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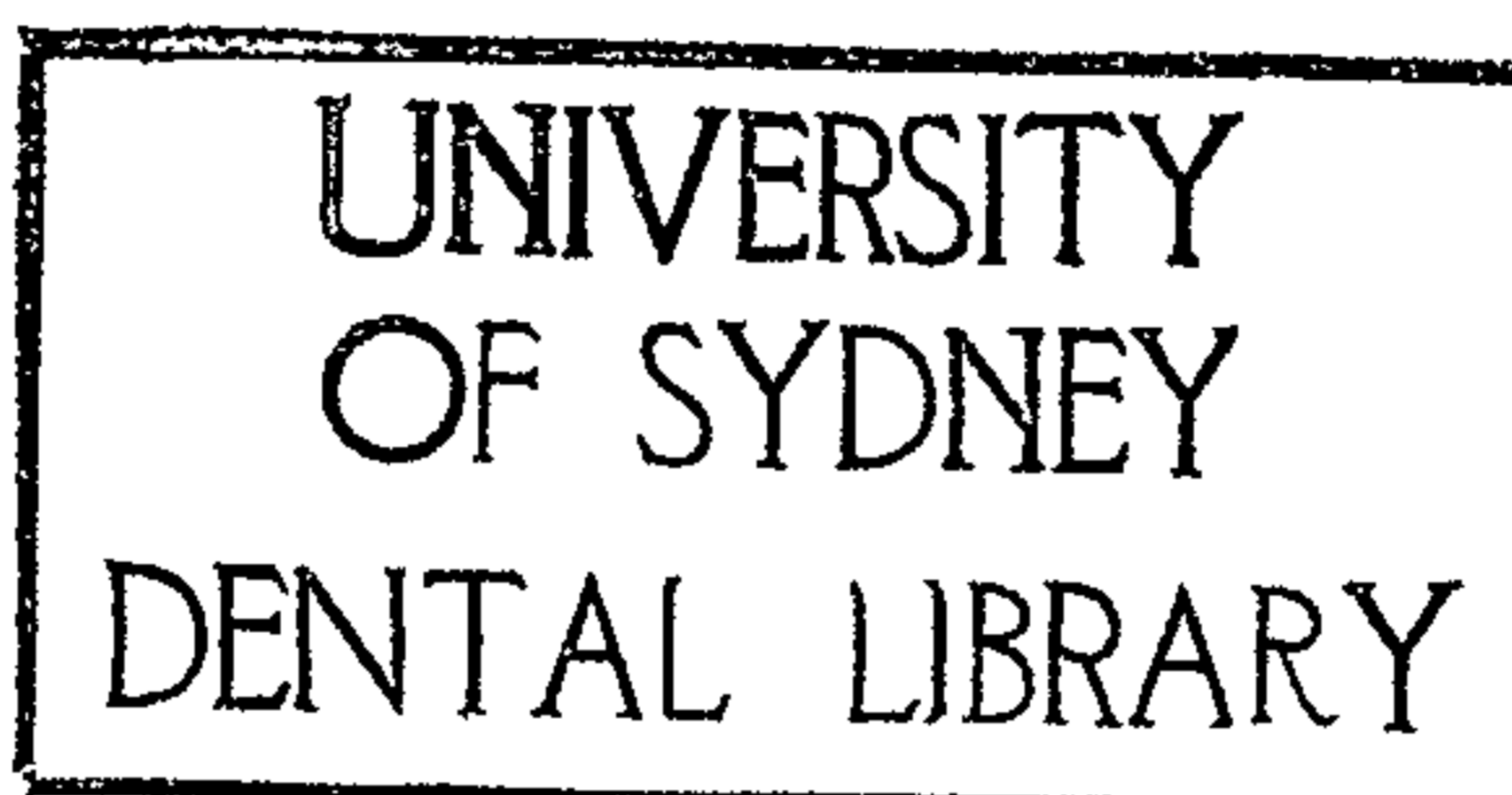
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SURVEY OF DENTAL CARIES EXPERIENCE OF
6, 9 AND 11 YEAR OLD NI-VANUATU SCHOOL
CHILDREN IN VILA

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A thesis submitted in partial requirement
for the
DIPLOMA IN PUBLIC HEALTH DENTISTRY

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1986

SUMMARY

A survey of the dental caries experience in the permanent dentition of 6, 9 and 11 year old children attending primary schools in Vila was carried out by the writer in May, 1985. The results of the survey are presented.

The aim of the survey was, to obtain baseline data on the dental caries experience of school children following the introduction of a school based program of prevention for primary school children in Vila in 1985. Activities in the program include weekly fluoride mouth-rinsing, daily toothbrushing drills, dental health education and screening of children.

Over 2,000 children were involved in the school based program. This is between 65% to 70% of the total number of primary school children in Vila.

A review of the value of such preventive activities in school dental services is presented.

For this survey, it was decided to follow WHO protocol where practical and to examine children, both males and females, in a sample of age groups (6, 9, 11 years).

A sample of 361 children was examined of whom 187 were males and 174 were females.

The conditions observed and recorded were the prevalence of dental caries and the mean number of decayed, missing and filled permanent teeth per child in each age

group.

An analysis of the total components of DMFT scores recorded showed that 74% accounted for decayed permanent teeth, 15% and 11% accounted for missing and filled permanent teeth, respectively. Furthermore, the decayed and missing tooth components increased with age.

The mean number of decayed, missing and filled permanent teeth per child (DMFT) were 0.37, 0.87 and 1.31 for the 6, 9 and 11 year olds, respectively. Severity of dental caries of the age groups in the study is very low according to WHO standards.

These mean DMFT figures were even lower than the findings of Hollis⁷ in 1970. The mean DMFT figures presented by Hollis⁷ were 0.66, 2.05 and 3.32 for the 6, 9 and 11 year olds, respectively.

Factors associated with dental caries and affecting the provision of dental service in and to the children in Vila respectively, have been discussed in the presentation.

Improvements to clinical dental care delivery to children including an organised program of prevention to children, parents and others is proposed as a means of avoiding any increase in the prevalence of dental caries in children in Vila.

ACKNOWLEDGEMENTS

I wish to acknowledge the assistance and support given to me by Associate Professor P.D. Barnard, of the Department of Preventive Dentistry, University of Sydney, in the compiling of this thesis. His guidance, encouragement and assistance were very much appreciated.

I also wish to thank the following organisations and people:

1. World Health Organisation who sponsored me on this D.P.H. (DENT.) program.
2. The Ministry of Health in Vanuatu, for allowing me to continue and complete my study.
3. The staff of the Training Centre, the Chairman and Members of the Public Service Commission.
4. Mrs. Toumelu M. Kalsakau, for her assistance at the dental examination and recording of the data.
5. The head teachers of all the primary schools involved, for allowing me access to their students and to the students themselves for taking part in the survey.
6. My wife, Rachel, and my children, Rhoda, Michael, Julie and Kate, for their patience, support and encouragement during the course of my studies.

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1. INTRODUCTION

The writer has chosen this thesis topic because of its relevance to the type of school based dental program that he is directly involved with in Vanuatu.

There is a need for a baseline study for the program in Vila, Vanuatu, for the purpose of evaluation, in assessing the benefit of the dental program on children's dental health. Over 2,000 children are participating in the dental program. This is approximately 65 to 70% of the total number of primary school children in Vila.

The data collected will not only be used as a basis for comparison in the future but more so, it will give an indication of the present state of dental caries of this priority group of school children in the community. Data from a survey would also be a valuable aid to the planning of a school dental service.

Barnes (1975) has said that Dental Health Services should logically be based on a survey of dental problems and demands for dental services. Therefore, no services can be well developed without a knowledge of disease levels and trends.

After any baseline study, regular surveys are needed to determine the changing prevalence of dental caries and dental needs. Change in the prevalence of dental caries will usually indicate a need to change the direction or type of service.

Another important aspect of evaluating programs is to see if the program has produced the benefit expected from it.

Programs do take a lot of time and a good amount of available resources. Unless monitoring systems are properly established, valuable time, money and manpower resources can be wrongly utilised.

In developing countries, where resources are not readily available, wastage of resources should be avoided and the resources should be used for cost-effective programs.

Government Dental Services in Vanuatu until 1983, were available only in Vila. The service was heavily curative orientated with the bulk of its responsibility directed towards a relief of pain and infection type of service.

A second dental centre was established in the Northern Region of Vanuatu in 1984. This centre was also set up to provide a relief of pain and infection type of service.

In 1985, a program of dental policies and guidelines was drawn up by the writer and approved by the Directors of the Health Departments for implementation (see Appendix 1). This led to the establishment of a preventive component of the dental health service. Thus, the school based program in Vila is the first program of prevention established in the country as far as dental service is concerned.

In Vanuatu, there are five health administrative centres. Two centres have already had dental services within their hospitals. Three remaining centres will have a dental clinic, sometime in the future, when resources become available. The head of the dental centres will be responsible to the Principal Dental Officer in Vila. The Principal Dental Officer will be responsible to the Director of Health Services.

Currently, the government is employing two dental officers, one dental technician, two dental therapists and four dental assistants. The Government of China provides a dental officer and a dental technician under its Aid Program to Vanuatu. The Government of France provides also, under its Aid Program to Vanuatu, a dentist.

At present, there are three Ni-Vanuatu students in training overseas on a three year dental therapy program. Shortly, in-country training for six dental hygienists will commence. These hygienists will have three months' basic training in Vila and will be responsible for preventive activities within the dental health service in Vanuatu.

Clinical records are kept of children visiting the clinic for consultations and treatments. These records, however, are limited to children who visit the clinic usually only for the relief of pain and infections.

This observation has brought strong concern and interest to establish a program with an attempt to dentally educate Ni-Vanuatu children.

In order that the benefit of the program can be assessed in terms of its value to those receiving it, baseline data is needed at this stage.

In this thesis, the writer has given some details of the school dental services in Vila, has reviewed the value of preventive programs for school dental services and presents the method and results of a survey that he has conducted of dental caries experience of school children in Vila, Vanuatu.

2. THE SCHOOL DENTAL SERVICE IN VILA

2.1 PROGRAM

There are nine primary schools in Vila. Two of the nine primary schools consist of both Ni-Vanuatu and non-Ni-Vanuatu children. The school dental health program involves the seven primary schools with children of Ni-Vanuatu parents.

Activities within the program include:

- . a weekly mouthrinse with a 0.2% sodium fluoride solution;
- . dental health education;
- . applications of fissure sealants.

A weekly mouthrinse with a 0.2% sodium fluoride solution is carried out by all children in the schools participating throughout the school year. The only exclusion from the program are children in kindergarten.

Each class in the school has a mouthrinsing chart to record each child's participation. This chart is prepared by the school dental health section and then given to schools.

The school principal or a member of staff prepares the solutions for the program:

- 3 gm of sodium fluoride powder is dissolved in 1.5 litres of water in a graduated jug to give the 0.2% concentration required.

- 10 mls of this mixed solution is dispensed into each child's mug. Mugs are provided by the children. Fluoride powder, graduated jug, and a 10 ml measuring guide are provided by the dental health service.

Under the teacher's supervision and directions, the solution is taken into the mouth and is swirled around in the mouth for one minute before the child spits out the solution on to grass or back into the mugs. If it is back into the mug, tissue papers are used to absorb the solution. Tissues are then collected and disposed of into waste bins.

Dental health education, through a visiting school dental therapist, is directed towards toothbrushing, the right type of toothbrush, mechanics of brushing and when to brush. It also refers to diet and nutrition and the consequence of eating foods containing sugar too frequently. Emphasis is placed on the use of fluoride-containing toothpaste

The importance of visits to the dentist for regular check-ups is also stressed in the program.

Clinical dental examinations are done in the schools. Children needing treatment are served with notes which they take home to parents. An appointment date for a visit to the central clinic is indicated on the form.

Parents are responsible to see that their children attend the clinic as specified on the form.

On the visit, the child is given the treatment required and at the same time the parent is advised of the child's oral health status and of the care that is required.

Application of fissure sealant has been delayed for implementation from 1985 to 1987 at which time there will be available:

- . sealant materials
- . manpower
- . portable equipment.

The dental health education program is taken care of by a dental therapist who has done a basic dental therapy program with nine years in the service and a period of attachment with the dental health education unit in Singapore.

Mouthrinsing and toothbrushing are supervised in schools by teachers. Because of the manpower shortage, the use of the non-dental personnel is essential.

Oral health workshops are held with teachers to enlighten them on the common dental problems, the consequence of neglect and how to prevent their onset. Two workshops of this nature have been run in the country in 1985 and 1986. The World Health Organisation provided the finance and a consultant on both occasions.

2.2 DENTAL CARIES

Vila is the main urban centre in Vanuatu.

In mid 1985, its population was estimated to be 11,260, which is 18.3% of the total population. This is an increase from the 4920 and 9971, respectively, at the 1965 and 1979 census.

Overall, the Vanuatu population is said to be very young, as 44.3% is under the age of 14 years and there are slightly more males than females - 51.6% to 48.4%.¹³

The flow of people from rural villages and outlying islands into Vila is said to be one of the factors associated with the increase in Vila's population.

Hollis⁷, in his survey report of 1970 (16 years ago), commented on this movement of people from villages into town.

In the same dental survey report, Hollis⁷ showed that among 11 to 12 year old children 76% in Vila had dental caries in their permanent teeth. In Luganville Town, the figure was 60%. In Ambae and Ambrym, which are non-urban areas, the figure was 31% and 4%, respectively.

In terms of the mean number of decayed permanent teeth per child in the 11 to 12 years of age group, there was a DMFT mean of 3.32 in Vila; 2.43 in Santo (Luganville); 0.88 in Ambae and 0.17 in Ambrym.

Of these decayed teeth, only a very low percentage had been treated with fillings - 4% in Vila; 14% in

Luganville; 0% in Ambae and Ambrym.

The high prevalence rate of dental caries in Vila and Luganville as compared with Ambae and Ambrym is indicative of the fact that the former are the areas where sugar-containing foods are readily available.

Though the traditional diet of taro, yam, coconut, cassava and banana is regarded as rich in carbohydrate, Hollis⁷ indicated that among children and adults living in remote areas of Vanuatu, the prevalence of dental caries for people consuming the traditional diet was low.

Sugar is second to rice (48%) out of the total food items imported into the country.¹⁴

The Vanuatu Bureau for Statistics on trade figures showed that in 1982 sugar and confectionary consumption was 9 kg per person. In 1984, the figure was 12 kg per person, giving a consumption increase for the period 1982-1984 of 33%.¹⁴

3. PROGRAMS FOR PREVENTION OF DENTAL CARIES

In this brief literature review, reference is made to countries, both industrial and developing, that have carried out baseline and regular surveys that demonstrate effectiveness of preventive programs.

Reference is also made to communities with school based preventive programs comprising of mouthrinse, dental health education and application of fissure sealants.

Prevalence of dental caries is generally said to be on a decline in industrialised countries and generally increasing in developing countries. In both situations, though, some countries show no signs of changes.

The extent of reduction differs again within countries from a notable significant change to a moderate or little change.

Within developing countries again the prevalence of dental caries ranges from low to a very high rate.

Table 1 and Table 2 show existing survey data, DMFT at 6 years old and DMFT at 12 years old for baseline and follow-up surveys in some industrialised countries.

All countries with baseline for 6 year olds have shown a reduction in DMFT figures. Some are quite significant as in the case of Australia and Finland, while some like Japan have shown moderate or little change.

For DMFT at 12 years old in industrialised countries, Australia, New Zealand, Norway and U.S.A. show a decline in the prevalence of caries. Japan has shown no change at

Table 1. DMFT at 6 years in some highly industrialised countries at baseline and follow-up surveys.

COUNTRY	BASELINE		FOLLOW-UP SURVEY	
	INDEX	YEAR	INDEX	YEAR
AUSTRALIA	0.51	1977	0.16	1982
JAPAN	0.68	1975	0.61	1980
FINLAND	1.2	1975	0.3	1982
NORWAY	0.6	1973	0.2	1977

Source: Joint FDI/WHO Working Group 5 (1984).

Table 2. DMFT at 12 years in some highly industrialised countries at baseline and follow-up surveys.

COUNTRY	BASELINE		FOLLOW-UP SURVEY	
	INDEX	YEAR	INDEX	YEAR
AUSTRALIA	4.78	1975	2.80	1980
U.S.A.	4.0	1965	2.7	1980
JAPAN	5.9	1975	5.9	1980
GERMANY F.R.	6.0	1973	6.2	1983
NEW ZEALAND	6.0	1973	3.3	1983
NORWAY	6.7	1973	4.4	1982

Source: Joint FDI/WHO Working Group 5 (1984).

all and the Federal Republic of Germany showed an increase in 1980 from the baseline of 1973.⁸

The high levels of dental caries in industrialised countries is related to a very high sugar consumption rate. Some countries with a decrease in sugar consumption per capita, show a reduction in dental caries levels. Countries with an increase in sugar consumption rate per capita, show an increase in dental caries level.

Australia was traditionally one of those countries with high levels of dental caries and a very high sugar consumption rate. The level of sugar consumption per capita has reduced slightly but is at a high level. There has, however, been a significant reduction in the dental caries level in Australia. This is due to the widespread use of dental preventive measures. The level of sugar consumption per capita in Australia in 1960 was 57.6 per person and in 1982 it was 51.6 kg per person.⁸

The level of dental caries in Japan rose from a low to moderate dental caries level with increase of sugar consumption within 20 years. In 1960 per capita sugar consumption in Japan was 15.2 kg per person and in 1982 it was 26.1 kg per person.⁸

Table 3 presents the caries prevalence trends in developing countries at 12 years of age. All the countries have shown a marked increase in DMFT figures. The increase ranges from a mean figure of 1.5 for Uganda and Ethiopia to 10.7 in French Polynesia.¹⁵

Table 3. Caries prevalence trends in developing countries.
DMFT at 12 years.

COUNTRY	LOWEST		HIGHEST	
	INDEX	YEAR	INDEX	YEAR
CHILE	2.8	1960	6.3	1978
ETHIOPIA	0.2	1958	1.5	1975
FRENCH POLYNESIA	6.5	1966	10.7	1977
ISRAEL	2.4	1966	3.7	1976
JORDAN	0.2	1962	2.7	1981
LEBANON	1.2	1961	3.6	1974
MEXICO	2.7	1972	5.3	1976
MOROCCO	2.6	1970	4.5	1980
PHILIPPINES	1.4	1967-68	2.9	1981
THAILAND	0.4	1960	2.7	1977
UGANDA	0.4	1966	1.5	1982
ZAIRE	0.1	1971	2.3	1982

Source: WHO Technical Report Series No. 713. Geneva (1984).

Table 4 gives the caries prevalence in urban and rural areas in developing countries.

In urban and rural areas in developing countries, the DMFT figures at 12 years of age show a low figure for rural and a moderate to high figure for urban areas.¹⁵

For Vila in Vanuatu, in the absence of other data, the DMFT figures would be expected to be within the range of those in urban areas of developing countries.

The decline in caries prevalence in most of the industrialised countries listed in Tables 1 and 2 is said to be associated with the increased involvement of these countries in dental public health program experience in the last 15 to 20 years.

Others like Japan, which is a highly industrialised country, whose dental service was highly curative-orientated over the last 15 to 20 years, show higher DMFT figures for 12 year olds.⁸

The public health dental programs which accounted for these declining figures in caries prevalence include water fluoridation, fluoride supplements, use of fluoride dentifrices and an organised dental health education program aimed at creating an increased dental awareness.

Water fluoridation is the best means of preventing dental caries and it simply means increasing the natural content of fluoride in water up to the required optimum level. Fluoridation of the water system gives a good population coverage regardless of family socio-economic level and education.

Table 4. Caries prevalence in urban and rural areas in developing countries. DMFT at 12 years.

COUNTRY	YEAR	RURAL	URBAN
BURMA	1982	0.8	3.1
CAMEROON	1982	1.4	1.8
CHINA	1981	0.6	1.9
JORDAN	1981	2.2	3.4
MOROCCO	1982	2.5	4.3
OMAN	1978	0.7	2.5
SAUDI ARABIA	1979	1.3	2.2
SOMALIA	1979	0.3	1.5
SUDAN	1979	0.4	1.4
SYRIAN ARAB REPUBLIC	1980	1.3	3.4
THAILAND	1977	1.6	3.0
UNITED ARAB EMIRATES	1981	1.2	2.6

Source: WHO Technical Report Series No. 713. Geneva (1984).

In New South Wales, an Australian state, with a total population of 5,310,800, fluoridated areas cover a total population of 4,307,060, which is 81% of the total population (Barnard²).

New South Wales has had the majority of its water fluoridated since 1968. A survey was done in 1956 by Barnard⁴ and this has served as a baseline study for the State. Subsequent surveys were done at periodic intervals up to 1984. Results of the baseline figures and follow-up surveys through the dental school service are tabulated in Table 5.

It is evident from studying this table of survey results, that there has been a significant reduction of decayed, missing and filled teeth.

The reduction was as a result of water fluoridation and other preventive measures.

In areas where water fluoridation is not possible, other alternative means of applying fluoride are necessary. One of the most recommended means is through fluoride mouthrinse in a school based program.

Birkland and Torrel (1978) did some studies on the fluoride mouthrinse on school children. From this study they found that daily or weekly mouthrinses with sodium fluoride solutions can reduce dental caries by 40%. The 40% reduction is achievable with the fluoride mouthrinse program over a 2 to 3 year period.

Benefit, however, is better still, a 50% reduction, with the fluoride mouthrinse on a long term participation of

Table 5. DMFT at 6 to 12 years. New South Wales baseline 1956 and follow-up surveys 1977-1984.

AGE	1956	1977	1979	1980	1981	1982	1983	1984	STATE POPULATION
6	0.99	0.34	0.15	0.13	0.11	0.10	0.09	0.09	90,682
7	2.31	0.88	0.53	0.40	0.35	0.30	0.28	0.28	95,399
8	3.22	1.58	0.99	0.81	0.60	0.59	0.51	0.49	95,165
9	4.44	2.10	1.40	1.27	0.97	0.85	0.82	0.77	87,130
10	5.28	2.57	1.92	1.68	1.39	1.22	1.07	1.02	86,926
11	6.98	3.25	2.35	2.21	1.81	1.68	1.46	1.41	82,734
12	9.32	3.99	2.93	2.64	2.37	2.27	2.03	1.88	82,728

Source: Wright (1985).

5 years and over. Another benefit shown is a decrease in the need for fillings by about 70%. The fillings required are also simpler and will last longer.

Ripa, Leske and Sposato (1985) reported a 55% reduction in the DMFS of participants who were on a school based fluoride mouthrinse program for children aged six years and over. This was the longest continual monitored school based program of its kind in the United States of America. Table 6 contains some of the results.

From this study it was also evident that the fluoride mouthrinse is more effective on the smooth and proximal surfaces. Furthermore, the fluoride mouthrinsing effect persists after children discontinue their participation in the program.

Although there is a marked decrease in smooth and proximal surface caries from fluoride effects, the decrease of caries in pit and fissure areas is not as great. Further preventive action is required for these areas.

Craig and Burton (1985) attempted to determine the caries pattern in 12 year old children from the Northern Metropolitan Region in Sydney with the use of clinical and radiological examinations for the 178 children. They found that on the basis of surfaces involved with caries, 75.6% of all decayed and filled surfaces were those of pit and fissure areas. Pit and fissure areas, therefore, need further attention.

This noticeable pattern of caries calls for the additional inclusion of a new treatment form in addition

Table 6. Mean caries prevalence (DMFS) at baseline and after prior participation in fluoride mouth-rinsing program for 6 and 7 year. Central School District, Long Island, New York.

GRADE	YEARS OF RINSE PARTICIPATION	MEAN DMFS	
		BASELINE	FINAL
7	7	5.69	1.84
8	7	7.46	3.23
9	6	8.96	4.42

Source: Ripa, Leske, Sposato (1985).

to fluoride application.

A common choice is that of the application of pit and fissure sealants. Sealant is a relatively new product and its use has not been extensive as yet, though it is recommended for pit and fissure areas.

A program, therefore, should be one of a combination of fluoride and sealants. Such a program is used in Guam.¹⁰

A baseline survey in Guam indicated a high caries prevalence with a mean DMFT of over 8 at age 12 years.¹⁶ The current estimation for caries reduction in Guam, where both the fluoride and sealant program is implemented, is an expectation of caries reduction to a mean of 2 DMFT.

Dental health education has been a major component of dental public health programs in countries where services have both preventive and curative orientation.

Estimation of the effect of a good dental health program can be assessed from how the public utilises dental services by the number of dental consultations, type of treatment received and the increased use of oral hygiene aids as toothpaste with fluorides.

Barnard³ summarised data collected from household interview surveys in May 1979 and November 1983 conducted by the Australian Bureau of Statistics.

This series of findings indicated that "There has been an increase in the number of children who had a dental consultation - 77% to 80%, who had a dental consult-

ation in the last 12 months - 63% to 69%, and those having regular check-ups - 54% to 80%. The type of treatment received at the most recent dental consultations was more preventively orientated in 1983 than in 1979, with an increase of persons having check-ups, teeth cleaning and polishing, fluoride treatment, with a marked decrease in extractions and filling of teeth." Such an achievement quoted above was possible through a continuing dental health education program.

The DMF rate has dropped greatly in Sydney. This DMF rate is still dropping. Expectation was for it to be static. One of the reasons for the continual decrease in DMF figures is the effect of the use of toothpaste with fluoride.¹⁸

Almost all children are using fluoride toothpaste because of dental health education drives and commercial advertisement of the product - again an effect of a good dental health education program.

The bulk of dental health education activities is carried out by dental auxiliaries. Their training is geared to the provision of preventive aspects of the dental service.

Supervisory roles are provided by dentists.

The training and use of auxiliaries began early this century by Alfred C. Fones at Bridgeport, Connecticut, 1913. It was a program designed to enable women to carry out dental health education and prophylactic procedures under the supervision of registered dentists and they

were known as dental hygienists (McIntyre 1982).

The principle basis for the utilisation of auxiliaries is the same, but the names and responsibilities differ from country to country, or even within the same country as is the case in Australia.

In New Zealand, the provider of dental health education is the school dental nurse. In Australia, it is either the school dental therapist, dental hygienist, dental therapist or dental health educator. Use of such auxiliaries differs by State.

Guam utilises the service of dental hygienists for its dental health education program. It also makes use of primary school teachers in its dental health education program for toothbrushing and mouthrinsing supervision in schools.

4. METHOD

4.1 GENERAL PROTOCOL

For this survey it was decided to follow W.H.O protocol where practical and to examine children (both male and female) either 6, 9 or 11 years of age at their last birthday. Only Ni-Vanuatu children were included in the survey.

Information on age and nationality was extracted directly from each school registration register.

Ages 6, 9 and 11 represent the entry, mid and exit levels in primary education in Vanuatu. Observations can, therefore, be followed on the caries experience on the first permanent molars, anterior teeth and erupting bicuspids.

The selection of these age groups gives a baseline for preventive programs in the application of sealants.

4.2 SAMPLE SIZE AND SAMPLE PROCEDURE

Three hundred and sixty one children, ages 6, 9 and 11, were included in the survey. Each group consisted of over one hundred children, both male and female.

This sample was drawn from seven out of eight primary schools on the school based program. Children examined were from different socio-economic levels. The total number of children in each age and sex group differs in each school.

All children in these age groups in each school were examined. The only exclusions were children from one non-participating school, children absent from school at the time of the examination and a few children who had a primary dentition with no permanent teeth erupted.

With a small population, the sample was a total sample of all the age groups required for the study.

Thirty six children that were registered for examination were absent. Approximately fifty three children of all three age groups were in the one school that did not participate in the survey. The school did not supply information from its registration register.

Seven children registered for examination had to be excluded because they had all deciduous teeth.

The total original estimated number of children registered was four hundred and fifty seven.

From this total, only three hundred and sixty one subjects were examined, a 78.9% representation.

4.3 SURVEY CRITERIA AND INDICES USED

The criteria used in this survey of dental caries experience are generally related to the standard set by W.H.O. in the "Oral Health Survey Basic Methods, 1977."

A tooth was recorded as:

- SOUND, if it showed no signs of treated or untreated caries.

- . DECAYED (DT), if there was a lesion in a pit or fissure, or on a free smooth tooth surface there was a detectable softened floor, undermined enamel or a softened wall, or the tooth had a temporary filling. On the approximal surfaces, the explorer point had to enter a lesion with certainty.
- . FILLED (FT), if there were one or more restorations present with no signs of further decay, either primary or secondary (recurrent).
- . FILLED WITH PRIMARY DECAY (counted as DT), if there were one or more restorations present with an area of decay not in association with the restorations.
- . FILLED WITH SECONDARY DECAY (counted as DT), if there were one or more permanent restorations associated with decay in physical contact with the restorations.
- . MISSING (MT), if the tooth was extracted due to caries. When in doubt, the child was often asked to indicate the reason for the loss. When the child was not sure, a decision was taken based on the knowledge of the tooth sequence of eruption or by comparison with the corresponding teeth on the opposite side.

The DMFT index was used for measuring the caries experience in this survey.

The missing and filled components of the index were recorded due to caries.

4.4 PRE-SURVEY ORGANISATION

The survey was regarded as a component of the school based program. As such, no special authority needed to be sought from the education authorities or additional consent from parents.

Each school's head authority was informed verbally of the purpose of the survey and likewise their co-operation was sought in getting all the required information needed prior to carrying out the survey.

On the 25th April, 1985, information was despatched to the schools requesting them to prepare lists of children of the ages 6, 9 and 11 into male and female groupings. All but one school responded to this request on the 1st May, 1985.

Based on this information, a timetable for the survey visit was worked out. Each school then had a notification note for the visit.

A session was conducted in the central clinic for the examiner and a recorder. This was to ensure uniform interpretation, understanding, application of the criteria and recording instructions both by the examiner and recorder.

As schools were quite a distance apart, transport arrangements were necessary. A Subaru 4-wheeled pick-up truck was made available for the one week.

Duplication of over five hundred W.H.O. Combined Oral and Treatment Assessment Forms was carried out for the

writer by the W.H.O. Office in Vila.

Instruments prepared included plane mouth-mirrors, tweezers, probes, towels, instrument trays, sterilised gauze, sterilising solution and disposable masks.

Time was very limited in the pre-survey organisation. All contacts needed with the schools had to be done before the school's first term break in May, 1985. The survey itself had to be done right after the two week break (last week of May, 1985) as the writer was due back in Sydney by the first week of June, 1985, to commence second term of the DPH Dent Program.

4.5 SURVEY IMPLEMENTATION

The actual survey was spread over a period of five days from 27th May, 1985, to 31st May, 1985.

Both morning and afternoon sessions were engaged in data collection. Because the morning session was longer, more data were scheduled for collection in the morning than in the afternoon. No limit for the number of examinations was fixed for collection in either sessions as time was limited and all registered children had to be examined in the five days. Considerations in procedural arrangement were made throughout the survey examination to minimise loss of time from school sessions by children.

Collection sites were actually in the schools, either in the school building or outside in the open. This depended on the available school facilities at the time of the visit. In all examinations, natural sunlight was used.

Data was collected by clinical dental examinations involving the writer as the examiner and a dental therapist as recorder. The recorder in all sessions positioned herself to face the examiner so as to avoid making mistakes in hearing the examiner. A standard examination procedure for the sequence of examination in the mouth was established which started at the upper right posterior molar tooth progressing to the upper left posterior molar down to the lower left and across to the lower right.

Because the subjects in the survey were of the age of mixed dentition, the FDI tooth number was called out first and then followed by the codes for status of that tooth.

Other information entered onto the W.H.O. Combined Oral Health and Treatment Assessment Form included: year in which the survey took place; registration number; sex; age in years; name of the child; school; and examiner's name.

4.6 ANALYSIS

Data collected were summarised onto worksheets with all schools combined, by sex within age groups. From these worksheets, the following statistical analyses were carried out:

- . Preparation of frequency distribution tables for individual DMFT scores.
- . Calculation of per cent of children with zero DMFT and component scores.

- . Mean values for age groups for permanent DMFT and its components.
- . Calculation of per cent D, M, and F components of total DMFT.
- . Calculation, using a statistical calculator, of standard deviation for mean values using the formula:

$$SD_{\bar{x}} = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{N}}{N - 1}}$$

- . Calculation of the standard errors for the mean values using the formula:

$$SE = \frac{SD}{\sqrt{N}}$$

- . Calculation of the standard errors for the percentage results using the formula:

$$SE_p = \sqrt{\frac{p \times q}{N}}$$

where $q = 100 - p$

5. RESULTS

A total of 361 children from seven primary schools in Vila were examined. Of these children, 126 were 6 years of age, 109 were 9 years and 126 aged 11 years (Table 7).

In the sample of children aged 6, 25% had experienced decay in their permanent teeth. Some 40% of children aged 9 and 46% of children aged 11 had at least one decayed, missing or filled permanent tooth.

As shown from the distribution of DMFT scores presented in Table 8, 75% of children aged 6 had zero DMFT scores as compared to 60% and 54% of children aged 9 and 11, respectively.

Of the sample of 361 children, there were 133 or 37% who had one or more permanent teeth either decayed, missing or filled because of caries.

The mean number of DMFT per child in each age group is also presented in Table 8. The DMFT for the age groups 6, 9 and 11 were 0.37, 0.87 and 1.31, respectively.

The total number of decayed teeth (DT), missing teeth (MT) and filled teeth (FT) components of the total DMFT were 228, 46 and 33, respectively, giving a total DMFT score, for all age groups, of 307 (Table 9). For all age groups combined, the percentage of the total decayed teeth component (DT) of DMFT was 74%. The percentages of total missing teeth component (MT) and the total filled teeth component (FT) of DMFT were 15% and 11%, respectively.

Table 7. Vila primary school children survey by age and sex, May, 1985.

AGE GROUPS	NUMBER OF CHILDREN		
	MALE	FEMALE	TOTAL
6 year	60	66	126
9 year	57	52	109
11 year	70	56	126
TOTAL			
ALL AGE GROUPS	187	174	361

Table 8. Frequency distribution of DMFT scores school children, Vila, May, 1985.

DMFT SCORES	AGE GROUP			TOTAL ALL AGE GROUPS
	6 year	9 year	11 year	
0	95	.65	68	228
1	22	20	21	63
2	4	14	6	24
3	3	3	10	16
4	2	4	10	16
5	0	0	7	7
6	0	1	3	4
7	0	1	0	1
8	0	0	0	0
9	0	1	1	2
<hr/>				
NUMBER OF CHILDREN - N	126	109	126	361
TOTAL DMFT - Σx	47	95	165	307
MEAN DMFT - \bar{x}	0.37	0.87	1.31	0.85
STD DEVIATION \pm SD	± 0.797	± 1.522	± 1.882	± 1.517
STD ERROR \pm SE	± 0.071	± 0.146	± 0.168	± 0.080
% WITH 0 SCORE	75.4%	59.6%	54.0%	63.1%
SE OF %	$\pm 3.84\%$	$\pm 4.70\%$	$\pm 4.4\%$	$\pm 2.54\%$

Table 9. Components of mean DMFT scores school children, Vila, May, 1985.

AGE GROUPS	INDEX	DT	MT	FT	DMFT
6 year	Σx	45	0	2	47
(N = 126)	Mean $\frac{\Sigma x}{N}$	0.36	0.00	0.01	0.37
	% of DMFT	95.7%	0.0%	4.3%	100.0%
	Children with 0 score	97	126	124	95
	% of children with 0 score	77.0%	100%	98.4%	75.4%
9 year	Σx	73	12	10	95
(N = 109)	Mean $\frac{\Sigma x}{N}$	0.67	0.11	0.09	0.87
	% of DMFT	76.8%	12.7%	10.5%	100.0%
	Children with 0 score	71	102	100	65
	% of children with 0 score	65.1%	93.6%	91.7%	59.6%

(Continued)

Table 9. (Continued)

AGE GROUPS	INDEX	DT	MT	FT	DMFT
11 year	Σx	110	34	21	165
(N = 126)	Mean $\frac{\Sigma x}{N}$	0.87	0.27	0.17	1.31
	% of DMFT	66.7%	20.6%	12.7%	100.0%
	Children with 0 score	78	106	112	68
	% of children with 0 score	61.9%	84.1%	88.8%	54.0%
ALL AGE GROUPS	Σx	228	46	33	307
(N = 361)	Mean $\frac{\Sigma x}{N}$	0.63	0.13	0.91	0.85
	% of DMFT	74.3%	15.0%	10.7%	100.0%
	Children with 0 score	246	334	336	228
	% of children with 0 score	68.1%	92.5%	93.1%	63.1%

6. DISCUSSION

The aim of this survey was to provide information on the dental caries experience in permanent dentition in children age 6, 9 and 11.

The survey results indicated the following dental caries pattern of the groups in the study:

1. The percentage of children affected by caries in these age groups decreased with increase in age.
2. More permanent teeth were missing due to caries than filled. This increased with increase in age.
3. The percentage of children with zero DMF scores decreased as the child got older.

The high decayed tooth component (DT) of the DMFT (decayed, missing or filled permanent teeth) for all age groups and a high missing tooth component (MT) for age eleven as against a low filled tooth component (FT), show that the program of service is poor.

In the 11 year age group, of the total DMFT, 67% accounts for decayed teeth, 20% for missing teeth and 13% for filled teeth. In the 9 year age group, 77% accounts for decayed teeth, 13% for missing teeth and 10% for filled teeth. Some 96% of the DMFT in the 6 year old age group is accounted for by decayed teeth, with zero percentage for missing teeth and 4% for filled teeth.

The DT index includes a very small number of cases of recurrent caries and faulty fillings. The majority of cases were because of lack of utilisation of the presently

available facilities by the individuals themselves.

The MT index shows that there was permanent tooth loss due to dental caries in the community amongst children in early childhood and in such numbers to be of concern.

The relationship of caries experience with age is similar to the findings by Hollis⁷ (1970). However, there is a significant difference in the mean number of permanent teeth affected by dental caries per child in each age group. The mean DMFT figures recorded for each age group in this survey are very low (according to W.H.O. standards) as compared to Hollis⁷ (1970) findings.

The mean number of DMFT (decayed, missing and filled permanent teeth) per child in the 6, 9 and 11 year olds is 0.37, 0.87 and 1.31, respectively. There is a reduction if compared to the mean of 0.66, 2.05 and 3.32 for the 5-6, 9-10 and 11-12 year olds, respectively, by Hollis⁷ (1970).

Though the mean for all age groups in the study is very low, the high decayed tooth (DT) component and the missing tooth (MT) component of the DMFT indicates a need for more intervention into the dental caries problem, both curatively and preventively, with more emphasis on the latter at an early age, before the age of eleven. The aim should be to increase the filled tooth component (FT) of the DMFT with a reduction in the number of decayed and missing teeth.

The sample was made up of Ni-Vanuatu children from different family backgrounds and were residents of Vila.

Hollis⁷ (1970) showed that the prevalence of dental caries in the non-urban area in Vanuatu was very low as compared to urban areas. The present survey finding, though it is low according to W.H.O. standard, is still higher than the mean figures for Ambae and Ambrym (non-urban areas) as indicated by Hollis⁷ (1970).

Distinction between the two areas as far as dental caries is concerned reflects the change from an original diet of yam, taro, banana, cassava, kumala and some meat and vegetables to a more western diet, which is rich in refined carbohydrate, especially sugar in the form of sucrose (table sugar).

Sucrose is the major cause of dental caries in Vanuatu. Increased consumption of sucrose will lead to increased caries activities.

The frequency of eating and the form in which sucrose is in are more important than the amount of sucrose consumed. It is more harmful to the teeth, if large amounts of sucrose are eaten in between meals than it will be if the same amount is taken at meal times. Furthermore, sucrose in liquid form is much less harmful than that which is in sticky form. In liquid form, oral clearance is faster. In the sticky form, it tends to adhere better and longer on the tooth surface supplying plaque with sucrose and giving time for the bacteria to produce the acid that attacks the tooth surface.

The low level of dental caries as indicated in this survey reflects the low level of the sugar consumption rate in Vanuatu. Sugar consumption per capita in Vanuatu in 1982 was 9 kg per person and in 1984 it was 12 kg per person.¹⁴ The estimated sugar consumption figure is based on import figures and is not on the actual consumption rate. This is lower than the average world per capita figure which was 19 kg per person in 1981.⁸ Sugar is more readily available in Vila than in the rural areas. There may also be the presence of fluoride from some dietary sources as seafoods, to some extent.

Restorative treatment shown in this survey is inadequate. The factors affecting the inadequate provision of restorative intervention were:

- . The operator to patient ratio, which is low.
- . Dental facilities were either inadequate or poor.

The dental service up to 1982, was operating with a sole dental officer, a dental therapist and a dental technician. These dental personnel not only catered for children on an unorganised basis but also for the public in Vila and the rest of the population on the island of Efate, on which Vila is situated. This was the only government dental facility in the country at that time. The total population for Efate alone in 1979 was 19,819. In mid-1985, its population had increased to 26,044.¹³

The majority of patients seen and treated were for relief of pain generally arising from teeth at a very advanced stage of decay.

Dental facilities were either poor or limited to the central hospital system. There were no other fixed or mobile dental clinics other than this central dental clinic in the hospital system. Technical problems associated with the dental equipment were common and spare parts for any malfunctioned piece take a considerable time to replace as such replacements are usually obtained from overseas.

All of these problems faced by the dental clinic have arisen either because of lack of financial resources or the existence of other priorities in the health service in general, that were regarded by the medical administrators as more important than the dental needs.

This state of affairs is now gradually changing with more attention being given to the dental service than in the past.

In 1985 the number of dental officers increased from one to three. Non-operating dental assistants increased from zero to two. A further increase in the number of operating dental auxiliaries (both dental therapist and dental hygienists) is expected as of the end of 1987. Dental units are being replaced with the intention of standardising the whole establishments so that stocking of necessary items will avoid unnecessary delay in ordering.

A program, commenced in 1985 and on-going in 1986, is to send local dental therapists to Singapore to attach with the Dental Health Education Unit to observe their

school dental health education programs and the production of educational materials to support teachers in dental health education.

These gradual improvements in the number and experience of the present manpower and facilities, should be utilised to the maximum benefit of the population and more especially towards provision of dental service to children. Better planning of the school dental service is thus necessary for the proper and effective utilisation of available resources. Unless this is done, the dental caries problem already identified, may increase with time, in proportion to increase of population of the community and any increase in sugar consumption. The latter should be monitored as there is an indication of an increase in consumption for the period 1982 to 1984.

Considerations in planning should be directed at organising the service to meet the needs, especially of children. An organised service of dental health education to both children, parents and influential groups in the community is required.

Improvements in dental care delivery may be considered in the following areas:

- . Defining clearly areas of responsibility for each dental personnel.
- . Establishing effective assessment approach and treatment planning.

- . Organising work patterns to maintain team work efficiency.
- . Updating the recording and filing of children's records.
- . Establishing a sound recall system.
- . Use of mobile clinics to provide dental service to children at school sites.
- . Maintenance of adequate essential supplies in stock.
- . Improvements of equipment and facilities in quantity and quality.
- . Introduction of educational programs for dental personnel.
- . Gaining adequate financial compensation for work performed.

Improvements in prevention should be stepped up at individual, professional and community levels with the overall aim of controlling the loss of teeth in children for the relief of pain and infection and reduction in the requirement for fillings.

Children should be motivated to avoid eating, too frequently, foods rich in refined carbohydrate, especially sucrose, in between meals and to establish the habit of good oral hygiene practices. Emphasis should be placed on toothbrushing - the right type of toothbrush, mechanics of brushing and how often to brush. The use of fluoride toothpaste should be encouraged. The findings of over

100 clinical trials based on the use of fluoridated toothpastes have indicated that the incidence of new carious lesions can be reduced by 20-30%, though the evidence from widespread use over a long period of time indicates that reduction may even be greater.¹⁵

The use of fluorides is recognised as the most effective means available for the prevention of dental caries. It helps to build up resistance of the enamel tooth surface to the attacking agents.

Application of preventive measures at professional levels should be organised so as to be effective. This approach will involve the professionals in the dental surgery. The procedure should be a dental health education orientated program including necessary restorative treatment. It should involve:

- . Direct face to face communication with the child and to convince him/her of the importance of dental health.
- . Screening of oral health status.
- . Sealing of teeth.
- . Prophylaxis of teeth using fluoride prophylaxis paste at least once a year.
- . Application of topical fluoride.
- . Toothbrush selection and instructions using fluoride toothpaste and disclosing tablets.
- . Dental floss instructions.
- . Instruction in diet and oral hygiene habits.

- . Establishing a recall system and emphasising the need for regular check-ups.

Other public health measures such as water fluoridation should be given strong consideration. This is quite important, not only in terms of its benefit, but more so as it will involve a good population coverage including the disadvantaged portion of the population, those who are financially, geographically isolated, physically and medically handicapped.

Training of auxiliaries should go ahead to provide the preventive services very much needed and also to supplement the basic manpower requirements for curative needs. This will allow the dental therapists, who are trained to do minor operating procedures, to concentrate more of their efforts on children in schools with the aim of maintaining all children dentally fit throughout the school year.

Currently, resources are very limited - facilities, manpower and finance. In spite of these shortfalls, children are a priority group as far as dental caries is concerned. They should be given a high priority of attention in the dental health service.

The severity of dental caries is very low. Dental caries is an irreversible process. It is, therefore, essential that measures discussed should be taken to prevent dental caries initially or if a caries lesion has been established, that it is treated at its earliest stage of development. In this way, permanent tooth loss for

relief of pain and infection can be avoided during children's school life, at primary, high school levels and later on in life.

7. CONCLUSIONS

Data collected and analysed indicated that the prevalence of dental caries in children of Vila primary schools is very low.

From the recorded total number of permanent teeth affected by decay, the majority were not being treated and permanent tooth loss early in childhood was very common. A number of school children only received extractions for emergency relief of pain and infections.

This observation indicates the need for a comprehensive school dental service program and preventively orientated programs.

The school dental service should be directed towards the restoration and filling of teeth affected by dental caries. The aim should be to increase the filled tooth component (FT) of the DMFT (decayed, missing or filled permanent teeth) with subsequent reduction in the number of decayed and missing permanent teeth. This should be an immediate requirement of the school dental service.

Other involvement of school dental services should be directed to:

- . Screening of all school children.
- . Providing toothbrushing instruction to children.
- . Dental health education instructions in nutrition and dietetic habits.

- . Introduction of fissure sealants in newly erupted teeth in susceptible patients.
- . Prophylaxis with fluoride prophylaxis paste at least once a year.
- . Referral of cases beyond the responsibility of the operating auxiliary.

The present preventive measures in the school based program consisting of weekly fluoride mouthrinsing, daily toothbrushing drills, dental health education and screening of children should be maintained with the aim of maintaining the low prevalence of dental caries identified in this survey.

Essential requirements for the school dental service, its manpower and its facilities, should be given priority consideration by the authorities responsible for health services in general. The pattern of dental caries observed in this study, does require the service of operating dental auxiliaries with the dental officers providing the supervisory roles.

It is essential that preventive measures should be established at individual, professional and community levels with the aim of reducing the total decayed, missing and filled permanent teeth scores.

Health education of adult groups, especially parents, is necessary so as to create awareness and concern to motivate them to help in improving children's oral health status.

Strong consideration should be given to the allocation of resources to implement fluoridation for the communal water supply of Vila.

Further periodic surveys of children's dental health should be carried out to assess the benefits that the school dental service and other preventive measures have on the dental health of the children. Benefits to aim for should be:

- . Decrease of pain and discomfort.
- . A change in oral health status from extraction for relief of pain and infections towards fillings and better utilisation of dental services available.
- . Reduction in the requirement for fillings through the use of preventive measures to reduce or maintain the present dental caries prevalence levels.

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APPENDIX 1DENTAL PROGRAMME POLICIES AND GUIDELINESGENERAL:

Vanuatu has in its First Five Year National Development Plan, 1982-1986, given the following as its Health Service objectives:-

- (a) To provide basic physical, mental and social service for the nation.
- (b) To promote and maintain better standards of Health throughout the country.
- (c) To ensure that Health Services are equally accessible to all communities throughout the country, with particular attention to upgrading those in lower income area.

It is apparent from the foregoing paragraph, that the present oral Health Service falls far short of the target set out in the Health Service Objectives of the National Development Plan (1982 - 1986).

In order to meet the targets and also to provide clarity, continuity and guidance to the Dental Programme the following policies, objectives, activities, and strategies should be considered for adoption:-

POLICIES:

- (1) That the Dental Department established a preventive section to supply Free Dental Care to all Pre-School and School Age Children in Vanuatu from early age to sixteen through proven cost-effective preventive activities to reduce Dental Diseases and to provide complete Basic Restorative services for children in Dental Clinics. That these clinics be in Vila and Santo and in other centres that may be established in future.
- (2) That the Dental Department continue to provide Adult Dental Care to the Public at large.

OBJECTIVE:

GENERAL: To promote and maintain better standard of Oral Health throughout the Country.

- SPECIFIC:
- To improve Oral Health Status of children in Vanuatu.
 - To introduce and carry out practical cost-effective preventive procedures including Oral Health Education.
 - To promote Dental Health in adult groups (especially parents).

ACTIVITIES:

- PREVENTIVE
- Water fluoridation.
 - Fluoride mouth-rinsing with 0.2% NaF once a week.
 - Oral Health promotion in Schools and Clinics.
 - Oral Health promotion among adults (especially parents).
 - Tooth brushing drills.
 - Application of adhesive pit and fissure sealants.
 - Training for staff to do fissures and pits sealants.
 - National survey on oral Health conditions in Vanuatu for base-line Data.
 - Follow-up survey and evaluation of Oral Health Programme.
 - Establish a Programme of systemic treatment particularly with children.

STRATEGIES:

- PREVENTIVE
- Gradually establish Dental Clinics in District Hospitals with Basic Dental Preventive component.
 - Establish and maintain mouth-rinsing programme. Sealant programme and tooth brushing drills in Schools.
 - Introduce a regular and sustained Programme of Oral Health Education for influential groups in Societies, e.g. Teachers, Nurses; parents-teacher, etc.....
 - Look into the possibility of introducing water fluoridation where it may be feasible.

ADMINISTRATION:

- Develop charts and forms for clinical records for quality check.
- Define clearly each staff's responsibility.