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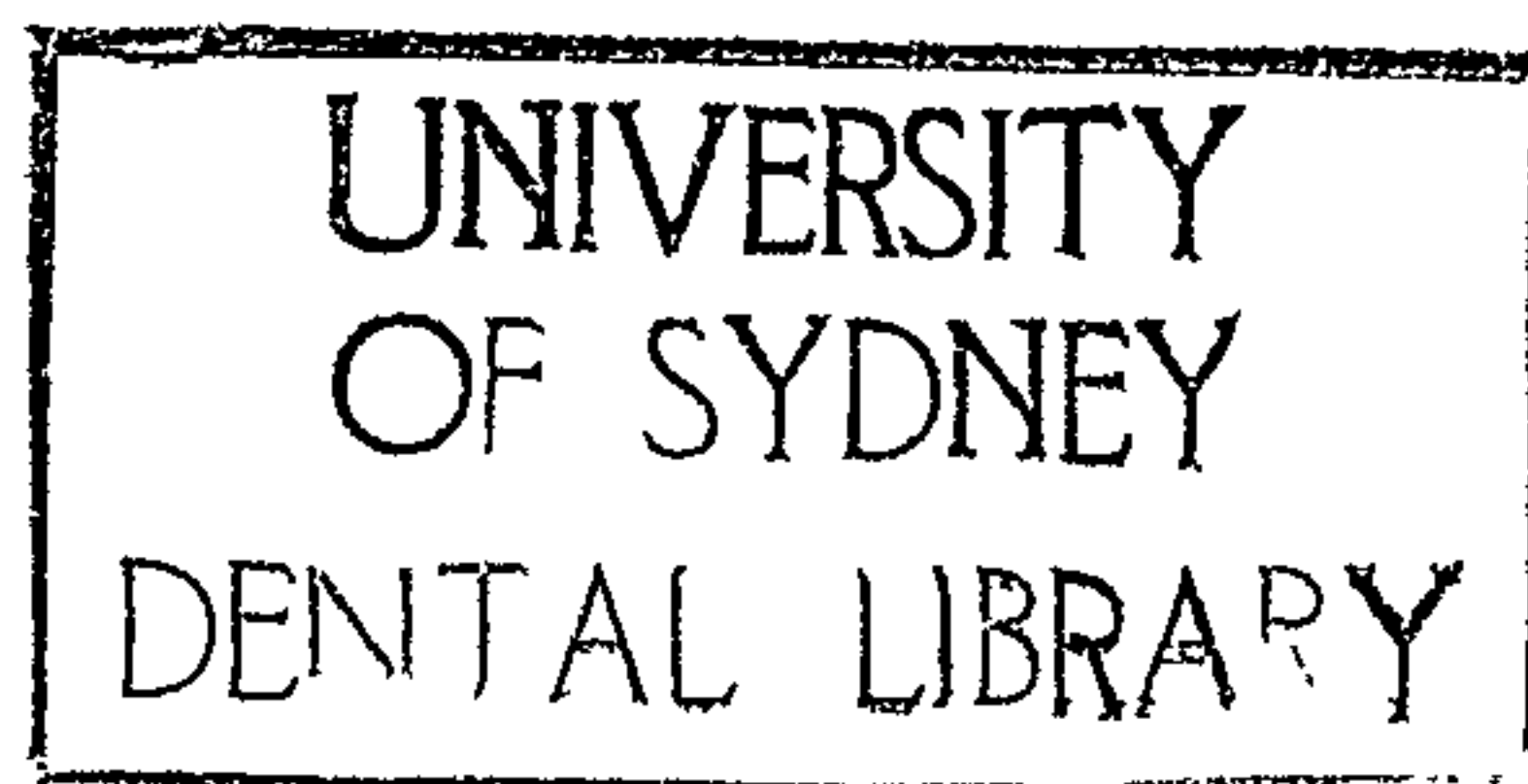
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NIUE PUBLIC DENTAL HEALTH SERVICES
AN EVALUATION 1965-1983

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for the
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SUMMARY

For any National Dental Health programme to function effectively and efficiently, periodic evaluation as an integral part of programme management is very important in order to:

- (a) demonstrate levels of attainment;
- (b) identify areas of weaknesses; and to
- (c) identify options to correct and improve future programmes and their efficiency.

Since the Niue public dental health service was established in July 1945, relatively few dental epidemiological studies have been carried out. The results from these studies have provided the base-line materials on which this evaluation is based.

The aims of the thesis were to:

- (a) discuss progress achieved during the period 1965-1983;
- (b) evaluate the present methods of delivery of dental health services in Niue; and
- (c) recommend future developments for the Niue dental health service.

The delivery of dental health services is provided by a team of three dentists, two dental technician-hygienists and 2 chairside assistants, through a hospital-based clinic and two mobile dental caravans. The mobile caravans enable the Dental Department to provide adequate and effective

dental care to schools and preschool children as well as the adult population in the outer villages.

The types of programmes available are curative, preventive and oral health education. All services are free of charge except for the provision of dentures where a small fee is charged.

The treatment programme in schools is focussed mainly on restorative dentistry. However, the preventive programmes available are:

- (a) systemic sodium fluoride tablets;
- (b) toothbrushing/toothpaste scheme;
- (c) stannous fluoride 'brush-in' programme; and
- (d) dental health education.

In the period 1964 to 1974, the prevalence of dental caries increased and the disease was fairly widely disseminated throughout the child population, starting very early in life at 2 years of age. The number of subjects in all age groups 2-10 years with 1 or more dmf teeth rose from 69.5% in 1964 to 78.7% in 1974. The mean number of dmf teeth per subject also increased. In the 2 year olds, for example, the mean dmft index increased from 0.6 in 1964 to 1.4 in 1974, and was 4.5 dmf teeth per 3 year old subject. Analysis of the dmft components showed that in 1974, the proportion of decayed teeth showed a reduction of 7%, there was a 57% reduction in missing teeth and a 38% increase in the proportion of filled teeth.

In 1983, the DMF index for children in the age group 5-12 years consisted almost mainly of filled teeth. Analysis

of the mean DMFT index showed that 27% of the decayed teeth were untreated and 73% were filled.

In the adult age group, the prevalence of dental decay was very high. In 1964 a very large proportion of teeth were missing (67% of the total DMFT index). Dental caries was an important cause of tooth loss and accounted for practically all teeth requiring extraction up to the age of 35 years. Even in the older age groups, it still accounted for approximately 50% of all teeth requiring extraction. In 1974 the proportion of missing teeth had been reduced by 32% since 1964.

Gingivitis was more prevalent in 1974 compared to that in 1964, affecting practically every age group. Periodontal pockets were not a significant problem under the age of 30 years (1964/1974 surveys). In 1983, a greater proportion among the 20-29 year group were affected. Periodontal disease accounted for approximately 40% of teeth extracted during the period 1975-1982.

Utilisation of the service by school and preschool children is very high (approximately 100%), and that by adults would be about 39%.

For future developments it has been proposed that:

- (a) a concept of decentralisation be considered, with the School Dental Service to be a separate section from that of the General Dental Service;
- (b) improved facilities are required;
- (c) the proposed national dental survey be carried out;

- (d) the department adopt a more positive attitude towards promoting the service and dental health;
- (e) the present sodium fluoride tablet programme be re-organised;
- (f) health education programmes be properly organised to obtain maximum benefit;
- (g) there be a shift in priorities from a restorative service in schools to a preventive based service; and
- (h) the services of auxiliary personnel be used to run the educational programmes.

Progress achieved has been discussed under the following headings of Service, Programmes and Oral health status.

Services: A comprehensive treatment care programme was extended to include the adult population in the late 1970's.

Programmes: The main characteristics used as criteria for the evaluation of success in oral health programmes are: effectiveness, adequacy, efficiency and appropriateness.

Oral Health Status: Analysis of the dmf/DMFT index data and data on periodontal conditions from surveys carried out in Niue in 1964, 1974 and 1983.

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TABLE OF CONTENTS

	<u>Page</u>
SUMMARY	i
ACKNOWLEDGEMENTS	v
TABLE OF CONTENTS	vi
LIST OF TABLES	ix
LIST OF FIGURES	xi
 1. INTRODUCTION	 1
1.1 Country Characteristics	2
1.2 Niue Dental Services	5
1.3 Aims of Thesis	6
 2. DEVELOPMENT OF DENTAL SERVICES	 7
2.1 Pre-Inception Period	7
2.2 Inception Period	8
 3. NIUE DENTAL DEPARTMENT	 10
3.1 Administration and Organisation	10
3.2 Staff	14
3.3 Facilities	15
3.4 Finance	16
 4. DENTAL PROGRAMMES	 17
4.1 School Dental Service	18
4.1.1 Treatment programmes	18
4.1.2 Preventive programmes	20
4.1.3 Organisation of treatment visits	22
4.2 General Public	25
4.2.1 Health education	25

	<u>Page</u>
4.2.2 Treatment programmes	26
4.3 Other Groups	28
5. ORAL HEALTH STATUS	30
5.1 Dental Caries	30
5.1.1 Deciduous dentition, 2-10 age groups	32
5.1.2 Permanent dentition, 5-12 age groups	43
5.1.3 Adult population	52
5.2 Periodontal Disease	59
5.2.1 Gingival inflammation	59
5.2.2 Periodontal pockets	64
5.2.3 Calculus	68
5.3 Dental Prostheses	71
5.4 Dento-Facial Anomalies	71
5.5 Social Factors	72
5.5.1 Attitudes and behaviour	72
5.5.2 Utilisation of services	73
6. FUTURE DEVELOPMENTS: DENTAL DEPARTMENT	76
6.1 Administration and Organisation	76
6.1.1 Staff	77
6.1.2 Facilities	78
6.2 Evaluation	79
6.3 Dental Health Promotion	80
6.4 Dental Programmes	82
6.4.1 Schools	82
6.4.2 Adults	85
7. DISCUSSION	87
7.1 Progress	87

	<u>Page</u>
7.1.1 Effectiveness	88
7.1.2 Adequacy	91
7.1.3 Efficiency	91
7.1.4 Appropriateness	92
7.2 Dental Services	92
7.3 Future Development	95
8. CONCLUSIONS	98
9. REFERENCES	100

LIST OF TABLES

<u>Table</u>		<u>Page</u>
1.	Itinerary: School treatment programme.	23
2.	School roll distribution 1974-1984.	24
3.	Dental caries in deciduous dentition. Children 2-10 years. By age. 1964/1974	33
4.	Mean dmft components. All children 2-10 years. 1964/1974	40
5.	Percentage of decayed deciduous teeth that require conservative treatment and extraction. Children 2-10 years. By age. 1964	41
6.	Percentage with 1 or more DMFT permanent teeth. Children 5-12 years. By age. 1964/1974/1983	44
7.	Mean DMF Teeth per child. By age. 5-12 years. 1964/1974/1983	45
8.	Mean DMFT components. All children 5-12 years. 1964/1974/1983	48
9.	Percentage of decayed permanent teeth that require conservative treatment and extraction. Children 5-12 years. By age. 1964	49
10.	Percentage of decayed permanent teeth that require conservative treatment and extraction. Children 5-12 years. By age. 1974	50
11.	Dental caries in adults. By age. 1964/1974	53

<u>Table</u>		<u>Page</u>
12.	Mean DMFT components. All adults. 1964/1974	56
13.	Percentage of permanent teeth requiring extraction because of dental caries and periodontal disease. Adults. By age. 1964	58
14.	Percentage with gingival inflammation and periodontal pockets. By age. 1964/1974	60
15.	Percentage with periodontal conditions. Adults. By age. 1983	62
16.	Utilisation of dental health services. 1975-1982	67
17.	Percentage with supra and subgingival calculus. By age. 1964/1974	69
18.	Percentage edentulous and wearing dentures. Adults. By age. 1964/1974	70
19.	Adults issued with dentures. Attending for treatment. 1972-1982	71
20.	Treatment ratios. School and preschool children. 1975-1982	75

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1.	Percentage of children aged 2-10 years with known (dmft) decay experience. 1964/1974	34
2.	Percentage of children aged 5-12 years with known (DMFT) decay experience. 1964/1974	35
3.	Caries prevalence in the primary dentition of children aged 2-10 years. 1964/1974	37
4.	Caries prevalence in the secondary dentition of children aged 5-12 years. 1964/1974/1983	38
5.	Mean number of dmf teeth per child aged 2-10 years. 1964/1974	39
6.	Mean number of DMFT per child aged 5-12 years. 1964/1974/1983	46
7.	Mean number of DMFT per adult. 1964/1974	54
8.	Caries experience. Individual components of DMFT index. Adult population. 1964/1974	55
9.	Percentage of subjects with gingivitis. 1964/1974	61
10.	Percentage of adults with gingivitis (Gingival Bleeding). 1983	63
11.	Percentage of adults with periodontal pockets. 1964/1974	65
12.	Prevalence of periodontal pockets in adults. 1983.	66

1. INTRODUCTION

For any National dental health programme to function effectively and efficiently, it is important that feed-backs on programme performances be regularly monitored. This is to ensure that the value, worth or the required outcomes of the planned programmes can be critically assessed.

Periodic evaluation, as an integral part of programme management, makes this possible and serves as a way of:

- (i) demonstrating levels of attainment;
- (ii) identifying areas of weaknesses; and
- (iii) identifying options to correct and improving future programmes and efficiency (Jong 1981).

Since the Niue public dental health service was established in July 1945, relatively few dental epidemiological studies have been carried out. In spite of this, these studies have been able to provide the base-line materials on which this evaluation is based.

1.1 COUNTRY CHARACTERISTICS

Geographical:

Niue is an elevated, flat coral atoll which emerged in stages from the ocean due to volcanic activities thousands of years ago, and is reputed to be the world's largest coral island.

Niue is an isolated island situated approximately:

480 kilometres East of Tonga;

980 kilometres West of Rarotonga, Cook Islands; and

560 kilometres South-East of Western Samoa.

It has a land area of 258 square kilometres (approximately 100 square miles), rising to a height of 60 metres above sea level.

The island has no surface water, but artesian bores enable the subterranean reservoir of fresh water to be tapped to supplement rainwater which is stored in tanks. The soil is mainly shallow and cultivation is difficult due to the rocky nature of the island. The principal crops are taro, tapiocca, yam, sweet potato, bananas and coconuts.

Climate:

There is a hotter, rainy season from November to March and a cooler, drier season from April to October. The mean monthly temperatures vary from 23°C to 27°C and humidity is high throughout the year. The rainfall averages 2100 mm annually and is very unreliable (SPEC).

Population:

The Niueans are polynesians and the island's small population continues to drop considerably, mainly through migration to New Zealand.

1969	census	5,290
1976	census	3,874
1981	census	3,296

Source: Justice Department, Niue.

Diet:

Locally grown root crops of taros, yams, and tapiocca as well as bananas, sweet potatoes and coconuts constitute the basic staple diet of the local population. However, the last 20 years or so has seen a change in the dietary pattern from the natural diet to a more Westernised diet.

Imported refined carbohydrates such as flour, rice, sugar and sugary foods are very popular and are now featured most prominently in the daily diet of the local community. The average sugar consumption per capita is approximately 16.8 kilogram per year (Speake 1981).

Local fish, chicken and beef are often supplemented by imported foodstuffs. Seasonal fruits are plentiful although apples and oranges and other fruits and vegetables are imported. Vegetables are locally available.

History:

When Niue was first inhabited, is not known (Smith 1903). The first European to discover the island was Captain James Cook in 1774, who named the place 'Savage Island' because of the hostile reception accorded the visitors when they attempted to establish contact.

Niue was administered by the Church (London Missionary Society) from 1846-1900 when it became a British Protectorate. It was later annexed to New Zealand (1901) and remained its dependency until 1974 when the island became self-governing though maintaining a free association with New Zealand.

1.2 NIUE DENTAL SERVICES

The Government dental services in Niue started essentially as a School dental service. Since the inception of the Dental Department in the mid 1940's, it has grown and expanded together with the other components of the health services. As a result of increased demand by the people, the dental services broadened to include the pre-school children in the mid 1950's, and the adults in the mid 1970's.

The Dental Department provides a comprehensive dental care service to everyone on the island. This is free of charge except for the provision of dentures and gold work, for which a small fee is charged. Dental treatment is provided through the main hospital dental clinic and two mobile dental caravans. There is no private practitioner on the island.

Between 1977 and 1979, there were four dental officers employed in the service. Since then, the previous Principal Dental Officer (who was one of the co-founders of the service) retired. The other co-founder of the service took up medicine, then later became the Director of Health. The latter recently retired at the beginning of 1984.

1.3 AIMS OF THESIS

The aims of this thesis are:

- a. To discuss progress achieved during the period 1965-1983; in relation to dental health and services provided in Niue;
- b. To evaluate the present methods of delivery of dental health services in Niue; and
- c. To recommend future developments for the Niue dental health services.

2. DEVELOPMENT OF DENTAL SERVICES

2.1 PRE-INCEPTION PERIOD

Early 1930's: The Niue Administration at the time had shown great concern over the decline in dental health of the population and the total lack of any organised dental service on the island. Radical treatments (extractions) were carried out by the Chief Medical Officer.

1940: The N.Z. Government on behalf of the Niue Administration, requested that the Chief Dental Officer, Western Samoa, visit the island and assess the dental condition of the population, especially that of the children.

1941: The Chief Dental Officer (Mr F. Williams) of Western Samoa visited Niue. Two local boys were selected for training at the school in Western Samoa. This signified an important first step towards the establishment of an organised dental health service in Niue.

1943: Mr F. Williams and the two Niuean dental cadets returned to Niue on a tour of duty.

1945: The two Niuean cadets qualified as Assistant Dental Officers in Apia, Western Samoa. They returned to Niue and established the Dental Department on the island. (Talagi 1981)

2.2 INCEPTION PERIOD

The development and progress of Government dental services has been quite rapid since its establishment. Service was, and is still, controlled by the Government and the Dental Department is integrated with other health services within the Health Department.

From the time of establishment of the Dental Department, the public dental health service has closely followed the principles as postulated by the WHO Authorities, namely:

- a. That dental treatment be organised with the aim of maintaining dental health, with particular emphasis on the dental care of children.
- b. That health education and instruction to patients and the general public be undertaken to encourage sound health practices regarding diet and oral care. (Williams 1965)

Initially, the plan for the development of the service called for the establishment of a priority group to receive free and routine treatment care. Here, the school children received top priority for routine care, while the preschool children and adults were only accorded emergency care for the relief of pain.

It was also established at the time that future development of the service be built up incrementally. The plan proposed was quite similar to the system practised in Denmark for the provision of oral health care service for children (Lind et al 1983), and in South Pacific territories (Cadell 1960).

Phase 1 - 1945-1953: Routine conservative treatment was confined to the school age groups.

Emergency treatment (extraction for the relief of pain) only for the preschoolers and adults.

Phase 2 - 1954-1965: A free and systematic oral health care programme for preschool children was developed. Routine conservative treatment was extended to cover this age group. Services to the adult age groups were slightly improved by the provision of artificial full upper/full lower acrylic dentures.

Third and final phase: The final phase of the development of routine services, which entailed the extension of the conservative and periodontal treatment to the adult age groups was finally achieved in the late 1970's through an additional level of professional development.

3. NIUE DENTAL DEPARTMENT

3.1 ADMINISTRATION AND ORGANISATION

Administration:

The provision of medical and dental care in Niue is integrated within the Department of Health, and is directly under the control of the Director of Health. (See organisation chart, p.12)

On matters of dental importance however, the Director of Health has delegated wide authority to the Principal Dental Officer, who is in charge of the Dental Department. He is responsible both to the Minister of Health and the Secretary to the Government through the Director of Health, on all matters relating to policies, duties and staff respectively, of the Dental Department.

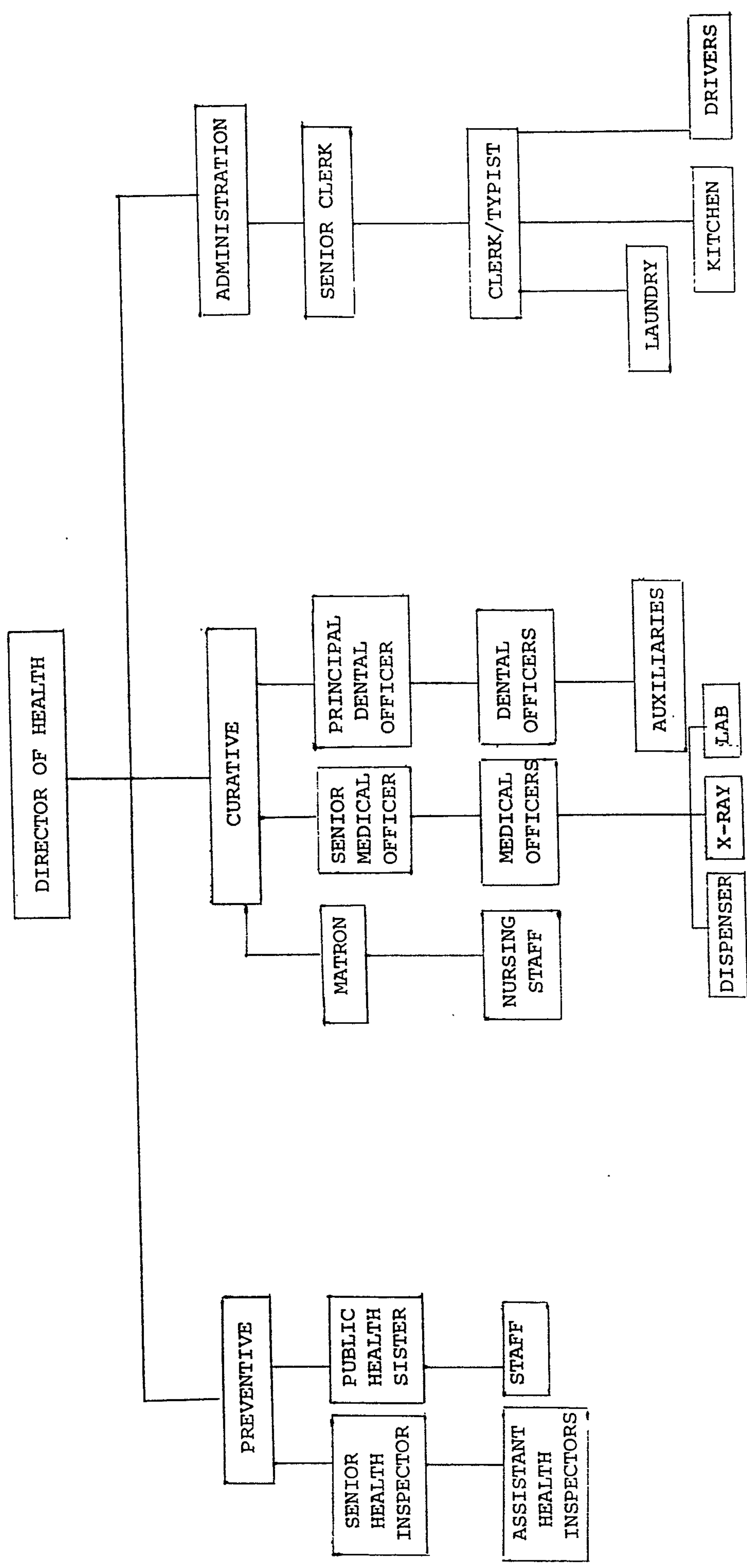
Some of the administrative responsibilities of the Principal Dental Officer (PDO) may be outlined as follows.

- a. Ensuring that the provision of dental care is sufficiently maintained to meet the demand and changing needs of the community.
- b. Planning, co-ordination and directing public dental health programmes, including school programmes.
- c. Responsibility for the ordering of supplies, and materials as well as dental equipments.
- d. Responsibility for staff:
 - (i) allocation of responsibilities;
 - (ii) recommendations;

- (iii) discipline;
 - (iv) welfare.
- e. Consultation and public relation activities.
- f. Organising and planning:
 - (i) manpower requirements;
 - (ii) in-service training;
 - (iii) registration and legal aspects.
- g. Advice to Director and correspondence with World bodies such as World Health Organisation, South Pacific Commission.
- h. Preparing annual budget submission.

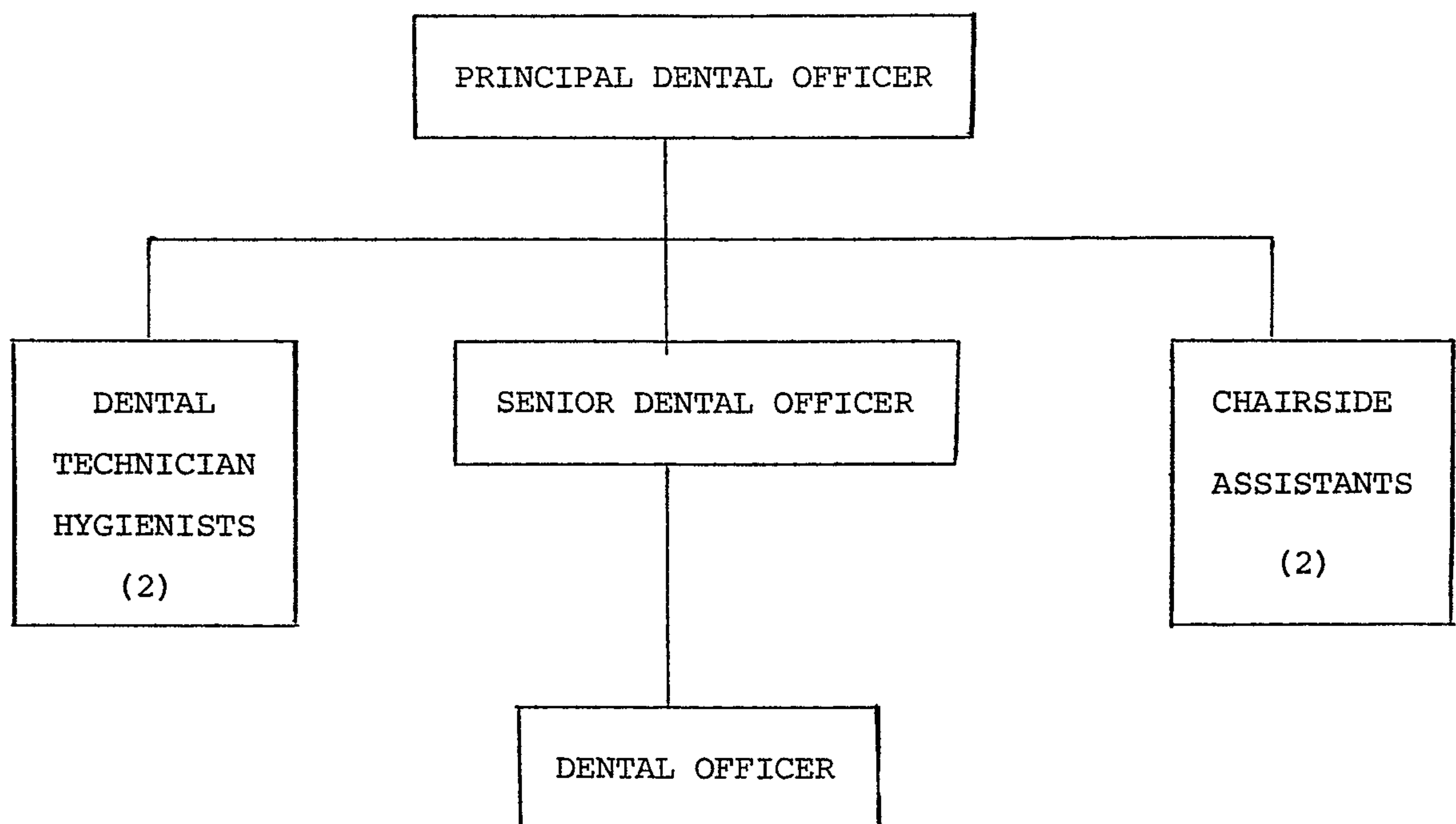
Generally, the PDO is responsible for controlling, organising and directing all the activities of the Dental Department.

ORGANISATION CHART OF THE HEALTH DEPARTMENT



Organisation:

Because the Island's dental service is small, the organisation is fairly simple. Nevertheless, the service is a fair representation of the entire profession of dentistry as member staff are active in most dental specialties.

INTERNAL ORGANISATION: DENTAL DEPARTMENT

3.2 STAFF

Professional Personnel:

There are three salaried dental officers in the Health Department running the dental services on the island.

- (i) Principal Dental Officer
- (ii) Senior Dental Officer
- (iii) Dental Officer.

All are graduates of the Fiji School of Medicine and have the qualification Diploma in Dental Surgery (FSM). All have had opportunities, throughout the years, for post-graduate experience in New Zealand and Fiji. There is no established staff association in the department.

Dental Technician-Hygienists:

There are two technician-hygienist members of staff, and both had their training in Fiji. Both have also had opportunities for further training and experience in New Zealand. They are specifically responsible for the processing of artificial dentures, servicing and maintenance of dental equipments, as well as carrying out chair side assisting; and supervision of "brush-in" activities. One is specifically responsible for the processing of the local fluoride toothpaste for the school children.

Chairside Assistants:

There are two chairside assistants in the dental team. They are assigned to assist the dental officers working in the caravans during their island tour to primary schools, villages and preschool locations.

3.3 FACILITIES

Static Dental Clinic:

There is only one fixed clinic on the island, and is located in the hospital premise in Alofi. The clinic is well equipped to provide most types of dental treatment and has:

- (i) two modern dental units complete with operating instruments installed in 1980.
- (ii) a small dental laboratory adjoining the main surgery.
- (iii) a store room.
- (iv) Office of PDO.
- (v) wall mounted X-Ray unit.
- (vi) electric water sterilizer.
- (vii) compressor to drive the units.
- (viii) a small waiting room.

The air conditioning units were installed in 1983 to give added protection to the equipment from getting rusty too quickly, as well as for comfort to the staff.

Mobile Clinics:

There are two mobile dental caravans operating around the island, providing treatment to:

- (i) all primary school children;
- (ii) preschool children;
- (iii) adult populations in the outer villages; and
- (iv) the Niue High School.

The caravans are normally towed to parking sites at different schools and villages. They have been operating for approximately 15 years and the rough climatic conditions have seen their bodywork becoming rusty and deteriorating. Both caravans are poorly fitted out and in great need of replacement.

3.4 FINANCE

The public dental health service is entirely financed by the Niue Government. Figures on recent budget allocation to the Department are not available. However, the annual budget allocated for Dental in the year 1/4/1978-31/3/1979 was approximately 12% of the total Health Department Budget.

Of the total dental allocation, 86% was for staff remuneration and 14% for dental supplies.

Total expenditure:	Medical	1978/79	=	\$371,776
	Dental	1978/79	=	\$45,616.

4. DENTAL PROGRAMMES

The ability of the existing dental services to cope with the current dental health problems in Niue can only be favourable, although there is always room for improvement.

In most countries, there are certain limitations which tend to restrict the delivery of health services to the community. Such limitations include:

- (i) Geographical location
- (ii) Accessibility
- (iii) Population size/distribution
- (iv) Finance
- (v) Facilities/equipment
- (vi) Manpower resources
- (vii) Transport.

The position in Niue for the delivering of dental services is quite unique in the Pacific as far as these limitations are concerned. The only exceptions are in the areas of finance, transport and possibly remoteness. With the favourable operator/patient ratio (1:1000) the opportunity exists in Niue to provide and maintain the whole population in a very high state of oral health.

4.1 SCHOOL DENTAL SERVICE

A feature of the dental service in Niue is that the school dental programme provides for comprehensive restorative care to all children and this service is provided by Dental Officers. In most other Pacific Island countries, such treatments are carried out by dental therapists under the supervision of dentists.

4.1.1 Treatment Programmes

The treatment programme in all primary and secondary schools is centred around restorative dentistry, with a small element of specialist service. The types of treatment provided are listed.

a. Emergency services:

This provides for the relief of pain, mainly by extraction and the control of dental infection.

b. Comprehensive care or general dental service:

- (i) Thorough oral examination
(X-Ray when necessary)
- (ii) Restorative treatment
- (iii) Scaling/polishing
- (iv) Regular re-call.

c. Endodontic therapy:

This service for secondary school children has become more common during the past few years.

d. Partial dentures:

Provision of partial plates in situations where a tooth has become dislodged or badly fractured as a result of trauma.

e. Minor oral surgery:

Carried out when indicated.

In the provision of restorative services (fillings) Niue appeared to rank well in comparison with six other Pacific Island countries from which recent comparable data is available (Speake et al 1979). With an F-ratio in excess of 0.55, it comes second only to Rarotonga, in the Cook Islands, for effectiveness in the provision of restorative care (Speake 1981).

4.1.2 Preventive Programmes

To help strengthen the preventive character of the clinical restorative services, preventive programmes were introduced.

Systemic sodium fluoride (tablets) programme:

This has been an on-going project since it was introduced in 1964. The control and allocation of tablets (containing 2.2 mg Sodium fluoride) to individual primary school children is carried out by the Dental Division with the co-operation of the Education Department through teachers, to supervise and to ensure that each child takes his or her daily tablet.

Toothbrushing/Toothpaste Scheme:

The toothbrush scheme was started at the same time as the sodium fluoride tablet programme, and has been continuing since that time. The brushes are made available to the children at a much cheaper price (15 cents) than those selling in the shops.

In the mid 1970's, the Dental Department started making the local toothpaste to help support the toothbrushing scheme. The toothpaste is issued free to all primary school children.

Analysis of samples of the toothpaste, by the Dental Research Unit, N.Z., indicated that the fluoride content was much lower than that found in commercial toothpastes (Cuttress 1983). Analysis results were:

Total fluoride - 782 micrograms per gram paste
Free fluoride - 232 micrograms per gram paste
Bound fluoride - 550 micrograms per gram paste.

Stannous fluoride "brush-in" programme:

The programme was started in 1979 to supplement the sodium fluoride programme (Speake 1979). It has been reported that the combination of sodium fluoride tablets together with the application of a 10% stannous fluoride paste in a school "brush-in" programme gave a reduction in dental caries incidence by approximately 79%, while a 38% reduction in children who only participated in the "brush-in" alone (Woods et al 1976).

The programme also has the potential to improve oral hygiene and in the long term help reduce the prevalence of periodontal disease. This "brush-in" programme is directly supervised by the dental staff and is carried out six times a year for all primary school children.

Dental health education:

Instruction of children in the principles and importance of oral cleanliness in the prevention of dental disease is an important activity of the staff. This includes individual instruction in oral health; carried out at the chairside and class instructions.

4.1.3 Organisation of Treatment Visits

The systematic treatment services have continued to be based, as in the past, on the numerical distribution of the school age groups. Treatment is carried out in the two mobile dental caravans. Organising of the itinerary is normally the responsibility of the Principal Dental Officer, and is often set out as in Table 1.

The Number 1 caravan will examine and treat Halamahaga Primary School first. Once completed, it then treats Niue Side School. Upon completion of Side School, the caravan is towed to the next location at Alofi South, to treat the preschool children. This is followed by Alofi North preschool treatment and then finally to Niue High School.

All efforts are made to ensure that the schools are seen and treated at least twice a year. Caravan No. 2 follows the same system.

The total school population during the past 10 years has gradually decreased from 1,260 in 1974 to a mere 800 children in 1984.

Table 1. Itinerary: School Treatment Programme

Caravan	Schools	Roll 1983	Village
No. 1	Halamaha Primary	176	Alofi
	Niue Side School	40	
	Niue High School	366	
No. 2	Liolau Primary	73	Avatele
	Tuatea Primary	36	Hakupu
	Halavai-Lialagi Primary	44	Liku-Lakepa
	Kofekofe Primary	64	Mutalau
	Matalave Primary	89	Tuapa

Table 2. School Roll Distribution 1974-1984

Year	Total School Roll	Total Roll
	Primary Schools	Niue High School
1974	951	309
1975	861	264
1976	840	-
1977	831	268
1978	793	424
1979	799	426
1980	705	336
1981	644	397
1982	591	390
1983	522	366
1984	453	350

Source: Education Dept., Niue

4.2 GENERAL PUBLIC

The dental health programme for adults provides guidelines for the prevention of dental caries and periodontal disease as well as the arrest of progressing disease and prevention of recurrence following adequate treatment. The basic programmes include health education and treatment.

4.2.1 Health Education

Information on dental diseases:

The aim is to provide patients with sufficient knowledge as to the causes of dental diseases so that they may be able to understand the recommendations given by the dental staff for the improvement of dental health, and to realise that the occurrence of these diseases can be prevented through better self-care.

Information on diet:

Information is given to emphasize the harmful effect of sugar and sugary products, and poor dietary habits, e.g. frequency with which sugar-containing snacks are eaten between meals.

Information on the use of fluorides:

The caries preventive effect of fluorides is stressed and persons are encouraged to use fluoride-containing dentifrices regularly.

Oral hygiene instruction:

This aims at informing the patient on various methods of plaque removal. Instructions include demonstration of a suitable tooth-brushing technique and the use of dental floss for cleaning the interproximal spaces.

4.2.2 Treatment Programmes

The basic treatment includes:

a. Restorative care:

A comprehensive restorative treatment is available to all adults.

b. Routine dental examination with X-Ray.

c. Emergency services:

(i) Post operative complications

(ii) Extractions

(iii) Infection management

(iv) Traumatic injuries.

d. Periodontal disease management:

(i) Corrective periodontal surgery

(ii) Scaling/root planing

(iii) Crevicular curettage

e. Endodontic treatment

f. Minor oral surgical procedures:

(i) Cystic lesions

(ii) Soft tissue lesions

(iii) Impactions.

g. Provision of artificial dentures:

- (i) Full upper/full lower acrylic dentures
- (ii) Partial dentures.

h. Gold inlays.

Adult patients requiring treatment are required to attend the main dental clinic in the hospital. However, those who are unable to do so may seek treatment in one of the mobile caravans. The services available in the caravans are limited to:

- (i) Fillings
- (ii) Simple scaling
- (iii) Relief of pain by extractions or sedative dressings.

All services provided are free, except in the provision of:

- (i) Acrylic full upper/full lower dentures
- (ii) Acrylic partial dentures
- (iii) Gold inlays.

Supportive specialised services are also available in the hospital for:

- (i) Extra-oral radiographs
- (ii) Pathology laboratory tests
- (iii) General anaesthesia.

Patients are seen as outpatients, by appointment, or as one of the following groups:

- (i) Handicapped, either physically or mentally retarded

- (ii) Inpatients
- (iii) Medically compromised
- (iv) Expatriates.

4.3 OTHER GROUPS

There are three further groups who receive priority care.

Ante natal mothers:

Once a week after attending follow-up medical examinations, mothers-to-be are required to attend the main clinic for routine dental check-up and treatment if necessary. Information on oral hygiene and diet is emphasized.

Post-natal mothers:

Preventive programmes for this group include:

- (i) Oral health education
- (ii) Diet, the importance of a well balanced diet to tooth formation
- (iii) Advice on teething problems and eruption times of deciduous teeth
- (iv) Motivation to increase utilisation of the available services
- (v) Encouragement in the use of fluoride tablets by the child.

Preschool children

Children from 2-5 years of age are automatically enrolled in the preschool dental service. Services provided include:

- (i) Routine examination
- (ii) Emergency services
- (iii) Restorative care

The preventive aspects are normally channelled through the mother and include:

- (i) Oral health counselling
- (ii) Motivation of mother
- (iii) Regular check-up for child
- (iv) Dietary advice
- (v) Importance of regular intake of fluoride tablets
- (vi) Supervision of tooth brushing by mother.

5. ORAL HEALTH STATUS

5.1 DENTAL CARIES

It is important to monitor the changes in the prevalence of dental decay because it not only provides the Department with valuable information on national dental needs but also information on the effectiveness of the programmes provided. Both are important for planning purposes.

The statistical materials discussed here have been obtained from past studies carried out by Williams in 1964, John Espie (1974) and Dr L. Keke of the South Pacific Commission in 1983. The writer wishes to indicate that because there is no data available which covers the deciduous teeth of children in the age groups 2-10 years, and adults after 1974, discussion on these groups is limited to the period from 1964-1974.

The following codes were used to record dental caries status.

(i) "DMFT" index for permanent teeth, where the components are:

D = number of teeth decayed

M = number of teeth extracted, therefore missing

F = number of filled teeth

T = permanent teeth

(ii) Dental caries in deciduous teeth is expressed as "def" index with the component:

d = number of teeth decayed

e = number of teeth extracted, therefore missing

f = number of filled teeth

t = deciduous teeth

Note: In the discussion that follows, "e" component is correctly substituted by the letter "m" to form the index "dmft".

5.1.1 Deciduous Dentition 2-10 Age Groups

The number examined and the mean numbers of "dmf" teeth and percentage affected for children aged 2-10 years are given in Table 3.

In the period 1964 to 1974, Table 3 shows that the prevalence of dental caries increased with age, and that the disease was fairly widely disseminated throughout the child population, starting very early in life at 2 years of age. The total number of subjects in all age groups 2-10 years with one or more "dmf" teeth has risen from 69.5% in 1964 to 78.7% in 1974. These results are graphically expressed in Figure 1, which gives the proportion of children aged 2-10 years with some known decay experience in the primary dentition.

From Figure 1 and Table 3 it can be seen that there has been an overall increase in the proportion of children with some decay experience over the 10 year period, and that the prevalence was very high. Among the 2 year olds, for example, the proportion of children with some decay experience increased from 16% in 1964 to 33% in 1974. This was followed by a sudden increase in the proportion of 3 year old children affected, which was 79% in 1974. The 5 year olds showed an increase from 84% in 1964 to 94% in 1974. The 6 and 7 year olds, however, showed the greatest prevalence at 97% in 1974.

With an increase in the prevalence of dental caries, there was also a substantial and progressive reduction in the proportion of children who were caries free.

Table 3. Dental Caries in Deciduous Dentition
 Children 2-10 years. By Age. 1964/1974

Age Group	Number		dmft		% with Caries	
	1964	1974	1964	1974	1964	1974
2	58	43	0.7	1.4	16	33
3	57	47	3.4	4.6	63	79
4	66	48	4.1	5.3	68	83
5	51	35	5.1	7.3	84	94
6	42	35	5.4	7.2	88	97
7	41	37	5.2	4.5	88	97
8	40	30	3.9	3.0	95	83
9	32	23	2.4	2.7	72	91
10	13	7	1.6	0.0	84	0
2-10 years	400	305	3.5	3.9	69.5	78.7

Source: Williams (1965), Espie (1974)

Figure 1. Percentage of children aged 2-10 years
with known (dmft) decay experience.
1964/1974

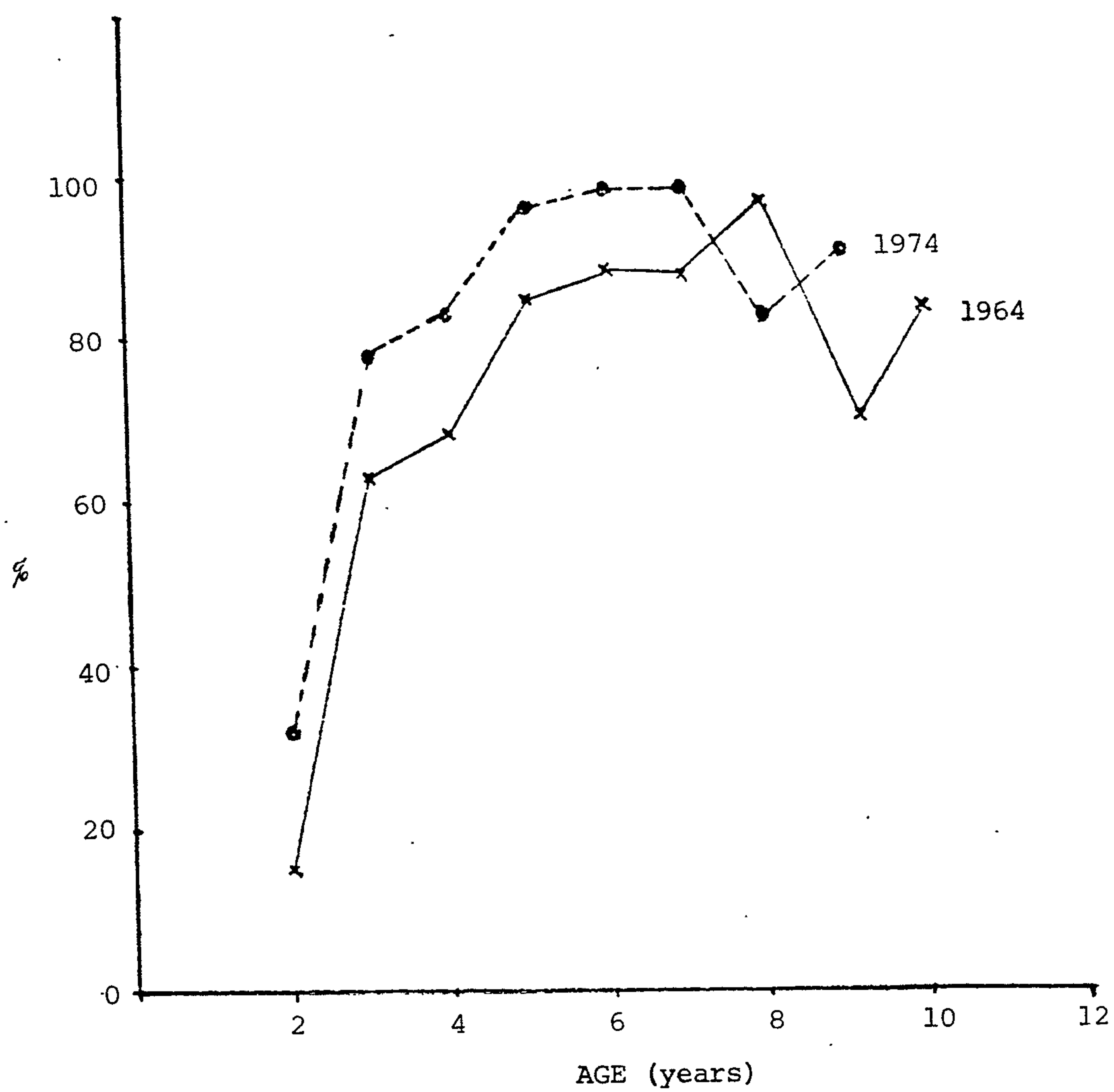


Figure 2. Percentage of children aged 5-12 years
with known (DMFT) decay experience.
1964/1974

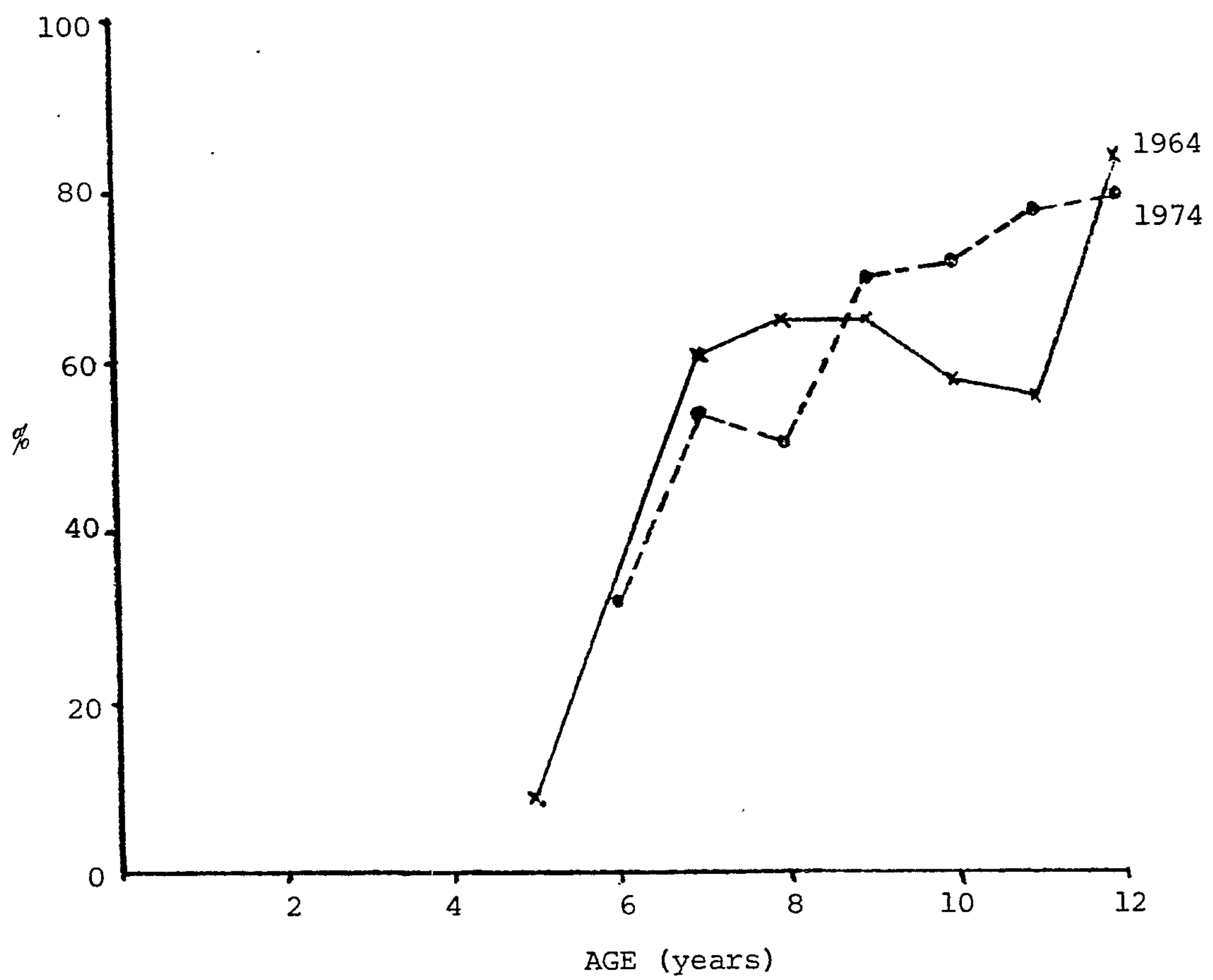


Figure 3 indicates that although the prevalence was high in 1974, a greater proportion of the problem had been cared for by the provision of restorative dentistry.

Figure 5 and Table 3 show the mean number of decayed, missing and filled (dmft) deciduous teeth per subject, for the years 1964 and 1974. The results indicate that in 1974, the mean number of dmft teeth per subject was much higher than that recorded in 1964, and also, the rate of the active decay process appeared to be very rapid.

In the 2 year olds for example, the mean dmft index increased from 0.6 in 1964 to approximately 1.4 dmft teeth in 1974. In the 3 year olds, the decay process was quite rapid in that from 1.4 dmft teeth in the 2 year olds, it greatly increased to affect approximately 4.6 teeth per child in 1974.

Dental caries continued to affect the 4, 5 and 6 year olds, peaking at about 7.2 dmft teeth in the 5 year olds in 1974. Figure 3 indicates that approximately half of the dmft index consisted of the filled component. In the period 1964 to 1974, the difference in the mean dmft score per subject was minimal ($3.9 - 3.5 = 0.4$). This means that in 1974, all children in the age groups 2-10 years had a slightly higher mean dmft score than those in 1964. The overall increase was approximately 10%.

Analysis of the dmft individual components shown on Table 4 indicate that in 1964:-

- (i) the proportion of decayed teeth untreated was 56%;
- (ii) 10% were missing, and

Figure 3. Caries prevalence in the primary dentition of children aged 2-10 years. 1964/1974

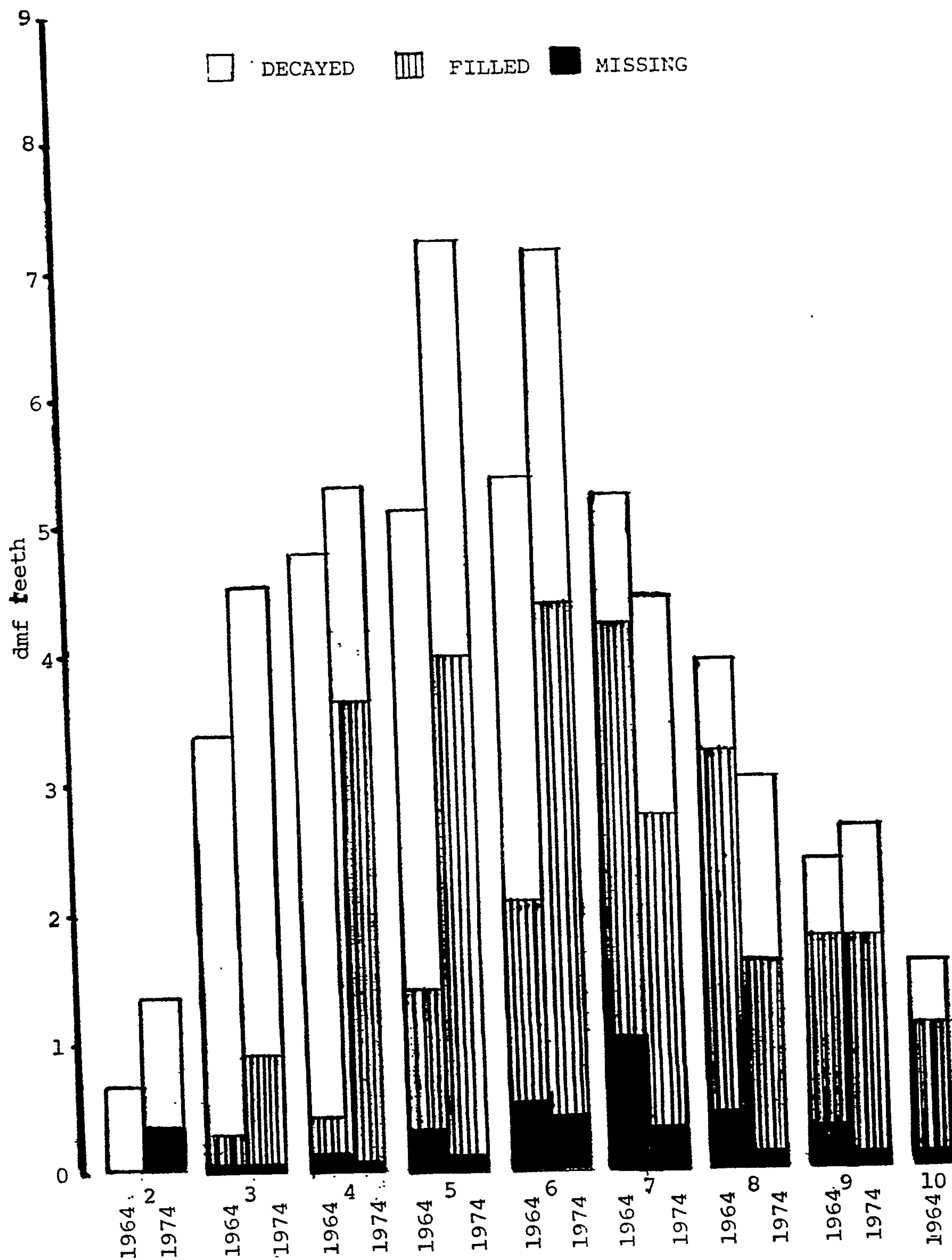


Figure 4. Caries prevalence in the secondary dentition of children aged 5-12 years. 1964/1974/1983

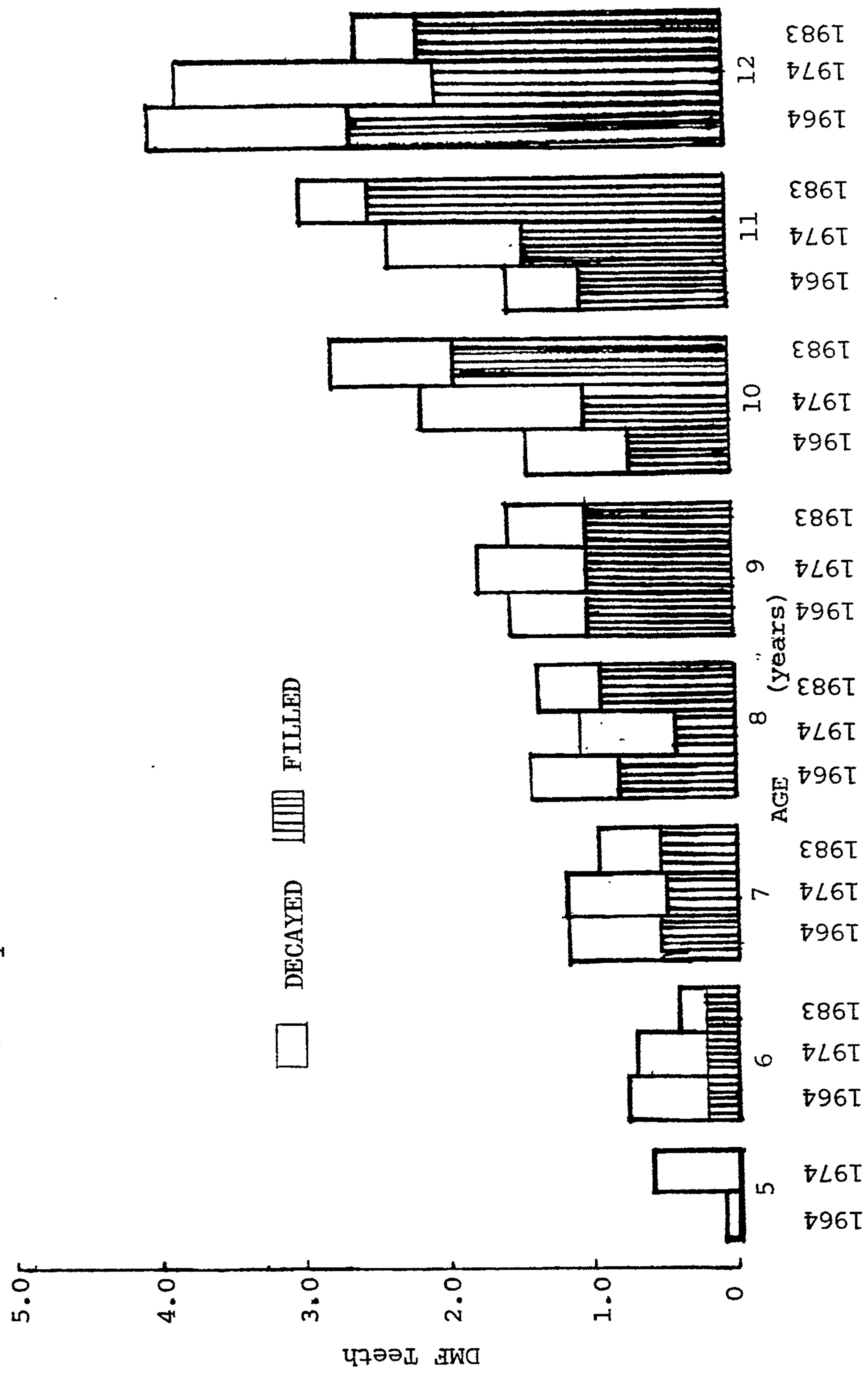
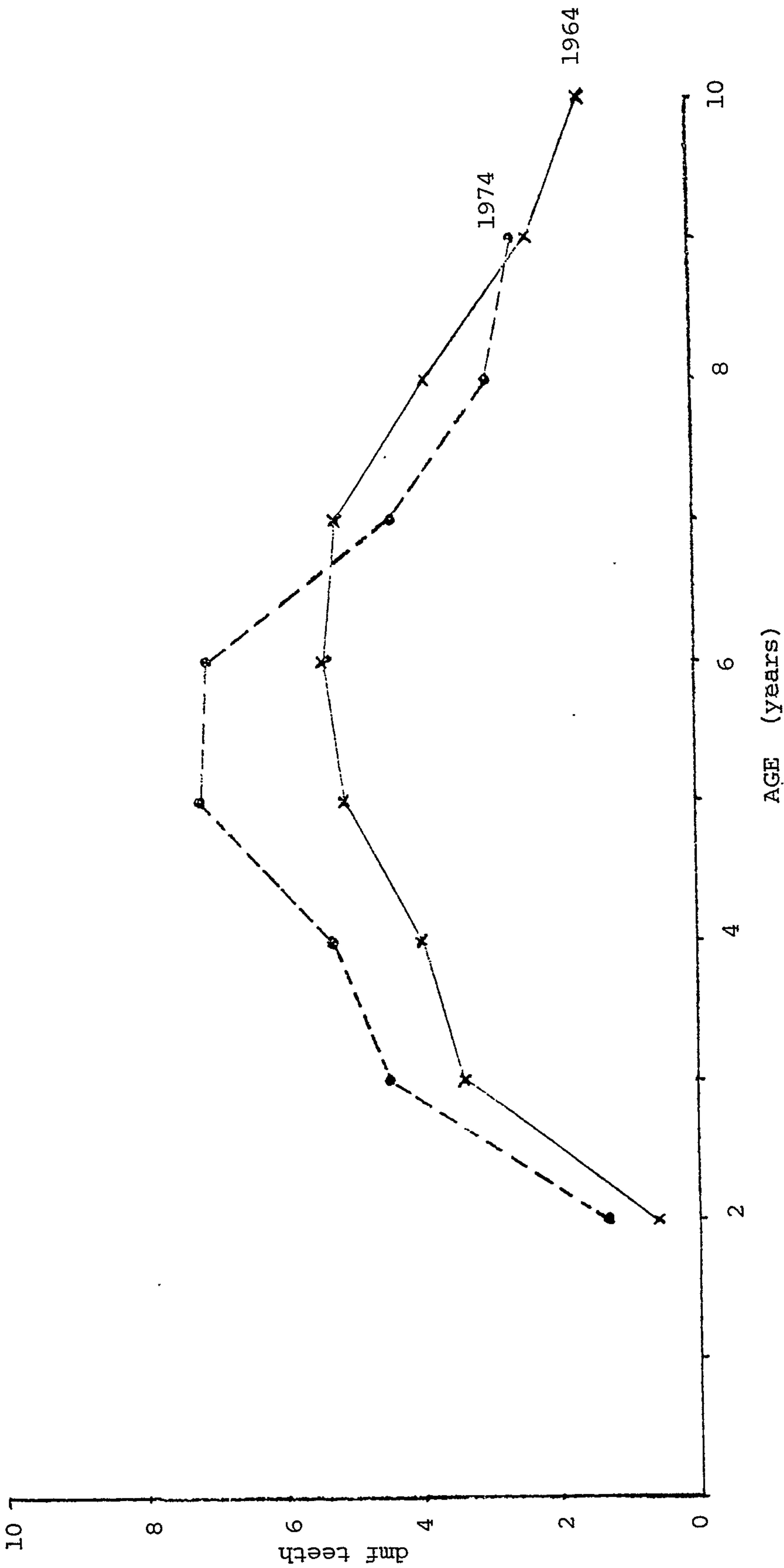


Figure 5. Mean number of dmf teeth per child aged 2-10 years. 1964/1974



(iii) approximately 1/3 (35%) were filled.

Table 4. Mean dmft Components

All Children 2-10 years. 1964/1974

Mean and (percentage)						
dmft	1964		1974		Differences	
Components					1964/1974	
dt	1.96	(56%)	1.82	(46%)	-0.14	(-7)
mt	0.35	(10%)	0.15	(3.8%)	-0.20	(+57)
ft	1.23	(35%)	2.00	(51.2%)	+0.67	(-38)
dmft	3.5		3.9		+0.4	(+11)

dt = decayed teeth

mt = missing teeth

ft = filled teeth.

Table 5 shows that most of the decayed deciduous teeth could be treated conservatively.

Ten years later, Espie (1974) in his survey showed that the average number of decayed, missing and filled deciduous teeth was slightly higher than it was in 1964.

Table 4 indicates that in 1974

- (i) The proportion of decayed teeth untreated was slightly less than it was 10 years before with a total reduction of 7%.

Table 5. Percentage of Decayed Deciduous Teeth that
require Conservative Treatment and Extraction
Children 2-10 years. By Age. 1964

Age Group	Total No. of Subjects	Total No. of "d" Teeth	"d" Teeth Requiring Conservative Treatment %	"d" Teeth Requiring Extraction %
2	58	40	100	0
3	57	179	99	1
4	66	204	99	1
5	51	170	94	6
6	42	114	96	4
7	41	82	95	5
8	40	47	89	11
9	32	29	83	17
10	13	8	100	0

* All the extractions were required because of dental caries.

- (ii) A great reduction in the proportion of missing teeth (Fig. 3). The total reduction for the period was 57%.
- (iii) An increase in the proportion of filled teeth with an increase for the period of 38%.

5.1.2 Permanent Dentition, 5-12 Age Groups

The caries prevalence of children in the age groups 5-12 years for the period 1964/1974 and 1983 is presented. Table 6 shows the numbers of subjects in the surveys and the percentage of children with 1 or more DMFT teeth. The mean numbers Decayed, Missing and Filled Teeth (DMFT) for the children in the age groups 5-12 years are given in Table 7, and graphically expressed in Figure 6.

In the period 1964 to 1974, it was shown that the prevalence of dental caries was high and increased with age (Figure 2). Table 6 indicates that the total number of children in all age groups 5-12 years with one or more DMF teeth hardly changed from 53% in 1964 to 55% in 1974. From Figure 2, it can be seen that in 1964, the prevalence of dental caries among the 7-11 year old children was just about constant, then suddenly, increased for the 12 year olds. Williams accounted this sudden increase to the eruption of the second molars which appeared more susceptible to decay.

In 1974, however, there had been an increase in the proportion of children with some decay experience, in the age groups 9, 10 and 11 years. In the period 1974 to 1983, Figures 4 and 6 would indicate that the prevalence of dental decay among the children in the age groups 5-9 years did not vary as much from that in the 1964/1974 period.

Table 7 shows the mean number of decayed, missing and filled teeth (DMFT) per child for the period 1964, 1974 and 1983. The results are graphically expressed in Figure 6.

The results indicated that in 1983, the mean numbers

Table 6. Percentage with 1 or more DMFT Permanent Teeth
Children 5-12 years. By Age. 1964/1974/1983

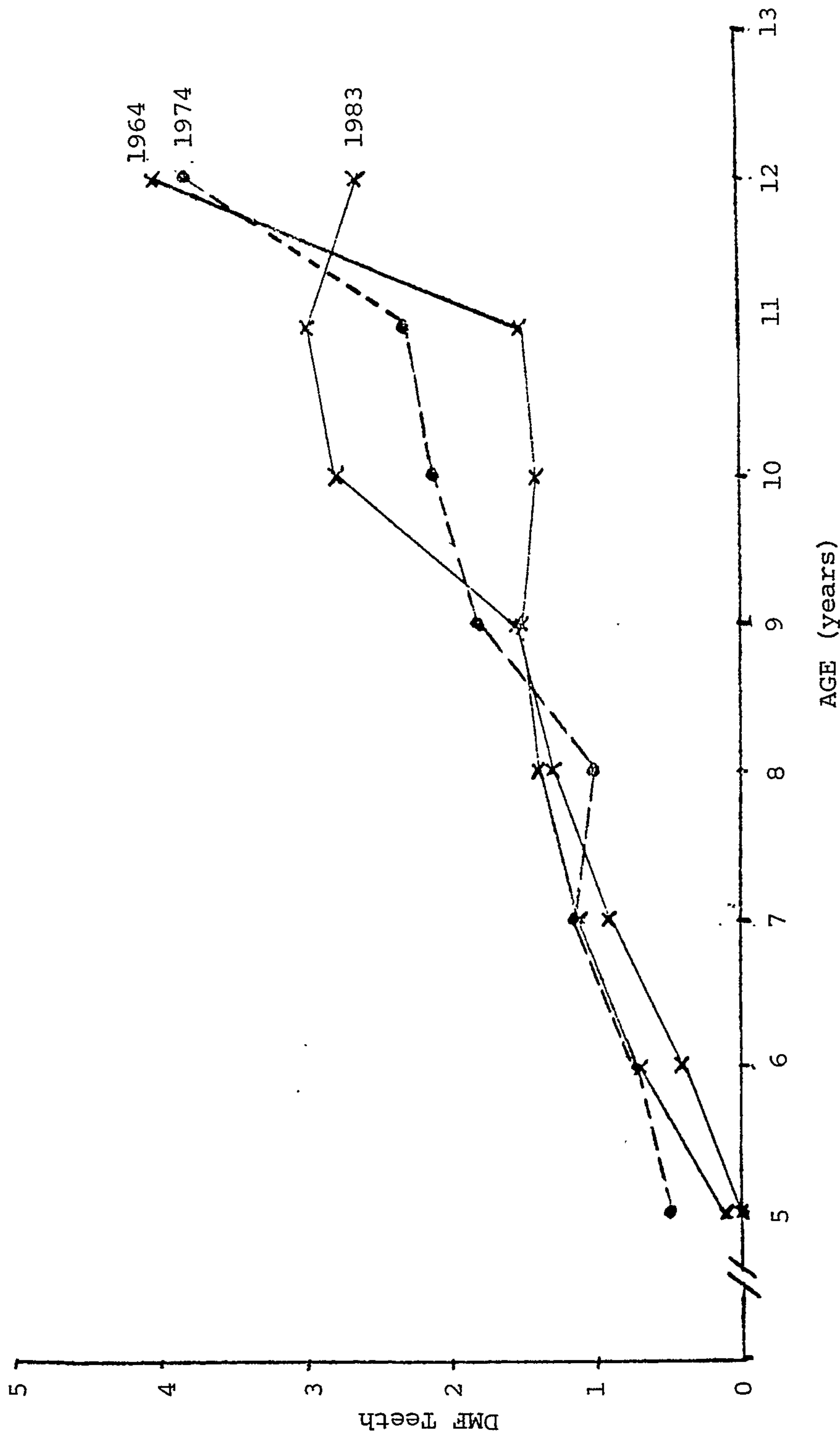
Age Group	Number of Children			% with Caries		
	1964	1974	1983	1964	1974	1983
5	41	25	35	10	-	
6	42	34	75	33	32	
7	41	37	68	62	54	
8	40	31	59	65	52	
9	38	34	74	66	71	
10	29	29	66	59	72	
11	30	33	64	57	79	
12	33	15	17	85	80	
5-12 years	294	238	458	53.4	54.6	

Source: Surveys 1964 Williams (1965)
1974 Espie (1974)
1983 Keke (1983)

Table 7. Mean DMF Teeth per Child
By Age. 5-12 years. 1964/1974/1983

Age Group	Mean DMFT per Child		
	1964	1974	1983
5	0.2	0.7	0.1
6	0.8	0.7	0.4
7	1.2	1.2	0.9
8	1.4	1.1	1.3
9	1.5	1.8	1.6
10	1.4	2.1	2.8
11	1.5	2.3	3.0
12	4.0	3.8	2.6
5-12	1.5	1.7	1.6

Figure 6. Mean number of DMFT per child aged 5-12 years. 1964/1974/1983



of DMF teeth per child in the age groups 5-9 years (except the 8 year olds) were much lower than those recorded in 1964 and 1974 for the same age groups. Children in the age groups 10-11 years however, showed an increase in the mean DMFT compared to those recorded in 1964 and 1974.

The key age group 12 year olds recorded a much lower mean DMFT (2.6) in 1983 in comparison to those in 1964 (4.0) and 1974 (3.8).

Figure 4 reveals that in 1983, the DMFT index consisted almost entirely of filled teeth.

By working out the difference of the mean numbers of DMFT per child between the survey periods 1964, 1974 and 1983 (Table 8), the following results are obtained. Taking the 1964 and 1974 period first, the difference in the mean DMFT score per subject was minimal ($1.49:1.70 = +0.21$). This means that in 1974, all children in the age groups 5-12 years had a slightly higher mean DMF score than those in 1964 with an overall increase of 12%.

Approximately nine years later (1983), the difference in the mean DMF scores from that in 1974, was again minimal ($1.70:1.58 = -0.12$), except that in 1983, the children in the age groups 5-12 years had a slightly lower DMF score, an overall reduction of approximately 7%.

The breakdown of the DMFT into individual components is given on Table 8. Analysis of the mean DMFT components showed that in 1964:

- (i) 40% of the decayed teeth were not treated;
- (ii) 1% were missing due to caries;
- (iii) 59% were filled.

Table 8. Mean DMFT ComponentsAll Children 5-12 years. 1964/1974/1983

DMFT Components	Mean and (Percentage)			Difference	
	1964	1974	1983	1964/1974	1974/1983
DT	0.60 (40)	0.85 (50)	0.43 (27)	+0.25 (+29)	-0.42 (-49)
MT	0.02 (1)	0.00	0.00		
FT	0.87 (59)	0.85 (50)	1.15 (73)	-0.02 (-2)	+0.30 (+26)
DMFT	1.49 (100)	1.70 (100)	1.58 (100)	+0.21 (12)	-0.12 (7)

DT - decayed teeth, MT - missing teeth, FT - filled teeth.

Table 9 indicates that just about all of the decayed teeth can be treated conservatively.

In 1974, the analysis of the mean DMF components (Table 8) showed:

- (i) 50% of the decayed teeth (compared to 40% in 1964) were not treated;
- (ii) 50% of the DMF teeth were filled (8% less than that in 1964).

Table 10 shows that any decayed permanent teeth within this age group could all be saved by conservative means.

For 1983, the analysis of the mean DMFT components (Table 8) showed that:

- (i) 27% of the decayed teeth were left untreated, and
- (ii) 73% of the decayed teeth were treated conservatively.

Table 9. Percentage of Decayed Permanent Teeth that require
Conservative Treatment and Extraction
Children 5-12 years. By Age. 1964

Age Group	Total No. of Subjects	Total No. of "d" Teeth	"D" Teeth Requiring Conservative Treatment %	"D" Teeth Requiring Extraction %
5	41	5	100	0
6	42	23	100	0
7	41	26	100	0
8	40	23	100	0
9	38	18	100	0
10	29	20	95	5
11	30	14	100	0
12	33	45	96	4

Table 10. Percentage of Decayed Permanent Teeth that require
Conservative Treatment and Extraction
Children 5-12 years. By Age. 1974

Age Group	Total No. of Subjects	Total No. of "D" Teeth	"D" Teeth Requiring Conservative Treatment %	"D" Teeth Requiring Extraction %
5	25	15	100	0
6	34	16	100	0
7	37	26	100	0
8	31	18	100	0
9	34	24	100	0
10	29	33	100	0
11	33	31	100	0
12	15	26	88	12

Figure 4 also gives a good indication of the proportion of filled teeth to decayed teeth. These results may serve to show the success and effectiveness of the present dental service in the delivery of its oral health care treatment (restorative care) as a way of controlling and preventing dental decay, and ultimately tooth loss, among the school children.

5.1.3 Adult Population

Dental caries prevalence in the adult age groups is shown on Table 11. The prevalence of dental caries was very high and the results in 1974 did not vary much from those in 1964. It is also seen that the total number of subjects in all age groups with one or more DMF tooth was slightly reduced from approximately 95% in 1964 to 93% in 1974.

Dental caries experience in these adults measured by the mean number of DMF teeth per subject is shown on Figure 7, in graphical form, and on Table 11. The results indicate that in 1974 the DMFT index for the age groups under 45 years all showed some increase when compared to the results in 1964; with the exception in the 20-24 age group, which showed a slight reduction in the DMFT index from that in 1964. In the age groups 55-64 years and 65+, the 1964 index was much higher than that recorded 10 years later.

Figure 8 shows a fairly steep rise in the DMFT index after 35-44 years of age. This has been due mostly to the missing tooth factor. This "M" component had been reduced considerably in 1974. It is also noted that the DT component, after age 30-34 years, was much less and the MT component was much higher. This would indicate that after 30-34 years of age, periodontal diseases would have been the major cause of tooth loss and was included under "MT".

By calculating the mean numbers of DMFT for all the age groups combined and determining the differences (Table 12), the following results have been obtained. The mean DMFT for all age groups in 1964 was 8.8, and it was

Table 11. Dental Caries in Adults
By Age. 1964/1974

Age Group	Number		DMFT		% with Caries	
	1964	1974	1964	1974	1964	1974
15-19	78	119	4.6	4.8	92	93
20-24	76	11	5.9	4.4	95	73
25-29	83	62	5.6	7.8	89	95
30-34	53	63	6.4	9.6	94	98
35-44	101	99	7.3	8.3	96	94
45-54	68	70	9.9	11.3	97	91
55-64	44	13	21.1	16.8	98	69
65+	26	2	26.3	8.5	100	100
15+ years	529	439	8.8	8.1	94.5	92.7

Figure 7. Mean number of DMFT per adult. 1964/1974

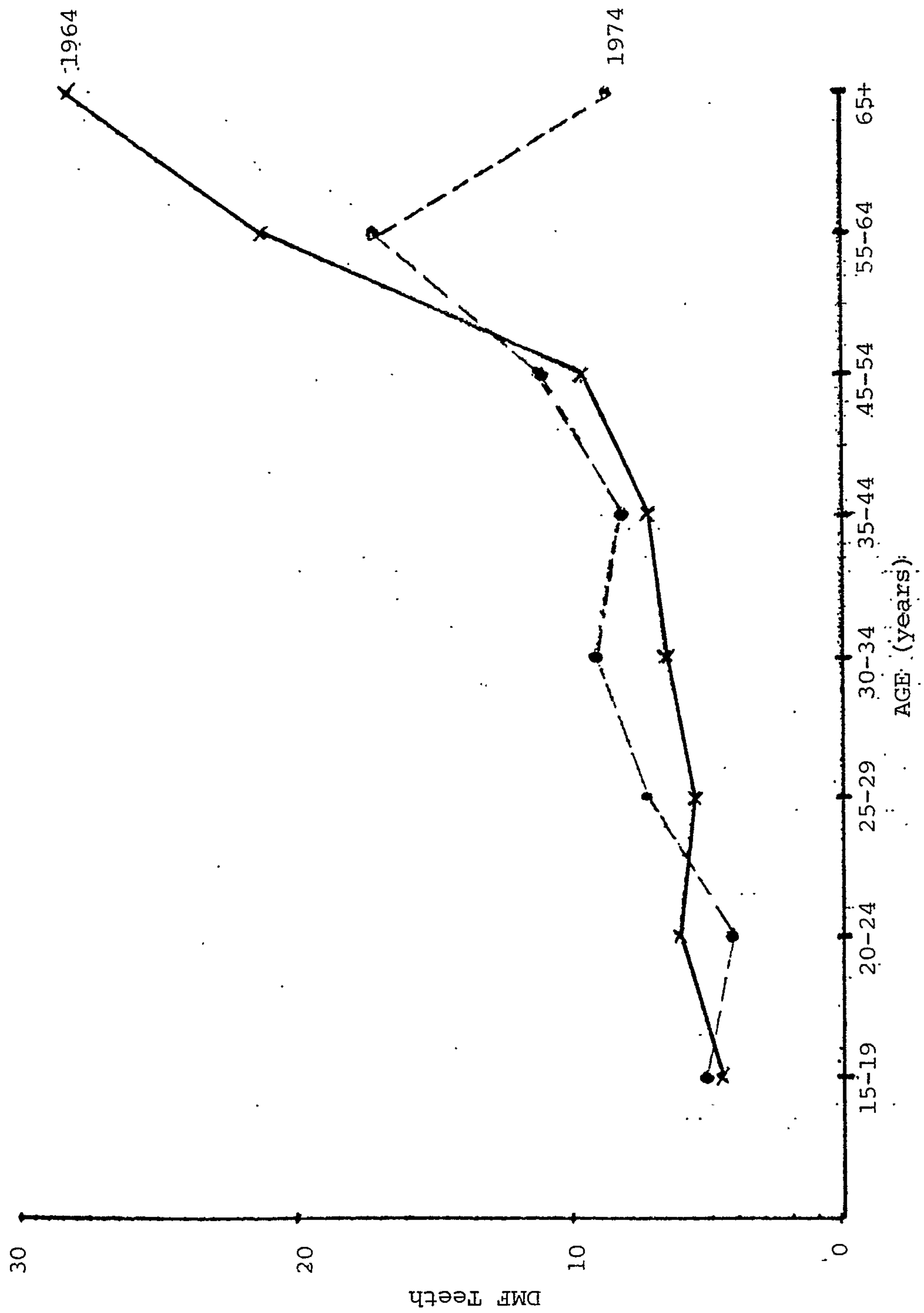
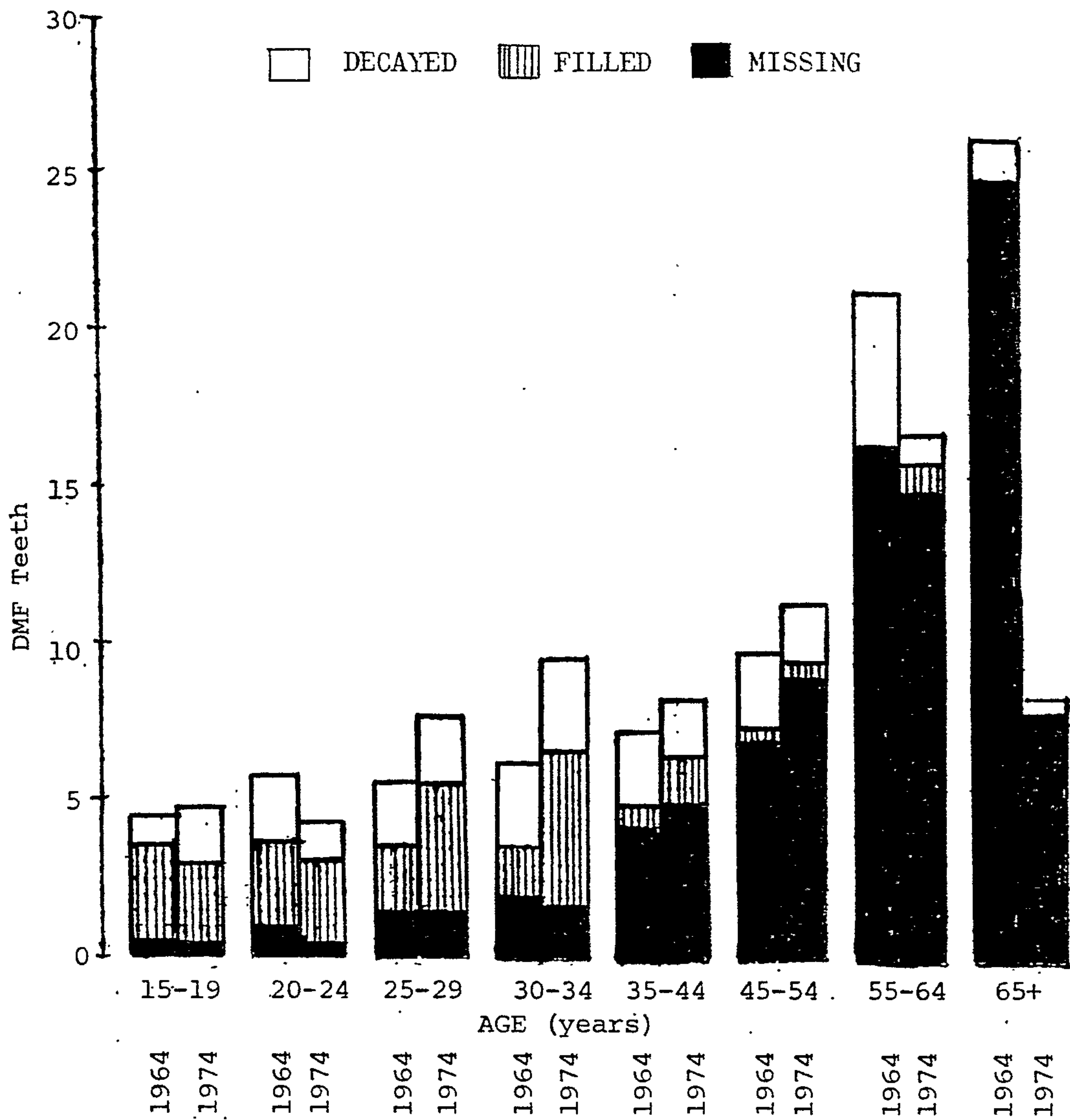


Figure 8. Caries experience. Individual components of DMFT index. Adult population. 1964/1974



8.1 in 1974. The difference in the mean DMFT score per person would be 0.7 (8.8-8.1). This means that the all adults group had a lower DMF score in 1974 than those in 1964; an overall reduction of 8%.

A summary in the breakdown of the DMFT index into individual components is also given in Table 12.

Table 12. Mean DMFT Components

All Adults. 1964/1974

Mean and (Percentage)					
DMFT Components	1964		1974		Difference
DT	2.1	(23)	1.9	(23)	-0.2 (-9%)
MT	5.0	(57)	3.5	(44)	-1.5 (-29%)
FT	1.7	(20)	2.7	(33)	+1.0 (+56%)
DMFT	8.8	(100%)	8.1	(100%)	-0.7 (-8%)

From this table it can be seen that in 1964:

- (i) the proportion of untreated decayed teeth was 23%;
- (ii) 20% of the teeth were filled;
- (iii) a very large proportion (57%) of teeth were missing.

Williams (1965) in his report indicated that dental caries was an important cause of tooth loss accounting for practically all the teeth requiring extraction up to the age of 35 years, after which the proportion fell. Even in the older age groups, it still accounted for more than 50% of

teeth requiring extraction as shown on Table 13.

Table 12 also indicates that in 1974:

- (i) the proportion of decayed teeth untreated was slightly less than that in 1964. The reduction was 9%.
- (ii) an increase in the proportion of filled teeth with an overall increase of 56%;
- (iii) a reduction of 29% in the proportion of teeth missing.

Figure 8 would also give a clear indication of changes in the proportion of individual components of the DMFT from 1964 to 1974.

Table 13. Percentage of Permanent Teeth requiring Extraction
because of Dental Caries and Periodontal Disease
Adults, By Age. 1964

Age Group	Total No. of Subjects	Total No. of Teeth Requiring Extraction	Teeth Requiring Extraction Because of	
			Dental Caries %	Periodontal Reasons %
15-19	78	2	100	0
20-24	76	18	100	0
25-29	83	47	96	4
30-34	53	40	100	0
35-44	101	76	63	37
45-54	68	73	77	23
55-64	44	128	71	29
65-74	26	14	57	43
75+	11	9	56	44

N.B. No extractions were required for orthodontic reasons,
i.e. crowding, etc.

5.2 PERIODONTAL DISEASE

5.2.1 Gingival Inflammation

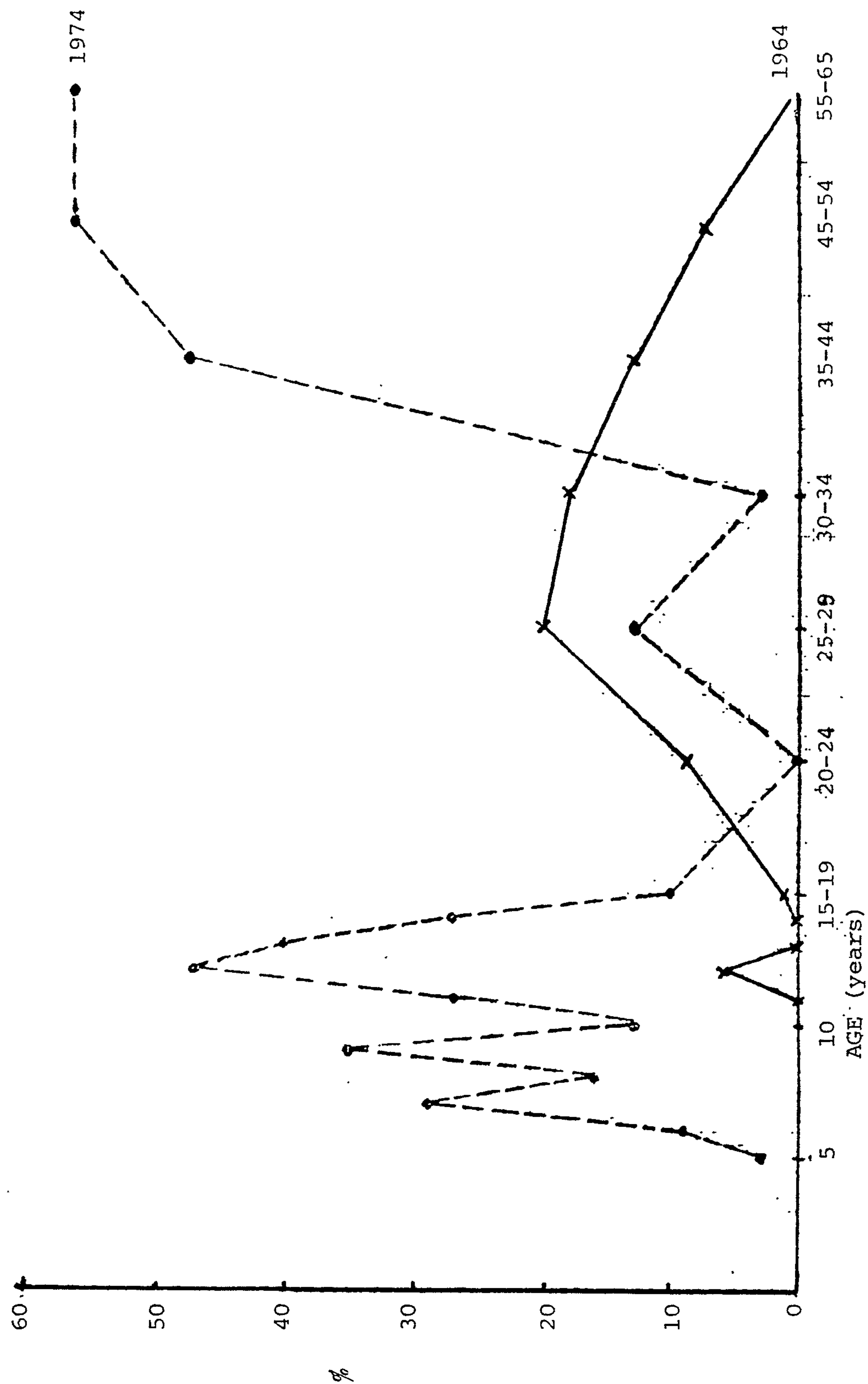
Espie in his 1974 study found an increasing prevalence of gingivitis with age. The prevalence of gingival inflammation (gingivitis) was rare until age 20-24 years (Table 14). The 1974 survey 10 years later presented a totally different set of data. Gingivitis was prevalent among the children as young as 7 years old, with a much higher proportion among the age group 12-13 years affected (Table 14). Figure 9 shows that among the 12 year olds, almost 50% showed signs of gingival inflammation in 1974, against only 6% in 1964.

The most affected in 1964 were those in the 25-29 year age group in which 13% showed the presence of gingivitis. In 1974, gingivitis peaked at about 55% for the age groups 45-54 years and 55-64 years.

Table 14. Percentage with Gingival Inflammation and
Periodontal Pockets. By Age. 1964/1974

Age Group	Number of Persons		Gingival Inflammation		Periodontal Pockets	
	1964	1974	1964	1974	1964	1974
<u>2-4</u>		138	-	0		
5		35	-	3		
6		35	-	9		
7		37	-	30		
8		31	-	16		
9		34	-	35		
10		29	-	14		
11		33	-	27		
<u>2-11</u>	452	(252)	0	(18)		
12	33	15	6	47		
13	42	45	0	40		
14	38	37	0	27		
15-19	78	119	1	10		
20-24	76	11	9	0		
<u>2-24</u>	(719)	(498)	-	-	(0)	(0)
25-29	83	62	20	13	2	2
30-34	53	63	19	3	2	5
35-44	101	97	14	47	17	46
45-54	66	65	8	55	52	65
55-64	38	9	0	56	84	67
65+	15	2	0	0	67	50

Figure 9. Percentage of subjects with gingivitis. 1964/1974

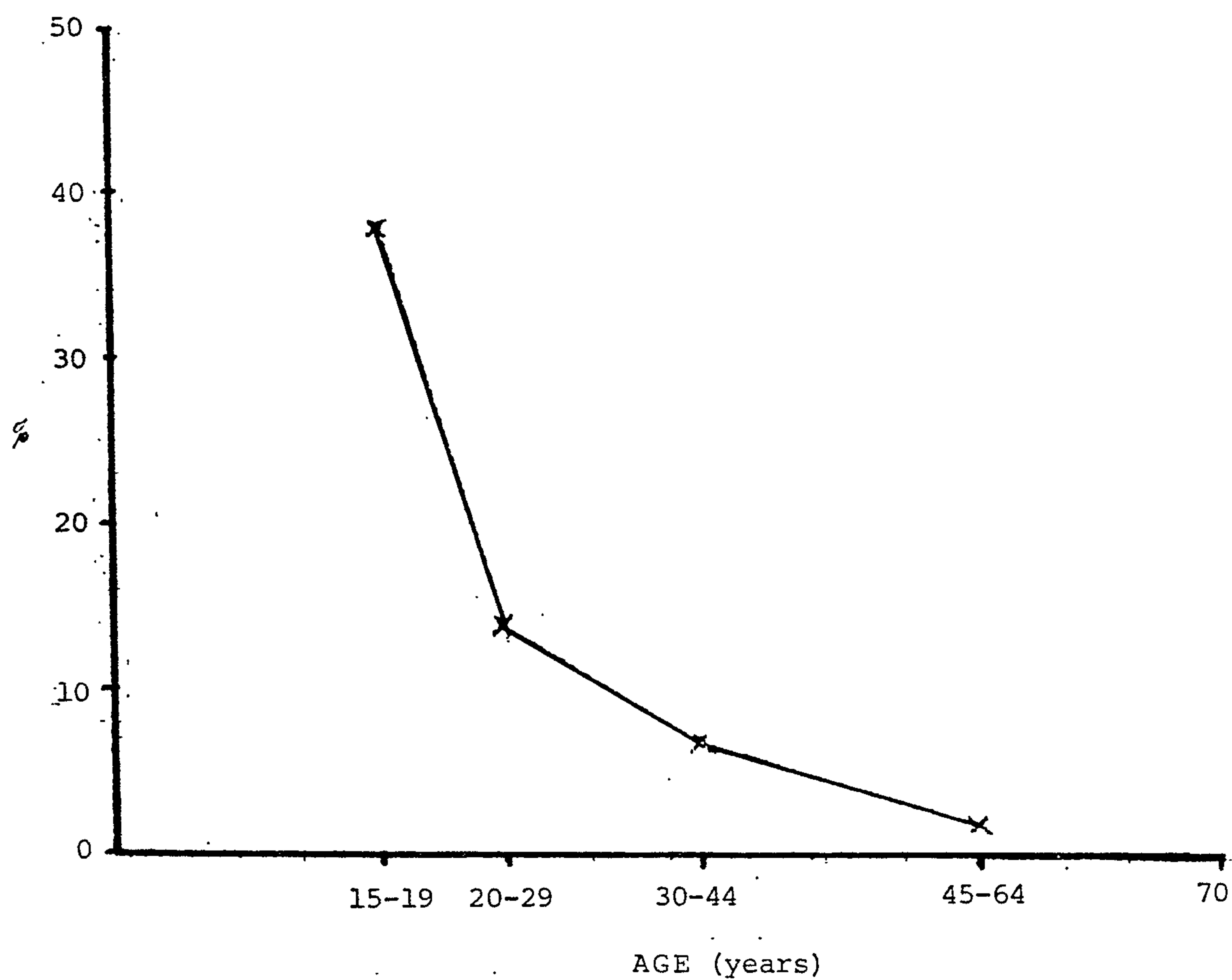


In 1983, a survey undertaken by the Principal Dental Officer of Niue, Dr M. Poihega, revealed a high prevalence of gingival bleeding among the age group 15-19 years. Figure 10 indicates that of 34 in this age group examined, in 1983, 38% showed signs of gingival bleeding. The prevalence then declined among the 20-29 year olds in which only 14% of the subjects were affected. (Table 15)

Table 15. Percentage with Periodontal Conditions
Adults. By Age. 1983

Age	No.	No	B	C	P ₁	P ₂
Group		Periodontal disease	Bleeding Only	Calculus with or without B	Shallow Pockets with or without B, C	Deep pockets with or without B, C, P ₁
15-19	34	3	38	56	3	0
20-29	43	7	14	53	26	0
30-44	54	4	7	48	39	2
45-64	58	0	2	29	62	7

Figure 10. Percentage of adults with gingivitis
(Gingival Bleeding). 1983



5.2.2 Periodontal Pockets

In the 1964 and 1974 surveys, it was noted that periodontal pocket formation was not a significant problem below the age of 30-34 years. In both studies, the prevalence of periodontal pockets dramatically increased among the age groups 35-44 years and older. Table 14 and Figure 11 show that the prevalence increased with age until the 65 and over age group where it showed a decline, an indication that the teeth may have been extracted.

In the 1983 survey, the prevalence also increased with age except that now, a greater proportion among the age groups 20-29 years were affected. See Figure 12 and Table 15. Periodontal disease was an important cause of tooth loss in subjects 35 years and over, accounting for upwards of 40% of teeth requiring extraction in the older age groups in 1964 (Table 13). Analysis of the Department's Annual Returns data from 1975-1982 also indicated that approximately 40% of all teeth extracted were because of periodontal problems. (Table 16)

Figure 11. Percentage of adults with periodontal pockets. 1964/1974

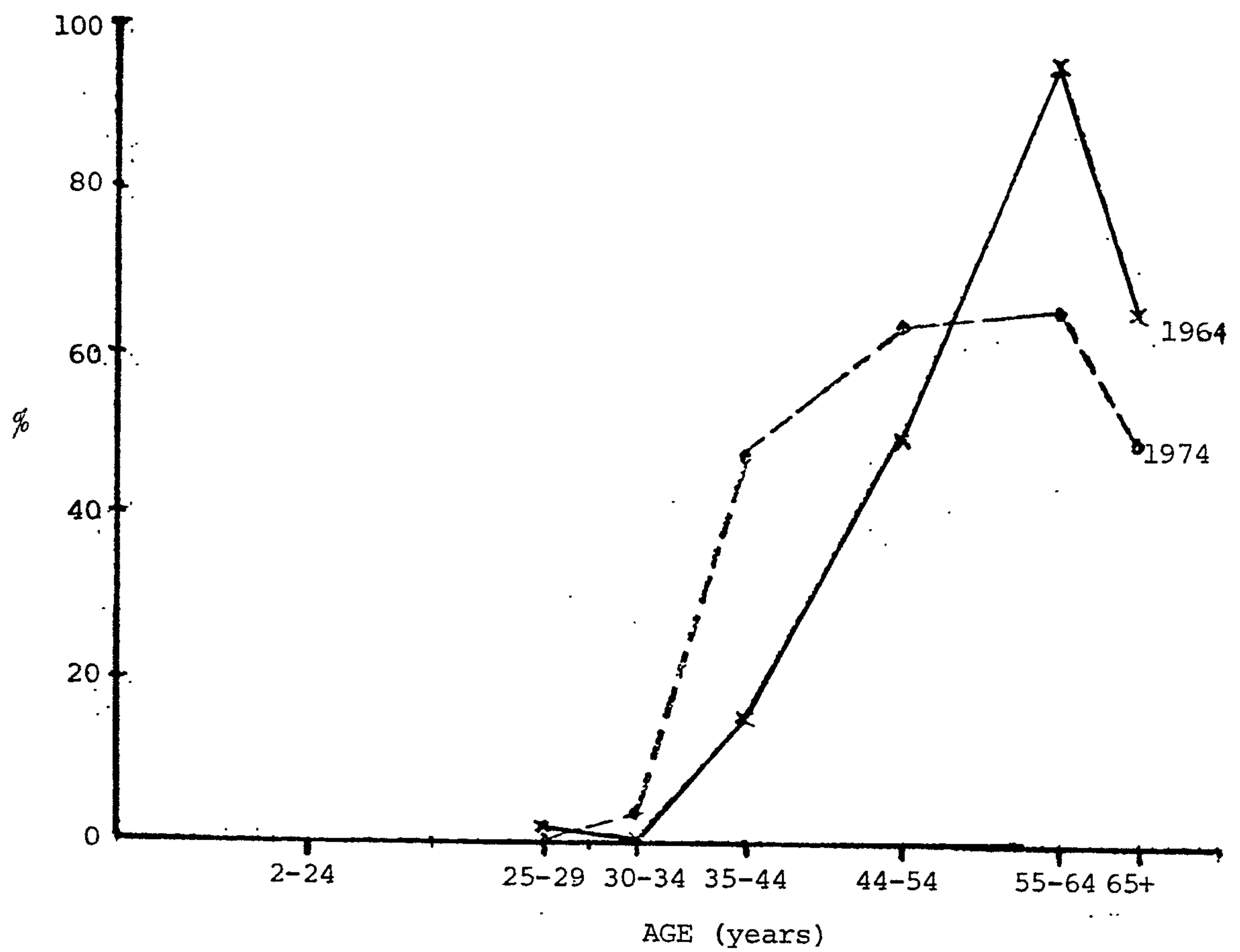


Figure 12. Prevalence of periodontal pockets in
adults. 1983.

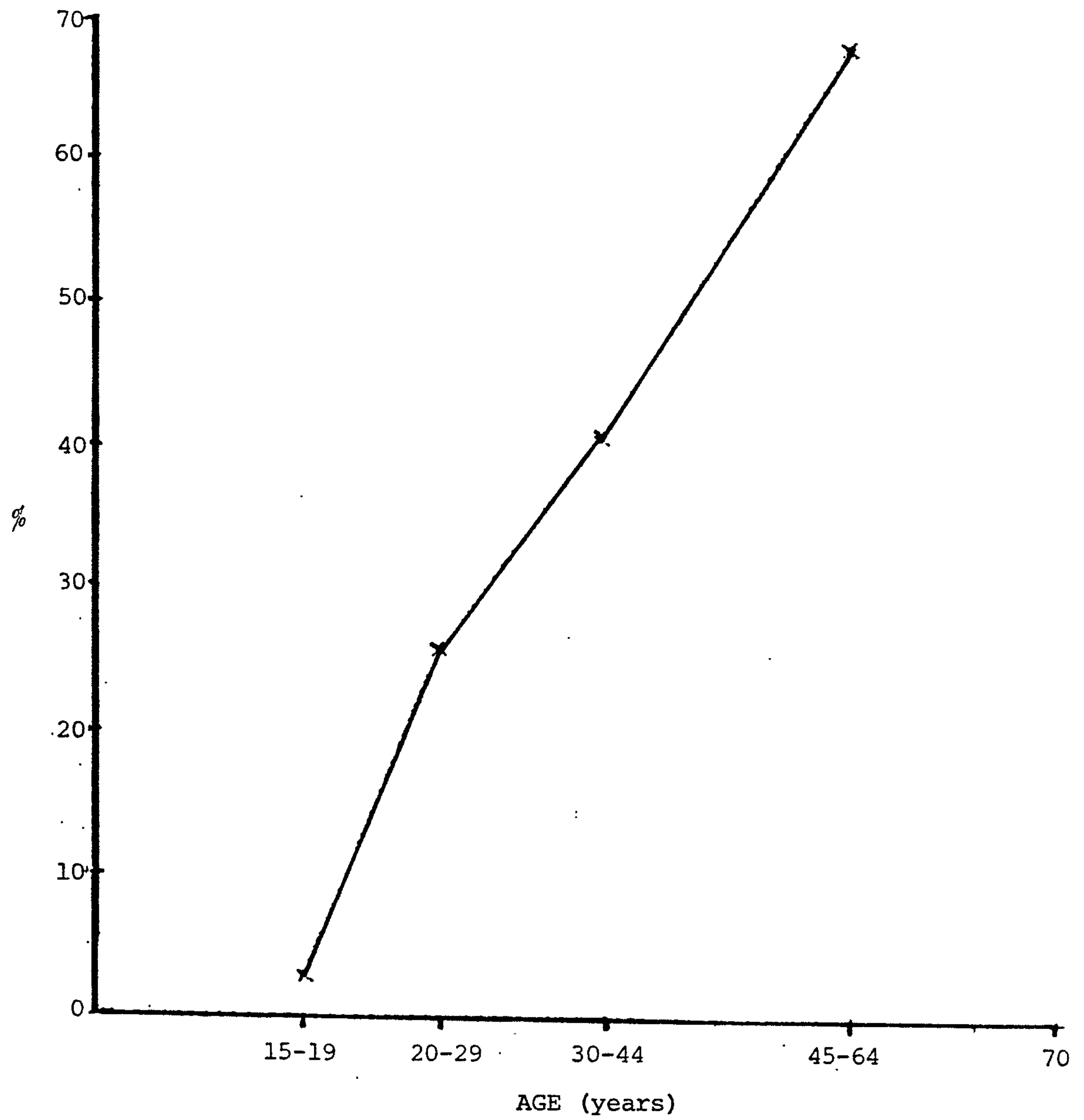


Table 16. Utilisation of Dental Health Services. 1975-1982

Source: Annual Returns: Niue Dental Service

SCHOOLS AND PRESCHOOLS										ADULTS						
Year	Schools Population	Examination	Fillings Decid. Perm.		Extraction 1° 2°		Attendance	No. Who Actually Received Treatment	Examined	Fillings	Extractions Caries Perio.		Attendance	Full Upper + Full Lower Dentures	Partial Dentures	
1975	1467	-	1062	1235	94	9	2534	1306	-	764	347	132	1638	20	11	
1976	approx. 1357	1292	746	1114	76	9	3890	-	732	708	347	233	1466	29	19	
1977	1344	1555	1175	1316	159	12	2741	1495	820	628	362	255	1438	30	12	
1978	1383	1275	805	918	86	11	1647	1275	855	682	315	241	1354	16	14	
1979	1374	1379	779	553	52	10	1423	1379	855	528	261	235	1022	18	20	
1980	1220	864	772	444	36	8	932	382	825	537	310	244	1135	5	14	
1981	1162	1103	615	950	73	10	1332	617	1372	616	299	204	1208	7	18	
1982	1122	803	545	1363	58	16	996	-	797	637	237	168	1220	9	8	

1° = Primary teeth

2° = Secondary or Permanent teeth

5.2.3 Calculus

Supra-gingival Calculus:

In the 1964-1974 period, there was little evidence in the subjects examined of the presence of supragingival calculus before the age of 14 years. (Table 17)

In both surveys, the prevalence of supragingival calculus reached a peak of approximately 52% in the age group 25-29 years in 1964 and 63% in the age group 20-24 years in 1974.

Subgingival Calculus:

Table 17 also shows that within the 10 year period (1964-1974) the prevalence of subgingival calculus after the age of 20 years remained fairly unchanged.

Table 15 also indicates that in 1983, the prevalence of calculus deposits continued to remain high, only recording a greater proportion in the age groups 15-19 years as being affected.

Table 17. Percentage with Supra and Subgingival Calculus
By Age. 1964/1974

Age Group	No. of Persons		Supragingival Calculus		Subgingival Calculus	
	1964	1974	1964	1974	1964	1974
<u>2-11</u>	452	339	0	1	0	0.5
12	33	15	3	0	0	0
13	42	45	0	0	0	9
14	38	37	3	0	3	17
15-19	78	119	18	17	0	0
20-24	76	11	38	64	12	9
25-29	83	62	52	7	22	50
30-34	53	63	42	13	34	71
35-44	101	97	32	23	53	72
45-54	66	65	17	15	74	86
56-64	38	9	11	22	50	67
65+	15	2	8	0	47	100

Table 18. Percentage Edentulous and Wearing Dentures
Adults. By Age. 1964/1974

Age Group	Number		Edentulous		For Extraction [*]		Wearing Full Denture	
			Upper/Lower		Upper/Lower		Upper/Lower	
	1964	1974	1964	1974	1964	1974	1964	1974
30-34	53	13	0/0	0/0	2/2	0/0	0/0	0/0
35-44	101	99	0/0	2/2	3/3	4/4	0/0	2/2
45-54	68	70	3/4	7/7	13/13	17/15	1/1	7/7
55-64	44	13	14/20	31/0	45/39	0/0	7/7	31/31
65/74	26	2	54/69	0/0	27/15	0/0	27/27	0/0
75+	11	-	73/73	-	9/9	-	64/64	-

* Remaining teeth indicated for extraction

5.3 DENTAL PROSTHESES

In 1964 and 1974, no persons under the age of 30 years were either wearing a full denture or required all their remaining teeth extracted. (Table 18) In 1974, of 247 subjects examined, 11 were wearing full-upper/full lower dentures compared to 18 in 1964.

From 1975 to 1982, monthly returns of the Department indicated that the numbers of patients wearing full upper/full lower dentures were much higher than in 1974 (Table 19), especially prior to the 1980's. There were also more partial dentures than were recorded in the 1974 survey (2 in 197 adults over 30 years).

Table 19. Adults Issued with Dentures
1975-1982

Denture	1975	1976	1977	1978	1979	1980	1981	1982
Full Upper								
+	20	29	30	16	18	5	7	9
Full Lower								
Partial	11	19	12	14	20	14	18	8

5.4 DENTO-FACIAL ANOMALIES

Results from the 1974 survey confirmed those of 1964 in which no anomalies of a handicapping nature were recorded. Spacing of the teeth was the most prevalent anomaly found.

5.5 SOCIAL FACTORS

5.5.1 Attitudes and Behaviour

Since oral and dental health status depends largely on individual behaviour it is important that emphasis be concentrated in the area of education. Effective utilisation of the educational approach is important in bringing about a change to one's attitude and behaviour. Through education (dental health education) an individual may be effectively motivated to adopt a more positive attitude towards a better and improved oral health standard.

Equally important to this effect comes the interest, personality and common sense of the practitioner.

"Successful patient education seems to be largely dependent on the personality, persuasiveness, and interest of the practitioner as well as his common sense and sensitivity in dealing with the infinite variety of fellow humans".

[FDI Technical Report No. 20, 1984]

There is little information on the attitudes to oral health in Niue, but it seems clear from the studies reported that there has been some change in the dental health status of the population at large, which may reflect some changes in attitudes and behaviour towards dentistry in general.

When dentistry was first introduced to the island, emergency service was the only one available to the adult population, and the associated procedures were rather rough and painful. This probably created a negative attitude

among this group towards dentistry. Gradual expansion of the types of services available, additional professional staff with pleasant personalities and interest, together with the increase in dental health activities and chairside counselling created a gradual change of attitude among the adult population towards dentistry.

Dental attendances are becoming more regular, appointments have increased, and the young adult who formerly received only extractions, now has instead a mouth full of amalgam fillings. From the writer's personal experience, people are beginning to accept that teeth will last a lot longer than they used to. This view is supported by that of the Principal Dental Officer in his 1974 Annual Report, quote "...more and more people are aware of this free treatment and try their best to take advantage of this scheme and most of them keep their appointments regularly...".

However despite changes in attitudes, tooth loss is still a frequent occurrence among young adults.

5.5.2 Utilisation of Services

The utilisation of the dental service by the pre-school children is very high and just about all the children received regular dental examination and treatment when necessary. The present organisation of the services allows for a regular recall of those in need of treatment. However, getting the child to attend is generally dependent on the influence of the parents who quite often fail to do so.

The utilisation of the service by both the primary

and secondary school children is also very high. Practically all children receive a dental examination and treatment on a regular basis.

With regard to utilisation of the dental services by the adult population, personal experience indicates that most young adults, in Government employment, etc., are keen on regular routine dental check-ups and appointments for treatment. However there are still some young adults who tend to seek treatment only when in pain despite the availability of a comprehensive and free dental care. This view is best supported by that of the Principal Dental Officer in his Annual Report 1982 in which he commented, quote "..... perhaps it is Free dental treatment could be one of the reasons for neglecting dental health. This is especially true in the case of school leavers who turn up in a year or less for removal of badly diseased teeth".

Table 16 provides some information on the utilisation of the service by the children and adults of Niue during the period 1975 to 1982. As seen on Table 20 the ratios of extraction of teeth to the number of fillings have remained much the same in 1982 as they were in 1975 and 1976. There has been an increase in the number of extractions as well as the number of fillings per patient receiving treatment.

Table 20. Treatment Ratios
School and Preschool Children
1975-1982

Year	Extraction per 100 Patients Examined	Extraction per 100 Fillings	Extraction per 100 Fillings Deciduous	Extraction per 100 Fillings Permanent	Fillings per patient Receiving Treatment
1975	-	4.5	8.9	0.7	1.7
1976	6.5	4.5	10.2	0.8	-
1977	10.9	6.5	13.5	0.9	1.7
1978	7.6	5.6	10.7	1.2	1.4
1979	4.5	4.6	6.7	1.8	1.0
1980	5.1	3.6	4.7	1.8	3.2
1981	7.5	5.3	11.9	1.1	2.5
1982	9.2	3.8	10.6	1.1	-

Source: Calculated from Monthly Return Data summarised in Table 16

6. FUTURE DEVELOPMENTS: DENTAL DEPARTMENT

6.1 ADMINISTRATION AND ORGANISATION

For the service to become more effective, efficient and productive the present system of dental administration needs to be improved. The concept of decentralisation - a model now successfully operating in the state of NSW, should be open for consideration. This would require reorganising the Department to give more responsibilities to other professional dental staff on matters involving programme planning and organisation, among other duties. Sharing of administrative responsibilities would allow the P.D.O. to concentrate more on areas of departmental planning, consultation, reports, financial submissions and recommendations.

Possibilities of creating a new internal organisation structure should also be open for consideration. For example, the creation of a School Dental Service Division clearly separated from the Adult or General Dental Service Division. Such School Division to be administered separately (preferably by a Division Controlling Officer) from the General Dental Service Division. Funding allocation, how it is used and the organising of dental programmes, to be the responsibility of each particular division.

The PDO as the Chief Administrator, would monitor and have an overview of services by direct consultation with the Division Controlling Officers to ensure that policy guidelines are followed.

On Financial issues, the Department's budget allocation should be managed by the Principal Dental Officer. Only then will he be able to relate, with confidence, the department's operations and position to the level of finance available. Planning and running of programmes are related to the financial situation, and if the PDO has no idea on the financial situation of the Department, then the operations of the programmes will naturally be affected.

6.1.1 Staff

Professional personnel:

Consideration should be given to the training of one dentist in the near future. This is in anticipation of the lead time involved in training someone and the expected retirement of one of the staff in a few years time.

Dental technicians:

With the expected retirement of one of the technicians in the not too distant future, it is recommended that a candidate be put forward for training in the near future. Such training to include servicing and maintenance of dental equipment.

Dental therapist:

It is also recommended that there be someone trained as a dental therapist, who shall be responsible for the running of dental education programmes in schools.

6.1.2 Facilities

Main fixed clinic:

Despite having air conditioning recently installed, the physical environment still needs improvement. The following points should be favourably considered:

- (i) A separate room to house the air compressor unit. Presently, this unit is operating from the dental laboratory room and the heat and noise poses a serious health problem to the staff.
- (ii) A staff room for staff discussions.
- (iii) the existing dental library needs to be updated with recent textbooks.
- (iv) purchase of an autoclave sterilising unit to replace the present water-boil sterilizer.

Mobile caravans:

- (i) High speed units - the present units have reached the end of their usefulness and should be replaced.
- (ii) Dental lights - Proper dental lights must be installed in both caravans.
- (iii) Transport - The present system of transport arrangement is most unfavourable to the staff who work in the caravans as this affects the level of output of the service. New arrangement to this effect should be worked out by the Department with the Director of Health in order to improve the frustrating situation where time is lost for treatment.

6.2 EVALUATION

An analysis of the situation in which programme planning will take place is essential to obtain an idea of the current health situation, manpower requirement, the performance of the health service delivery system, the effectiveness of current oral health care and preventive programmes and the cost-effectiveness of these programmes. Since the last survey in Niue was in 1974, it is strongly recommended that a national dental survey be undertaken as soon as possible in order to assess more accurately the:

- (i) performance of the existing educational, preventive and treatment programmes;
- (ii) the current health situation as measured by the oral health status and treatment needs;
- (iii) the level of personnel required, and
- (iv) the level of finance associated with the above programmes (i.e. whether the programmes are cost-effective or not).

Evaluation is an essential component of responsible programme administration, therefore it should be planned as an integral part of all programmes and should assess health programmes in terms of appropriateness, adequacy, effectiveness and efficiency (WHO 1976). Programme administrators should also see that survey and evaluation be treated as a continuous process.

6.3 DENTAL HEALTH PROMOTION

With such a favourable operator to patient ratio, the opportunity exists in Niue to maintain the whole population in a very high state of oral health.

To help strengthen this favourable situation, it is desirable to see that the Dental Department adopts a more positive attitude towards their field of work and plays a more active role towards promoting the service to the general public. One of the barriers identified during discussions in a dental seminar held in Niue (Speake 1979) was a lack of dental consciousness on the part of the majority of the population. This attitude of the adult population may be influenced by the dental staff firstly in the satisfaction they provide to those who seek dental care, and secondly in the success of their attempts to explain good dental health to the people.

To further promote dental health, the following avenues should be explored:

(i) Annual Dento-Medical exhibition day. Here, the dental division should combine with the medical, the public health division, and the maternal health care units, to promote health awareness among the population (the school population or adults). Such an exhibition would feature materials and displays which are relevant to dental health and health in general.

(ii) Dental health promotion activities should be directed at target groups such as teachers, mothers groups and nurses.

(iii) Such activities to be reinforced with the use of back-up facilities through newspaper and radio and the use of films, videos and regular health talks. Content would include information on benefits of fluoride, dental plaque, oral hygiene and dietary advice.

(iv) Limiting and discouraging direct selling of snacks, and sweets to school children. Research findings have indicated that the removal of sweets from school canteens was followed by a demonstrably lower decay rate (Roder 1973).

(v) The inclusion of dental health education as a part of the school curriculum.

6.4 DENTAL PROGRAMMES

6.4.1 Schools

Areas for consideration include preventive education and treatment programmes.

Preventive programmes:

(a) Fluoride tablet programme.

The need to assess the effectiveness of this programme which has been running since 1964. However, there has not been any evaluation of the project apart from the results on the survey by Espie in 1974 (Keke 1982). John Speake, in his report on a visit to Niue (1979) commented on the future of the systemic fluoride programme because in its present form it has clearly not produced the desired results of reducing the prevalence of dental decay in the primary dentition.

To discontinue the programme on the grounds that it has not proven effective in reducing caries of deciduous teeth would mean an increase of the caries rate of the permanent teeth. Therefore, it would be most desirable if the present system of distribution could be improved.

The following suggestions are made, in an effort to improve the programme.

- (i) Seek total co-operation from teachers to ensure that under their supervision each child takes his or her tablet daily. (One 2.2 mg tablet per day.)

- (ii) The distribution be closely monitored to ensure that the number of tablets distributed is reconciled with the number of children who constitute the target group.

For post-natal parents the benefits of fluoride should be fully explained, especially to the mothers, and the fact stressed that their co-operation is most essential to the success of the programme.

The distribution of tablets to post-natal parents should be closely monitored and the dental staff should work in close relationship with the maternal welfare nurse.

A pre-natal programme for fluoride tablets should be considered to help prevent deciduous caries.

(b) Prolonged fluoride application programme

The Department should review the effectiveness and cost-benefits of this technique with the view of having it introduced into the school preventive programme.

(c) Weekly fluoride mouth rinsing programme

The possibility of starting a weekly fluoride mouth rinsing programme to supplement the sodium fluoride tablet programme should be considered.

Education programme:

- (a) Organise regular dental health education activities as a means of re-enforcing information given at the chairside.

- (b) Seek the co-operation of the Education Department to have Dental Health included in the school curriculum (non-examinable subject).
- (c) Utilise audio-visual aids to supplement the educational programmes.
- (d) Recruit auxiliary personnel to run the education programmes in schools.
- (e) Conduct a questionnaire type survey to measure the effectiveness of dental health education efforts.
Assess the achievement regarding: Dental health knowledge; dental health attitudes and beliefs; and dental health behaviour.

Treatment programmes:

- (a) There should be a shift in priorities from restorative to preventive dentistry. Since the introduction of the dental service to schools, the treatment programme has been primarily centred on the provision of restorative care to all children. This has been a very costly service to run and maintain mainly because the cost of dental materials and equipment have continued to increase over the years. Therefore, it would be most desirable to see a shift in the direction of priorities regarding the school service, from conservative dentistry to preventive dentistry. More emphasis should be placed on prevention and related programmes rather than relying on restorative treatment to control dental caries.

- (b) Any operative treatment should be confined to those carious lesions involving dentine. This follows the new developments and understanding of the disease process (caries) and the reversibility of the early enamel lesions (Silverstone 1978).

6.4.2 Adults

Future developments should include some form of survey to determine utilisation rates among the adult group. There should be an education programme with the objective being to provide the individual patient with knowledge of the major causes and contributing factors of dental disease (caries and periodontal disease). This should be sufficient so that they understand the recommendations given by the dental personnel for the improvement of dental health. This would also increase their awareness that there is a possibility of preventing these diseases through better care.

Instruction on oral hygiene should be given with the aim being to inform the patient about plaque and how it can be removed and to demonstrate its removal. The demonstration would use disclosing dyes and include tooth brushing technique and the use of wood points and dental floss for inter-proximal tooth cleansing.

The caries preventive effect of fluoride should be stressed to encourage the daily use of fluoride-containing dentifrices.

It should be noted that most of this information is currently provided by the staff as part of the dental health

education activities. Nevertheless, it is recommended that more emphasis be concentrated on the provision of health education information. Personal experience shows that provision of health education information has not been properly presented in the past and the programme plays a minor role in the service.

A positive attempt should be made to establish a regular preventive recall programme for adults to allow for chemical prevention of dental caries and prevention of periodontal disease.

7. DISCUSSION

7.1 PROGRESS

The writer proposes firstly, to discuss progress achieved by the Niue Public Dental Health Service in its delivery of oral health care in the period 1965-1983. Areas of progress shall be related to the following sub headings:

- (i) Service
- (ii) Programmes
- (iii) Oral health status.

Service:

Progress with regard to service can be viewed through the development achieved in recent years. The final phase in the planned development of the dental service was to ensure that total dental coverage was extended to include the whole population. Considering the constraints that are common in any developing country (socio-economic level and professional development) the planned development of the service has been quite successful.

In the initial development of the service till the early 1970's, limited resources restricted the service to providing only routine dental care to the children as the priority group. In the late 1970's, appropriate manpower establishment together with the Government having fully committed policy to provide a free medical and dental care to everyone enabled the Department to broaden and extend its policy to allow comprehensive dental care treatment to be

accorded to the adult population. This in itself has been a major achievement and had long been envisaged since the service was started.

Today, Niue's position is unique as it is probably the only place in the Pacific to provide full coverage and comprehensive dental treatment to all age groups in the island.

Programmes:

The school dental service aimed at improving dental health as well as the maintenance of a high state of oral health by providing a regular and comprehensive restorative programme supplemented by the preventive and educational programmes.

The provision of restorative care has certainly helped control and reduce the level of tooth loss among the children.

The main criteria used for the evaluation of success in oral health programmes are:

- (i) effectiveness
- (ii) adequacy
- (iii) efficiency and
- (iv) appropriateness.

7.1.1 Effectiveness

Schoolchildren:

One of the most notable achievements of the oral health care service is the maintenance of the school population largely free from active caries. In all sections of the school

population, this is largely managed by restoration without resorting to the extraction of teeth. The extraction ratio per 100 fillings is fairly low.

For the dental caries experience of the deciduous dentition analysis of the dmf components showed that in 1964, the proportion of decayed teeth left untreated was 56 percent, with 10 percent missing and 35 percent filled. Improvement in the service saw a slight reduction in the proportion of untreated decay in 1974, a great reduction in the proportion of missing teeth (57%) and an increase in the proportion of filled teeth (38%).

For the permanent dentition, analysis of the mean DMFT components showed that in 1964, 40% of the decayed permanent teeth were not treated, 1% were missing and 58% filled. The situation was much worse in 1974 which saw an increase of the decayed component to 50% and a drop in the percentage of filled teeth from 58% in 1964 to 50%.

In 1983 however, the dental service was most effective and successful in its effort to control dental decay by restorative means. The proportion of untreated decayed teeth was greatly reduced from 50% in 1974 to 27% in 1983, while 73% of the decayed teeth were restored. The percentage of missing teeth was negligible.

The Dental Care Index (F-Ratio) is used to measure the effectiveness of a restorative dental service. In the period 1964 to 1974, the prevalence of dental decay greatly increased. However, a greater proportion of the caries problem had been successfully cared for by the provision of restorative treatment.

In the provision of restorative services, the Niue dental service would appear to rank well in comparison with six other Pacific Island countries from which comparable data is available (Speake 1979). With an F-ratio in excess of 0.55, Niue comes second only to Rarotonga in The Cook Islands.

The success of the service in meeting urgent needs and reducing tooth loss through regular care may also be monitored by changes in the ratio of extraction to restorations placed. The extraction ratio per 100 fillings did not change much from 1975 to 1982, and of all the teeth extracted, only a very small proportion were permanent teeth. Overall, the ratio was very low.

Adult population:

Within the period 1964 to 1974, the prevalence of dental caries remained high, but showed a slight reduction in the proportion of subjects with 1 or more DMF teeth from 95% to 93% in 1974.

The 1974 survey results showed that there had been a slight increase in the number of DMF teeth per subject in the age group 45 years and under compared to that in 1964, but some improvements were shown in adults 54 years and over. Although the DMFT index was higher in the younger age groups (1974), the FT component was much improved, the DT component lower and the MT component much reduced. In the age groups 55 years and over, the MT component showed the greatest reduction in 1974 compared to that in 1964.

The prevalence of gingival inflammation was much higher in 1974 than it was in 1964. The condition was most prevalent among the 45-54 year olds in 1974 while in 1964, those in the 25-29 year age group showed the greatest increase. In 1983, the age group 15-19 years showed the greatest increase.

The prevalence of periodontal pockets has continued to show an upward trend and results indicated that periodontal disease could be the major oral dental health problem the service will encounter in the coming years.

In the period 1975 to 1982, the proportion of teeth lost because of periodontal disease was approximately 40%, however if the condition is not checked in the near future it could become the most important cause of tooth loss not only in the older age group but also in the younger age groups.

7.1.2 Adequacy

The school treatment programme has managed to successfully cover the major dental health problem of dental caries which commonly affects the majority of children in the island. The service is widely available to all children (schools/ preschool children) and utilisation is approximately 100%. Utilisation by adults, especially young adults, is lower.

7.1.3 Efficiency

An evaluation of efficiency requires an examination of costs against a measure of achievement. The major item of cost in the provision of service is the remuneration of personnel, which, to quote the proportion for the year 1/4/78-

31/3/79, amounts to approximately 86% of the total budget. The service is undoubtedly very effective and coverage of the child population as well as the adult population is virtually complete, but the high cost of achieving these objectives must cast some doubt upon its efficiency.

7.1.4 Appropriateness

In examining the strategies of the children's oral health care service, consideration is given to the elements of the programme which were likely to achieve the desired results in the best way. The aspects of the service regarded as questionable were the employing of costly personnel in the service, the continuation of use of expensive sodium fluoride tablets without proper distribution and monitoring system used, and the extensive use of resources for restoration of dental caries problems rather than the prevention of dental caries.

7.2 DENTAL SERVICES

The basic methods involved in the delivery of dental health services in Niue are through:

- (i) Hospital based clinic
- (ii) Mobile dental clinics.

Hospital based services:

This is the main treatment centre for all dental related conditions and is available to all members of the public because of its central location, accessibility is easy and it is most convenient for the public.

The types of programme or services available are basically routine treatment of dental disease (dental caries/periodontal disease) together with some elements of dental health education. The use of topically applied fluorides for the prevention of dental caries is not widely practised except on some children for whom the provider might recommend for treatment.

Types of treatment provided:

- (i) routine dental examination
- (ii) emergency services
 - (a) relief of pain
 - (b) control of dental infections
 - (c) traumatic injuries
- (iii) periodontal disease control
- (iv) restorative care
- (v) minor oral surgery
- (vi) full upper/full lower dentures
- (vii) partial dentures
- (viii) endodontic
- (ix) gold inlays.

These services are provided by dentists. Normally, one dental officer is stationed in the main clinic with a chairside assistant.

The facilities available are adequate to provide the necessary treatment for special groups of patients as supportive specialised services are readily available. These include medical consultation, hospitalisation/general nursing care, general anaesthesia and pathology laboratory. Biopsy specimens are often sent to N.Z. for histo-pathological examination.

Dental health educational programmes are normally presented at the chairside, where the patient is given general information on the causes of both dental decay and periodontal disease, dietary habits associated with sugary products, oral hygiene instruction and methods of plaque removal, and motivated to adopt a more positive attitude towards dental health and seek regular dental examinations.

All after hours emergency services are provided for in the main clinic. In most instances, free use of the hospital transport allows the patient to be brought to the hospital for treatment and returned after completion of the treatment. All treatment is free of charge except the provision of artificial dentures where a fee of about \$20 is charge for a full upper/full lower set of teeth.

Mobile dental services:

The mobile dental caravans (2) have an important role in the delivery of dental health services in Niue. These mobile dental caravans enable the service to be extended and reach out to serve every village in the community and every school child and preschool child is included.

The treatment programmes carried out in the caravans are normally prepared by the PDO. The itinerary requires that the caravans first examine and treat a particular school. Once the school has been completed, the mobiles are then towed to a central location in the village ready for the dentists to examine and treat the preschool children and adults. The system continues until a tour of the whole island is completed and the cycle starts again.

On the average, most schools are treated twice a year. The services are provided by a dentist plus a chair-side assistant in their own respective caravans. Types of treatment available in the caravans are limited and restricted to routine examination (without X-Ray), extractions, conservative treatment and scaling and prophylaxis.

7.3 FUTURE DEVELOPMENT

The Niue oral health care service for children has not changed much over the past two decades. Traditionally, the school dental service has focussed on restorative therapy. Up to the present time, the service is still focussing on restorative therapy, although some preventive programmes have been recently introduced.

As have been expressed before, it is most desirable to see that the future oral health care system for children should be based on prevention, implying that treatment was to be considered only as a supportive programme for the preventive programmes.

The aim of the future oral health care system for children expressed in preventive terms, is to prevent the onset of dental disease as early as possible as well as securing an adequate treatment programme to a degree which will ensure the best possible function of both the primary and secondary dentitions.

Sodium fluoride tablet programme:

The writer is most critical of the way in which this programme was organised. The programme was started in 1964 and has been continuing since. However, there has not been any evaluation undertaken to determine the effectiveness or factors which may have affected the outcome of the project, apart from the survey results by Espie in 1974, which clearly showed that the prevalence of dental caries among children was not reduced. John Speake also commented on the future of the programme because in its present form it has clearly not produced the desired results. However, it was thought desirable to continue the programme and try to improve on the present form of tablet distribution and the organisation of the programme in general.

Education programmes:

This programme needs to be measured for effectiveness by carrying out a questionnaire survey among children mainly to determine the level of dental health knowledge, their dental health attitudes and beliefs, and their dental health behaviour. The programme needs to be well organised and requires the service of auxiliary personnel to run and manage the programme.

Dental health promotion: The Department needs to step up, or play a more active role, in promoting the service and dental health to the public. Some of the methods or ways to promote dental health are to:

- organise a dento-medical health day: organise

promotional activities aimed at target groups (teachers, mothers), organise regular health talks, and to utilise the local media (newspaper and the radio) effectively; and discourage direct selling of snacks and sweets to schools.

In the near future, it is reasonable to expect the development of a system which will be characterized by some of the following:

- (i) Ongoing, systematic national planning.
- (ii) Administrative and organisational changes within the Department.
- (iii) Development of a well organised educational system as an integral part of the total delivery system.
- (iv) An organised system to define, or help determine, the significant problems involved in the effective and efficient delivery of oral health care.

8. CONCLUSIONS

Established in 1945 to provide routine dental care to primary school children, the Niue public dental health services have undergone further development that saw the Dental Department extend and broaden its policy to allow the adult population to receive a free and comprehensive treatment. This has long been envisaged since the service started, and is now regarded as one of the important achievements of the service.

Delivery of dental health services is provided through a Hospital-based clinic and mobile dental clinics (caravans). The use of the mobile dental caravans enables the Department to provide adequate and effective dental care to schools and preschool children as well as allowing the service to reach out and serve the adult population in the outer villages.

All services are provided by dentists and the high cost involved in providing the services has cast some doubt upon the efficiency of the service. It is apparent however, that the Niue Dental Service has succeeded in providing an exceptionally high quality level of care to the satisfaction of the children and the community generally.

With a favourable operator to patient ratio (approximately 1:1000), the Department has been very successful in reducing the amount of active caries in school children by restorative means and tooth loss has been very much reduced. With a dental caries index (F-Ratio) of 0.73 (73%), Niue appeared to rank well in comparison to other Pacific Island

countries in the provision of restorative care. The extraction ratio per 100 fillings is fairly low. In the younger adult population, the filling component of the DMF index has improved. The decayed component is slightly reduced and in the older age groups, the missing component has been very much reduced.

Traditionally, the school dental services have focussed mainly on restorative therapy, but because this service is expensive to run and maintain, the Department cannot keep on providing it and hope to control the level of dental decay in children. Therefore, recommendations for the future development of the oral health care system have indicated the need for a shift or change in priority so that the future oral health care service to children be based on prevention, with treatment care to play a supportive role.

Other recommendations call for the:-

- (i) improvement to the organisation and control of the sodium fluoride tablet programme;
- (ii) Department to play a more active role in promoting the service and dental health to the public;
- (iii) improvement to dental health education programmes and how they are organised and presented;
- (iv) services of auxiliary personnel required to run the education programmes; and
- (v) use of a questionnaire survey to measure the effectiveness of dental health education programmes.

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