

Oral conditions among Tongan children and adults, 1966 and 1986

TERRY W. CUTRESS *
N. MOI TAPEALAVA **
SILILO TOMIKI **

Abstract

Two national surveys, 20 years apart, provide a substantial description of the oral health status of children and adults in the Kingdom of Tonga before and following significant changes in traditional lifestyle. Not only do the two data sets offer valuable epidemiological information on natural (normal) trends in oral health with age and time but they also provide a guide on 'urbanisation' effects introduced by changed economic, dietary and migratory patterns. Both surveys included about 10,000 children and adults. Survey procedures, clinical criteria and sampling were based on WHO recommended procedures.

The indicators chosen were the prevalence of decayed and filled teeth, number of missing teeth, periodontal criteria, and the edentulous. Overall, it appears that the profiles for tooth morbidity and mortality in adults and children are very similar in 1966 and 1986 but there has been a significant increase in the number of edentulous persons. The common profiles that emerge are: a low prevalence of dental decay at all age levels; endemic gingivitis and dental calculus in young and older adults; a moderate level of periodontitis in older adults, and a high level of missing teeth after middle-age (> 44 years). While the morbidity and mortality characteristics are well-defined, the explanation of the high level of missing teeth from middle-age on is not readily explained. Gum disease appears to be the

principle factor but unlike dental caries, endemic gum disease is not known to be a consequence of urbanised communities, but rather a standard feature of ageing. Other morbid conditions of the mouth are uncommon. Comparison with other Pacific populations provide some relativity for Tonga's oral health status.

Introduction

The Kingdom of Tonga is geographically located in the south-west Pacific. It consists of 159 small islands with a total land area of approximately 270 square miles. Tongatapu is the largest of the 36 inhabited islands. Geographically and administratively the islands are divided into three main groups: Tongatapu in the south, Ha'apai in the centre and Vava'u in the north. One-half of the people of Tonga live on Tongatapu. The climate of the Tongan archipelago is subtropical. Communication between islands is almost entirely by sea with a regular air service.

The economic basis of the family is generally the ownership of land. Every male Tongan is able, at the age of sixteen, to own land for agricultural purposes and space to build his dwelling in the village. The composition of families and households even in the urbanized port of Nuku'alofa is similar to that in the small islands. The population is 97% indigenous Tongan.

The staple crops are yam, kape, sweet potato, taro, banana and cassava; but pork, poultry, sea foods, and seasonal fresh vegetables and fruits supplement the basic food. However, European influences are changing the dietary pattern of the people. Tinned meat and fish, pudding, flour, white bread, biscuits, and sugar have gained popularity. Consumption of salted meat, condensed milk, jam, butter, rice, tea, coffee and cocoa is mostly in the towns and adjacent villages. Among European foodstuffs, tinned corned beef and mutton are the most popular and offers a variety to the simple meals which are often mostly carbohydrates.

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*Director, Dental Research Unit, P O Box 27-007, Wellington, New Zealand. **Dental Officers, Ministry of Health, Tonga Is.

Oral health in Tonga, was documented through two national surveys of oral conditions of adults and children carried out on two separate occasions, twenty years apart, 1966 and 1986^{1,2}. The design and size of the studies have value for public health and epidemiology of transitional populations. In South Pacific populations the prevalence of dental caries ranging from high (French Polynesia, New Caledonia, Cook Islands) to very low (Tonga, Western Samoa)^{3,4,5,6}. The variation is largely explained by the introduction of western-type foods, particularly refined carbohydrates. Periodontal disease, however, appears endemic and unchanged with time^{5,7,8,9}. Until comparatively recent times many island groups remained in geophysical isolation. This has, for many, now changed with individual travel, food distribution and changes in cultural habits and lifestyles. A low caries prevalence in Tonga in earlier decades was explained by the rural lifestyle and natural diets, particularly the low usage of refined sugar and it appears the endemic chronic periodontitis is the reason for tooth mortality in adults^{3,4}. The natural levels of fluoride in water and diets available to most communities is lower than the optimal required for caries suppression^{3,4}. Improved access to and from Tonga since the 1960's has increased the exposure to Western influences.

The surveys of 1966 and 1986 were cross-sectional prevalence studies using WHO epidemiological guidelines. This report compares the two data sets for those oral conditions which were recorded and reported similarly. The purpose of both surveys was to determine the prevalence of dental caries; periodontal disease; dental fluorosis; dento-facial anomalies and mucosal lesions; prosthetic status and denture requirements. Secondly, to supply baseline data for subsequent evaluation of oral health care programmes and assist health administrators in determining dental health priorities.

Methods

Both survey samples targeted about 8 - 10% of the total child and adult population of Tonga, using a multi-stage, stratified sample selected from a wide geographical cross-section of the population. The number examined in each age group was based on the projected population size for the survey year (estimated at 76 596 in 1966 and almost 100 000 in 1986).

In 1966 the target age group was between 6 and 54 years whereas in 1986 specific age groups were targeted; children at 6, 9

and 12 years; adolescents between 15 and 19 years and adults over the age of 25 years.

Data for comparable age groups, common to both 1966 and 1986, surveys form the basis of this report. An exception is the inclusion of older adults, over age 54 years, in the 1986 survey. These have a particular interest as an indicator of the cumulative long-term morbidity and mortality of teeth in a population with a low prevalence of dental caries in childhood, young and mature adults. Data computation and statistical analyses were undertaken by the World Health Organization, Western Pacific Region.

The Survey Teams: Each survey team comprised a dental officer and a recorder. The examiners were familiar with the procedures and basic requirements of national dental surveys from participation in WHO training courses. They were also responsible for the organization and conduct of the surveys. The period of data collection was approximately one year for each survey.

Criteria and instructions: The examination procedure, clinical criteria and survey forms used for 1966 were described in the WPRO Report (1964)¹⁰ and for 1986 in WHO Oral Health Surveys (1977)¹¹.

Results

Sample examined: The sample was distributed throughout the Kingdom which primarily is divided into three territories: Tongatapu, Ha'apai and the Vava'u group of islands.

In 1966 a total number of 7309 subjects (9.5% of estimated total population, 1966) were examined. In 1986 a total of 7966 subjects (9.0% of estimated total, 1986) were exam-

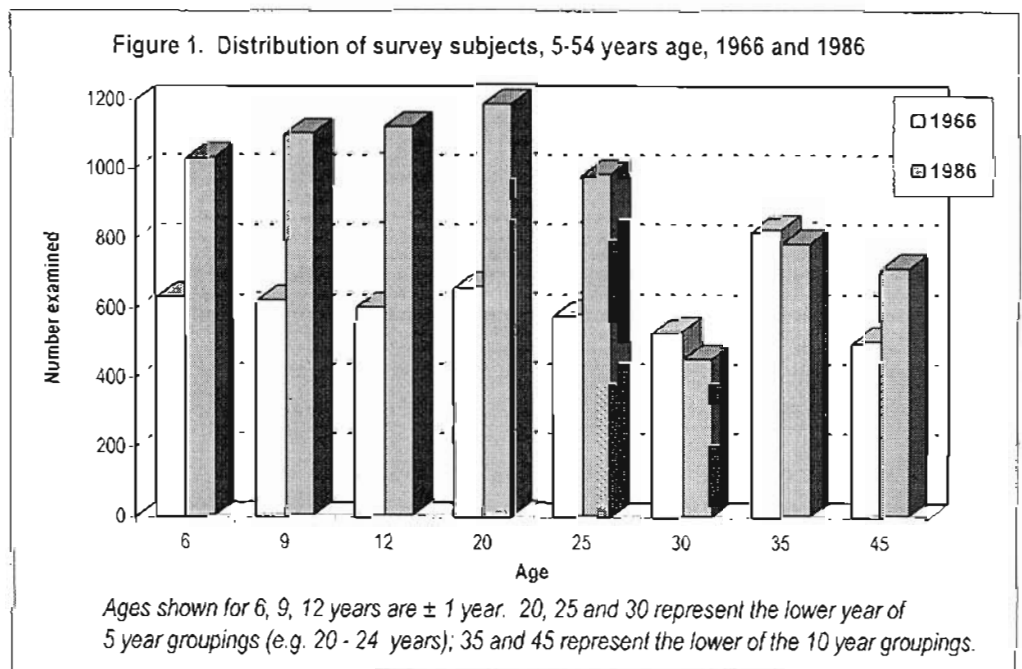
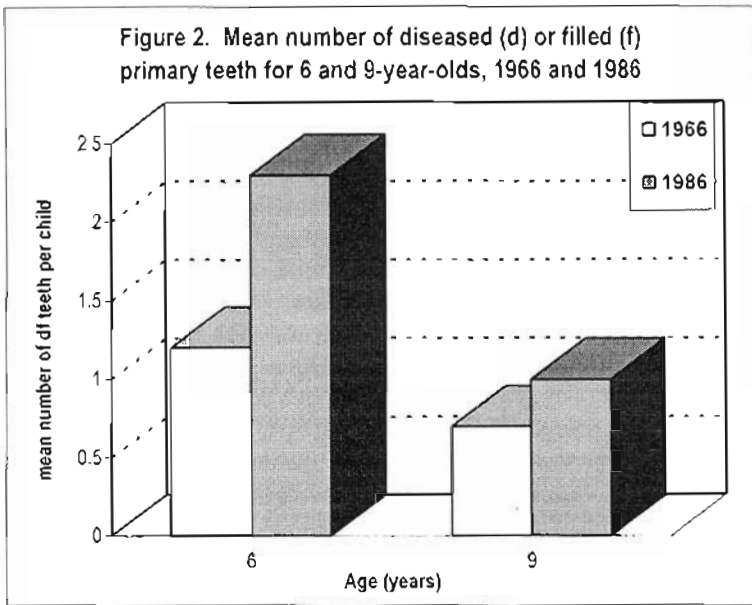


Figure 2. Mean number of diseased (d) or filled (f) primary teeth for 6 and 9-year-olds, 1966 and 1986



ined. The distribution of subjects by age is shown in Figure 1. This includes only subjects within the age range 5-54 years, that is ages common to both surveys. Males and females were similarly represented (within 10%). The 1986 survey included 663 adults aged 55 years or older; the 1966 survey included 424 children younger than 5 years.

Tooth conditions

Children: A low caries frequency was evident in the primary teeth of 6 and 9 year olds (Figure 2) although a high proportion (40 - 60%) of children had experienced some decayed teeth (Figure 3). Nevertheless a distinct trend towards higher caries affecting children in 1986 than in 1966 was evident with almost twice the number of decayed teeth per child (Figure 2).

The percentage of 12-year-old children, with no dental caries experience of their permanent teeth (caries-free) was 67% and 62% and the mean number of diseased, missing, filled (dmf) teeth were similar at 0.7 and 1.0 in 1966 and 1986 respectively.

Adults: The number of dmf teeth increased with age although the mean number of df teeth was low, and similar at all age levels at between 1 to 2 teeth (Figure 4). Increased numbers of dmf teeth with age was mostly associated with an increase in the numbers of m teeth. Less than 10% of teeth were affected by decay and changed little with age.

The average number of missing teeth was low (mean person less than four) until the fifth decade of life (Figure 4). At that time the numbers of m teeth (extracted) increased considerably; this is even more evident in older persons in age groups >54 years in 1986. Tooth mortality and morbidity were similar for all ages in 1966 and 1986. By age of 54 years more

than 25% of all teeth were m. A direct comparison of tooth mortality rates showed that, on average, by age 30 years, adults experienced less than two extractions each, whereas by age 54 years tooth extractions approximated to 8 teeth per subject.

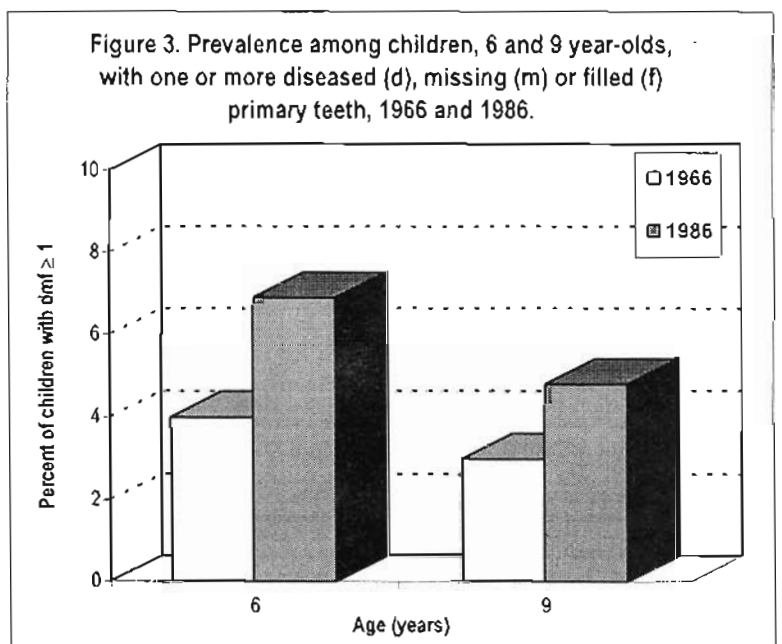
Total tooth loss affected only about 5% of adults, a further 10%, however, were recorded as having a clinical need for total removal of remaining teeth (Figure 5). These patterns were similar in 1966 and 1986. The 1986 data for adults >54 years indicated a continuing rapid increase in the mortality of teeth, noted for 45 - 54 year-olds, and hence a continuing increase in the prevalence of edentulous (toothless) persons.

Periodontal conditions were similarly assessed, in 1966 and 1986 although the method of data reporting differed. Therefore the 1966 data were transformed into the categories defined by the periodontal scoring procedure known as CPITN which was used in 1986 survey. Under these procedures individuals were categorized by their highest score on a scale of zero to four (Figure 6).

The distribution of scores by age groups were very similar for 1966 and 1986, an exception is a higher prevalence of healthy scores for younger subjects 15-25 years in 1986 compared with 1966.

Prevalence of the higher scores (three and four) are indicative of pathological pocketing being low (<10%) for deep pockets and moderate (20%) for shallow ones. Calculus deposits, however, were endemic among younger as well as mature adults.

Figure 3. Prevalence among children, 6 and 9 year-olds, with one or more diseased (d), missing (m) or filled (f) primary teeth, 1966 and 1986.



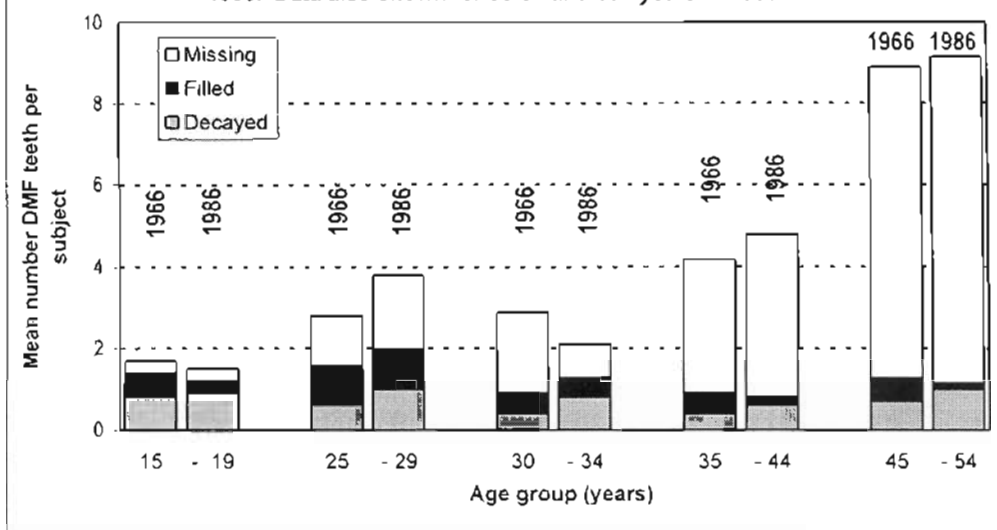
Other conditions: All non-tooth related conditions, such as bone and soft tissue abnormalities were uncommon (<0.1%). Dental fluorosis was not observed.

Discussion

The results show remarkable similarities for dental caries and periodontal disease, in both 1966 and 1986, for children and adults. Oral health features of note are the very low prevalence of dental caries in young and old, the low prevalence of 'missing' teeth until the fifth decade of life. In the fifth decade the rapid increase in the numbers of 'missing' teeth was attributed to the outcome of periodontal disease although its assessed severity (score four associated with advanced periodontitis) did not readily substantiate this explanation.

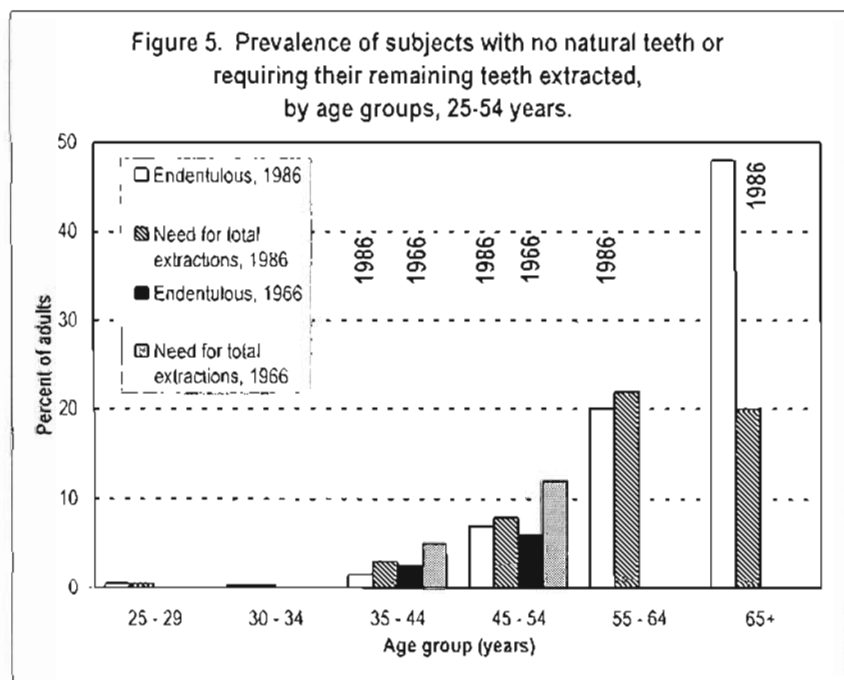
In 1991 a cross-sectional study over a period of two months documented the cause for clinical extraction of teeth¹². The results revealed that periodontal disease is the main reason for high tooth loss in adults and is increasingly evident with age, particularly the middle years onwards. Caries as a cause of tooth loss is mostly evident in early adulthood but was found to be more significant in adults than previously. Dental data available from other studies^{3, 4, 7} also indicate an overall

Figure 4. Mean number of diseased (d), missing (m), and filled (f) permanent teeth per person, by age groups, 15-54 year-olds, in 1966 and 1986. Data also shown for 55-64 and 65+ years in 1986.



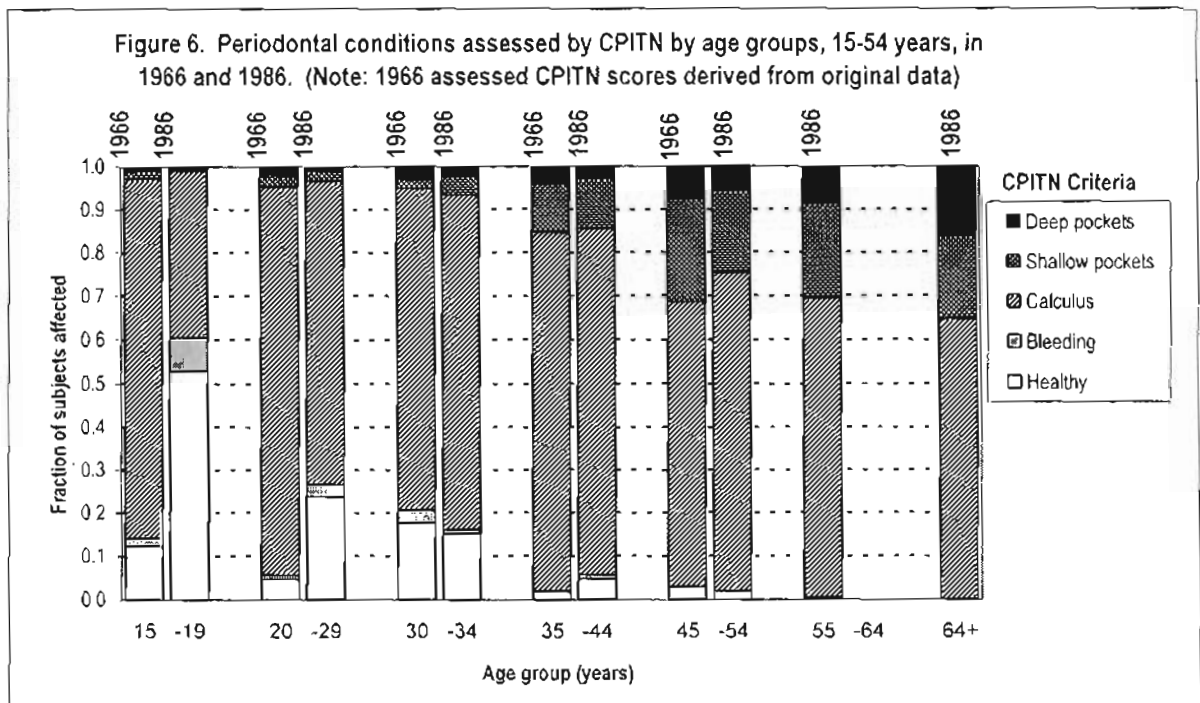
profile of oral conditions of low caries, chronic periodontitis, high tooth loss after age 40 years. Neither in 1966 nor 1986 was the disease category 'root caries' recorded. Exposure of tooth root surfaces following gingival recession, commonly induced by periodontal disease, provides the opportunity for cavitation of the root. This is a well-recognized phenomenon in the Pacific area^{8, 13}. Clinical diagnosis, particularly under survey conditions, is made difficult by the endemic deposits of calculus, often extensive, which obscures root cavitation. Cutress *et al.*⁸ identified cavitation, not obscured clinically, from radiographs. This condition may contribute significantly to the need for tooth extractions⁸.

Figure 5. Prevalence of subjects with no natural teeth or requiring their remaining teeth extracted, by age groups, 25-54 years.



The Tongan surveys are exceptional for size and representativeness, reliability, comparability of methodology, and the similarity of findings. Over 20 years, significant changes in lifestyle and mobility of population have occurred. Fluoride effects would appear negligible as past studies have identified a low level of fluoride in drinking waters. This is supported by low accumulated levels of fluoride in tooth enamel of 12-14-year olds — a study which also identified the Tongan population as having the lowest sugar usage, (10 kg/capita), in the South Pacific³. As Speake (1980) pointed out that whereas, high sugar consumption is offset by high fluoride (natural sources), low sugar is associated with low caries in spite of low fluoride intakes⁴. This balance is liable to change as use of sugar increases in the changing Tongan economy.

Comparison with other ethnic groups in the Pacific region; Polynesian, Asian and European populations provides a perspective



on the Tongan oral health status (from WHO Data Bank, Geneva). Comparison of the numbers of dmft teeth in adult by age with selected populations emphasises certain characteristics. (Figs. 7a - g). The chronic endemic periodontal disease prevailing in the Tongan population compares similarly with many countries world-wide, particularly the Pacific Region^{5, 6, 7}. Improved oral health in Tonga and other countries can be achieved by reducing periodontal disease. This is possible through self-care and community programmes⁹.

Despite a remarkable similarity in the data of 1966 and 1986 there are some indications that caries has increased in children and therefore will impose influences on adult conditions, tooth loss^{8, 14}. The evidence is for a rapid move towards edentulism, which while reducing the need for long-term care imposes an economic burden on the individual and state, increases the need for trained personnel and expensive technology.

Conclusions

Although, there is evidence that dental caries in Tonga has been increasing over the last 20 years, the overall prevalence has remained low compared to other countries. This has been previously recognised in a small field study¹⁴. There is however, a high prevalence of periodontal disease and dental calculus.

A high prevalence of "missing" teeth is evident for adults >45 years and the magnitude of this and the rate of tooth extraction in older subjects should be considered a public health matter of concern. The cause of a rapid increase in the rate of tooth loss (m) after age 40 years appears most likely explained by the long-term presence of periodontitis al-

though the criteria recorded did not identify alarming levels of severity. A public health program dedicated to reducing plaque levels appears to be a priority, together with an increased provision of prevention and treatment programmes to curtail the increasing caries situation.

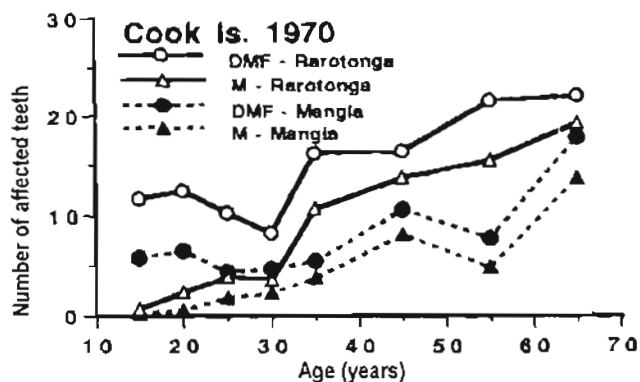
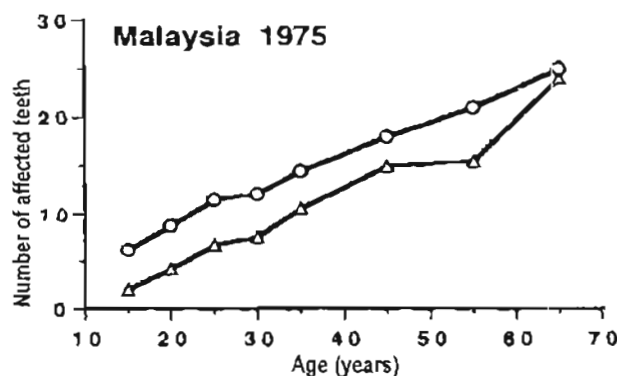
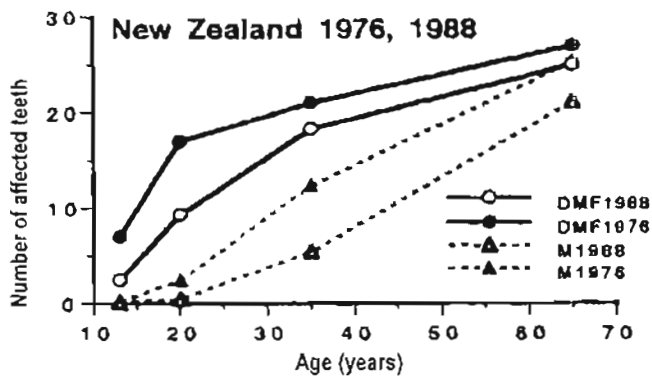
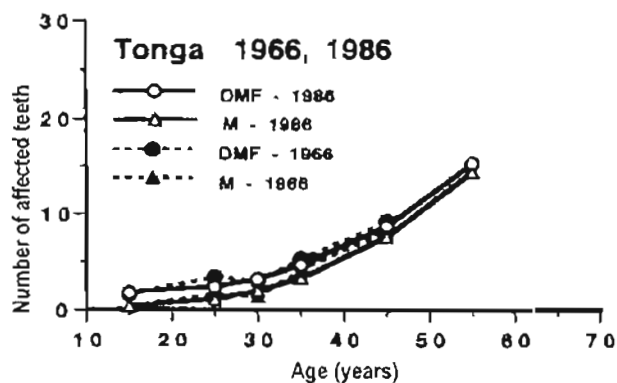
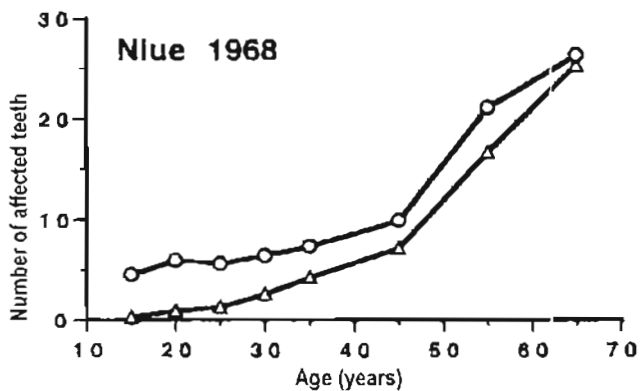
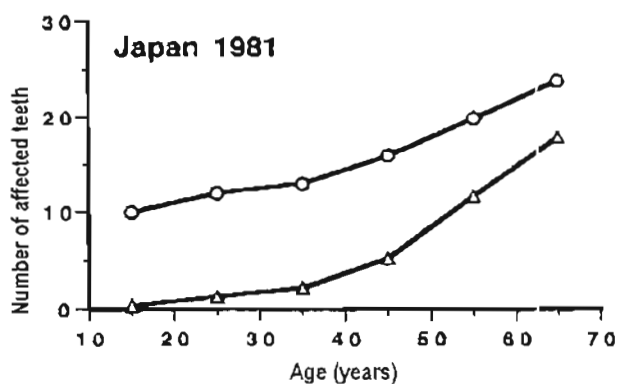
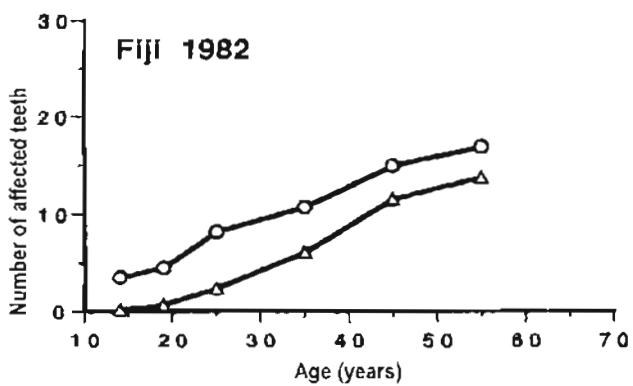
Acknowledgement

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Figure 7. Diseased, filled and missing teeth in selected countries



KEY

- — Diseased, missing and filled teeth (dmf)
- △ — Missing teeth (m)

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