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FINANCING GOVERNMENT DENTAL SERVICES IN FIJI

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Diploma in Dental Surgery (Fiji)

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

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Department of Preventive Dentistry
Faculty of Dentistry
University of Sydney
1984
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1. The Australian Development Assistance Bureau for funding the award
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3. The Fiji Government for the nomination
4. Associate Professor P.D. Barnard for guidance, assistance and encouragement throughout the preparation of this manuscript.
A. SUMMARY

Fiji adopted a democratic system of government based on the Westminster model. The country had a population of 646,561 at the 1981 census and its economy is primarily agrarian.

This thesis reviews the government dental services in Fiji and draws a comparison between the National Health Budget and the dental expenditure. It stands as:

1. Salaries of the personnel \$1,090,126.00
2. Staff training \- 135,687.00
3. Dental equipment \- 90,000.00
4. Transport and facilities \- 50,000.00
5. Material and other expenses \- 441,600.00

Total \$1,807,413.00

The National budget is \$86,759.7 million
The National Health and Social Welfare budget \$32,217.3 million

The Health and Social Welfare budget is allocated in four programmes. The current programmes are:

Programme I - Policy and administration
Programme II - Medical Services
Programme III - Health Education and Training
Programme IV - Social Welfare.

The Dental Services allocation is incorporated in Programme II, Medical Services, which has five distinct activities:
1. Urban Hospitals and Health Centres (22-2-1)
2. Subdivisional Hospitals (22-2-2)
3. Rural Medical and Nursing Stations (22-2-3)
4. Public Health Services (22-2-4)
5. Drug and Medical Services (22-2-5)

The dental problems faced by the nation are:

1. **Dental caries.**

   Dental caries is the prime concern of the dentists. The prevalence rate is 3.5 DMFT in 6-14 year olds for the permanent teeth and 6.1 for the deciduous teeth in the 5-6 year olds. Periodontal disease affects the population mainly in the older age groups over 45 years old.

2. **Malocclusion**

   Malocclusion is not a major problem, however it frequently occurs among the Indian children.

   The dentists to population ratio is 1:10.428. This ratio is high in comparison to the recommended WHO ratio, which is 1:3.000.

   Dental Auxiliaries (Dental Therapists) are utilized in the government service to alleviate the shortage problem and work under supervision of dental officers. The dental therapists mainly treat children in various schools.

The dental treatments available at government dental services are:

1. **Palliative treatment to relieve pain.**

   All persons are eligible for this type of treatment.
2. Free conservative treatment for children below the age of 15 years, because they are the government priority group. Conservative treatment for adults is provided by the private sector.


5. Orthodontic services are available in the private practice sector.

   In preventive services, health education is emphasized particularly with:
   (1) Pre- and post-natal mothers.
   (2) Adult groups through primary health care seminars.
   (3) Individual patients, who attend the dental clinics for treatment.

   Water fluoridation and topical application of fluorides are highly recommended in this thesis, especially water fluoridation, because it is the least expensive, most effective and most equitable way to reduce dental caries in large groups of people.

   About 31% of the population utilize government dental services. Lack of utilization may be due to geographic, educational and economic reasons.

   The dental clinics are normally located within institutions such as hospitals and health centres and so they are part of that institution, therefore the funds for dental services are controlled by the head of the institutions,
in these cases the medical superintendents or divisional and subdivisional medical officers. When the funds are controlled this way, the dental unit within the institution seems to be given less priority.

Two alternatives have been recommended in this thesis to improve dental services:

1. To consider a separate Programme for Dental Services, or
2. To create an additional activity for dental services within Programme II.

The writer is of the opinion that a separate allocation for Dental Services will improve dental services, preventive or otherwise. It is also recommended that funding should be controlled by the Assistant Director of Dental Services, so that dental programmes can be efficiently monitored and coordinated according to priorities and needs.
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A REVIEW OF THE COST OF THE GOVERNMENT
DENTAL SERVICES IN FIJI

1. INTRODUCTION

The dental disease is a recent history of man and perhaps the most prevalent disease of mankind. It may be rampant in industrial and developing countries alike. Dental caries is rare in the teeth of ancient skulls. It remains relatively rare in the primitive world, but virtually every person in the civilization is attacked by the disease. Urban dwellers in developing countries are rapidly becoming victims of a high prevalence of dental caries and periodontal disease, and ultimately lead to tooth loss. Corrective dentistry accounts for an increasing large part of dental care expenditure in developing countries. Dental problems, while occasionally painful, are rarely fatal and may be relatively asymptomatic until they reach a serious stage.

For this reason many persons leave dental care until problems are beyond repair. This lack of urgency keeps people away from the dentist, and the social background is also a powerful determinant of contact with the dental care system. The time and distance involved in obtaining dental treatment is another factor. Fear of pain may keep people out of the dental office and others who are under the misconception that they are not susceptible to dental disease, postpone visits until symptoms become unbearable.

These are some of the barriers today in Fiji and are causing very rapid growing dental problems in the country and
therefore shares its rising expenditure. The dental service in Fiji is mainly financed by the Government. The Government in the past was more receptive to treatment services than preventive services, because the output is more tangible, however in the recent years, it has placed more emphasis on prevention.

In this respect finance is made available for prevention, health education and personnel training. Oral surveys have demonstrated, that existing dental services both in public and private are unable to provide the treatment needed. Dental caries and periodontal diseases are costing more and more to treat and the number of people affected is increasing. The manpower and finance to meet these needs are not enough and certainly not as prevalence increases.

The cost of meeting the need for the treatment of dental caries, let alone periodontal disease, malocclusion and other oral conditions is far beyond the economic and manpower resources of the country. Dental caries and periodontal diseases are preventable and could be reduced by widespread application of safe preventive measures. To do this, it will become necessary to overcome the barriers to prevention that exist at both community and individual levels and to develop comprehensive national plans for prevention. To meet some of the existing barriers and recommend national plans for prevention, a review of financing government dental services is necessary, therefore the aim of this thesis is to assess the Financing of Government Dental Services in Fiji.
2. INTRODUCTION TO FIJI

2.1 History

According to Fijian legend, the great chief Lutunasobasoba led his people across the seas to the new land of Fiji. Most authorities agree that people came into the Pacific from the south-east via the Indonesian Islands. Here the Melanesians and the Polynesians mixed to create a highly developed society before the arrival of the Europeans.

The first European discoveries of the Fiji group were accidental, occurring when the early navigators were on their way elsewhere. The first was made in 1643 by the Dutch explorer Abel Tasman. English navigators including James Cook, who sailed through in 1774, made further exploration in the 18th century.

Major credit for the discovery and recording the Islands goes to Captain William Bligh, who sailed through the group after the mutiny on the "Bounty" in 1789.

The first Europeans to land and live among the Fijians were shipwrecked sailors and run-away convicts from Australian penal settlements. Sandalwood traders and missionaries came by the mid-19th century.

Cannibalism was rampant throughout the Islands, but quickly disappeared as the missionaries gained influence. When Ratu Seru Cakabau accepted Christianity in 1854, the rest of the country soon followed and the tribal warfare came to an end.

From 1879 to 1916, the Indians came as indentured
labourers to work the sugar plantations. After the indentured system was abolished, many stayed on as independent businessmen. Today, the Indians outnumber the indigenous Fijians and represent more than half the population.

Fiji is made up of about 332 islands, which vary in size from 10,000 square kilometres to very small islets. These islands spread over thousands of square kilometres of ocean in the heart of the South-Pacific. Around one third of these islands are inhabited. The total land area is 18,333 square kilometres. The largest island is Viti Levu and measures 10,429 square kilometres; the second largest is Vanua Levu which is 5,556 square kilometres. Other main islands are: Taveuni, 470; Kadavu, 411; Gau, 140; Koro, 104; Ovalau, 101; Rabi, 69; Rotuma, 47; and Beqa, 36.

Situated in the hulp of the South-West-Pacific, Fiji has become the crossroads of air and shipping services between North America, Australia and New Zealand.

Fiji lies between 15° and 220° south of the equator and straddles the 180 meridian of longitude, or the International Dateline and so becomes the gateway of a new day.

2.2 Population

The population at the June 1981 census was 646,561. This compares with a population figure of 588,068 at the 1976 census. The average annual growth rate for the past five years has been 1.8 per cent. The mid-1981 population showed the following ethnic breakdown in table 1.
Table 1.

<table>
<thead>
<tr>
<th>Race</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indians</td>
<td>323.707</td>
<td>50.7%</td>
</tr>
<tr>
<td>Fijians</td>
<td>287.952</td>
<td>44.5%</td>
</tr>
<tr>
<td>Part-Europeans</td>
<td>11.145</td>
<td>1.7%</td>
</tr>
<tr>
<td>Rotumans</td>
<td>8.078</td>
<td>1.2%</td>
</tr>
<tr>
<td>Other Pacific Islanders</td>
<td>7.033</td>
<td>1.0%</td>
</tr>
<tr>
<td>Chinese</td>
<td>4.603</td>
<td>0.7%</td>
</tr>
<tr>
<td>Europeans</td>
<td>4.048</td>
<td>0.6%</td>
</tr>
</tbody>
</table>

The average expectation of life at birth is nearly 70 years and the infant mortality and crude death rates are low.

Average Expectation of Life at Birth

Table 2.

<table>
<thead>
<tr>
<th>Race</th>
<th>1976 Census</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>Fijian</td>
<td>60.7</td>
</tr>
<tr>
<td>Indian</td>
<td>59.5</td>
</tr>
</tbody>
</table>

Crude birth rate per 1,000 of population 1979

- Fijians 27.2
- Indians 32.3

Crude death rate per 1,000 population

- Fijians 3.2
- Indians 4.5

Infant death rate per 1,000 live births

- Fijians 27.4
- Indians 28.7
Average annual rate of population growth (pc) 2.0
Population density (km²) 34.2.

2.3 Government and Economy

Fiji is a member of the Commonwealth and maintains close ties with Great Britain and pays homage to Queen Elisabeth II, who is also the Queen of Fiji.

The nation gained independence on October 10, 1970, and accepted a democratic system of constitutional government based on Westminster model, 96 years to the day after the Fijian chiefs ceded the islands to Queen Victoria in 1874.

The Queen's representative in the Country is the Governor General.

The economy of Fiji is primarily agrarian and sugar is the backbone.

Tourism is another key factor and is second only to sugar as a money earner. Other export money earners are gold, timber, fish, copra and coconut oil.

2.4 Education and Culture

The standard of education in the past two decades has seen great improvement both in quality and quantity of Fijian education. There are 662 primary schools, 138 secondary schools and 36 vocational-technical schools in the country. The University of the South-Pacific, a regional institution established in 1968, has an enrolment of about 2,300 students. It offers six first degree courses, two
The richness of Fiji's multiracial background is reflected in the diversity of its singing, dancing and craft work which reach back to traditional sources.

A little over a century ago Fiji was a country with one major race — the Fijians. Today, people of many races form part of the new, complex culture of Fiji.

Race in Fiji is a fact of life ... something the people are proud of. All races in Fiji make their own unique contribution to the enrichment of the society.

Like many parts of the Pacific, the culture of Fiji has undergone much transformation in the last hundred years when the present multiracial community evolved.
post graduate courses, eight Diplomas and six Certificate programmes. Fiji accepted many nationalities to its shores and therefore is rich in diverse cultural backgrounds. Today this blend of people from different origins and traditions enjoy peace and harmony in a stable democratic nation.

The government implemented tuition free education in 1973 to class 1 and has added a class each year afterwards. Now class 1 to seven (7) are tuition free for the school children. Allocation of funds by sectors continue to show that the highest portion of the overall budget is channelled to Social Services. The share of the Social Services Sector has increased from 27.0 per cent in 1982 to 30.6 per cent mainly because of the intake of teachers and medical personnel into Education and Health in 1983.
3. HEALTH SERVICES

3.1 General Health Services

Fiji is a healthy country and free from most tropical diseases, including malaria. Public Health services are of high standard and infectious diseases are not a problem.

Environmental sanitation is good in all the main centres where there is waterborne sewage disposal and good refuse services. Water supplies are modern and carefully supervised, tap water is drinkable in all urban and town areas. The government provides most of the medical care facilities in the country. There are at present 25 hospitals, 20 dental clinics, 49 health centres and 89 nursing stations operating in both rural and urban centres.

The Minister for Health and Social Welfare is the political head of the ministry with the Permanent Secretary in charge of the daily administration.

The Permanent Secretary is supported by staff based at the Headquarters. The headquarters staff are divided administratively into four Directorates or Divisions, namely:

(i) Preventive and Primary Health Services.
(ii) Hospital and Supportive Services.
(iii) Nursing Services.
(iv) Welfare Services.

Fiji has begun its Development Plan 8, which covers the 1981-1985 period.

The Ministry of Health and Social Welfare has redirected
and emphasized its health development plan to give priority to promotion and development of Primary Health care. It is part of the national commitment to achieve the target of health for all in the year 2000.

The Health Division of the Ministry has divided its five year development plan programme in three areas, namely:

(i) Primary Health Care Services.
(ii) Hospital Services.
(iii) Manpower Development.

The Ministry in its redirected effort to develop Primary Health Care, has listed nine components of Primary Health Care as follows:

(i) Nutrition
(ii) Safe water supplies
(iii) Environmental sanitation/Refuse disposal
(iv) Family Planning
(v) Control of communicable diseases and chronic disabilities.
(vi) Immunisation
(vii) Appropriate Health Care
(viii) Essential Drugs
(ix) Health Education

Primary Health Care is defined as the provision of health care by the people in villages who are bound together by customs and traditions and under traditional leadership system which practises on the basis of community participation and cooperation. This has been practised among Fijians for many years. The involvement and role of community in village health promotional work declined as the colonial medical
administration developed. The Colonial Administration concentrated on building hospitals, Health Centres, and Nursing Stations with training of personnel to work in these institutions.

The nine components of the primary health care programme have planned objectives, activities, and targets to be achieved.

It is envisaged that the implementation of primary health care as strategy would bring about self-sufficiency and improved standards of family health (Bavadra, 1981).

The components of Primary and Preventive Health Care Programme do not include dental health as such. The organisation chart shows only the topmost dental post, i.e. the Assistant Director of Dental Services. Dental Health is recognised as a primary health care in the programme and therefore members of the Divisional Dental staff are very much involved in the activities of the Primary Health Care Services.

The organisation structure of public health dentistry as seen in figure 3 could fit very well into organisation structure of Primary and Family Health Care as shown on figure 4.

This is because public health workers in dentistry work with the medical team. Therefore figure 3 should be integrated into figure 4 to show a more correct structure to give dentistry a more formal recognition in Primary Health Care Services (J.F. Yasa). Despite the omission of dentistry in the nine components of the primary health care, the dental health workers are working together with the Nutrition
and appropriate health care units at Divisional and Sub-Divisional levels. The Divisional and Sub-divisional Dental Officers in their own rights are heads of their own units and are very much involved in dental health activities. The aim is to achieve a good dental health for all by the year 2000.

3.2 Dentistry in Fiji

Dental services are closely linked with the history of the Fiji School of Medicine. Medical students had been taught to extract teeth, so that as native medical practitioners, they could relieve pain, but in those days they had no means of judging what was a saveable tooth.

In this way many teeth would have been extracted which could have been saved by conservative means.

In 1921, Mr. Leslie Bruse, an Englishman established his practice in Suva. He was followed by another Englishman,
Figure 4.
Primary and Preventive Health Care

Key:

DPPS = Director of Primary and Preventive Health Services
ADPPHS = Assistant Director Primary and Preventive Health Services
ADDS = Assistant Director of Dental Services
CHI = Chief Health Inspector
PHI = Principal Health Inspector
CNS = Controller of Nursing Services
DMO = Divisional Medical Officer
SDMO = Sub-Divisional Medical Officer
DHI = Divisional Health Inspector
DHS = Divisional Health Sister
SDHI = Sub-Divisional Health Inspector
SDHS = Sub-Divisional Health Sister
AM = Area Medical Officer
HI = Health Inspector
HS = Health Sister.
Mr. H.J. Mount in 1930 (San Juan Dentistry in Fiji 1982). Mr. Mount was an Honorary Dentist of the Colonial War Memorial Hospital in 1941 and taught medical students some dentistry. In 1943, Ratu Vosailagi graduated with a Bachelor of Dental Surgery from the University of Otago in New Zealand. He took over from Mr. H.J. Mount and trained dental students in 1945 and saw the graduation of the first dental students from the Central Medical School, later renamed the Fiji School of Medicine (San Juan 1982).

3.3 Dental Education

The Fiji School of Medicine has four dental programmes:

(i) Diploma in Dental Surgery

This is a four-year course and a Diploma in Dental Surgery (DSD) is granted. The graduates are commissioned as Dental Officers. After three years of satisfactory Government service, they may elect to go into private practice in Fiji.

(ii) Dental Hygienist/Therapist Course

This is a three-year course designed to train a dental auxiliary with sufficient skills and knowledge to perform simple fillings, prophylaxis, simple extractions and give dental health education to both children and adults.

(iii) Dental Technology Course

There is a three-year course to train a non-operating dental auxiliary to assist dental officers in carrying out laboratory procedures such as fabrication of Orthodontic and Prothodontic Appliances. These auxiliaries are expected
to help in the service and maintenance aspect of equipment.

(iv) Junior Dental Assistants

This is a one-year apprenticeship training under Dental Hygienist/Therapist with some theoretical exposures to lectures by dental officers. They work as chairside assistants upon completion of the course for both Dental Officers and Dental Hygienist/Therapist.

3.4 Public and School Dental Services

In 1984, there are 45 Government Dental Officers. Two are full-time tutors and one Dental Health Education Officer. There are 17 active private practitioners, 36 Dental Hygienist/Therapists, eleven Dental Technologists and 49 Junior Dental Assistants.

The Dentist to population ratio is about 1:10,428. The private practitioners cater for the majority of adults who purchase dental care on a direct for services basis. Dental clinics and hospital services provide dental care for both adults and children. The type of treatment includes:

(a) Extraction or emergency relief of pain
(b) Minor oral surgery
(c) Conservative dentistry
(d) Periodontics
(e) Orthodontics
(f) Prothodontics.

In the school dental services, all the children up to the age of 15 years are given free dental treatment as they are the priority group of the Government. Schools which are accessible by road in the main islands are served by mobile
clinics manned by Dental Therapists and Junior Dental Assistants under the supervision of Dental Officers. Schools in the isolated islands are served by touring teams at periodic intervals which depend on the availability of boats.
4. DENTAL PROBLEMS

4.1 Prevalence of Dental Caries in Fiji

To determine the dental caries pattern in Fiji five epidemiological studies have been carried out. Firstly, Gault in 1934 in a communication with general observations only, suggested that Fijians living in remote areas suffered much less from dental caries than those living in town areas. He suggested that there appeared to be a low prevalence of dental caries in the Fijian race as a whole.

Secondly, Davies in 1949 surveyed 909 Fijian children and young adults. He recorded these findings:

Average DMF in:

- (a) urban areas 9.1
- (b) sub-urban areas 8.6
- (c) between remote and urban areas 6.9
- (d) close to the remote areas 4.8
- (e) remote areas 3.4

The findings gave strong scientific support for Gault's general observations. Although the samples were small, this study gave a valuable description of the distribution of dental caries in Fiji and adds further evidence on the relationship of primitive diets and low caries prevalence and the effects of refined foods.

Thirdly, Wong and others conducted a national base-line epidemiological survey in 1965 using WHO criteria and methods. The findings in the deciduous teeth are shown on table 3.
Table 3.

<table>
<thead>
<tr>
<th>Race</th>
<th>Age Group</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fijian</td>
<td>5-6</td>
<td>1.6</td>
</tr>
<tr>
<td>Indian</td>
<td>5-6</td>
<td>2.4</td>
</tr>
<tr>
<td>Combined races</td>
<td></td>
<td>4.2</td>
</tr>
</tbody>
</table>

The Indian children had a higher df rate than the Fijians and this finding may be explained by the fact that Fijian children grow up in a more natural environment than the Indians, who live in towns and settlements close to the urban centres and have more access to sweets and biscuits.

The findings in the permanent dentition for all age groups are shown in Table 4.

Table 4.

<table>
<thead>
<tr>
<th>Race</th>
<th>Age Group</th>
<th>DMF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fijian</td>
<td>8-14</td>
<td>5.6</td>
</tr>
<tr>
<td>Indian</td>
<td>8-14</td>
<td>4.2</td>
</tr>
<tr>
<td>Combined races</td>
<td></td>
<td>4.9</td>
</tr>
</tbody>
</table>

This is a reverse state from the deciduous dentition of the two main races.

There is a definite indication that the Fijian population in early adulthood and late adolescence tend to drift into urban centres seeking employment. The survey team reported that the DMF rate increased with age in all races and
reached a DMF of 11.0 at the age of 45-54 years.

In 1978, John Speak and others carried out another survey in the country's six urban centres and the report on the permanent teeth is shown on table 5. The report stated that the Fijian children in the study age groups have higher disease levels than the Indian children. The difference tends to increase with age.

**Table 5.**

<table>
<thead>
<tr>
<th>Age group</th>
<th>Percentage with DMF</th>
<th>Mean DMF rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>21</td>
<td>0.3</td>
</tr>
<tr>
<td>8</td>
<td>50</td>
<td>1.1</td>
</tr>
<tr>
<td>10</td>
<td>63</td>
<td>1.7</td>
</tr>
<tr>
<td>12</td>
<td>70</td>
<td>3.0</td>
</tr>
<tr>
<td>14</td>
<td>82</td>
<td>4.0</td>
</tr>
</tbody>
</table>

By 14 years, Fijians averaged DMF 6.3 teeth with caries, while Indians only 3.3. The team reported that the df rate of the primary teeth of all races among 6 and 8 year olds was 6.6. The findings of this survey showed that caries rates outside the capital (Suva), which had been fluoridated since 1969, were approximately twice as high as in Suva.

The last survey was conducted in 1980 to estimate the prevalence of dental disease of rural school children and comparisons were made with the results of the urban survey. The results indicates that the urban caries rate was low. The findings of 1965, 1978, 1980 on permanent teeth are shown on table 6.
Table 6.

<table>
<thead>
<tr>
<th>Age group</th>
<th>1965</th>
<th>1978</th>
<th>1980</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DMF</td>
<td>DMF</td>
<td>DMF</td>
</tr>
<tr>
<td>6</td>
<td>-</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>8</td>
<td>0.5</td>
<td>1.1</td>
<td>1.0</td>
</tr>
<tr>
<td>10</td>
<td>0.9</td>
<td>1.7</td>
<td>1.5</td>
</tr>
<tr>
<td>12</td>
<td>1.6</td>
<td>3.0</td>
<td>2.8</td>
</tr>
<tr>
<td>14</td>
<td>2.5</td>
<td>4.0</td>
<td>3.5</td>
</tr>
</tbody>
</table>

The findings of 5-6 year age groups in the primary teeth is also shown on table 7.

Table 7.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Year</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-6</td>
<td>1965</td>
<td>4.2</td>
</tr>
<tr>
<td>5-6</td>
<td>1978</td>
<td>6.6</td>
</tr>
<tr>
<td>5-6</td>
<td>1980</td>
<td>6.1</td>
</tr>
</tbody>
</table>

Both Indian and Fijians caries rates in rural areas fall into the "Low" category as opposed to the urban areas (with the exception of the fluoridated capital Suva city) which were "moderate".

The data collected in 1978 and 1980 indicated that there are at least three factors affecting caries rates in school children in Fiji. These are the urban or rural location, the ethnic group and the fluoridation of the water supply.
According to the last census (1976) approximately 65% of the children live in rural areas, 19% live in Suva, which is fluoridated, and 16% in non-fluoridated urban areas. About 50% of the children in the rural areas are Fijian and 47% Indian, while 37% of the children in non-fluoridated urban areas are Fijians and 52% are Indians.

To estimate the national situation, these rates have been adjusted to allow for differences by dividing into 5 sub-groups (urban Fijian, urban Indian, rural Fijian, rural Indian and Suva (fluoridated). This gives age specific DMF and df rates in tables 6 and 7.

4.2 Etiology of Dental Caries in General

Dental caries simply means decay or rotting of the teeth. It is a progressive destruction of enamel, dentine, and cementum initiated by microbial activity at the tooth surface (L.M. Silverstone, N.W. Johnson, J.M. Hardie, R.A.D. Williams - Dental Caries). Theories have been established to describe the causes, but the most accepted present-day theory is the chemico-parasitic or acidogenic theory put forward by W.D. Miller in 1890. It proposes that carious lesions are the result of a process of demineralisation of enamel and dentine by acids. The prime factors of dental caries can be grouped into three categories: (1) microbial agents, (2) host and teeth; (3) general and local environment. In order for carious lesions to occur in human beings or experimental animals, adverse conditions of these three categories must be met simultaneously:

(1) Caries producing micro-organisms must be present in the
mouth and colonize the teeth in sufficient numbers.

(2) The host and the teeth must be prone to develop carious lesions.

(3) Foods with caries-producing potential must be consumed in a caries conducive way (James H. Shaw - A Text book of Preventive Dentistry).

Unless all three parameters are fulfilled simultaneously (as indicated at the centre of the figure shown), carious lesions can not occur. Dental caries is a chronic disease, and so these conditions must prevail for weeks, months, or years in order for tooth substance to be destroyed sufficiently for carious lesions to be evident clinically.

The three categories now will be discussed:

1. Microbial Agents

Studies on gnotobiotic animals have shown that many strains of Streptococcus mutans of both animal and human origin are highly cariogenic under suitable experimental conditions. Some other bacteria, to a lesser extent, are capable of inducing caries. Among these species shown to have this ability are strains of Streptococcus sanguis, Streptococcus salivarius, Streptococcus milleri, Lactobacillus acidophilus, Lactobacillus casei, Actinomyces naeslundii and Actinomyces viscosus.

The cariogenic potential of streptococci in animals may be modified by the presence of other microorganisms such as Veillonella species in the mouth.

Cross-sectional surveys on human populations have indicated an association between the presence of Streptococcal
This scheme demonstrates the interrelationship between cariogenic agents (A), the host and his teeth (H), and the general and local environment (E). (Modified from Keyes, P. H., and Jordan, H. V.: Factors influencing the initiation, transmission, and inhibition of dental caries. In Sognnaes, R. F.: Mechanisms of Hard Tissue Destruction. Publication 75. Washington, D.C., American Association for the Advancement of Sciences.

**Figure 5.** Microbial agents in the process of dental caries
mutans and the degree of caries experience. Few longitudinal studies on humans have been undertaken, but there is some evidence of a relationship between colonisation of teeth by Streptococcal mutans and the incidence of caries; more extensive longitudinal studies are required. Such studies should include examination of other microorganisms in addition to Streptococcal mutans.

In some situations, such as root surface caries, other bacteria (for example, Actinomyces species) may play a significant role in the initiation of caries. All the bacteria which have been implicated in dental caries are capable of producing acid from carbohydrates. Streptococci and Lactobacilli in particular will reduce the pH of glucose broth to below 5.0 in conventional culture-systems. Streptococcus mutans strains generally produce a terminal pH in the range 4.2 to 4.6. Lactic acid is the expected end-product of fermentation of these bacteria, although other products are found when strains are grown under conditions of carbon-limitation. Similar variations in the types of acid are produced in dental plaque in vivo, under different conditions of carbohydrate availability.

In addition to their ability to produce acid, Streptococcus mutans and Streptococcus sanguis possess two further properties which may be relevant to their cariogenic potential:

1. Both species produce extracellular glucose polymers (glucans) from sucrose.
2. Both species display an ability to adhere to and grow upon hard surfaces such as glass, wire or teeth.
The latter property can be demonstrated in the laboratory, and artificially produced deposits of such bacteria are used experimentally to stimulate dental plaque. The formation of adherent surface deposits is not confined to Streptococci. Several filamentous bacteria, including some Actinomyces also share this property. The relative ability of different bacterial species to adhere to and colonise hard and soft tissue surfaces may be an important factor in the formation of dental plaque.

A great deal of research has been carried out on the extracellular polysaccharides produced by oral Streptococci, especially Streptococcus mutans and on the enzymes involved in their synthesis. Strains of S. mutans appear to produce both water-soluble and water-insoluble glucans. It has been demonstrated that mutant strains of S. mutans which have lost their ability to produce insoluble extracellular glucans are less cariogenic in gnotobiotic animals than the present strains from which the mutants were derived (L.M. Silverstone, N.W. Johnson, J.M. Hardie, R.A.D. Williams - Dental Caries, Pathology and Prevention, p. 59). The extracellular glucans produced by Streptococcus sanguis strains differ in some respects from those of Streptococcus mutans. It is not known if this is the only reason why Streptococcus sanguis appears to be less cariogenic.

In studies on the relationship of oral bacteria to dental caries, much reliance has been placed on colonial morphology under particular cultural conditions. This has been common with the investigation on the Streptococcal flora, since extracellular polysaccharide-producing species
often produce characteristic colonies on culture plates containing sucrose.

2. Host and Teeth

The factors influencing dental caries in the etiologic category associated with the host and his teeth may be divided into three segments:

(a) those related to the genetic (determinants) constitution of the individual;

(b) those influenced by the physiologic status of the host;

(c) those non-genetic factors associated with the development of the teeth.

(a) Genetic determinants

In rodent animals, the search for genetic determinants of caries activity suggested that some strains tended to be more prone to develop caries lesions than other strains of the same species, when offered the same diet and maintained under identical conditions. In the human populations the evidence for truly genetic determinants of caries proneness also appears to be weak.

The difference between the lower dental caries prevalence in the people of developing countries and the higher prevalence of those in the industrialized nations was thought to be possible evidence of genetically determined resistance among some races. Early evidence that did not support this premise was provided by a study of Eskimos in Alaska. Those groups in remote areas from the influencing of colonizing and trading Europeans continued to have low dental caries prevalences. Those to whom the sugars,
refined flours and the confections of the "outside" world became available had striking increases in dental caries. Information is available now for individuals who moved from a country with low caries experience to an industrialized nation with high caries experience. When these individuals adopted the dietary habits of their new home, their caries experience dramatically increased. In the same manner, as the economic resources of the developing nations increased, they began to adopt the use of sugars and various foods and confections of the more developed countries, and the caries experiences increased rapidly.

It has been suggested that genetic influences are expressed in tooth structure and chemical composition and the morphology of the pits and fissures of the occlusal surfaces. If truly genetic influences on the caries susceptibility of human populations exist, they appear to be relatively weak, and easily overwhelmed by the oral environmental exposure to foods, that have high caries potential and are frequently consumed.

(b) Physiologic determinants

In experimental animals, surgical removal of the parotid, sub-maxillary and sub-lingual salivary glands causes a 20-fold increase in caries activity above that for normal siblings fed the same cariogenic diet for the same interval. Likewise, in humans, the congenital absence of one or more major salivary glands results in increases in dental caries incidence (Stallard, R. - A textbook of Preventive Dentistry) which is presumably a result of the reduced salivary flow.
The value of the saliva can be attributed to at least the following characteristics:

(1) The normal volume of about one litre per day washes and lubricates all surfaces routinely with augmented rates of flow during food consumption.

(2) The carbonate buffer system in saliva neutralizes substantial amounts of acids without important reductions in pH.

(3) Numerous organic compounds, including secretory immunoglobulin A and inorganic components, have the potential to be antimicrobial by various mechanisms.

Investigations are still being carried out into salivary composition, its viscosity and phosphorus content to determine if such differences are related to dental caries. Investigators believe that saliva is one of the most obvious physiologic components of the oral milieu, in which physiologic variations such as the rate flow and the composition could influence the development of carious lesions.

(c) Developmental influences on the host

The best known example of an influence on the developing teeth is the ingestion of optimal amounts of fluoride, because of the resulting increased concentrations of fluoride in enamel and dentine and well-documented increased resistance to tooth decay. In 1920, Wolbach and How demonstrated the need for an adequate amount of vitamin A to maintain the integrity of the ameloblasts and to enable them to form normal enamel, and an adequate amount of vitamin C to maintain the odontoblasts to form dentine at the optimal
rate. In the same era, Mellanby demonstrated the inadequate mineralization of the organic matrix of enamel and dentine during vitamin D deficiency, resulting in enamel hypoplasia. Other experimental models suggest that the dietary composition during tooth development may influence not only the teeth, but also the development and ultimate functions of salivary glands and their quality of secretion. Other investigators also demonstrated the adverse influence of calcium or phosphorus deficiencies and of grossly unbalanced calcium to phosphorus ratios on the mineralization of developing teeth.

No clear relationship of protein-calorie malnutrition, in children in developing countries, to an increased susceptibility to dental caries has been demonstrated. This may be because their overall dietary habits and the resulting oral environment are not conducive to high dental caries experience.

3. General and Local Environment

The factors which are of significance are dental plaques, the structure and the resistance of the teeth; the position, form and contour of the teeth; oral hygiene and systemic factors.

The presence of dental plaques provide a habitat for the growth of organisms, retention of the substrate and maintaining the acid in contact with the teeth. Surfaces which are poorly formed and irregular are conducive to retention of plaques, while smooth well-formed surfaces are less apt to retain plaques. Teeth which are highly calcified with complete maturation of the enamel are not readily
destroyed by acid than those having poorly mature enamel. Deep fissures provide a habitat for the growth of organisms, retention of substrate and maintain the acid with tooth surface. The surfaces of the teeth beneath the plaque are partially separated from the buffering system of the saliva so that high concentration of acid may occur. The viscosity of the saliva has been suggested to be of significance in dental caries because:

(1) a thick mucinous saliva provides added material to form plaques, hangs to the surfaces of the teeth and entraps food debris, and

(2) conversely a thin copious saliva provides little material to form plaques and washes away food debris.

In those situations where the teeth are malpositioned, there is a tendency for the retention of food debris and for plaques to be protected from the detergent action of food. The nature of the food eaten is of significance in other ways, such as carbohydrate content soft diets have a tendency to adhere to the tooth surfaces and have little detergent effect, whereas coarse diets have a detergent action and prevent the formation of plaque.

Summary

The primary causes of dental caries are exclusively of external and local nature.

(1) Dental plaque (microbial deposits).

The dental plaque is really a bacterial colonization which is firmly adherent to a hard surface, such as the tooth or prosthesis. Everything that promotes plaque accumulation
is potentially cariogenic: for example oral uncleanness, tooth positional anomalies, improper fillings and poorly contoured crowns present so-called retention zones. The slogan "No bacteria, no caries" (Mühlemann, H.R. - Introduction to Oral Preventive Medicine, page 24) emphasizes the importance of mechanical and chemo-therapeutic measures of oral hygiene in caries prevention.

(2) **Fermentable carbohydrates**

If dental plaque is exposed to a fermentable substance, for example a sugar solution, lactic acid is formed immediately due to enzymatic glycolysis. The resting of pH of plaque falls within a few minutes from approximately 6.7 to 4.0. At the "critical" pH of 5.5, enamel is decalcified. All mono- and disaccharides are rapidly fermented to acids. Only sucrose plays an additional role in plaque genesis. Certain plaque Streptococci can synthesize from sucrose the sticky extracellular polysaccharides (Levans, dextrans, mutans) which cement plaque bacteria together. This promotes the accumulation of microbial deposits on the teeth. "No fermentable carbohydrates, no caries!" This slogan also points out the significance of a rationally regulated intake of sugar, both for caries prevention and, as well as for the prevention of gingivitis.

There are two additional oral factors which can determine the incidence of dental caries to a great degree:

(a) An abundant flow of saliva.

The bicarbonate buffer system of stimulated saliva can partially neutralize the acids produced by plaque. This
clarifies the role of the hard, saliva-stimulating food-stuffs in caries prevention. On the other hand, a dry mouth (Xerostomia) promotes caries and gingivitis

(b) High fluoride content inhibits enamel demineralization by acids produced in the plaque. This is one of several ways in which fluoride aids in the prevention of dental caries.

4.3 Prevalence of Periodontal Disease in Fiji

There is still no accurate data to record periodontal conditions from the past surveys in Fiji, however Wong's survey in 1965 indicated that there are periodontal problems.

Periodontal Status

Wong reported that the percentage of people affected by gingival conditions increased with age, 58.6% Indians and 69.1% Fijians were affected.

Of the persons examined between 20-54 year old age group, 40% had periodontal pockets greater than 4 mm, 5% had pockets greater than 6 mm and 60% had no pockets.

The presence of calculus increased with age and was widespread even in children of the 5-6 year old age group. There is a direct correlation existing between calculus and gingivitis. Oral hygiene was best in school children from 9-19 years of age. Materia alba was more prevalent in preschool children. Other findings recorded in the survey are:

(i) Dentofacial anomalies

This is not really a problem yet, children usually
have well-developed jaws; it is however more prevalent in Indian children.

Maxillary overjet (10.6%) in association with deep overbite (5.7%) accounted for the majority of anomalies.

The next most common anomalies are crowding (5.6%) and overbite (4.2%), 21% of the children require treatment. (ii) The need for prosthesis is small, only 40% of the people between 20-54 years of age require full dentures either full upper or lower dentures. The prosthetic needs beyond 54 years were not assessed. The number requiring prosthesis beyond this age group appear to be increasing. Life expectancy in Fiji is as follows (1981 census):

(a) Fijians - males 67 years
    females 72.5 years
(b) Indians - males 65 years
    females 67.05 years

These findings were recorded in 1965, therefore they may not be the true indices for the prevalence of periodontal diseases in Fiji today.

4.4 Etiology of Periodontal Diseases in General

The term periodontal disease refers to those disturbances which are unique to the periodontium because of its form and function. Thus, the term refers to diseases which occur primarily because of, but not incidental to the presence of the periodontal structures (Donald A. Kerr, Major M. Ash Jr.). In this sense, gingivitis and perio-
dontitis are examples of periodontal disease.

Other types of lesions such as oral manifestations of dermatologic disorders involving periodontium are not unique to periodontium and can not be considered as periodontal disease; e.g. herpetic gingivostomatitis.

The etiologic factors or causes of periodontal disease may be divided for discussion purposes into two groups:

A. **Initiating Factors**

1. Surface irritants: calculus, materia alba, dental plaque and bacteria
2. Faulty dentistry: overhanging margins of restorations, open contacts, improper marginal ridges, porous filling material and lack of functional contours
3. Mouth breathing.

B. **Modifying (Contributory) Factors**

1. Dysfunctional factors: malposed teeth, unilateral mastication, traumatic occlusion, loss of teeth
2. Systemic Factors: hormonal imbalance, nutritional deficiencies, metabolic errors, resistance, constitution and hereditary factors.

A. **Initiating Factors**

These are the factors which cause injury to the periodontium. The initiation of periodontal disease involves poor oral hygiene, because of the presence of calculus, dental plaques, and materia alba, which produce chemical,
bacterial, and mechanical irritation of the periodontium.

1. **Surface irritants**

   Dental plaques, materia alba and calculus are irritants of local origin which injure the gingiva. Calculus may produce injury to the gingiva, especially that of unkeratinized crevicular epithelium, because of mechanical trauma arising from the hard and rough surfaces of the calculus.

   During movement of teeth and when pressure is placed on the gingiva, the calculus produces physical injury to the soft tissue.

   The irritation of the gingiva, especially the gingival crevice, by plaque and calculus leads to ulceration of the crevicular epithelium.

   Changes in the local resistance of the tissues with inflammatory response may result from interference of the blood supply and trauma. Such changes and ulceration of the epithelium predisposes the tissues to the effects of microorganisms.

   The action of microorganisms is not by direct invasion of healthy tissues, but by the production of substances which facilitate the spread of organisms and inflammation. These substances (enzymes) include hyaluronidase which acts to break down hyaluronic acid, an important component of connective tissue. Thus, bacterial toxins and enzymes are important agents in the production and spread of inflammation.

   The spread and extension of gingivitis is an
important consideration in the loss of the supporting structures of the teeth.

The removal of dental plaque, materia alba and calculus is a primary consideration in the prevention of periodontal disease. A periodic prophylaxis and maintenance of good oral hygiene by the patient is absolutely necessary to prevent the formation of the above surface irritants and to prevent periodontal disease.

Faulty dental restorations as manifested by overhanging margins, faulty marginal ridges and improper proximal contacts are important factors in the causation of periodontal disease.

Poorly constructed restorations or appliances often lead to mechanical injury of the tissues and the retention of food debris and bacteria.

Food impaction may be the result of open proximal contact, faulty marginal ridges, and inadequate functional contouring of the restored surfaces of the teeth. The wedging of the teeth by the food in the gingival crevice and in the interproximal areas lead to mechanical, chemical and bacterial irritation. The wedging of the teeth by the food may also produce circulatory disturbances. If the impacted food is not removed, it will break down and ferment with the production of toxins and bacterial enzymes.

The removal of overhanging margins of restorations and the prevention of food impaction is an important part of periodontal therapy.

Porous filling materials, especially poorly processed acrylic and silicates, are detrimental to the soft tissues
since they become impregnated with soft debris and bacteria and also provide a basis for the attachment of plaques and calculus.

Faulty toothbrushing and improper massage of the gingiva will cause soft tissue laceration, pressure atrophy, and circulatory disturbances of the gingiva. Gingival recession is frequently seen in association with cross-stroke or scrub-brush methods of brushing and where excessive pressure is applied.

Mouthbreathing which causes constant drying of the gingiva will produce gingival irritation. Mouthbreathing may be a residual habit formed during childhood in response to tongue and lip habit associated with enlarged tonsils and adenoids.

Mouthbreathing may also be related to functional or organic obstruction of the nasal passages. Functional obstruction may occur as the result of an enlarged venous bed in the nasal mucous membrane. Organic nasal obstruction may be due to a deviated nasal septa, traumatic injury or growth in the nasal passages.

Gingival irritation associated with mouthbreathing is often limited to the area of the gingiva which is left uncovered by the lips. Constant drying of the mucosa may also be present in non-mouthbreathers where malposed and protruding teeth prevent normal closure of the lips.

Chemical, thermal and mechanical irritants which produce injury elsewhere in the mouth may also cause gingival irritation. The use of tobacco in any form will act as an
irritant. The mechanism by which this occurs may be related to heat, stains, deposits, or by-products of the tobacco. Caustic drugs, aspirin, toothache drops, and other medicaments are capable of producing an acute gingival inflammation.

B. Modifying or Contributing Factors

Several factors contribute to the initiation and maintenance of periodontal disease and modify the response of the tissue to injury. Such contributory and modifying factors may be grouped into dysfunctional and systemic factors. Dysfunctional factors include hyper and hypofunction of the teeth. Systemic factors include endocrine and nutritional disturbances.

Dysfunctional irritation of the periodontium may result from traumatic occlusion arising from purposeless tapping, grinding and gnashing of the teeth (bruxism), loss of teeth, malpositioned teeth and "high" restorations.

Traumatic occlusion results in circulatory disturbances which interfere with the normal metabolic and functional characteristics of the periodontium.

It may also cause hyperemia, inflammatory oedema, degeneration, atrophy and necrosis of the tissues of the periodontium.

Circulatory and metabolic disturbances are of special significance in the gingiva, when the surface irritants such as calculus, and plaques, are present.

The lowering of the resistance of the tissues of the periodontium by traumatic occlusion predisposes to the
extension of inflammation arising from surface irritants into the supporting structure.

Dysfunctional irritation arising from traumatic occlusion may also lead to periodontal atrophy and gingival recession.

Occlusal dysfunction may bring about drifting and repositioning of teeth.

Hypofunction of teeth occurs from nonocclusion, unilateral mastication and tooth malposition.

Teeth which are out of physiologic function or occlusion do not properly stimulate the supporting structures and lead to disuse and atrophy of the periodontal structures.

Thus, hypofunction of the teeth leads to a lowering of the resistance of the supporting structures of the teeth. This fact may be readily appreciated by observing accumulation of plaques and calculus which are present on the teeth which do not have an occluding tooth in the opposing arch. This same effect may also be noted as well in unilateral mastication.

The side which is not used in mastication will tend to accumulate soft debris and plaques and will exhibit more gingivitis than that of the side which is habitually used.

Systemic disease does not produce periodontal disease, however the response of the periodontium to local injuries which initiate the disease is reflected in the nutritional, hormonal and metabolic state of the individual.

In the absence of an injurious agent, no response of the tissues as manifested by gingivitis or periodontitis is to be anticipated.
The type and severity of the response to injury is dependent upon the local factors present and upon systemic influences which modify the response of the tissues to injury. In most instances systemic influences on the periodontium cannot be altered and the treatment of periodontal disease is directed toward the removal of all the local factors which initiate and contribute to the disease. Thus, rational periodontal therapy is directed toward the removal of local and dysfunctional irritants.

Nutrition is an essential factor in the maintenance of a normal periodontium, there is little conclusive evidence to indicate that human nutritional deficiencies are widespread or important specifically in the production of periodontal disease (Donald A. Kerr, Oral Pathology for Hygienists).

Subclinical deficiencies of various vitamins, minerals and other foodstuffs do not appear to be clinically important in the production of periodontal disease.

Vitamin C deficiency is often pointed out as the cause of gingivitis. Hormonal imbalance is potentially capable of modifying the response of the gingiva to irritation. Severe response of the gingiva to irritation may be seen in puberty and in pregnancy. Gingivitis is associated with pre-menopause and postmenopause. Gingivitis associated with endocrine dysfunctions at the time of menopause is referred to as hormonal gingivitis.

Diabetes mellitus, especially those with uncontrolled diabetes appear to be more susceptible to presence of local
irritants, therefore it is also associated with gingivitis.

From the foregoing discussion of the etiologic factors of periodontal disease, it is obvious that the primary cause of periodontal disease is of local origin, i.e. periodontal disease is inflammatory in nature and the reaction of the tissues to injury.

It is local in origin in that it is initiated by surface irritants arising from poor oral hygiene, faulty dentistry, mouthbreathing, improper toothbrushing and other irritants.

Furthermore, dysfunctional irritants may also contribute to the production of periodontal disease and systemic influences may alter the response of the tissue to the irritants.

This concept of the etiology of periodontal disease places the emphasis of the treatment and prevention of the periodontal disease and on the removal of surface and dys-functional irritants.

4.5 **Etiology of Malocclusion**

The causes of malocclusion can be considered in two main groups:

(a) Those of general origin.
(b) Local causes.

Any of these causes may exist singly or in various combination in any individual case.
A. General Causes of Malocclusion

(1) Discrepancy in basal relationship of the jaws.
Inherent differences in size in various parts of the cranial base and the mandible may result in a disproportion in size and relationship between the maxilla and the mandible. Such differences in jaw or basal relationship may be discussed under the heading: "normal", "post-normal", and "pre-normal".

Normal basal relationship - When the basal relationship is normal, malocclusion can exist if there is either:

(i) A disparity in size between the teeth and the jaw bases, or

(ii) a malrelationship between the alveolar processes and teeth and jaw bases.
Protruding maxillary incisors and post-normal molar occlusion with a normal basal relationship is an example of the latter type. In such a case the upper arch, that is the alveolar process and teeth is forward in relation to the maxillary base.

Post-normal basal relationship - This indicates that the mandible is posteriorly placed in relation to the maxilla and may be associated with any of the circumstances:

(i) A mandible small in antero-posterior dimension.

(ii) A maxilla of average size in a relatively forward position due to an original prominence of the nasal capsule.

(iii) A maxilla of excessive size associated with a well-formed or small mandible.
These cases will show abnormal incisor relationship.
Pre-normal basal relationship - This indicates that the mandible is anteriorly placed in relation to the maxilla and may be associated with any of the following circumstances:

(i) An excessive long mandible and a well-formed and normally positioned maxilla.

(ii) A well-formed maxilla associated with a short and more acutely angled cranial base. The mandible may be of average size.

(iii) A small maxilla associated possibly with an originally small nasal capsule and an average or large mandible. The relatively anterior position of the mandible will usually result in the lower incisors occluding labially to the uppers.

(2) Soft Tissue Morphology

The environment of the erupting dentition is such as to guide the teeth into a correct occlusion. This muscular balance is achieved by the lips, cheeks and tongue, but sometimes is disturbed by abnormal or habitual behaviour patterns. As a result, the position of equilibrium will be altered from the accepted normal, once this has brought about a differing inclination of the teeth, their position may progressively alter until a new stable position is attained. This can be illustrated by a consideration of lip morphology. The lips may be competent, incompetent or potentially competent.

Competent lips are those which rest lightly together with the mandible in the rest position. Incompetent lips are those which cannot produce an anterioal seal with the mandible in the rest position, without the contraction of the
circumoral musculature. The seal may not be produced by the lips alone, as protruding incisors and tongue may help to bring about the final seal, which is produced each time a person swallows. Lips may be incompetent due to the shortness of the upper lip or due to obtuseness of the angle of the mandible or a combination of both factors. Potentially competent lips are those which, but for the protrusion of the upper incisors between them would be able to assume the position of competence.

Tongue morphology - The normal position of the tongue and action of the tongue acts as a counter to the action of competent lips, maintaining a stable incisor position at the accepted normal inclination.

(3) **Tooth/Tissue Ratio**

This ratio refers to the relationship between the size of the jaws and the size of the teeth contained in them. An abnormality of this relationship is one of the most important single causes of malocclusion.

(4) **Interference with Normal Growth and the Mandibular Condyles**

Lesions of condyle are rare in infancy, but when they occur they may cause restricted movement at the joint, damage to the condylar growth centre, or complete ankylosis.

(5) **Endocrine Dysfunction**

(i) **Hyperpituitarism** - Acromegaly results when an adenoma of the anterior lobe of the pituitary gland develops during adult life. There is an excessive growth of the mandible,
hence the teeth become spaced and the occlusion disarranged.

(ii) **Hypopituitarism** - When this occurs in very young children, it results in dwarfism, so that the jaws are much under-developed and smaller than normal. The teeth are of normal size and hence they are crowded.

(6) **Developmental and Congenital Malocclusion**

Clefts of primary and secondary palates and micrognathia give rise to malocclusion.

**B. Local Causes of Malocclusion**

(1) **Anodontia** - may be partial or complete. The most frequently missing teeth are the maxillary second incisors, the mandibular second premolars and the third molars of both arches.

(2) **Extra Teeth**

Supernumerary teeth may cause displacement or rotation of the permanent teeth, and may prevent eruption.

(3) **Premature Loss of Deciduous Teeth**

Associated with the growth of the alveolar bone, there is a marked forward migration of the whole dentition.

(4) **Early Loss of Permanent Teeth** - may occur through caries or trauma. The effects will follow closely those resulting from early loss of deciduous teeth, and will primarily depend upon the soft tissue influence and tooth/tissue ratio.
(5) Retained Deciduous Teeth

Retained deciduous teeth may cause their permanent successors to deviate from their normal path of eruption or occasionally they may prevent their eruption. This results in the lingual or buccal displacement of these teeth with a consequent local malocclusion.

(6) Pathological Conditions

The presence of a cyst or an odontome may prevent the eruption or cause displacement of one or more permanent teeth.

(7) Abnormal Position of Crypts

The canines and the lower third molars are most commonly displaced teeth in both arches. The canine may be situated labially, but occasionally found on the palate.

(8) Teeth of Abnormal Size

If too small, as in the case of a peg-shaped maxillary second incisor, for aesthetic reasons a porcelain jacket crown can be made. If an extra large tooth is present, due to germination or partial dichotomy, then it may fail to erupt or prevent neighbouring teeth from erupting.

(9) Transposition

This rare condition is usually to be found in the 432 234 region, but it may occasionally occur in the 32 23 region. No treatment is called for to correct the actual transposition.
(10) Impaction of Permanent First Molars

This may occur against the cervix of the deciduous second molar. It may cause resorption of the deciduous tooth and in some cases the apical portion of the distal root is completely cut off.

(11) Maxillary Median Diastema

A median diastema exists between the maxillary first incisors at the time of their eruption. Normally closure of this space occurs during the eruption of the second incisors and canines; their eruption producing pressure on the distal aspect of the first incisors. If the incisors are within the limits of normal inclination to the maxillary plane then the diastema may be due to:

(a) Where the jaw size is excessive in relation to the tooth size.
(b) Partial anodontia.
(c) Presence of midline supernumeraries. These teeth in this position are called niesiodens, and by their presence provide a mechanical obstruction to the approximation of the incisors.
(d) Presence of pathological conditions such as cysts and ordontomes.
(e) Enlarged fraenium labii.
(f) Heredity.

Occasionally, none of the foregone factors can be found present to account for diastema; however a familial history of a parent or grandparent having the same condition can be found.
ETIOLOGY OF MALOCCLUSION

Malocclusion from finger-sucking.

Figure 6.

Malocclusion caused by an abnormal tongue-thrusting habit during swallowing.

Figure 7.
(12) **Trauma**

Mechanical injury to the permanent dentition during the formation of the crowns and roots may change or arrest the normal development of the teeth in the affected area. This commonly occurs in the upper and incisor regions as a result of a blow transmitted through the deciduous incisors.

(13) **Habits**

(a) **Thumb and finger sucking**

Digital sucking is practised by many children for various reasons.

(b) **Tongue-thrusting**

Tongue-thrust swallows that may be etiologic to malocclusion are of two types:

(i) The simple tongue-thrust swallow, which is a tongue-thrust associated with a normal or teeth-together swallow,

(ii) The complex tongue-thrust associated with a teeth-apart swallow.

The simple tongue-thrust swallow is associated with a history of digital sucking, even though the sucking habits may no longer be practised, since it is necessary for the tongue to thrust forward through the open bite to maintain an anterior seal with the lips during the swallow. Complex tongue-thrusts are more likely to be associated with chronic naso-respiratory distress; mouth-breathing; tonsillitis or pharyngitis.

(c) **Lip-sucking**

Lip-sucking may appear by itself or it may be seen with
thumb-sucking.

(d) **Other habits**

(i) The constant holding of a very young baby supine on a hard, flat surface can mould and shape the head by flattening the occiput or produce facial asymmetry.

(ii) The significance of pillowing and sleeping on the arm.

(iii) The habitual sucking of pencils or other hard objects may affect the position of the growing teeth.
5. **PREVENTIVE MEASURES**

5.1 **Water Fluoridation**

There are three basic approaches to the prevention of dental decay. Attempts may be made:

1. to reduce the mat of microbial plaque on teeth using mechanical means or chemical agents;
2. to control dietary practices by urging people to eat less refined carbohydrates less frequently, and
3. to increase the resistance of the teeth through the use of various fluorides and pit and fissure sealants.

The third strategy, increasing tooth resistance is by far most effective and feasible a way to prevent dental caries and therefore this chapter will be mainly devoted to fluoridation.

Fluoridation involves the controlled addition of fluoride, a normal constituent of bone and teeth to reticulate water to adjust the natural fluoride level to a level of 1.0 ppm which has been proven to most effectively reduce the incidence of dental caries.

The evidence suggests that fluoride provides anticaries effects in several ways, and that under certain conditions several mechanisms may function simultaneously.

The mechanism by which fluoride increases caries resistance may arise from both systemic and also topical applications of fluoride and can be broadly grouped as follows:

1. Increased enamel resistance.
2. Increased rate of maturation.
3. Remineralisation of incipient caries.

4. Improved tooth morphology.

The definition of community water fluoridation is the process of adjusting the amount of fluoride in a community's water supply to an optimal concentration for prevention of dental decay.

According to the literature, the word "adjusting" is critical in definition because virtually all water supplies naturally contain some fluoride. There is really no such thing as a fluoride-free water supply.

In community water fluoridation we are merely adjusting the amount that is there naturally to a concentration that is optimal for dental health.

The use of fluoride in various forms remains pre-eminent among the measures available for increasing the resistance of teeth to carious attack.

Continuing attention should be focused on the resolution of the Twenty Second World Health Assembly on fluoridation and dental health, which "Recommends member States examine the possibility of introducing where practicable water fluoridation of those community water supplies, where the fluoride intake from water and other sources for the given population is below optimal levels, as a proven public health measure, and where fluoridation of community water supplies is not practicable, to study other methods of using fluorides for protection of dental health". (Training Course for Fluoridation Personnel by J.C. Cantwell, page 32.)

Despite this recommendation, Fiji has not fully
exploited the full potential of this and other methods using fluorides for the prevention of dental caries due to financial constraints.

School water fluoridation has proved to be very effective in other countries. Preliminary results from studies in the USA have established that this is a safe, effective and inexpensive procedure. It is particularly to be recommended where children are provided with regular meals at school and only when the maintenance of equipment and fluoride levels can be properly controlled under surveillance of a responsible engineer, teacher or health worker.

5.2 **Fluoridation and the Benefits**

There are several attributes of community water fluoridation that are better than any other method of fluoride delivery.

The advantages of water fluoridation are:

1. It is the least expensive, most effective and most equitable way to reduce dental caries in a large group of people.

2. It is eminently safe.

Because there has been so much controversy over community water fluoridation, and because opponents have continued to make allegations against the procedure, water fluoridation is the most studied disease-preventive method known at the present time.

There have been hundreds of studies on the safety as well as on the efficacy of community water fluoridation during the past 40 years and it has proved extremely safe.
3. It is an extremely equitable public health method

The entire community benefits from water fluoridation. It reaches everyone regardless of age, socioeconomic status, education level or any other social variable, which is not necessarily true of other public health methods. Vaccinations, for example, although highly effective, may not reach everyone for a variety of reasons.

With water fluoridation, the very fact that one lives in a community means that there will be automatic benefits when water is consumed or when food is cooked in the water from the community water supply.

4. Essentially no conscious, cooperative effort or direct action on the part of individuals is required for the benefit to be derived. However, it is important that individuals drink the water, and it is also essential for individuals to be knowledgeable about the benefits of fluoridation so that public support for the measure is maintained.

5. Benefits of fluoridation continue for a lifetime if consumption continues. It has been recently reported that life-long consumption of fluoridated water significantly lowers the prevalence of root surface caries later in life.

6. The costs of dental care are reduced considerably for persons consuming fluoridated water.

The most frequently reported level of protection for primary teeth has been between a 40 and 50 per cent reduction in the prevalence of dental caries. For permanent teeth, the most frequent degree of caries protection has been 50 to 60 percent. This is a very profound level of protection.
No studies have reported less than a 20 per cent reduction in decay, and likewise only very few studies have reported reduction as high as 80 to 90 per cent reduction.

Some key facts about water fluoridation are that:

1. The optimal concentration is 1 part fluoride per million parts water (1 ppm). But, there is a gradient in this optimal concentration, depending on temperature zone of an area, cold climates require about 1.2 ppm of fluoride in a water supply and in very hot climates 0.7 ppm of fluoride is recommended. This is because it has been shown that people in a hot climate consume more water than those in colder climates.

2. Caries reduction range between 50 and 65 per cent.

3. Safety and effectiveness have been widely demonstrated.

4. Fluoridation is the least costly method of caries prevention.

5. About 51 per cent of the (1971) total U.S. population is now living in communities that have optimal concentration of fluoride in their water supplies. This 51 per cent includes communities that contain natural concentrations of fluoride at optimal or greater levels. Nearly two-thirds of the people in the U.S. who live in communities with central water supplies derive benefits from this preventive measure.

It is envisaged that the Fiji Government will seriously look at this preventive health measure, and will fluoridate water supplies in other parts of the country in the near future.
5.3 **Topical Preventive Measures**

Fluoride mouth rinses and brushing of teeth with fluoride solutions are recommended. Provided that the school authorities co-operate, either mouthrinsing or brushing of the teeth with fluoride solutions can be recommended as a simple, inexpensive and practical procedure. However, if it is to be effective, both the technique and the frequency should be carefully controlled and the results monitored by periodic epidemiologic studies on selected samples.

Any programme in which fluorides are applied for a limited period, e.g. in schools - should be followed by continued self-application to achieve continued benefits.

**Application of fluoride by health personnel**

The incidence and prevalence of clinical caries can be reduced by the direct application of fluoride solutions to the clean surfaces of teeth.

According to the International Dental Federation's Policy Statement on Alternative Water Fluoridation:

"Individual methods are time consuming, relatively expensive, and difficult to administer on a public health scale."

The group methods using the techniques of rinsing or brushing the teeth with fluoride solutions, are preferable and much more economical and practical, particularly, if natural congregating centres such as nursery and other schools are in common use.

The Group endorsed this view, but in addition recommended that dental practitioners should be encouraged to incorporate topical applications of fluoride solutions into
their regular procedure of treatment for children and young adults. Furthermore, topical applications by trained auxiliaries should be incorporated into public dental programmes." (p. 34, Training Course for Fluoridation Personnel by J.C. Cantwell) This is the case in Fiji.

In Fiji topical fluorides in non-fluoridated areas is being undertaken. This is a project with the help and advice by the South Pacific Commission. The methods used are:

1. NaF rinse (3000 children, 6 - 13 years)

   NaF is available in powder and tablets. They are dissolved in water to give a 0.2% NaF solution. The children are asked to rinse the solution around their mouth for one minute before spitting it out. There are about 20 rinsing solutions per year and these are supervised by the members of dental staff and teachers.

2. SnF₂ Brush-In programmes (1000 children, 6 - 13 years)

   A 10% SnF₂ paste is used and the children brush their teeth for about three minutes. This is done six times a year for each child.

3. APF-SnF₂, Double Brush-In programme (1500 children, 6 - 13 years)

   A 1.23% APF gel followed by 10% SnF₂ is repeated three times a year.

Both these brush-in programmes are supervised by the dental staff, teachers and mothers.
Results: After one year of the implementation of the above programmes, it was found that NaF rinse produced a 33% reduction in caries, and SnF₂ 34% reduction and APF and SnF₂ paste a 41% reduction in dental caries.

The programme is being undertaken in other areas of Fiji. (Adopted from Hussein, 1981)

Advantages

NaF

Advantages associated with the use of a 2% sodium fluoride solution is that it is relatively stable, when kept in a plastic container and there is no need to prepare a fresh solution for each patient.

The solution is non-irritating to the gingiva and does not cause discolouration of tooth structure or silicate fillings. Once applied to the teeth, the solution is allowed to dry, thus the clinician in a public health programme can pursue a multiple chair procedure. The series of treatments must be repeated only four times in the general age range of three to seventeen years, rather than at annual or semi-annual intervals, therefore in a public health programme, other groups of children can be treated in intervening years.

The disadvantage of the use of sodium fluoride is that the patient must make four visits to the dentist within a relatively short time.

Stannous Fluoride

One advantage in using stannous fluoride solution at 10% at six to 12 month intervals is that this frequency
conforms to practicing dentists' usual patient-recall system.

The recommended scheduling for stannous fluoride topical applications has the advantage of permitting the teeth to be treated soon after eruption, when they are highly susceptible to fluoride incorporation in the period after eruption.

There are several disadvantages:

(a) In aqueous solution, the material is not stable, it undergoes rapid hydrolysis and oxidation and forms stannous hydroxide. This reaction reduces the agent's effectiveness. Consequently, a fresh solution must be prepared for each treatment.

(b) An 8% solution is quite astringent and disagreeable in taste, its application is unpleasant. Addition of flavouring agents to mask the unpleasant taste is contraindicated.

(c) The solution occasionally causes a reversible tissue irritation, manifested by gingival blanching. The reaction usually occurs in individuals with poor gingival health.

(d) Pigmentation of teeth after the topical application of stannous fluoride solutions has been reported by various investigators. The pigmentation has a characteristic light brown colour. It usually appears in association with carious lesions and hypocalcified regions of the teeth and around margins of restorations.

**Acidulated Phosphate-Fluoride**

This is relatively a new agent and the solution contains 1.23% fluoride. The acidulated phosphate-fluoride solution is
stable when kept in plastic containers and thus a fresh solution need not be prepared for each patient.

It does not have any of the disadvantages that sodium or stannous fluoride have. It causes no discolouration of the teeth and is non-irritant to the gingiva.

Single annual application is recommended.

5.4 Health Education

Health education is a complex process of interactions set in motion by the educator by means of which he hopes to influence first the attitudes and then the behaviour of the learner. (Dunning, J.M., 3rd Ed., p. 348) The learner may thus achieve for himself a desired goal in the field of health.

Dental health education is a process affecting a change in health behaviour. It changes the attitudes of people to health. In our personal lives we do what we do mainly as a result of our attitudes and feelings and not because of what we know. Therefore, health education demands more than the dissemination of knowledge and information. The providing of information is the first step which must be followed up with motivation to stimulate and interest people with the problems. Motivation is insufficient unless action is taken to put into effect the measures which help to solve problems. Effective health education demands the understanding, sympathy, cooperation and support of health specialists in the school programme.
Figure 8.
(A conceptual model of the educational process as related to dental health.)

There should be a change in attitudes and health behaviour on the part of both the recipient and the donor in health relationship so that effectiveness and completeness of the health care operation will be maximized (Martin, N.D.)

Motivation and action are key words in dental health education. Dental health education is applied to all areas of society from the public at large to the individual patient in the dental surgery. It is therefore evident that the responsibilities for a complete dental health education programme must rest with all sections of the community - the Department of Health, the Dental Association, the private practitioner, the Dental Hygienist-Therapist, the Department of Education, the teachers associations, parents associations, the civil servants associations, allied health organisations and the dental School. Each group has an important function with education programmes, commencing with the individual
dental patients and working up through the various groups to the public at large.

In Fiji the Dental Department of the Ministry of Health is responsible for the correlation of a formal programme for educating the public on dental matters, but because it organises and administers the School Dental Service, its programme is directed particularly towards school children.

The Assistant Director of Dental Services is responsible for co-ordinating the dental health education programme and must justify the various activities as part of the overall programmes of the Health Ministry.

The administration of dental health education and the provision of information are basic necessities, but to change people's attitudes towards health, which health education implies, requires further efforts on the part of all people involved in the programmes.

It has been stated earlier that "motivation and action" are key words. This concept applies to all levels, the individual where the dentist undertakes instruction of a single patient at the chairside and the group where information is passed on to numbers of people simultaneously, either through the spoken word, with or without audiovisual aids, or through the mass media such as newspapers, magazines and radio.

Prevention of dental diseases is the ultimate aim in dentistry, but without health education this is impossible. With perhaps one major exception, fluoridation, all presently
available preventive measures can be promoted through health education of the individual.

Measures for prevention of dental diseases may be classified in three categories:

1. Those that can be applied by a dentist or dental hygienist/therapist, e.g. topical fluoride therapy, routine scaling and polishing, space maintenance. Here the parent and school authorities must be convinced of the need for the measure and the reason for applying it, and its effectiveness. It can be used as routine as part of the dental service programme.

2. Those methods that can be applied by the patient, e.g. plaque control by the correct use of the toothbrush and other aids, and dietary control. In this case the patient must know how the measure is to be applied as well as the need for it and how effective it is likely to be.

3. Those methods that can be applied by the state or local government, e.g. water fluoridation. In this instance the general public and its elected representative must be convinced of the advantages, effectiveness and safety of a measure before agreeing to its proposed implementation.

In general terms, therefore, the application of any measure for the prevention of dental disease must be preceded or accompanied by education, which explains the reason for its application, how it is to be applied, and its effectiveness.

It is generally accepted that individual health
education at the chairside is more effective than health education through mass media. At the individual level, it can be applied and adapted to the particular need and the educational and sociological background of the patient.

A most important aspect of this situation is the dentist-patient relationship. A favourable relationship must exist before the patient can gain the confidence of the dentist and the dentist must be convinced in his own mind of the value of all the preventive measures as part of the service he provides.

Patients are incapable of judging the technical competence of their dentist but rather seek the dentist's technical competence in him. They then attribute technical competence to him.

There seems to be a barrier between the dentist and the patient created by fear, anxiety, a failure to understand the real basis of his own concern, a ready distortion of the cost of services and some people even distrust dentists and their motives.

Dentists must have a better appreciation of human behaviour and be able to help patients accept them more than just as their dentist. It has been said that dentists may not fail patients technically or professionally, but they do emotionally; for this failure the dentist is felt to fail them professionally.

It should be appreciated that a more favourable dentist-patient relationship must exist before there is a better communication and education. Dentists must talk to
patients, motivate them into accepting measures and follow them up to ascertain if they were put into practice and appreciate the value of preventive measures.

Experience has shown that to be successful, any programme of health education must be continuous and co-ordinated. Therefore, it is the responsibility of the dentists to ensure that the public is correctly advised on dental matters.

It is becoming more accepted by the public that dental services are more than just the placement of fillings, removal of teeth and replacement of missing teeth by dentures. Consultative and advisory services are now an integral part of dentistry. Health education has helped to change attitudes and the dentist's role in health services which includes prevention is a changing concept in modern practice.

![Figure 9]
Recommendations for Specific Children's Age-Groups

(1) The Pre-School Child

Objective

No dental disease.

(a) Increase resistance of the tooth

Where the fluoride in the public water supply is below the optimum, or not available, topical fluoride solutions may be applied to the tooth surfaces as teeth erupt and toothpaste containing fluoride should be advocated.

(b) The control of plaque and calculus

The children should be taught how to care for their teeth at as early an age as possible. This should be preferably in the presence of a parent or guardian since supervision will be needed in the early stages to ensure that the children carry out instructions properly.

(c) Modification of diet

The parent should be encouraged to keep the content of meals as low in fermentable carbohydrates as possible: it should also be emphasized to them that between-meal snacks, if taken at all, should not contain fermentable sugars, that infant comforters which dispense fluids with a high sugar content should be avoided.

(d) Establishment of a patient-operator relationship

Children should be introduced to dentistry at the earliest opportunity, no later than three years of age by
having their teeth examined, and polished, and where necessary fluoride salts topically applied. The best time for the child to visit the dental clinic is when she/he is dentally fit. His or her orientation would be pleasant and would help to reduce fear which he/she would have to face one day. The children should be instructed in oral hygiene practice generally. Long term treatment planning should also begin at an appropriate age. It should be simple and consistent with the establishment of a satisfactory and lasting patient-operator relationship. Those concerned in the organisation of nursery (kindergarten) schools must be encouraged to recognize that dental disease in this age group is an unavoidable catastrophe.

(2) The Young School Child (5 to 13 Years)

Objective

To maintain or improve the dental health of the young school child, paying special attention to the influence, which parents, particularly mothers and teachers, have on the behaviour of the children of this age.

(a) Increase the resistance of the tooth

Every opportunity must be taken to educate parents in the value of fluoridating water supplies. The promotion of other methods of using fluoride wherever appropriate should be encouraged, such as school water fluoridation, and topical fluoride application.

(b) Control of plaque

Young children and their parents must be convinced
of the value of a clean mouth by the dental personnel. Parents should be made aware of the influence they exert on their children in dental situations. Cleaning techniques and timing can be more formally explained and must be regularly reinforced by the members of the dental team both individually and collectively. The use of toothpaste containing fluoride should be advocated. The school plays an important role and can improve habits:

(i) Youth is the time of habit formation. Health habits among others are being formed at school.

(ii) The school furnishes the kind of training that is needed for habit formation.

(iii) The school works with home programme. The children are taught the basics of good oral hygiene and if they are encouraged to practice it continually in their primary school years, they will develop good oral habits which will remain with them for life.

(iv) It is necessary to develop health practices on the part of the child, before he is old enough to understand the scientific reasons upon which the practice is based. Health training begins in the home, yet it is supplemented at school.

(v) Correct attitudes are important. Health contributes to happiness, comfort, enjoyment and the maintenance of friendly social relationship.

(c) **Modification of diet**

Parents of individual children should be informed in realistic terms of the significance of the frequency with
which foods high in fermentable sugars are eaten, as also of the time of the day at which they are eaten. School meal organisers should be made aware of harmful effects on dental health of such foods in an effort to influence dietary habits at school. When food is necessary outside meal-times, parents and teachers should be encouraged to provide items with low cariogenic properties. The promotion of teachers' health is also important to the health education programme as well as the quality and cost of education. A well teacher will do better in classroom work than a sick teacher.

(d) The use of the patient-operator relationship

Attitudes to dental care are probably determined in this age group, and clinical methods should therefore emphasize the importance of prevention: the principles involved and the prospect of success should be fully explained to parents and children. Every effort must be made to explain the special problems of newly erupted teeth and the vulnerability of the six-year-old molar. With appearance as a prime factor in an individual's own assessment of the importance of teeth, orthodontic treatment begins to have special significance.

Orthodontic appliances create special problems of oral hygiene and encouragement will be necessary to maintain a high standards of oral cleanliness. The dental team concept must be used to its fullest potential and increase in number of available ancillary personnel.
(3) The Expectant Mother

Dental health education for this group does not differ from other young adults, except in the following respects:

(i) The motivation which already exists to do what is best for the child must be harnessed towards achieving total prevention of dental caries and periodontal diseases.

(ii) The expectant mother must be encouraged to accept any necessary advice and treatment for herself and for the future dental health of her unborn child.

(iii) The emotive situation of pregnancy should be used to increase the expectant mother's sense of personal responsibility for the continuing dental health of all members of the family unit. Further she should be encouraged to a sense of community responsibility to promote the concept, that the teeth matter, because they have a direct influence on all aspects of health and development, including speech, facial expression and nutrition.

(iv) The expectant mother must be also advised to ensure an adequate intake of all nutritional elements, including fluorides, but avoid dietary fads, which are known to be harmful to dental health.

(v) A warning should be given on the harmful effects of sweetened comforters once the primary teeth have erupted.
Broad Aims of Dental Health Education

The aims of a national health education programme are:

1. Arouse interest in dental aspect of health.
2. Make people aware of the prevalence and distribution of dental disorders in the population.
3. Communicate information about causes of dental diseases and deformities.
4. Communicate about measures for promotion of positive dental health.
5. Persuade people that positive dental health should be valued as community assets and help people to make decisions, both individually and collectively, to improve on their dental health status and that of the total population.
6. Persuade people to adopt and sustain dental health practices conducive to positive dental health.
7. Make people aware of the existence of dental health services and promote use of available services (Logan, 1976).
6. **BUDGET ALLOCATION**

6.1 Fiji's Budget Cycle

**The Stages of Budget Preparation**

1. The budget in principle is a continuous process in which the policies are formulated and reviewed, and programmes of expenditure being developed and revised accordingly.

   Information from the previous year's spending is an important base for estimating future requirements, equally important is the development and accurate costing of new policy proposals.

2. The new budget system has drawn distinction within the budget estimates according to whether expenditures are for *existing commitments* or for *new expenditure*. The former are for continuation of expenditure at the level of the previous year's budget and the level of this expenditure is defined (before allowing for inflation) by the projections shown for future years in the budget document. New expenditures are simply any substantial level of expenditure above this level whether for completely new projects or expansion of existing projects. These have to be justified in detail in the budget estimates.

3. The process of budget preparation in the new system is centred around the above two elements of expenditure and is phased to allow a spread of effort over a period of several months rather than the concentrated budget preparation effort required under the previous system.

4. The main work of budget preparation within Ministries
is thus phased over the first half of the year, extending from about mid-January to June.

An important point from figure 10 is that the basic directions of budget preparation each year come from the policy and technical branches of departments on staffing and material requirements and of likely proposed programmes. Co-ordination between various sections in the Ministry/department is assisted by establishing a formal set of procedures for setting priorities at the beginning of each budgeting cycle. A simplified process, involving four key staff groups in a Ministry and the main operations to be carried out over the period January to March is shown on figure 11. Thus, very early in the year, the top policy staff in the Ministry meet to review policies and determine the main objectives to be aimed at and main apparent priorities for achieving this. It could result in preliminary selection of possible new budget proposals and some directions for switching allocations within the existing commitment budget. Planning and Technical staff as a result of the meeting, are requested to undertake preliminary design and analysis of a number of alternative new proposals that could be commenced in the following budget year. Accounting staff are asked to assist in this by providing details of costing and administrative requirements. Around late February, these proposals are re-submitted to a policy meeting with recommendations from the planning and technical staff on preferred alternatives.

A decision is reached on which alternatives are to be given top priority for submission in the budget estimates.
The budget preparation process

Cabinet/Budget Coordinating Committee

- Budget guidelines issued
  January

Ministries

- Policy review and priority setting
  January/February

- New expenditure proposals
  March 16th submissions

Design list of approved new proposals
April/May

Budget appraisal by Budget Coordinating Committee
July/August

Cabinet meeting on Budget
September 8th

Figure 10. Simplified process of budget preparation in relation to the key dates for submission of estimates
Figure 11.
The final preparation is done jointly by technical and accounting staff. The former provide the technical details and documentation and through a listing of technical needs, while the budget and accounting staff consolidate this for presentation by the March 16th deadline.

All major proposals to introduce new projects or to increase the level of activity on existing projects are to be submitted to the Ministry of Finance by no later than March 16th of the budget year. A proposal would be considered major, if it involves additional expenditure of around $100,000 in total (over three years) above the level of existing commitments shown in the budget forecasts of expenditure. Lesser amounts could be considered as major proposals if a Ministry consider them of fundamental importance to its programmes and/or if a substantial proportion of total spending on the proposal were to be funded by re-allocation from the existing commitments or by funds from overseas aid. In these cases the additional funds requested should be clearly distinguished from funding from aid sources or by re-allocation of existing commitments. All new expenditure proposals must be justified in full detail to be considered for funding in the budget.

Estimates of expenditure requirements to maintain existing commitments are to be submitted by June 2nd approximately the same time of the year as required for the new proposals. These estimates will simply be updating of expenditure forecasts made for the previous year estimates preparation making allowance for inflation and minor variation policy. The Ministry for Finance will later in the
Table 8.
Fiji's budget for 1984 is:

<table>
<thead>
<tr>
<th></th>
<th>$000</th>
<th>$000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Estimated expenditure:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>operating</td>
<td>319,914.7</td>
<td></td>
</tr>
<tr>
<td>capital</td>
<td>83,845.9</td>
<td>403,760.9</td>
</tr>
<tr>
<td><strong>Estimated revenue:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>299,286.1</td>
<td></td>
</tr>
<tr>
<td>Capital</td>
<td>17,714.8</td>
<td>317,000.9</td>
</tr>
<tr>
<td><strong>Estimated deficit 1984</strong></td>
<td></td>
<td>86,759.7</td>
</tr>
</tbody>
</table>

This has been approved by the Parliament
year with the approval of the Cabinet, issue specific, cash ceilings for each Budget Head or Programme which will give allowance for anticipated price variations for the new budget. All ministries must prepare a budget submission within a prescribed ceiling, but certain items particularly of a capital nature will not have been foreseen in the original forecast, then a supplementary request is submitted giving full details of the nature of the expenditure, its necessity for maintaining existing commitments and reasons why it cannot be funded under the existing commitment ceiling. The new budget is usually approved by the parliament in November.

The budget for 1984 expenditure for Fiji is shown on table 8 and the amount is $86.759.7 million. 37.1% or $32.217.3 million is allocated to the Ministry of Health and Social Welfare as shown in table 9.

6.2 Allocation for Health and Social Welfare

Programme Statement

The main objectives of the Ministry of Health and Social Welfare are to:

(a) promote the physical, mental and social well-being of the people of Fiji;
(b) promote and maintain the quality of all the health standards of the nation;
(c) distribute the benefits of health services equitably by directing services and monitoring basic needs in areas, where deficiencies exist, and
(d) provide the community with appropriate basic social welfare services for those in need.
Table 9.

Summary of total expenditure: Health and Social Welfare

<table>
<thead>
<tr>
<th>Description</th>
<th>$000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Established staff</td>
<td>19,950.7</td>
</tr>
<tr>
<td>2. Unestablished staff</td>
<td>4,068.2</td>
</tr>
<tr>
<td>3. Travel and Communication</td>
<td>414.5</td>
</tr>
<tr>
<td>4. Maintenance and Operations</td>
<td>263.7</td>
</tr>
<tr>
<td>5. Purchase of Goods and Services</td>
<td>4,556.8</td>
</tr>
<tr>
<td>6. Operating Grants and Transfers</td>
<td>1,108.0</td>
</tr>
<tr>
<td>7. Special Expenditures</td>
<td>188.8</td>
</tr>
<tr>
<td><strong>Total operating</strong></td>
<td>30,550.7</td>
</tr>
<tr>
<td>8. Capital construction</td>
<td>972.1</td>
</tr>
<tr>
<td>9. Capital purchase</td>
<td>664.5</td>
</tr>
<tr>
<td>10. Capital Grants and Transfers</td>
<td>30.0</td>
</tr>
<tr>
<td><strong>Total capital</strong></td>
<td>1,666.6</td>
</tr>
<tr>
<td><strong>Total expenditure</strong></td>
<td>32,217.3</td>
</tr>
<tr>
<td><strong>Total Aid-in-kind</strong></td>
<td>632.3</td>
</tr>
</tbody>
</table>

**Staff summary 1984:**

- Established Posts: 2,870
- Unestablished staff: 955
These objectives are to be achieved through improvement in hospital services, strengthening of preventive services through primary health care, training of manpower and technical personnel relevant to the needs of the nation.

In the social welfare context, every encouragement is being given to income-generating activities rather than handouts from Government.

A close encouragement of working relationship with the voluntary welfare organisations and community leaders will be vigorously pursued to bring about a better understanding and better co-ordination of services and utilisation of resources to avoid overlapping and wastage of scarce resources.

The main points of the 1984 programmes are listed below:

(a) **Policy and administration**

This programme includes both general administration costs at Headquarters and the expenditure of health research. Health research is confined to virus typing and vector control.

(b) **Medical services**

This programme includes all the main activities associated with the achievement of the Ministry's health objectives.

Expenditure on Urban Hospitals and Health Centres and Subdivisional Hospitals budget activities cover the overall increases in general hospital services.

On the capital side of the budget, provision is made for the extension of dental services, replacement of medical
equipment and the upgrading of laundry services in urban hospitals.

At the subdivisional hospital level, provision is made for the extension of medical and dental services in various places.

(c) Health education and training

The activity is mainly carried out at the Fiji School of Medicine and the Fiji School of Nursing.

On the capital budget side, provision is made to anticipate further development in the degree (MBBS) course now in progress at the Fiji School of Medicine.

(d) Drug and medical supplies

The Bulk Purchasing Scheme for Drugs is to be further developed in 1984 with the setting up of the Pharmaceutical Quality Control Care. Aid funding for this project is being pursued. Meanwhile, the quality control of drugs within the National Bulk Purchasing Scheme is being done by the Australian Government, until such time as the National Quality Centre is established in Fiji.

(e) Social welfare

This programme provides a wide range of professional and other services to the community consisting of care and protection of juveniles, marriage counselling, child care, including fostering care, education, vocational training.

Counselling continues to be provided at the Nasinu Boys' centre and Girls' Home for juveniles brought under voluntary care or committed to the care of the Director.
The Old People's Homes at Samabula, Natabua and Labasa provide residential, medical care and occupational therapy for old people.

The Department provides professional legal assistance, subject to a means test, to persons involved in domestic court proceedings.

The summary of total allocation is shown on table 9.

6.3 Operational Allocation within the Ministry

The Ministry of Health and Social Welfare is responsible for the formulation and implementation and social welfare policies, administration of current legislation and introduction of new legislation on all matters relating to public health, including dental health.

There is no special allocation for dental services as such in the health services. The fund comes from the general medical services in programme 2 as shown in table 13. The total annual expenditure on dental care is about 0.6% from the total operational allocation for the Ministry of Health and Social Welfare.
Breakdown on detail programme allocations

Table 10.

<table>
<thead>
<tr>
<th>Programme 1. Policy and Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity 1. General Administration</td>
</tr>
<tr>
<td>(22-1-1)</td>
</tr>
<tr>
<td>$000</td>
</tr>
<tr>
<td>1. Established staff (94)</td>
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<tr>
<td>2. Unestablished staff (6)</td>
</tr>
<tr>
<td>3. Travel and Communication</td>
</tr>
<tr>
<td>4. Maintenance and Operations</td>
</tr>
<tr>
<td>5. Purchase of Goods and Services</td>
</tr>
<tr>
<td>6. Operating Grants and Transfers</td>
</tr>
<tr>
<td>7. Special Expenditures</td>
</tr>
<tr>
<td>8. Capital Constructions</td>
</tr>
<tr>
<td>9. Capital Purchase</td>
</tr>
<tr>
<td>10. Capital grants and Transfers</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Aid-in-kind</td>
</tr>
</tbody>
</table>
### Table 11.

**Programme 1. Policy and Administration**

**Activity 2. Research**

(22-1-2)

<table>
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<tr>
<th>Item</th>
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<tr>
<td>2. Unestablished staff</td>
<td>15.2</td>
</tr>
<tr>
<td>3. Travel and Communication</td>
<td>3.9</td>
</tr>
<tr>
<td>4. Maintenance and Operations</td>
<td>1.2</td>
</tr>
<tr>
<td>5. Purchase of Goods and Services</td>
<td>6.0</td>
</tr>
<tr>
<td>6. Operating Grants and Transfers</td>
<td></td>
</tr>
<tr>
<td>7. Special Expenditures</td>
<td></td>
</tr>
<tr>
<td>8. Capital Construction</td>
<td></td>
</tr>
<tr>
<td>9. Capital Purchase</td>
<td></td>
</tr>
<tr>
<td>10. Capital Grants and Transfers</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td>126.6</td>
</tr>
</tbody>
</table>

| Aid-in-kind                                 | 24.0 |
### Programme 2. Medical Services

#### Activity 1. Urban Hospitals and Health Centres

(22-2-1)

<table>
<thead>
<tr>
<th>Description</th>
<th>$000</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>2. Unestablished staff (56)</td>
<td>2,606.5</td>
</tr>
<tr>
<td>3. Travel and Communications</td>
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</tr>
<tr>
<td>4. Maintenance and Operations</td>
<td>107.9</td>
</tr>
<tr>
<td>5. Purchase of Goods and Services</td>
<td>917.8</td>
</tr>
<tr>
<td>6. Operating Grants and Transfers</td>
<td>.......</td>
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<td>7. Special Expenditures</td>
<td>.......</td>
</tr>
<tr>
<td>8. Capital Construction</td>
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<tr>
<td>9. Capital Purchase</td>
<td>430.0</td>
</tr>
<tr>
<td>10. Capital Grants and Transfers</td>
<td>.......</td>
</tr>
</tbody>
</table>

| Total                                 | 15,770.0 |

| Aid-in-kind                           | 170.0   |
Table 13.

Programme 2. Medical Services

Activity 2. Subdivisional Hospitals

(22-2-2)

<table>
<thead>
<tr>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Established staff (120)</td>
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</tr>
<tr>
<td>Unestablished staff (5)</td>
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</tr>
<tr>
<td>Travel and Communications</td>
<td>90.5</td>
</tr>
<tr>
<td>Maintenance and Operations</td>
<td>56.9</td>
</tr>
<tr>
<td>Purchase of Goods and Services</td>
<td>204.5</td>
</tr>
<tr>
<td>Operating Grants and Transfers</td>
<td>......</td>
</tr>
<tr>
<td>Special Expenditures</td>
<td>......</td>
</tr>
<tr>
<td>Capital Construction</td>
<td>320.0</td>
</tr>
<tr>
<td>Capital Purchase</td>
<td>70.0</td>
</tr>
<tr>
<td>Capital Grants and Transfers</td>
<td>......</td>
</tr>
</tbody>
</table>

Total                                                                 | 3,954.4|

Aid-in-kind                                                             | ...... |
**Table 14.**

**Programme 2. Medical Services**

**Activity 3. Rural Medical and Nursing Stations**

(22-2-3)

<table>
<thead>
<tr>
<th>Item</th>
<th>$000</th>
</tr>
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<tbody>
<tr>
<td>1. Established staff (237)</td>
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<tr>
<td>2. Unestablished staff (56)</td>
<td>239.0</td>
</tr>
<tr>
<td>3. Travel and Communications</td>
<td>54.3</td>
</tr>
<tr>
<td>4. Maintenance and Operations</td>
<td>22.1</td>
</tr>
<tr>
<td>5. Purchase of Goods and Services</td>
<td>112.6</td>
</tr>
<tr>
<td>6. Operating Grants and Services</td>
<td>......</td>
</tr>
<tr>
<td>7. Special Expenditures</td>
<td>......</td>
</tr>
<tr>
<td>8. Capital Construction</td>
<td>402.1</td>
</tr>
<tr>
<td>9. Capital Purchase</td>
<td>10.0</td>
</tr>
<tr>
<td>10. Capital Grants and Transfers</td>
<td>......</td>
</tr>
</tbody>
</table>

**Total**                                          | 3,168.6|
### Table 15.

#### Programme 2. Medical Services

#### Activity 4. Public Health Services

(22-2-4)

<table>
<thead>
<tr>
<th>Description</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>3. Travel and Communication</td>
<td>11.6</td>
</tr>
<tr>
<td>4. Maintenance and Operations</td>
<td>9.6</td>
</tr>
<tr>
<td>5. Purchase of Goods and Services</td>
<td>43.5</td>
</tr>
<tr>
<td>6. Operating Grants and Transfers</td>
<td>96.3</td>
</tr>
<tr>
<td>7. Special Expenditures</td>
<td>10.4</td>
</tr>
<tr>
<td>8. Capital Construction</td>
<td>.....</td>
</tr>
<tr>
<td>9. Capital Purchase</td>
<td>.....</td>
</tr>
<tr>
<td>10. Capital Grants and Transfers</td>
<td>.....</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>976.3</td>
</tr>
<tr>
<td><strong>Aid-in-kind</strong></td>
<td>181.9</td>
</tr>
<tr>
<td></td>
<td>$000</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>1. Established staff (23)</td>
<td>156.9</td>
</tr>
<tr>
<td>2. Unestablished staff (25)</td>
<td>105.8</td>
</tr>
<tr>
<td>3. Travel and Communication</td>
<td>6.6</td>
</tr>
<tr>
<td>4. Maintenance and Operations</td>
<td>3.4</td>
</tr>
<tr>
<td>5. Purchase of Goods and Services</td>
<td>1,893.3</td>
</tr>
<tr>
<td>6. Operating Grants and Transfers</td>
<td>......</td>
</tr>
<tr>
<td>7. Special Expenditures</td>
<td>10.0</td>
</tr>
<tr>
<td>8. Capital Construction</td>
<td>32.0</td>
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<td>......</td>
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<td>10. Capital Grants and Transfers</td>
<td>......</td>
</tr>
<tr>
<td>Total</td>
<td>2,208.0</td>
</tr>
</tbody>
</table>
### Table 17.

**Programme 3. Health Education and Training**

**Activity 1. Fiji School of Medicine**

(22-3-1)

<table>
<thead>
<tr>
<th>Description</th>
<th>$000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Established staff (79)</td>
<td>715.2</td>
</tr>
<tr>
<td>2. Unestablished staff (22)</td>
<td>90.4</td>
</tr>
<tr>
<td>3. Travel and Communication</td>
<td>5.4</td>
</tr>
<tr>
<td>4. Maintenance and Operations</td>
<td>3.4</td>
</tr>
<tr>
<td>5. Purchase of Goods and Services</td>
<td>57.9</td>
</tr>
<tr>
<td>6. Operating Grants and Transfers</td>
<td>......</td>
</tr>
<tr>
<td>7. Special Expenditures</td>
<td>200.0</td>
</tr>
<tr>
<td>8. Capital Construction</td>
<td>......</td>
</tr>
<tr>
<td>9. Capital Purchase</td>
<td>......</td>
</tr>
<tr>
<td>10. Capital Grants and Transfers</td>
<td>......</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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<tr>
<td><strong>Aid-in-kind</strong></td>
<td>230.4</td>
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</tbody>
</table>
### Table 18.

**Programme 3. Health Education and Training**

**Activity 2. Fiji School of Nursing**

(22-3-2)

<table>
<thead>
<tr>
<th>Item</th>
<th>$000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Established staff (32)</td>
<td>410.9</td>
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</tr>
<tr>
<td>3. Travel and Communications</td>
<td>3.5</td>
</tr>
<tr>
<td>4. Maintenance and Operations</td>
<td>0.5</td>
</tr>
<tr>
<td>5. Purchase of Goods and Services</td>
<td>57.5</td>
</tr>
<tr>
<td>6. Operating Grants and Transfers</td>
<td>......</td>
</tr>
<tr>
<td>7. Special Expenditures</td>
<td>......</td>
</tr>
<tr>
<td>8. Capital Construction</td>
<td>......</td>
</tr>
<tr>
<td>9. Capital Purchase</td>
<td>......</td>
</tr>
<tr>
<td>10. Capital Grants and Transfers</td>
<td>......</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>589.8</td>
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</tbody>
</table>

**Aid-in-kind**

50.0
Table 19.

Programme 4. Social Welfare

Activity 1. Administration and Voluntary Organisation Support
(22-4-1)  

<table>
<thead>
<tr>
<th>Description</th>
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<tr>
<td>1. Established staff (10)</td>
<td>101.6</td>
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</tr>
<tr>
<td>3. Travel and Communications</td>
<td>9.9</td>
</tr>
<tr>
<td>4. Maintenance and Operations</td>
<td>22.5</td>
</tr>
<tr>
<td>5. Purchase of Goods and Services</td>
<td>7.1</td>
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<tr>
<td>6. Operating Grants and Transfers</td>
<td>54.1</td>
</tr>
<tr>
<td>7. Special Expenditures</td>
<td>0.4</td>
</tr>
<tr>
<td>8. Capital Constructions</td>
<td>......</td>
</tr>
<tr>
<td>9. Capital Purchase</td>
<td>......</td>
</tr>
<tr>
<td>10. Capital Grants and Transfers</td>
<td>30.0</td>
</tr>
</tbody>
</table>

Total 234.1
### Table 20.

**Programme 4. Social Welfare**

**Activity 2. Institutional Services**

(22-4-2)

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<tr>
<th>Description</th>
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</tr>
<tr>
<td>3. Travel and Communication</td>
<td>4.5</td>
</tr>
<tr>
<td>4. Maintenance and Operations</td>
<td>14.4</td>
</tr>
<tr>
<td>5. Purchase of Goods and Services</td>
<td>139.7</td>
</tr>
<tr>
<td>6. Operating Grants and Transfers</td>
<td>.....</td>
</tr>
<tr>
<td>7. Special Expenditures</td>
<td>.....</td>
</tr>
<tr>
<td>8. Capital Constructions</td>
<td>.....</td>
</tr>
<tr>
<td>9. Capital Purchase</td>
<td>2.0</td>
</tr>
<tr>
<td>10. Capital Grants and Transfers</td>
<td>.....</td>
</tr>
</tbody>
</table>

**Total**                                      | 545.4|
### Table 21.

**Programme 4. Social Welfare**

**Activity 3. Field Services**

(22-4-3)

<table>
<thead>
<tr>
<th>Description</th>
<th>$000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Established staff (45)</td>
<td>306.9</td>
</tr>
<tr>
<td>2. Unestablished staff (4)</td>
<td>18.2</td>
</tr>
<tr>
<td>3. Travel and Communication</td>
<td>20.2</td>
</tr>
<tr>
<td>4. Maintenance and Operations</td>
<td>15.5</td>
</tr>
<tr>
<td>5. Purchase of Goods and Services</td>
<td>22.3</td>
</tr>
<tr>
<td>6. Operating Grants and Transfers</td>
<td>834.3</td>
</tr>
<tr>
<td>7. Special Expenditures</td>
<td>......</td>
</tr>
<tr>
<td>8. Capital Construction</td>
<td>......</td>
</tr>
<tr>
<td>9. Capital Purchase</td>
<td>......</td>
</tr>
<tr>
<td>10. Capital Grants and Transfers</td>
<td>......</td>
</tr>
</tbody>
</table>

Total                                                                 1,217.4
<table>
<thead>
<tr>
<th>Description</th>
<th>$000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Established staff (3)</td>
<td>31.1</td>
</tr>
<tr>
<td>2. Unestablished staff</td>
<td>1.5</td>
</tr>
<tr>
<td>3. Travel and Communications</td>
<td>0.1</td>
</tr>
<tr>
<td>4. Maintenance and Operations</td>
<td>2.1</td>
</tr>
<tr>
<td>5. Purchase of Goods and Services</td>
<td>.....</td>
</tr>
<tr>
<td>6. Operating Grants and Transfers</td>
<td>.....</td>
</tr>
<tr>
<td>7. Special Expenditures</td>
<td>.....</td>
</tr>
<tr>
<td>8. Capital Construction</td>
<td>.....</td>
</tr>
<tr>
<td>9. Capital Purchase</td>
<td>.....</td>
</tr>
<tr>
<td>10. Capital Grants and Transfers</td>
<td>.....</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>34.8</strong></td>
</tr>
</tbody>
</table>
7. COST OF DELIVERY OF DENTAL SERVICES IN FIJI

There is no special allocation as such to cover dental service expenditure. It is integrated with the general medical service. This includes general hospital services, Public Health activities, health centres, rural medical and nursing stations.

7.1 Staffing and Salary Costs

The dental personnel in Fiji in 1984 consists of:

<table>
<thead>
<tr>
<th>Position</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Officers</td>
<td>45</td>
</tr>
<tr>
<td>Dental Hygienist/Therapist</td>
<td>41</td>
</tr>
<tr>
<td>Dental Technicians</td>
<td>11</td>
</tr>
<tr>
<td>Dental Assistants</td>
<td>51</td>
</tr>
<tr>
<td>Clerk/Typist</td>
<td>2</td>
</tr>
<tr>
<td>Unestablished staff</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>155</strong></td>
</tr>
</tbody>
</table>

The emoluments are determined according to the established posts. For convenience this will be tabled according to geographic locations:

IA. Central Division

1. Suva

   Headquarters

<table>
<thead>
<tr>
<th>Position</th>
<th>No. of personnel</th>
<th>Emolument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assistant Director Dental Services</td>
<td>1</td>
<td>$22,275</td>
</tr>
<tr>
<td>Senior Dental Health Education Officer</td>
<td>1</td>
<td>14,300</td>
</tr>
</tbody>
</table>
2. **Suva Dental Clinic**

<table>
<thead>
<tr>
<th>Position</th>
<th>No. of Personnel</th>
<th>Emolument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chief Dental Officer</td>
<td>1</td>
<td>$18,865</td>
</tr>
<tr>
<td>Principal Dental Officer</td>
<td>1</td>
<td>17,985</td>
</tr>
<tr>
<td><strong>Senior Dental Officers:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i Dental Public Health</td>
<td>1</td>
<td>15,675</td>
</tr>
<tr>
<td>(Divisional Dental Officer)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central/Eastern</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii Oral Surgery</td>
<td>1</td>
<td>15,675</td>
</tr>
<tr>
<td>iii Prosthetic</td>
<td>1</td>
<td>15,675</td>
</tr>
<tr>
<td>iv Conservative</td>
<td>1</td>
<td>13,750</td>
</tr>
<tr>
<td>v Tutors</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Dental Officers</td>
<td>12</td>
<td>129,360</td>
</tr>
<tr>
<td>Dental Hygienist/Therapists</td>
<td>15</td>
<td>91,575</td>
</tr>
<tr>
<td>Dental Technicians</td>
<td>7</td>
<td>56,210</td>
</tr>
<tr>
<td>Dental Assistants</td>
<td>15</td>
<td>62,295</td>
</tr>
<tr>
<td>Clerk/Typist</td>
<td>2</td>
<td>8,456</td>
</tr>
<tr>
<td>Drivers</td>
<td>1</td>
<td>4,224</td>
</tr>
<tr>
<td>Cleaner/Servant</td>
<td>2</td>
<td>4,224</td>
</tr>
</tbody>
</table>

3. **Nausori**

<table>
<thead>
<tr>
<th>Position</th>
<th>No. of Personnel</th>
<th>Emolument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Dental Officer</td>
<td>1</td>
<td>13,750</td>
</tr>
<tr>
<td>(Sub-divisional)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental Officer</td>
<td>1</td>
<td>9,900</td>
</tr>
<tr>
<td>Dental Therapists</td>
<td>2</td>
<td>12,210</td>
</tr>
<tr>
<td>Dental Assistants</td>
<td>3</td>
<td>12,459</td>
</tr>
</tbody>
</table>

4. **Navua**

<table>
<thead>
<tr>
<th>Position</th>
<th>No. of Personnel</th>
<th>Emolument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Officer</td>
<td>1</td>
<td>9,900</td>
</tr>
<tr>
<td>Dental Hygienist/Therapist</td>
<td>1</td>
<td>6,105</td>
</tr>
<tr>
<td></td>
<td>No. of personnel</td>
<td>Emolument</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------</td>
<td>-----------</td>
</tr>
<tr>
<td><strong>Dental Assistants</strong></td>
<td>1</td>
<td>4,153</td>
</tr>
<tr>
<td><strong>Wainibokasi</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental Officer</td>
<td>1</td>
<td>9,900</td>
</tr>
<tr>
<td>Dental Assistant</td>
<td>1</td>
<td>4,153</td>
</tr>
<tr>
<td><strong>Korovou</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental Therapist</td>
<td>1</td>
<td>6,105</td>
</tr>
<tr>
<td>Dental Assistants</td>
<td>1</td>
<td>4,153</td>
</tr>
<tr>
<td><strong>Vunidawa</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental Therapist</td>
<td>1</td>
<td>6,105</td>
</tr>
<tr>
<td>Dental Assistant</td>
<td>1</td>
<td>4,153</td>
</tr>
<tr>
<td><strong>Valelevu</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental Therapist</td>
<td>1</td>
<td>6,105</td>
</tr>
<tr>
<td>Dental Assistant</td>
<td>1</td>
<td>4,153</td>
</tr>
</tbody>
</table>

**Total Central Division**

|                        | 82               | 603,848   |

**II. Eastern Division**

1. **Levuka**
   | Dental Officer     | 1                | 9,900     |
   | Dental Therapist   | 1                | 6,105     |
   | Dental Assistants  | 2                | 8,306     |

2. **Lakeba**
<p>| Dental Therapist   | 1                | 6,105     |</p>
<table>
<thead>
<tr>
<th>Department</th>
<th>No. of Personnel</th>
<th>Emolument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Assistant</td>
<td>1</td>
<td>4,153</td>
</tr>
<tr>
<td>Dental Therapist</td>
<td>1</td>
<td>6,105</td>
</tr>
<tr>
<td>Dental Assistant</td>
<td>1</td>
<td>4,153</td>
</tr>
</tbody>
</table>

3. Lomaloma

<table>
<thead>
<tr>
<th>Department</th>
<th>No. of Personnel</th>
<th>Emolument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Therapist</td>
<td>1</td>
<td>6,105</td>
</tr>
<tr>
<td>Dental Assistant</td>
<td>1</td>
<td>4,153</td>
</tr>
</tbody>
</table>

4. Kadavu

<table>
<thead>
<tr>
<th>Department</th>
<th>No. of Personnel</th>
<th>Emolument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Therapist</td>
<td>1</td>
<td>6,105</td>
</tr>
<tr>
<td>Dental Assistant</td>
<td>1</td>
<td>4,153</td>
</tr>
</tbody>
</table>

| Total Eastern Division | 10 | 55,085 |

III. Western Division

1. Lautoka

<table>
<thead>
<tr>
<th>Department</th>
<th>No. of Personnel</th>
<th>Emolument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Dental Officer</td>
<td>1</td>
<td>15,675</td>
</tr>
</tbody>
</table>

(= Divisional Dental Officer - western)

<table>
<thead>
<tr>
<th>Department</th>
<th>No. of Personnel</th>
<th>Emolument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Dental Officer - Clinical</td>
<td>1</td>
<td>15,675</td>
</tr>
<tr>
<td>Dental Officers</td>
<td>3</td>
<td>29,700</td>
</tr>
<tr>
<td>Dental Therapists</td>
<td>3</td>
<td>18,315</td>
</tr>
<tr>
<td>Dental Technicians</td>
<td>2</td>
<td>16,060</td>
</tr>
<tr>
<td>Dental Assistants</td>
<td>4</td>
<td>16,612</td>
</tr>
<tr>
<td>Cleaner/Servants</td>
<td>1</td>
<td>2,112</td>
</tr>
</tbody>
</table>

2. Ba

<table>
<thead>
<tr>
<th>Department</th>
<th>No. of Personnel</th>
<th>Emolument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Dental Officer</td>
<td>1</td>
<td>14,300</td>
</tr>
</tbody>
</table>

(Subdivisional Dental Officer)
<table>
<thead>
<tr>
<th></th>
<th>No. of personnel</th>
<th>Emolument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Officers</td>
<td>2</td>
<td>19,800</td>
</tr>
<tr>
<td>Dental Therapists</td>
<td>2</td>
<td>13,210</td>
</tr>
<tr>
<td>Dental Assistants</td>
<td>4</td>
<td>16,612</td>
</tr>
</tbody>
</table>

3.  Nadi

<table>
<thead>
<tr>
<th></th>
<th>No. of personnel</th>
<th>Emolument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Officer</td>
<td>1</td>
<td>9,900</td>
</tr>
<tr>
<td>Dental Therapists</td>
<td>2</td>
<td>13,210</td>
</tr>
<tr>
<td>Dental Assistants</td>
<td>2</td>
<td>8,306</td>
</tr>
</tbody>
</table>

4.  Sigataka

<table>
<thead>
<tr>
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<th>No. of personnel</th>
<th>Emolument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Officer</td>
<td>1</td>
<td>9,900</td>
</tr>
<tr>
<td>Dental Therapist</td>
<td>1</td>
<td>6,105</td>
</tr>
<tr>
<td>Dental Assistants</td>
<td>2</td>
<td>8,306</td>
</tr>
</tbody>
</table>

5.  Tavua

<table>
<thead>
<tr>
<th></th>
<th>No. of personnel</th>
<th>Emolument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Officer</td>
<td>1</td>
<td>9,900</td>
</tr>
<tr>
<td>Dental Therapist</td>
<td>1</td>
<td>6,105</td>
</tr>
<tr>
<td>Dental Assistants</td>
<td>2</td>
<td>8,306</td>
</tr>
</tbody>
</table>

6.  Rakiraki

<table>
<thead>
<tr>
<th></th>
<th>No. of personnel</th>
<th>Emolument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Officer</td>
<td>1</td>
<td>10,340</td>
</tr>
<tr>
<td>Dental Therapist</td>
<td>1</td>
<td>6,105</td>
</tr>
<tr>
<td>Dental Assistant</td>
<td>1</td>
<td>4,153</td>
</tr>
</tbody>
</table>

Total Western Division

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40</td>
<td>277,992</td>
</tr>
</tbody>
</table>
IV. Northern Division

<table>
<thead>
<tr>
<th></th>
<th>No. of personnel</th>
<th>Emolument</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Labasa</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior Dental Officer</td>
<td>1</td>
<td>15,675</td>
</tr>
<tr>
<td>(= Divisional Dental Officer - Northern)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental Officers</td>
<td>4</td>
<td>39,600</td>
</tr>
<tr>
<td>Dental Therapists</td>
<td>3</td>
<td>18,315</td>
</tr>
<tr>
<td>Dental Technicians</td>
<td>2</td>
<td>16,060</td>
</tr>
<tr>
<td>Dental Assistants</td>
<td>4</td>
<td>16,612</td>
</tr>
<tr>
<td>Cleaner/Servants</td>
<td>1</td>
<td>2,112</td>
</tr>
<tr>
<td><strong>2. Savusavu</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental Officer</td>
<td>1</td>
<td>9,900</td>
</tr>
<tr>
<td>Dental Therapist</td>
<td>1</td>
<td>6,105</td>
</tr>
<tr>
<td>Dental Assistants</td>
<td>2</td>
<td>8,306</td>
</tr>
<tr>
<td><strong>3. Nabouwatu</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental Therapist</td>
<td>1</td>
<td>6,105</td>
</tr>
<tr>
<td>Dental Assistant</td>
<td>1</td>
<td>4,153</td>
</tr>
<tr>
<td><strong>4. Taveuni</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental Therapist</td>
<td>1</td>
<td>6,105</td>
</tr>
<tr>
<td>Dental Assistant</td>
<td>1</td>
<td>4,153</td>
</tr>
<tr>
<td><strong>Total Northern Division</strong></td>
<td>23</td>
<td>153,201</td>
</tr>
</tbody>
</table>
The dental personnel were classified in the public service by Nicol and Hurst salary review team of 1982 in the Deo category. There are seven grades; and the Assistant Director of Dental Services is graded with the upper salary range of officers as shown in Table 23 below at level USO₄.

Table 23.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Point</th>
<th>Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>USO₁</td>
<td>01</td>
<td>30,800</td>
</tr>
<tr>
<td>USO₂</td>
<td>01</td>
<td>27,500</td>
</tr>
<tr>
<td>USO₃</td>
<td>01</td>
<td>24,750</td>
</tr>
<tr>
<td></td>
<td>02</td>
<td>23,650</td>
</tr>
<tr>
<td></td>
<td>03</td>
<td>22,550</td>
</tr>
<tr>
<td>USO₄</td>
<td>01</td>
<td>23,100</td>
</tr>
<tr>
<td></td>
<td>02</td>
<td>22,275</td>
</tr>
<tr>
<td></td>
<td>03</td>
<td>21,450</td>
</tr>
</tbody>
</table>

Key:

USO₁ = Permanent Secretaries of Departments
USO₂ = Deputy Secretaries of Departments
USO₃ = Directors of Government Departments
USO₄ = Assistant Directors of Government Departments

The Chief Dental Officer (DEO₁) and the Principal Dental Officer scale ranges from 17,105 to 19,800.

The Senior Dental Officer (DEO₂) scale ranges from 13,200 to 15,675.

Dental Officer scale (DEO₃) ranges from 9,020 to 12,375.
Dental Officer (DEO₄) interns and overseas graduates range from $7,700 to $9,625.

Dental Technicians scale (DEO₅) ranges from $7,150 to $8,800.

Dental Hygienist/Therapist scale (DEO₆) ranges from $5,500 to $6,765.

Dental Assistants range from $3,256 to $5,115.

**Table 24. Summary table by category**

<table>
<thead>
<tr>
<th>Positions</th>
<th>Number</th>
<th>Emolument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assistant Director Dental Services</td>
<td>1</td>
<td>$22,275</td>
</tr>
<tr>
<td>Chief Dental Officer</td>
<td>1</td>
<td>18,865</td>
</tr>
<tr>
<td>Principal Dental Officer</td>
<td>1</td>
<td>17,985</td>
</tr>
<tr>
<td>Senior Dental Officers</td>
<td>12</td>
<td>150,150</td>
</tr>
<tr>
<td>Dental Officers</td>
<td>30</td>
<td>308,000</td>
</tr>
<tr>
<td>Dental Technicians</td>
<td>11</td>
<td>88,330</td>
</tr>
<tr>
<td>Dental Hygienist/Therapist</td>
<td>41</td>
<td>258,410</td>
</tr>
<tr>
<td>Dental Assistants</td>
<td>51</td>
<td>204,983</td>
</tr>
<tr>
<td>Clerk/Typist</td>
<td>2</td>
<td>8,456</td>
</tr>
<tr>
<td>Driver</td>
<td>1</td>
<td>4,224</td>
</tr>
<tr>
<td>Cleaner/Servants</td>
<td>4</td>
<td>8,448</td>
</tr>
</tbody>
</table>

**Total** 155 1,090,126
TABLE 25. Summary table by Divisions

<table>
<thead>
<tr>
<th>Division</th>
<th>Number of staff</th>
<th>Emolument $000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>82</td>
<td>603,848</td>
</tr>
<tr>
<td>Western</td>
<td>40</td>
<td>277,992</td>
</tr>
<tr>
<td>Northern</td>
<td>23</td>
<td>153,201</td>
</tr>
<tr>
<td>Eastern</td>
<td>10</td>
<td>55,085</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>155</strong></td>
<td><strong>1,090,126</strong></td>
</tr>
</tbody>
</table>

7.2 Facilities, Materials, and Other Expenses

General Considerations

The basic economic criterion for decisions as to health expenditure is the same criterion that guides businessmen in their decisions: the concept of return on investment. The total investment in health can be viewed as the sum total of a number of elements. As in business, spending on capital goods such as hospitals, dental clinics and durable equipment is classified as investment. In addition, current expenditures on health (supplies, payroll, and other items) can be viewed as an investment in the health of the population; or indirectly as an investment in the goods and services, which are expected to be produced by individuals in better health.

In Fiji the buildings and equipment used to provide dental services tend to have long economic life, hence it is hard to convince a health planner that an old building is
not economically worthy in the present improving technology. Improving technology is an on-going process, therefore the professional skills and techniques must keep phase with the process. This may result in alteration of the old building to suit future needs. Some problems that we may face in Fiji in future regarding facilities are:

1. Majority of the clinics were not planned, hence may not adequately accommodate modern equipment if it is required.

2. Population distribution may affect the need for dental facilities. In a populated area, there is a need to enlarge and improve the facilities.

3. Age distribution. The children tend to be increasing in the sub-urban and urban areas. These are the areas the planners should keep in mind, when forecasting future need for facilities.

An account for the 1984 expenditure will now be assessed. The expenditure on dental materials is based on previous records and may not be accurate. Other accounts are extracted from the 1984 budget estimates:

The allocation for dental material is about 0.05% of the total Activity 5 (or Code 22-2-5). In the current year it should amount to (0.05% of $2,208 million) = $441,600.

Allocation for dental equipment is $90,000 and $50,000 was allocated to update the prosthetic laboratory at CWM Hospital.

The total cost of material and other expenses is shown below:
Dental equipment .. $90,000
Facilities (including maintenance) 50,000
Materials .. 441,600

Total 581,600

7.3 Staff Training and Research

The average number of dental students from Fiji enrolled at the Fiji School of Medicine is 4 each year. The auxiliary students are not taken regularly, but the average intake for dental therapists is 5, depending on the need. The dental assistants average intake is also 5. The dental technician average is 2. This estimate is not very accurate because of the irregularities of intake for training, however the following is a detailed estimate cost for training of dental personnel.

Training per year for a dentist is about $6,000. The duration of the course is 4 years. Hence training one dentist is $24,000. Thus training four dentists is $96,000.

The dental therapists are registered as civil servants, while on training. The starting salary is fixed for three years, while training on $5,500 per year. Thus, 5 x 5,500 = $27,500 per year. In three years this costs the Government 3 x 27,500 = $82,500. The conditions of dental therapists apply also to the dental technicians and dental assistants. The training for dental technicians is 3 years. The cost of training is $6,150 per year. In three
years it will cost $18,450. Training two technicians for three years will cost the Government $55,350. The cost of training 5 dental assistants per year is $16,280. (Training one is $3,256) The duration of the course is one year.

The average number of dental post-graduates training is 2 per year, usually for one year. This cost is either funded by the Government or by aid programmes. To estimate the cost of the post-graduate training, the writer's own case is considered. While training in Australia, the expenses are $6,743.52 and the visa fee for Australia is $2,500. The training for two Scholarship holders will cost the Government $18,487.04.

Two dental officers are permanent staff members of the Fiji School of Medicine. Both are senior dental officers. Their salaries would be about $31,750. The total expenses for staff training and research per year is shown on table 26.

<table>
<thead>
<tr>
<th>Position</th>
<th>Number</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Officer</td>
<td>2</td>
<td>18,487.04</td>
</tr>
<tr>
<td>Teaching staff (dentists)</td>
<td>2</td>
<td>31,750.00</td>
</tr>
<tr>
<td>Undergraduate training</td>
<td>4</td>
<td>24,000.00</td>
</tr>
<tr>
<td>Dental Therapists</td>
<td>5</td>
<td>27,000.00</td>
</tr>
<tr>
<td>Dental Technicians</td>
<td>2</td>
<td>18,450.00</td>
</tr>
<tr>
<td>Dental Assistants</td>
<td>5</td>
<td>16,000.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>$135,687.04</strong></td>
</tr>
</tbody>
</table>
7.4 Cost Benefit and Effectiveness on Preventive Measures

General Consideration

Cost-benefit analysis is defined as the attempt to measure the benefits of a program in monetary terms and relate them to the cost of achieving these benefits. (Workshop, Michigan - 1978).

Cost-effectiveness analysis is defined as the determination of the least expensive method of achieving a stated objective. (Workshop, Michigan - 1978).

One of the relevant conclusions of the World Health Organisation Workshop held in Singapore in 1972 indicated the need for cost-benefit analysis in planning public health programs for topically applied fluorides. It also emphasized that the preferred methods are those involving self-application. Methods involving application by dental personnel to individual patients may be too time-consuming to be economically feasible (WHO Workshop - 1972). The direct cost savings from preventive programmes can be approximately estimated, though indirect costs cannot even be estimated. Data from several cost-benefit analyses (cost of implementing a preventive program divided by the potential cost of treating caries in the absence of prevention) indicate that community water fluoridation, for example, can result in a more than thirty-fold saving (Davies, G.N. - 1974).

For dental purposes, Davies suggested that cost-effectiveness may be expressed as the number of tooth surfaces protected from caries for each hour of time taken
by dental personnel. A realistic cost-effectiveness basis would be a saving of 3 DMF surfaces per hour of dental professional time (Davies, G.N. - 1974). It was also emphasized that cost-benefit ratios indirectly reflect the efficacy of the particular system in preventing caries as well as the cost of conducting the program. (*Efficacy is defined as the benefit or utility to the individual of the service, treatment regimen, drug, preventive or control measure advocated or applied. - Proceedings of a workshop at the University of Michigan, June 5-8, 1978.)

The cost-benefit ratios in programmes for dispensing fluorides by means other than water fluoridation, and other caries prevention methods, are not as dramatic as they are for water fluoridation, but they are significant enough to warrant utilization where water fluoridation is not possible (Davies, G.N. - 1974). An outstanding example of saving in manpower on a community basis was reported from New Zealand in 1966. It proves possible to alter a long-standing standard ratio of one operator to 475 school children in a comprehensive incremental care service to 1:690 in fluoridated areas after 10 years of fluoridation (Denby, G.C. and Hollis, M.J. - 1966).

According to Heifetz (Michigan Workshop - 1978) the cost effectiveness ratio can be derived as:

\[
\frac{\text{Cost (dollars) of procedure/child/year}}{\text{Mean number DMF surfaces saved/child/year}} = \text{or}
\]

\[
\frac{\text{Cost/child/year}}{1.0 \text{ DMF surfaces saved/child/year}}
\]
According to Davies (1974), the following cost-benefit ratios were reported:

(1) After 10 years fluoridation at Hastings (N.Z.), the cost-benefit ratio of 1:4.4 was achieved for children aged between 2½ to 15 years.

(2) Cost-benefit ratio of 1:4.1 was achieved at Newburgh (U.S.A.) for 5-6 years old children who had the benefit of fluoridation for five years.

(3) After 5½ years of fluoride tablets from birth a ratio of 1:5.5 was achieved in U.S.A.

(4) After six years of fluoride tablets from birth a cost-benefit ratio of 1:5.1 was achieved in Australia.

(5) A cost-benefit ratio of 1:15.4 was achieved after 8 years of school water fluoridation in the U.S.A.

Heifetz (1978), while assessing the cost-effectiveness of weekly fluoride mouthrinse programmes, indicates that because of wide variation in clinical results it is difficult to make an exact estimate of the effectiveness. He took a conservative stand and assumed a caries reduction of 25%, a level close to the lower boundary of efficacy. Cost of materials were based on a 36-week per year programme. It was also assumed that school personnel administered and supervised the programme and therefore no estimation of salary costs was involved (Heifetz, S.D. - 1978). His estimation of cost effectiveness of supervised weekly mouth-rinsing with a 0.2% NaF solution is presented on table 13. It shows total costs, which amount to the cost of materials
alone at $1.50 per child. The low cost of fluoride mouth-rinsing, therefore, mainly accounts for its highly favourable cost-effectiveness of $1.00 per surface saved. Heifetz considered that even if payment is made for supervision, cost-effectiveness is still only $1.60 per surface saved. To gain insight into specific cost-benefit and cost-effectiveness of mouthrinsing programmes, some of the studies were briefly reviewed.

(1) In a study concluded by Rugg-Gunn et al. (1973), the costs assessment of a 3-year trial of mouthrinses (0.05% NaF) (was 2 new pence (U.K.)) per rinse.

(2) In 1971, the cost per child per year was estimated at $0.31 (Horowitz et al.- 1971) for weekly oral rinsing with a 0.2% neutral NaF solution in a school dental programme. By mid-1977 the cost per child per year had increased to $0.42 (Leske, G.W. and Ripa, L.W. - 1977). By late 1977 it had increased to $0.45 (Ripa, L.W., et al. - 1977). These figures refer only to cost of materials and supplies.

(3) In 1975, 17 standardised school-based programmes were initiated for children in different locations in Guam and U.S.A. for a three-year period to evaluate the effectiveness and economic feasibility of weekly fluoride mouthrinsing. Information on the cost of supplies, equipment, personnel and school overhead was collected for each school year. The mean cost of supplies and equipment for the first two years ranged from 20 cents to 82 cents. The average for the 17 sites was 50 cents per child per year. When the salary of paid personnel (if any) is included, the costs range from $0.28 to $8.78 with a mean cost of $3.49 per child per
year over all studies. Differences in cost are mainly attributed to different methods in delivering the rinse and numbers and levels of supervising personnel.

Estimates of cost-benefit based on two years of experience indicate that the procedure is highly cost-effective in a variety of settings (Brunelle, J.A. and Miller, A.J. - 1978).

In an overview, Horowitz (1980b) assumed that if supervision is done by volunteers, weekly mouthrinsing can be carried out for as little as 21 pence per child per year. Cost-effectiveness of supervised weekly mouthrinsing with a 0.2% NaF solution.

**Cost**

Number of class treatments:

800 children/year x 36 treatments/year x 3 years = 864,000 child-treatments.

\[
\frac{864,000 \text{ child-treatments}}{30 \text{ children/class}} = 28,800 \text{ child-treatments}
\]

Time required:

28,800 class-treatments x 5 min/class-treatment = 2,400 hrs

Salaries:

Existing school personnel

Materials:

50/child/year x 3 years = $1.50/child

Total cost = $1.50/child.

Effectiveness:

6 DMFs/child x 25% reduction = 1.5 DMFs/child.
Cost-effectiveness

\[
\frac{1.50/\text{child}}{1.5 \text{ DMFs/child}} = \frac{\$1.00}{\text{surface}}
\]

A fortnightly mouthrinising programme in Gottenburg, Sweden, was evaluated by Torell (Torell, P. - 1965) and the estimates showed a cost-benefit ratio of 1:10.6. The programme was initiated in 1960 using 0.2% NaF solution. The costs of the programme have been detailed by Torell (1965) as follows:

Cost of implementation (Swedish kroner)

1 dentist = 14,600
1 head dental nurse = 33,600
10 dental nurses = 363,600
Paper cups and fluoride tablets = 14,600
Travelling costs = 6,600

Total in Swedish kroner 433,000

Savings in costs of fillings

Decrease in number of fillings = 2.3
per child per year
Number of children = 40,000
Total decrease in fillings = 92,000
Cost per filling = Sw. k. 50
Total savings = Sw. k. 4600,000
Cost-benefit ratio = \( \frac{\text{Cost of implementation}}{\text{Savings in costs of treatment}} \)

= \( \frac{433,000}{4,600,000} \)

= 1:10.6

In assessing the relative efficiency of various methods of topical fluoride application in dental public health, Heifetz (Michigan Workshop - 1978) ranked their cost-effectiveness shown on table 27.

The estimates indicate that some methods are able to protect teeth against caries at decidedly less cost than others. It could be seen that weekly fluoride mouthrinsing is the most economical procedure.

In public health terms, professional manpower and money are usually scarce in many countries. Of the various methods listed in the table, weekly NaF rinsing appears to best accommodate these constraints. According to Heifetz when comparison is drawn between, for example, the self-administered rinsing and the professionally administered Knutson's technique (although mouthrinse confers less cariostatic effect on a per child basis) implementation of the most cost-effective procedure will result in the largest total number of surfaces saved on a population basis for every dollar spent (Heifetz, S.B. - Michigan Workshop, 1978). However, since these assessments were based on conservative assumptions there is a need for this more realistic approach when dealing with cost-effectiveness of different procedures.
<table>
<thead>
<tr>
<th>Procedure</th>
<th>Estimated per cent reduction</th>
<th>$ Cost per 1.0 DMFs saved</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly mouthrinse 0.2%</td>
<td>25</td>
<td>$1.00</td>
<td>1</td>
</tr>
<tr>
<td>NaF solution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semiannual &quot;brush-in&quot;</td>
<td>25</td>
<td>$2.50</td>
<td>2 (tie)</td>
</tr>
<tr>
<td>9% SnF Zircate paste</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prof.-applied 2.0% NaF sol. multiple-chair method</td>
<td>40</td>
<td>$2.60</td>
<td>2 (tie)</td>
</tr>
<tr>
<td>Annual prof.-applied APP gel (1.23% in preformed trays)</td>
<td>40</td>
<td>$4.40</td>
<td>4</td>
</tr>
<tr>
<td>Toothbrushing 5 x yr</td>
<td>20</td>
<td>$5.60</td>
<td>5</td>
</tr>
<tr>
<td>APP sol. (0.6%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toothbrushing at home</td>
<td>20</td>
<td>$10.00</td>
<td>6</td>
</tr>
<tr>
<td>0.1% fluoride dentifrice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual prof.-applied 8% SnF</td>
<td>20</td>
<td>$21.00</td>
<td>7 (tie)</td>
</tr>
<tr>
<td>Daily self-application APP gel 0.5% in custom trays</td>
<td>80</td>
<td>$21.00</td>
<td>7 (tie)</td>
</tr>
</tbody>
</table>
7.5 Dental Needs and Resources

General Considerations

The need for dental treatment may be expressed in several ways. The treatment needs of an individual are determined by the attack of the dental diseases and by the amount of dental care received. The reduced incidence of dental caries resulting from preventive measures, for example, the use of domestic water supply containing optimum fluorides cut the need for restorative dentistry throughout life. At this point a useful classification of individuals according to their treatment needs may be employed. It is the American Dental Association "Dental Classification of Individuals" published in its Official Policies on Dental Health Programs and is as follows: (Dunning, J.M., 3rd Ed., pages 342-343).

Class 1:

Individuals apparently requiring no dental treatment related to the type of examination or inspection performed.

Class 2:

Individuals requiring treatment but not of an urgent nature, such as:
(a) Moderate calculus.
(b) Prosthetic cases not included in Class 3.
(c) Caries - not extended or advanced.
(d) Periodontal diseases - not extensive or advanced.
(e) Other oral conditions requiring corrective or preventive measures.

Class 3:

Individuals requiring early treatment of such conditions as:

(a) Extensive or advanced caries.
(b) Extensive or advanced periodontal disease.
(c) Chronic pulpal or apical infection.
(d) Chronic oral infection.
(e) Heavy calculus.
(f) Surgical procedures required for removal of one or more teeth and other surgical procedures not included in Class 4.

Class 4:

Individuals requiring emergency dental treatment for such conditions as:

(a) Injuries.
(b) Acute oral infections (periodontal and periapical abscesses, Vincent's infection, acute gingivitis, acute stomatitis.
(c) Painful conditions.

Some authors divide need for dental care into three categories: (1) met demand; (2) identified but unmet need and (3) unidentified need.

Met demand is measured by the utilization data. Identified but unmet need are the needs identified by the
profession which are not met or met after harmful delay. Unidentified need represents the undiscovered morbidity in the community which is capable of being alleviated – the submerged part of the iceberg. Bradshaw (1972) has enumerated four categories of need: (1) normative need, (2) felt need, (3) expressed need, (4) comparative need. The need for dental services must be distinguished for demand for care and from the use of services or utilization. Preventive care may be needed, when an individual is at risk but has no overt signs of disease. Need can be defined both in terms of the type of dental condition considered to need treatment or of the treatment or the resources required to provide it. Thus the need for dental services in a population refers to the number of individuals needing treatment, the type and extent of that treatment, the number needing preventive procedures and education for dental health, the type and extent of these interventions, and finally the number and type of personnel needed for carrying out the necessary measure.

The treatment, prevention and education must have been shown to be effective and specific for the groups for which they are to be applied.

In a public dental clinic, the staff basically consists of a dental team made up of: the dentist as the team leader, and dental auxiliaries such as:

i. the dental technician
ii. the dental therapist
iii. the dental assistant.

The dental team is essentially a group of workers, who have
come together for the express purpose of providing oral health service to people (H. Allrea and M.H. Hobdell - 1981).

In Fiji this concept has been adopted in the Government dental service. The functions of the auxiliaries as relate to Fiji will be discussed.

(1) **The Dental Laboratory Technician**

This group has little impact in the fields of preventive and dental care for young children, but affects, in a very important way, the efficiency of dental treatment for older patients.

Their main function is to assist dental officers in carrying out laboratory procedures, such as fabrication of orthodontic and prosthodontic appliances.

(2) **Dental Therapist**

This is a professionally trained auxiliary. The usual functions of the dental therapist are

i. Cleaning of mouth and teeth, with particular attention to calculus and stains.

ii. Topical application of fluorides and other prophylactic solutions.

iii. Screening or preliminary examination of patients as individuals or in groups such as school children or industrial employees.

iv. Instruction in oral hygiene.

v. Resource work in the field of dental health education.

vi. Actual classroom teaching is possible.

vii. Perform simple fillings in adults and children.
viii. Administration of local anaesthesia and extraction of primary teeth and simple permanent teeth (applied in Fiji).

(3) The Dental Assistant

This auxiliary is a general purpose personnel. The expert Committee on Auxiliary Dental Personnel of the World Health Organization list the duties as:

i. Reception of the patient.

ii. Preparation of the patient for any treatment he or she may need.

iii. Preparation and provision of all necessary facilities, such as mouth-washes, napkins and receivers.

iv. Sterilization, care, and preparation of instruments.

v. Preparation and mixing of restorative materials, including both filling and impression materials.

vi. Care of the patients after treatment until he or she leaves, including clearing away of instruments and preparation of instruments for reuse.

vii. Preparation of the surgery for the next patient.

viii. Presentation of documents to the surgeon for his completion, and filing of these.

ix. Assistance with X-ray work and the processing and mounting of X-rays.

x. Instruction of the patient, where necessary in the correct use of the toothbrush.

xi. Aftercare of persons who have had general anaesthetics.

From past experience, the use of an operating auxiliary in Fiji increases productivity and job satisfaction,
not to mention lifting of the physical and mental load from the dentist. A dentist directing a team of dental personnel works under less stress, leaving him fitter and in a better condition to work, and most importantly, may enable him to reach a higher standard of achievement. The dentist exercises more fully the skills he has learned during his training, hence this increases efficiency at less physical and mental cost in the community whose needs the dental team should meet.

When speaking of such a team leader, the writer is looking at a fully professional person, well trained, not only in the practice of the arts and skills of dentistry, but also in the area of auxiliary management; a professional who has realised that with delegation of responsibility he could spend more of his energy and skills in endeavours for which he alone had been trained and in which he prefers to become occupied.

The need to use therapists in the service under control and supervision of dentists, is to spread the dentists' knowledge as widely as possible and to keep costs within a reasonable boundary.
8. PAYMENT OF DENTAL CARE

8.1 Fiji Government Charges

Under the present legislation, the only exemption from dental charges are under:

(a) Section 33 - where no charge is to be raised in the case of the children up to the age of 18 years at a Mobile Dental Clinic, and

(b) In the proviso to paragraph 7 of the first schedule to the Principle Regulations 20 (1), where no charge is to be raised in the case of a school child who has not reached his 15th birthday.

There are a number of instances where dental charges will not be raised, but the authority under which exemption is given should be fully documented, as for example under Section 20 (3) of the regulations. Discretionary powers are also given to Medical Superintendents and Medical Officers in charge of institutions to levy lower fees under Section 20 (2) of the regulation, but any reduction from the normal maximum charge should have adequate explanations documented. The following are the extra categories for free dental treatments:

(1) **Certified Destitutes:** Receive free dental treatment, including necessary dentures.

(3) **Certified exempted patients:** also receive free extractions and fillings, but must produce a letter of income for dentures.

(3) Diplomatic Missions. Members of the diplomatic missions are provided free dental treatment, including dentures,
if necessary, and when recommended by the Foreign Office.

(4) **Prisoners:** Dental treatment on prisoners is confined mainly to simple extractions. Emergency fillings may be carried out on prisoners who serve a longer sentence (e.g. 3 years or more) as recommended by the visiting medical officer.

(5) **Police and Army Personnel:** General Order 16000 applies that free treatment is confined to extraction and simple fillings to the following officers:

(i) **Police** - Members of the Fiji Police Force below the rank of Assistant Superintendent.

(ii) **Army** - Members of the regular force of the Fiji Forces.

(iii) **Prison Service** - The officers below the rank of overseer are given free dental treatment.

(6) **Visitors:** The charges payable by visitors to Fiji shall be double those prescribed in the schedule for Fiji citizens. (Refer to Regulation 20, Paragraph 5.)

(7) **General Policy:** In the districts where private dental practitioner service is available, the adult patients may not be provided treatment, except for relief of pain. It is the responsibility of the dental officer in charge to ensure that correct fees are charged.

It was stated earlier in this chapter that the dental fee for service in public dental clinics in hospitals is subsidised by the Government. The detailed charges are shown as tabled:
Dental Charges

1. For each attendance and consultation $1.00 is the minimum fee that is to be charged for operations that are not specified in the Schedule. The fee for each post-operative observation appointment is $1.00, e.g. Dry sockets, removal of sutures, periodontal follow-up, and penicillin injections.

2. Extraction
   Under local anaesthetics for one tooth 2.00
   Each additional tooth on the same visit 1.00

3. Periodontics
   i. Gingivectomy, Flap surgery and other miscellaneous periodontal treatment 10.00
   ii. Surgery 2.50
   iii. Occlusal equilibrium 5.00
   iv. Scaling and Polishing - simple 3.00
       - complex 24.00
   v. Pericoronitis, Periodontal abscess 1.00

4. Oral Surgery
   i. Removal of impacted tooth, cyst 5.00
   ii. Removal of roots and apisectomy 3.00
   iii. Fracture mandible fixation (simple) 20.00
   iv. Fracture mandible fixation (compound multiple fractures) 30.00

The cost of required X-ray examination are charged in addition to the above.
5. **Conservative Dentistry**

   i. Sedative dressing (for relief of pain)  
      1.00

   ii. Amalgam filling 1 surface (e.g. Class I)  
       3.00

   iii. Amalgam filling 2 surfaces (e.g. Class II)  
        4.00

   iv. Amalgam filling 3 surfaces (e.g. MOD)  
       5.00

   v. Amalgam multi-surface with pins  
      8.00

   vi. Silicate fillings  
       5.00

   vii. Composite resin  
       8.00

   viii. Gold Inlays Class III  
        15.00

   ix. Gold Inlays Class IV  
      20.00

The cost of gold used shall be charged in addition to Endodontics (Pulp treatment of the tooth).

   Pulpotomy  
      3.00

   Each root canal filling  
      8.00

   ( = 3 roots = 24.00)

   + Amalgam/Syntrex/Composite Fillings

   + X-ray charges to be additional

6. **Dental Radiography (Intra-Oral)**

   Examinations for one Film  
      2.00

   Additional Film  
      1.00

7. **Dentures**

   (a) Full upper or full lower dentures  
       30.00

      i.e. F/F Dentures  
      60.00

   All patients earning below $3,000 per annum  
      30.00

   ($30.00 is the minimum fee to be charged for dentures and must have supporting evidence of income in writing from, e.g. a Justice of the Peace,
Welfare Officer, District Officer, Divisional Commissioner, etc.).

Income means income of husband and wife.

(b) **1 Tooth Partial Upper and Lower Denture**

For each additional tooth

$10.00

$2.00

Adjustment to dentures: Patients may be given up to three adjustments as part of the original fee. After this $1.00 for each adjustment visit must be charged.

(c) **Repair/Reline of Full Upper or Lower**

Full Denture or partial denture

(If income below $3,000.00 per annum) $3.00

Rebase $10.00

(If income is below $3,000.00) $5.00

8. **Orthodontics** $100.00

i. Multiband Therapy

ii. Removable appliance therapy

9. **General Anaesthetics** $25.00

(Charge for extraction is additional to above)

10. **Miscellaneous Treatment**

   e.g. Dry socket $1.00

   Control of haemorrhage $1.00

It has been stated earlier that the dental charges in the public service are subsidised by the Government. It is not a profit making organisation, therefore one can not expect a profit.
8.2 Methods of Payment of Dental Care

In Fiji, the main method employed is the direct purchase or fee for services. There is payment to a lesser extent by Labour Union plans, for example as in the case of workmen's compensation claims. When an employee has an accident on the job site or while travelling on official duties, resulting in lost teeth or other conditions needing conservative treatment, the company pays for the dental care required. This Chapter will deal with some other methods used in developed countries, for example in the United States and Australia. The common methods employed in these places are group-arranged methods of payment. These methods either help the participant to share catastrophic risks with other people; help him to spread his own health bills over a long period of time; or help to channel financial aid to him from an outside source. There are three main methods by which this is done:

1. Insurance
2. Post-payment plans
3. Prepayment plans.

The methods overlap somewhat under ordinary conditions, and in large tax-supported plans they actually merge. Prepayment is a form of insurance and also involves budgeting. Each method will justify individual consideration. Major differences emerge according to whether a given plan is operated by the government as with Medicaid, by the profession, as with dental service corporation plans, by the consumer as with labour union plans, or by private commercial carriers.
1. **Insurance**

The use of insurance is to help to spread the financial burden upon death or severe accident of long standing consequences. This principle is applied to medical and dental expenses. There are six aspects which make it particularly attractive for insurance coverage:

i. Unpredictability for the individual.

ii. Predictability among large numbers of individuals.

iii. A financial burden of catastrophic size if payment falls due at one time.

iv. The event must be infrequent enough to permit premiums to build up a good reserve fund.

v. The plan must include enough people over a wide area so that localised disasters such as epidemics will not produce demands involving a high proportion of policy holders all at one time.

vi. The existence of insurance should not of itself increase demand for service unduly. Demands for unnecessary dental and medical attention might constitute a hazard to an improperly controlled medical or dental insurance plan.

An individual has little reason to insure against a predictable condition. He can either save up for it, or budget it on instalment plans. For this reason, insurance programmes cover more or less predictable items such as dental care. This usually deals with groups of policy-holders rather than with individuals.
2. **Post-payment Plans**

One of the oldest aids to the financing of dental care in the United States is the post-payment or the budget-payment plan. Dentists (dental societies) arrange with the banks to allow their patients to take loans to pay the dental care at intervals over a period of time. Patients use this bank loan to pay their bills without involving the dentist in the transaction. There are several reasons behind this move.

(i) Dentists who wish to encourage patients to undertake initial care can do so more easily, if they have a specific financial arrangement to suggest with confidence a plan endorsed by the dental society.

(ii) The bank and the patient both gain by the knowledge that they are operating in a manner approved by the dental society.

The idea of the arrangement is that the bank pays the patient's bill to the dentist and the patient pays instalments to the bank over a period of time with interest.

3. **Pre-payment Plans**

Financial coverage for comprehensive dental care through prepayment is different from insurance. A pre-payment arrangement is an arrangement by which periodic, specified payments (premiums, dues, contributions) are made in advance and used to pay for health services. In developed countries people learn, before they are out of their teens, whether they have caries-susceptible mouth or caries.
resistant mouth. If they know that they are caries-susceptible, they may have periodic dental care. This is the best preventive dentistry because it ensures that only the yearly increment will require treatment, rather than big backlog of major restorative dentistry with high cost and above all damage to health.

Dental bills seem to be high but in periodic recall systems these high bills are unlikely.

The people who are likely to purchase dental care coverage are those who are caries-susceptible. They can produce high claims and may bankrupt the insurance program, unless they pay high premiums.

To keep the prepayment program in progress, the individuals form groups to include low risk with high risk people. There are several inducements to the formation of groups for dental care payment plans.

An important one is the convenience of group bargaining, e.g. Labour unions or other consumer groups. Bargaining can also be facilitated by the fact that a Labour group can negotiate a fringe benefit. The financing of a prepayment plan can be done on expense-sharing basis, the employer paying the basic cost of the policy, while the employee pays the deductible item. The co-insurance not only helps to reduce the financial burden on the underwriter by a given percentage, but maintains the interest of the patient in the size of the bill that is being run up. There are three other inducements to group programs:

(1) The extent to which such programs facilitate preventive
dentistry. Periodic visits can be specified, the best policies will exclude diagnostic and preventive procedures from any deductible items, so as not to spoil the inducement toward this type of care.

(2) **The Instalment Payment**

It is easy for an insurance underwriter to arrange instalment payments the way banks and loan companies assist in financing of automobiles and refrigerators.

(3) **Underutilization**

Some people, even the educated group, neglect their teeth or regard them as expendable. These people are often included in consumer groups such as Labour unions. Since they do not avail themselves of the care they are entitled to, it is easier for those who want care to obtain it at lower cost. There are rules designed for the administration of dental prepayment plans. One of the set of rules was formulated by a joint meeting of the executive Council of AFL-CIO and the representatives of the American Dental Association on August 5, 1964. They issued ten principles, but five of them will be quoted in this paper:

i. Dental prepayment programmes should make provision for ensuring high-quality comprehensive dental care.

ii. Where dental prepayment programmes are organised, preference should be given to serve groups within the entire community.

iii. Freedom of choice for individuals under group
programmes should include not only free choice of dentist, but free choice of plan or programme as well.

iv. Provision should be made for public consumer and professional representation on the governing board of dental prepayment and direct service organizations.

v. Dental health education should be part of the pre-payment programmes and should be jointly planned and conducted by the dental profession and the consumer organizations involved.
9. EVALUATING DENTAL SERVICES

9.1 Dental Services Standard

General Considerations

Dentists traditionally want to know the quality of work they carry out. Most of their standards have been drawn from:

1. Their leaders in the technical and therapeutic fields in dentistry.
2. Their own experience in private practice.
3. The reactions of their individual patients (who were not expected to know much of the scientific background of the work they were receiving).

Dentists have worked as individuals, resenting comments of either a critical or an authoritative nature from others. The dentist must not only have the quality of his work for an individual patient appraised by his peers, but must tailor his treatment plans to the needs and financial resources of the group or groups to which his patients belong.

Generally, the objectives of a director in a publicly funded dental care program are:

(a) To access the quality of health care in accordance with standards stipulated by the Health Department.
(b) To ascertain where there is over-utilization or under-utilization of services either performed by the practitioner or received by the patient.
(c) To identify fraud.
(d) To educate practitioners and recipients in the appropriate use of publicly funded health care programmes. The director must also consider the following aspects of quality:

(1) Program goals

The plan should clearly define goals as to how far it might go in providing comprehensive oral-health care for a specific population.

(2) Availability of care

The plan should provide sufficient facilities, manpower, including auxiliaries, and operating funds to furnish the specific scope of care to the highest proportion of the eligible population that can be expected to demand it.

(3) Scope of services covered

The plan should list specific services within the areas of prevention, diagnosis, correction of defects, and maintenance of oral health. Priority scales should be set up, where necessary.

(4) Accessibility of care

This refers to the ability of the consumer to enter the delivery system. The factors to be considered are convenience of location, culture, economics, communication, hours of operation, and transportation and outreach services.

(5) Acceptability of the programme

Policy-making within the program should provide for careful appraisal of patient satisfaction, including adjustment
of grievances. High levels of accessibility and acceptability may be expected to increase both demand and utilization.

(6) **Eligibility**

The duration of eligibility should be as long as possible to permit maintenance care beyond the initial treatment series.

(7) **Continuity of care**

Provision should be made for continuity of care as long as the patient is eligible, with the same dentist if possible.

(8) **Appropriateness and technical quality of care**

In addition to being of satisfactory technical quality, it is important that the level of care be adjusted to the patients prospects of getting lasting benefit from it.

(9) **Efficiency of patient care**

The dentist must be able to work efficiently at those tasks which require his personal skill.

(10) **Outcome and measurements of programme status**

The outcome of care for individual patients must be measured, as well as the progress of the programme toward its overall objectives.

9.2 **Evaluating Dental Services Standard for Fiji - Present and Future**

**Objectives**

(i) Meeting the demand and the need of the people.
(ii) Betterment of dental health.

The question arises:
"Are the methods of the past and present adequate to meet the need for the future?"

At present:
1. School dental service.
2. Relief of pain.
7. Orthodontic treatment (private-sector).
8. Preventive services.

1. **School Dental Services**

   The objective of the government is to give priority to the school children. All the children up to the age of 15 years are given free dental treatment, including orthodontic appliances and any prosthesis.

   The services are provided by mobile clinics using trucks and trailers. At present there are 4 trucks (mobiles) and two (2) trailers serving the whole of Fiji; working in the school grounds. Static clinics (20 in number), which are attached to hospitals and health centres, also give priority to school children, however, in areas where there is no private dental practitioner's service, a wider coverage may be given.
Future:

"Children may be victims of fate. They must never be the victims of neglect." (President John Kennedy) It is planned to visit school children regularly using mobile clinics as more staff become available. The use of operating auxiliaries should be stepped up. The 5-6 years age group has the highest df rate (6.1).

In view of high susceptibility of deciduous dentition to caries attacks, it is envisaged the use of operating auxiliaries – Dental Therapists, to do routine conservative work and dental health education in school children under the supervision of a dental officer. Teamwork will be the "catchword" of this programme. Additional trucks and trailers should be looked into seriously.

2. Relief of Pain

Palliative dental treatment is available to everyone at the static clinics and hospitals. Usual fee $2.00 is for one extraction.

3. Minor Oral Surgery

This is carried out in the static clinics and hospitals throughout the Dominion. The usual fee is $5.00 for each treatment. About 10,000 teeth are extracted per month.

Future:

In view of increased accidents, resulting in facial fractures, it is hoped that maxillo-facial units at the Suva Dental Clinic, Lautoka and Labasa Clinics will be established.
4. **Conservative Services**

No conservative treatment is undertaken for adults in government services at present; however where there is no private dental service available, services may be rendered for respective government set fees.

**Future:**

With the view of educating the expectant mothers and nursing mothers in dental health matters, it is envisaged that they be given priority in treatment, particularly those of the poorer class.

Perhaps free dental examination and advice on care of teeth in pregnancy. The importance of foundation teeth and six year molars and four monthly visits could be stressed. This, we hope, would help to ensure that mothers as well as children are well-established in oral health matters and habits.

5. **Periodontal Treatment**

Periodontal disease is the arch enemy of the dental profession in Fiji. So far, very little effort has been made to prevent, control or even to treat this disease. Adults who present with this disease are treated by the dental therapists under the direction of a dental officer.

**Future:**

Prevention, early detection and interception of periodontal diseases should be emphasised in our dental health education programmes for the community at large.

Greater emphasis in teaching of this subject should be placed on undergraduates and auxiliary students, and
dental therapists.

6. **Orthodontic Service**

This is available in the private sector. Malocclusion does not pose a major public health problem at present, but there are signs it will be in years to come.

**Future:**

There is a need to train an orthodontist to be based at the main dental clinic to care for the children in the Government dental service in future.

7. **Prosthetic**

The need for dentures is increasing in older people. This service is available to all who need dentures. However, the bulk of the patients are low-income group in three main hospitals' clinics, namely Labasa, Lautoka and Suva. Destitutes get free service. Fees charged range from $30 - $60.00, depending on the income of the family. There are 4 full-time dental officers seeing prosthetics patients. Over 50 dentures are completed per month in each centre.

8. **Prevention**

Preventive procedures already undertaken are health education for:

i. All school children.

ii. Parents, especially mothers at prenatal, perinatal and postnatal clinics.

iii. Parents and teachers associations members.

iv. Other adults at primary health care seminars.

v. Individual patients who attend the clinics for routine treatment.
Water-fluoridation has been implemented only in Suva in 1969.

Fluoride mouthrinses have been introduced in Suva, Nausori and Lautoka in 1980.

Toothbrushing scheme in schools has been operating since 1957.

**Future:**

It is anticipated that all schools in Fiji continue to participate in the toothbrushing scheme. Fluoride mouthrinses should be encouraged in other areas in the country. The existing procedures should be encouraged and maintained. Water-fluoridation should be introduced in other towns in the country.

The general outlook looks good, but needs cooperative efforts.

9.3 **Utilization**

About 28% of Fiji population utilised Government dental services in 1981, 34% in 1980 and 34% in 1979, as shown in table 28. There are various factors that affect the utilization. Fiji consists of several scattered Islands as shown in the introduction. This is one of the main factors that affects the attendance.

Adult patients who can purchase the services are seen in private practice. These are some other factors that may affect the utilization:

1. **Accessibility of care**

   The consumers are not easily able to enter the delivery system, because of the geographic location.
2. **Availability of care**

   The service is not available in all the Islands in Fiji.

3. **Acceptability**

   Dental service is often not acceptable to some people among the population. This again may be due to culture, economics, communication hours of operation and transportation.

4. **Eligibility**

   The adult patients are not eligible for conservative treatments in the Government service, where private practitioners are available.

   **Summary of utilization and services for 1979, 1980 and 1981 are shown on table 28.** Information on prosthetic utilization is not available, but about 50 dentures are made in Suva every month.

   It can be noted from table 28 that isolated places where transport is mainly by boat the attendance is low, for example in Lakeba, Lomaloma and Kadavu. The places are manned by Dental Therapists and Dental Assistants. Other places manned by auxiliary personnel without Dental Officers are: Vunidawa, Taveuni, and Nabouwalu. The Dental Officers in charge of the respective clinics in the Divisions visit these stations periodically. Complicated cases are usually transferred to the nearest Dental Officer.
<table>
<thead>
<tr>
<th>Table 28.</th>
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<tr>
<th>Service</th>
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<th>Nadi</th>
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<th>Lautoka</th>
<th>Ba</th>
<th>Nadir</th>
<th>Sigatoka</th>
<th>Tavua</th>
<th>Sarawana</th>
<th>Korovou</th>
<th>Navua</th>
<th>Rakiriki</th>
<th>Taveuni</th>
<th>Vanua Levu</th>
<th>LomaLoma</th>
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<td>8716</td>
<td>10285</td>
<td>11451</td>
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<td>5528</td>
<td>4645</td>
<td>4112</td>
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<td>1316</td>
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<td>6445</td>
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<td>4045</td>
<td>3701</td>
<td>2197</td>
<td>1974</td>
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<td>1704</td>
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<th>Fillings</th>
<th>Scaling</th>
<th>Surgical Extraction</th>
<th>Fractured Mandible (Fixtures)</th>
<th>Miscellaneous Surgery</th>
<th>General Anaesthesia</th>
<th>X-rays</th>
<th>Exam. only</th>
<th>Schools Visited</th>
<th>Oral Hygiene Instruction</th>
<th>Revenue in Dollars</th>
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<td>5520</td>
<td>2097</td>
<td>832</td>
<td>1689</td>
<td>1095</td>
<td>495</td>
<td>280</td>
<td>1572</td>
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<tr>
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<td>19529</td>
<td>17021</td>
<td>21436</td>
<td>15586</td>
<td>16682</td>
<td>7104</td>
<td>1736</td>
<td>6694</td>
<td>1595</td>
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<table>
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<th>Total 1981</th>
<th>Total 1982</th>
<th>Total 1979</th>
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<tbody>
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<td>115391</td>
<td>116155</td>
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<tr>
<td>Children</td>
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<td>48889</td>
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<tr>
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<th>Total 1981</th>
<th>Total 1982</th>
<th>Total 1979</th>
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<td>115391</td>
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<td>150295</td>
<td>164270</td>
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10. **DISCUSSION**

The intention of this chapter is to summarize the previous sections in this thesis and may include some additional material required to develop recommendations.

1. **Dental personnel**

   The past dental services in Fiji were mostly reparative and palliative. Recently preventive dentistry was emphasized and as such one of the main approaches now in this field is health education.

   The writer believes this area requires more specially trained staff. Selection of dental personnel to enter the dental profession in Fiji should be based on the following criteria:

   (a) **The Interest**

   We know that to be successful in dentistry the embryo practitioner needs an above average intelligence, possess a modest degree at least of manual dexterity, compassion for others and integrity.

   In addition, when they are entering general practice, they need to possess an adequate business sense. It would seem logical that if dentistry is to prosper as a profession we must attract a larger proportion of the "high-fliers" (intelligent) not only to become future consultants and research workers, but also our innovators in general practice. If we are to attract genuinely motivated students, we must look to our own image. We must make sure that career prospects in the profession are both sufficiently diverse and stimulating to
attract the bright young people of today.

We must also select candidates who are genuinely interested in dentistry. He/she must not be selected because he/she needs a job and qualifies for it. The interest in the profession should be the primary objective to justify for the selection to make a dedicated officer in the profession.

(b) Humanism

"Humanism" is a philosophy that asserts the dignity and worth of humanity and its capacity for self-realization through reason. (John S. Tecklenberg - Auxiliary Training and Utilization for Preventive Services, Clinical Preventive Dentistry by Louis P. DiOrio, page 313.)

The candidate requires a high degree of self-esteem and the ability to help the clients develop attributes of self-worth and self-reliance. The quality of humanism is conducive to providing an environment for training and growth.

(c) Personality

All the personnel should have a personality suited to the job, responsibility and office. A well-adjusted personality is important in public relation positions such as receptionist or junior dental assistant. The preventive assistant should be sensitive to the needs of others. Enthusiasm for preventive philosophies should be reflected while performing the tasks. At the same time, there must be warmth and sincerity. In other words, the candidate should possess a pleasant personality and should be interested in people. This type of person should be comfortable in most situations and have the ability to make other people at ease.
(d) **Communication**

This is the process by which information is exchanged through a common system of symbols, signs, or behaviour. It implies that two parties are involved; that one sends a message and the other receives it. It is important that the prospective candidate should be able to communicate with others freely. The ability to listen is as important as talking. It is not justified to select a candidate who is shy and unable to express himself/herself in front of an audience. It is recommended that the candidate should be pleasant and good in communicating with children and must like children.

2. **Factors Influencing the Effectiveness of the Existing Preventive Services**

(a) **Funding**

The primary health care does not include dental health as such. Hence provision of funds for specific preventive dental projects appear to be considered in the low priority group.

(b) **Incentives**

The lack of self-esteem among dentists in the Government dental service could be attributed, in part, to the lack of effectiveness in the preventive area in dentistry. By self-esteem, the writer is referring to regular flow of promotion to adequately recompense for services by deserving officers. Currently the average rate of promotion of Government Dental Officers is 14.3 years (table 29).
<table>
<thead>
<tr>
<th>Year joined the service</th>
<th>Year promoted to Senior Dental Officer</th>
<th>Number of years served</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955</td>
<td>1968</td>
<td>13</td>
</tr>
<tr>
<td>1956</td>
<td>1969</td>
<td>13</td>
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<td>13</td>
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<tr>
<td>1968</td>
<td>1983</td>
<td>15</td>
</tr>
<tr>
<td>1971</td>
<td>1983</td>
<td>12</td>
</tr>
</tbody>
</table>

| Total                   | 215                                   |

Average 14.3

Source: Fiji Civil List
New graduate dentists are aware that the rate of promotion is slow and so tend to be contented with routine conservative dentistry, rather than taking initiative for preventive projects. Others may leave for the private sector to open up their own surgeries after completing their bond with the Government. The divisional dental officers are graded on the same level scale with the senior dental officers. The divisional post should be upgraded to the principal level, because the divisional dental officer is responsible for all dental and related matters in his division. This will encourage him to promote dental health projects. These are some of the factors that stop the progress in promoting preventive measures.

3. Facilities

Some of the dental clinics in the rural districts are inadequate. A few are very small and usually converted one-room cubicles (not originally designed for a dental clinic), which provide a multi-purpose service for office, staff room, store room, sterilizing room and operating room. For comfort and efficient services for staff and patient, improvement in all clinics affected is required. There is an allocation of $90,000 this year for dental equipment. Hopefully this will remain an annual allocation.

4. Preventive measures

The old concept in Fiji among the medical officers in regard to dentistry was palliative or extraction to relieve pain. This idea still exists today among the public and the
Fijian villagers, when they refer to the dentist as "Vuniwai Ni Veicavu Bati", which literally means the doctor for tooth extraction. The impression is that the dentist is there only for extraction, therefore they only visit when in pain.

One may presume that some medical officers, particularly those involved in planning at divisional and sub-divisional levels are not aware of the present concepts in preventive dentistry. They must be made fully aware of the preventive methods available and the type of activities in the dental division, so that they support dental health projects financially in the overall health planning. The fact that dentistry has been given low priority in terms of finance may also be due to the fact that dental disease on its own is not fatal.

The prevalence of dental caries in Fiji is 6.1 dmf for 5-6 years old and 4 DMFT at 12 years of age. After reviewing literature in the course of studies, the writer is convinced that water-fluoridation and topical fluorides in all forms of application are the best solution to reduce the prevalence of dental caries for Fiji. In Australia, the United States of America, and many other parts of the world, fluoridation is utilized very effectively. Water fluoridation has been proved cost-effective in reducing dental caries.

5. General

(i) Under section 20 (2) of the regulation covering dental charges, discretionary powers are given to medical superintendents and medical officers in charge of institutions to levy lower fees for patients who can not afford to pay the full
dental charges, provided adequate documentation is received. This regulation was formulated by colonial masters before independence and should be modified to include dental officer in charge of an institution to exercise his discretionary judgement to levy lower fees, when he has satisfied the required formalities. This is because the medical superintendent or the doctor and the dentist are not always on duty at the same place. Besides the dental officer is the only person who can assess the correct value of the type of treatment to be rendered.

The regulation is practicable only in the main institutions, but not at the isolated rural areas where the doctor is not regularly present. It should be modified to provide efficient service for the patient and to save time for all concerned.

(ii) There have been decreases in the utilisation of dental services, 34% in 1979, 31% in 1980, 28% in 1981. This may have been attributable to economic factors. The Government increased the medical and dental charges in 1980 and this may have affected the attendance to some extent.

Wider use of preventive measures at community professional and individual levels will lower both the oral health needs of the community and the relative demands on financial and personnel resources, making comprehensive dental services available to a greater proportion of the Fiji population.
6. Recommendations

The estimated annual expenditure on dental services has been analysed at approximately 0.6% of the national health budget (Table 30). In order to manage an effective and efficient dental service for the Fiji population, an additional 1.5% of the national health budget is needed. The proposed increase should be provided to create three additional principal dental officer posts at divisional level and to carry out preventive programmes, particularly water fluoridation in other areas of Fiji. Any allocations for specific preventive programmes should be controlled by the Assistant Director of Dental Services. The dental officers at divisional and sub-divisional levels can approach him directly for their proposed projects, preventive or otherwise in their respective areas.

Two alternatives are recommended in this thesis to improve dental services:

(1) To consider a separate programme for Dental Services, or
(2) To create an additional activity for dental services within Programme II.

This allocation should be controlled by the Assistant Director of Dental Services. These are the only ways in the writer's opinion that will provide an efficient and effective dental service for the community. These methods will also eliminate the obstacles in the existing channel of communication through the non-dental personnel (Medical Superintendents, Divisional and Sub-Divisional Medical Officers).
Table 30.

Fiji's National Budget $86,759.7 million
The National Health Budget 32,217.3 million

The expenditure for dental services:

(1) Salaries $1,090,126.00
(2) Transport and facilities 50,000.00
(3) Dental equipment 90,000.00
(4) Material and other expenses 441,000.00
(5) Staff training total 135,687.00

Total $1,807,413.00

The total expenditure on dental services is 0.6% of the National Health Budget.
11. CONCLUSION

Dental disease is on the upward trend in Fiji, partly due to the influence of civilised diet and rapid increase in urbanization.

The types of treatment available are mainly curative and restorative. The dental manpower and facilities are stretched due to limitations of funds, while there still exists a great back-log of unmet needs. The use of operating auxiliaries is inconsistent and limited. The preventive programmes are sporadic in the school dental service and vary from division to division. Only Suva has introduced water-fluoridation and few areas have instituted the use of other forms of fluoride in the school dental programme. There seems to be an instability of school programmes due to lack of mobile clinics, which contribute to this inconsistent approach to dental needs of school children.

It appears that anyone who could help already has his handful of problems and worries. This has led to discouragement and frustration to the few who are trying their best to cope with increasing needs. Good cooperation and coordination in relation to financing dental programmes between and within the divisional levels and the department are needed.

The most economic approach to dental problems where many children could benefit the most at relatively low cost, would be introduction of public water-fluoridation in the main divisions, where adequate water supply is available. It has been proven to be the most effective and inexpensive
preventive method against dental caries. It has reduced dental caries prevalence in children 50-60% in other countries, when used at an early age.

The use of fluorides in other forms such as NaF mouth rinses, SnF₂ and APF-SnF₂ Brush-In programmes is recommended. Preventive control methods such as dental examination and treatment, dental health education and diet modification should be encouraged and practised. The use of other non-dental personnel, such as members of the medical professions, teachers and mothers should be fostered to enforce and maintain an effective school dental programme; especially in the rural areas, where there is an acute shortage of dental manpower.

Allocation of funds for preventive dental programmes should be controlled by a dental personnel, who is his own master in the profession.
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