence in Saudi Arabia, and barriers to implementation of preventive dental programs need to be identified and resolved. Indeed, with respect to military hospitals, these barriers could be more effectively addressed through a Preventive Oral Health Management Group administered centrally by MODA MSD. The present study has helped to highlight and resolve the major barriers at NWAFFH, so that proposals for new facilities and human resources have since been approved. These include establishment of a Child Dental Health Centre, which is thought to be the first government facility of its kind in the Kingdom. In addition, changes made within the existing database have allowed for the appointment of a specialist in public health dentistry, five dental

therapists and four dental health educators. These positions will provide the nucleus of a preventive team to target mainly pre-school and elementary schoolchildren.

The appointment of dental therapists could be considered controversial. In fact, a proposal for greater utilization of dental therapists has already been proposed,²⁹ but appears not to have been implemented in Saudi Arabia to date. However, recent advocates have called for increased utilization of dental auxiliaries,^{30,31} and the appointment of dental therapists and dental health educators is now considered pivotal to the planned preventive programs at NWAFFH.

Following current ideas on targeting high-risk groups,²² dental therapists will undertake screening examinations of primary school children commencing with Grades 1 and 6. Children identified with high caries levels will be placed on an intensive preventive program, including dental health education, dietary counseling, fissure sealing of permanent molars, topical fluoride applications, and recalled at intervals according to individual risk assessment. Urgent cases will be referred to paedodontists for specialist treatment. Parents of children identified in high-risk categories will also be contacted and invited to attend dental health education sessions presented by dental health educators. This may also have an indirect and beneficial impact on siblings, who are likely to have similar high caries risk.

The detection of early childhood caries in infants and toddlers has also been advocated through identification of early signs of the disease and addressing the social and economic factors associated with families where it is prevalent.³² Dental health educators will therefore target parents of infants and pre-school children through peri-natal clinics and well-baby clinics in the main hospital. Medical practitioners and nursing staff could also be trained to identify young children at high risk.

The team approach will be extended to include the preventive medicine department and schoolteachers. Assuming the cooperation of the education authorities can be obtained the feasibility of daily, supervised tooth brushing with a fluoride tooth paste in schools will also be pursued. Introducing a systematic, preventive oral health program for school children will provide an opportunity to gather data on caries prevalence in order to evaluate its effectiveness, a regime considered plausible in localized populations.¹³

Concentrations of fluoride ion in domestic tap water at the time of the survey varied between 0.16

to 0.39 mg/l. These concentrations are below the level required for any optimal effect. Around one third of respondents to the survey indicated that tap water was the primary source of drinking water and a smaller proportion used commercially bottled water, with optimum levels of 0.7 mg/l fluoride ion. About half of the respondents, however, indicated that the main source was derived from private water treatment stations. The levels of fluoride ion from the latter need to be determined, and further investigation needs to be carried out, following the finding that children acquire drinking water from different sources.

In the meantime, children should be instructed in tooth brushing using small amounts of fluoride toothpaste without rinsing the mouth afterwards so that the topical effect of fluoride is enhanced.

Finally, recognizing the currently high demand for restorative services as one of the barriers to implementation of a preventive policy at NWAFFH, employment of the atraumatic restorative technique (ART) using glass ionomer restorative material³³ could be advocated as a means of reducing the current, high level of untreated caries. ART has been shown to be an effective treatment modality in the management of dental caries,³⁴ and consideration could be given to the employment of systematic restorative treatment in primary teeth in elementary grade children. Such a task could be designated to paedodontists, GP dentists, dental therapists and dental hygienists following screening examinations by dental therapists. This would amount to employment of long term temporary restorations for many more patients than can presently be treated by a few paedodontists currently employing traditional and more complicated procedures such as provision of stainless steel crowns.

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