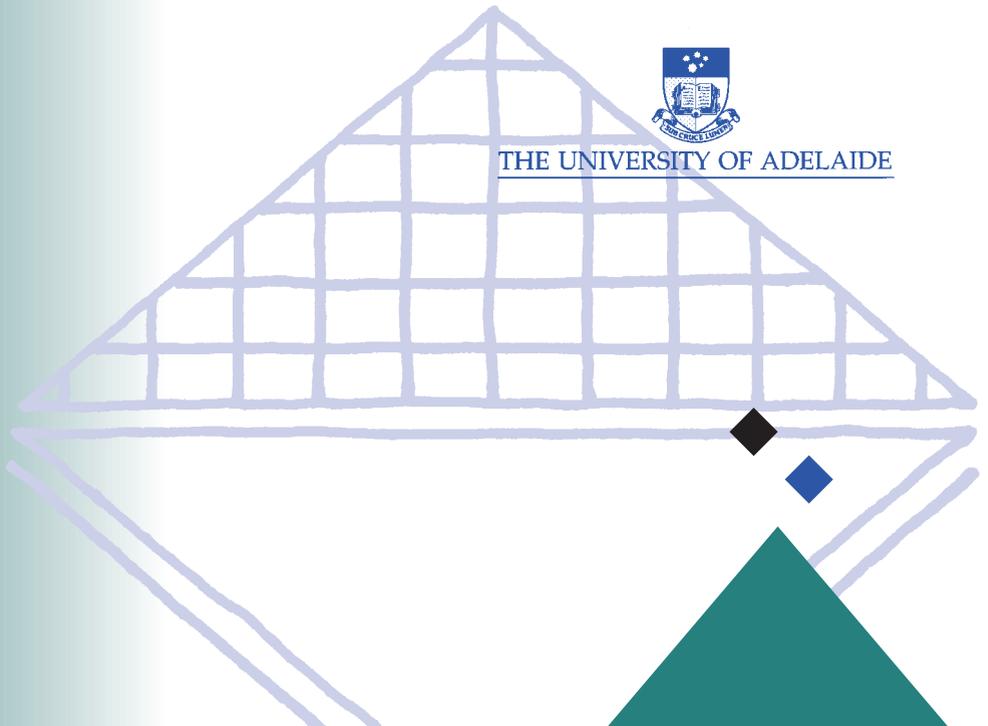


Aging and dental health

JM Chalmers
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DENTAL STATISTICS AND RESEARCH SERIES

Number 19

Aging and Dental Health

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1999

AIHW Catalogue No. DEN 45

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This is the nineteenth publication in the Australian Institute of Health and Welfare's Dental Statistics and Research Series. A complete list of the Institute's publications is available from the Publications Unit, Australian Institute of Health and Welfare, GPO Box 570, Canberra ACT 2601.

ISSN 1321-0254

Suggested citation

Chalmers JM, Ettinger RL, Thomson WM, Spencer AJ (1999). *Aging and Dental Health*. AIHW Dental Statistics and Research Series No. 19, The University of Adelaide, Adelaide.

Acknowledgements

The assistance provided by Mrs Lorna Lucas and Mr Knute Carter of the AIHW Dental Statistics and Research Unit in the preparation of this report is acknowledged and appreciated.

Disclaimer

This publication contains a collection of papers presented at a symposium titled 'Aging and Dental Health' at The World Congress of Gerontology, held in Adelaide, South Australia, August 1997. The symposium was coordinated by staff of the AIHW Dental Statistics and Research Unit. It is being published by the AIHW to put the information that they contain into the public domain. The views expressed in this report are those of the authors and do not necessarily reflect the views of the Australian Institute of Health and Welfare.

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Oral diseases in older adults

Dr Jane Chalmers

ABSTRACT

PURPOSE – This presentation describes: (1) the relationship of oral diseases to the general health of older adults; (2) oral diseases and conditions found in geriatric populations, their causes and relationship to ‘aging’; (3) the incidence of oral diseases and conditions found in geriatric populations, using data from longitudinal dental studies of older adults; and (4) changing disease prevalence and incidence, and identification of ‘high-risk’ older adult populations.

DISCUSSION – Management of oral diseases and conditions is needed: (1) to maintain quality of life, ensuring older adults can eat and talk comfortably and are pain free; and (2) for medical reasons, to prevent infections and manage medication side-effects. Data from laboratory studies and dental longitudinal investigations of older adult populations have improved our knowledge concerning the natural history and prevention of oral diseases, and indicate that oral diseases are not true ‘aging’ changes in all older adults. Oral diseases such as coronal and root caries and periodontal diseases, and conditions such as tooth-loss and oral mucosal problems are ‘age-related’ changes, reflecting both the accumulation of oral diseases over time and the influence of factors such as stress, trauma, medications, and psychological, neurological and medical conditions. As a consequence of demographic and oral health status changes, there will be a marked growth in the number of older adults retaining their natural teeth. High levels of oral diseases and conditions have been found in specific geriatric populations, such as older adults who are functionally dependent, institutionalised, have chronic mental illnesses, or have neurological disorders such as Parkinson’s disease and dementia.

PRESENTATION

This presentation will discuss four aspects of oral diseases found in older adults:

1. The relationship of oral diseases to the general health of older adults.
2. Oral diseases and conditions found in geriatric populations, their causes and relationship to ‘aging’.
3. The incidence of oral diseases and conditions found in geriatric populations.
4. Identification of older adults at high risk for dental diseases and conditions.

1. The relationship of oral diseases to the general health of older adults

Oral diseases, although not life-threatening or seriously impairing for most older adults, can affect quality of life and the management of medical conditions.

Management of oral diseases is needed for older adults to maintain quality of life; it ensures they can:

- eat and talk comfortably;
- feel happy with their appearance;
- maintain social interaction and self-esteem;

- stay pain free;
- maintain habits/standards they have had throughout their life; and
- stay as healthy as possible.

Management of oral diseases is also needed for medical reasons:

- to minimise oral sources of pathogens (especially those that are blood-borne, or can be aspirated into the lungs);
- to manage medication side-effects and interactions (such as salivary gland hypofunction, xerostomia, gingival overgrowth, lichenoid reactions, tardive dyskinesia, and problems with speech, swallowing and taste);
- to manage systemic diseases and their treatments that affect salivary, oral motor and oral sensory functions (e.g., radiation, chemotherapy and other medications);
- to detect dental pain that may be masked by analgesic and sedative medications;
- to minimise behavioural problems due to dental pain (such as disinterest in food and not eating, 'pulling' at the mouth or face, and chewing of the lip or tongue);
- to assist with nutritional intake.

Older adults' use of general health/physician services is the highest of all age groups (over age 5 years) in the population. However, older adults' use of dental services is the lowest of all age groups (over age 5 years). Many barriers do exist for the current cohorts of older adults when they are accessing dental services, and maintaining adequate oral health can be difficult for many older adults.

Longitudinal studies combining cohort and regression techniques have shown that successive cohorts of older adults have higher dental contact rates, suggesting that dental utilisation by these new cohorts of older adults will increase (Dolan & Atchison, 1993).

2. Oral diseases and conditions found in geriatric populations, their causes and relationship to 'aging'

Previously, there have been common misconceptions held concerning aging of the oral cavity, including the beliefs that:

- tooth loss was an inevitable part of the normal aging process;
- most teeth were lost as people became 'long in the tooth' because of advancing periodontal disease;
- all adults were susceptible to severe periodontal disease;
- dental caries was not a common oral disease in older adults, and occurred mainly in the young; and
- salivary flow decreased in all older adults.

Data from laboratory studies and dental longitudinal investigations of older adult populations have improved our knowledge concerning the natural history and prevention of oral diseases, and indicate that all oral diseases and conditions *are not true 'aging' changes* in all older adults. Oral diseases such as coronal and root caries and periodontal diseases, and conditions such as tooth-loss and oral mucosal problems *are 'age-related' changes*, reflecting both the accumulation of oral diseases

over time and the influence of factors such as stress, trauma, medications, and psychological, neurological and medical conditions.

Tooth appearance

However, some aging changes do occur in terms of the appearance of teeth. Occlusal attrition may result in the appearance of 'shortening' of the tooth crown. Also, teeth darken, become 'yellowed' and are less translucent because of:

1. decreased enamel permeability, altering the optical density of the enamel; and
2. increased 'thickness' of dentine, change in the type of dentine and dentine sclerosis from sedimentation of crystals.

Oral mucosa

There are differing reports concerning oral mucosal changes and aging, with some reporting thinning of the epithelium and clinical appearance changes. However, it seems likely from the investigations to date that oral mucosal disorders are age-related, and are associated with disease, nutritional status and medications.

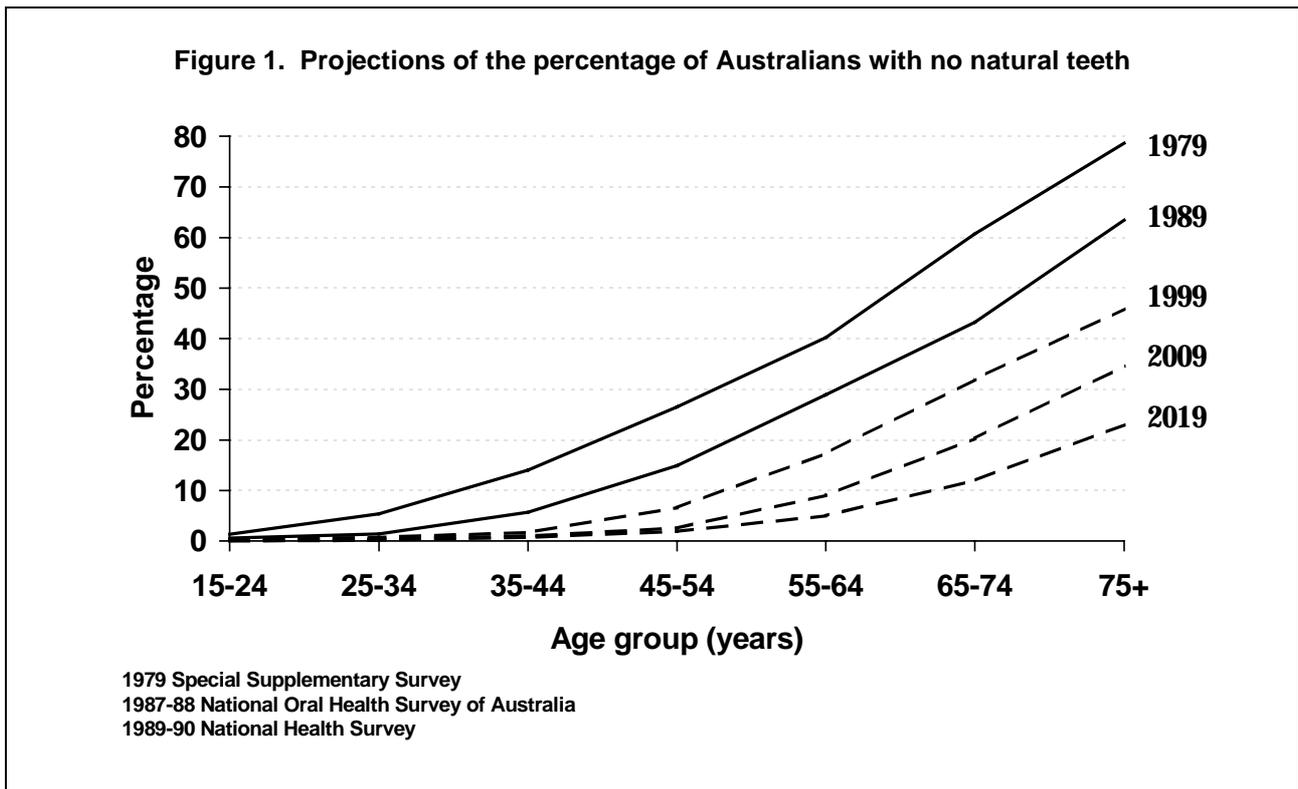
Tooth loss

Table 1. Tooth loss in the US and Australia

US	1958	60% of 65+ were edentulous
	1985	41% of 65+ were edentulous
Australia	1979	67% of 65+ were edentulous
	1996	39% of 65+ were edentulous

(Dolan & Atchison, 1993; Carter, 1997)

The complete loss of all teeth, or edentulism, is decreasing in industrialised countries (Table 1). In the US, in 1958 more than 60% of the 65+ population were edentulous. By 1985 this percentage had decreased to 41% (Dolan & Atchison, 1993).



Similar changes have been reported in Australia (Figure 1). In 1979, just over 67% of the Australian population aged 65+ were edentulous. In the 1996 National Dental Telephone Interview Survey, this percentage had decreased to 39%, a more rapid decrease than had been previously predicted (Carter, 1997).

The age association with this decrease in edentulism is due to a cohort phenomenon rather than to normal aging. The retention of teeth in ensuing cohorts of older adults is the result of:

1. greater retention of teeth in earlier life;
2. improved understanding of oral diseases by the dental profession;
3. improved methods and philosophies for dental treatment and oral disease prevention;
4. improved self-care behaviours;
5. increased availability of dental services; and
6. increased awareness of dental needs (Shay & Ship, 1995).

Dental caries

Dental caries is a chronic progressive disease, the causes and pathogenesis of which are not related to aging. Dental caries is classified according to the surfaces that are affected by the disease. Coronal caries occurs on the tooth crown, while root caries occurs on the exposed root surfaces. Coronal caries in older adults is mainly recurrent around existing restorations, while root caries occurs when active or prior periodontal disease, or tooth abrasion have exposed the root surface (Banting, 1991).

Periodontal disease

Periodontal disease is the term used to describe a cluster of diseases that involve the periodontal tissues. The understanding of periodontal disease has advanced in the last two decades, so that previous concepts have been dramatically revised. Some loss of periodontal attachment and alveolar bone is to be expected in older adults, but age alone in a healthy adult does not lead to a critical loss of periodontal support. Although mild gingivitis and mild/moderate loss of alveolar bone and periodontal attachment is common in the elderly, severe loss of periodontal attachment is not a natural consequence of aging. Gingivitis precedes periodontitis, but few sites with gingivitis later develop periodontitis. Thus, periodontitis is not the major cause of tooth loss in adults (Burt, 1994).

Saliva

The misconception concerning reduced salivary flow in older adults has also been revised. Healthy, non-medicated older adults do not have functionally decreased salivary flow rates or altered salivary composition due to aging (Baum, 1986). While medications have been implicated as contributing to decreased salivary flow and xerostomia in some older adults, their role is still being investigated. However, diseases such as Sjogren's syndrome and radiation therapy and chemotherapy do have direct effects on the salivary glands (Shay & Ship, 1995).

3. The incidence of oral diseases and conditions

Geriatric dental epidemiological research has focused on two main groups of older adults:

1. community-dwelling functionally independent older adults; and
2. institutionalised functionally dependent older adults (residing in nursing facilities).

There has also been some limited research concerning specific groups of older adults with medical conditions such as dementia, Parkinson's disease, and chronic mental illness.

This research has revealed that most community-dwelling functionally independent older adults have generally good oral health while they can access dental services; however, there appear to be some individuals who are at higher risk for some oral diseases and conditions, such as the socioeconomically disadvantaged. As older adults' functional status and medical status decline, and other complications of declining cognitive status, declining affective functioning, increased need for social support, increased caregiver burden, and increased barriers to dental care are encountered, oral health status also appears to become compromised. Institutionalised functionally dependent older adults have many complex oral problems, as do functionally dependent individuals with dementia, Parkinson's disease and chronic mental illness.

Community-dwelling functionally independent older adults

Tooth loss

While older adults continue to share the disproportionate burden of problems associated with tooth loss, successive cohorts of older adults are maintaining a greater proportion of teeth into later years (Dolan & Atchison, 1993). Higher rates of edentulism have been found in disadvantaged populations of community-dwelling older adults: (1) the oldest 'old'; (2) women; (3) those of lower socioeconomic status, with less education and lower incomes, and social security card holders; and (4) several subgroups such as black Americans, Native American Indians and Australian Aboriginals.

Table 2. Tooth loss incidence (from longitudinal study data)

Study	Time period	Subjects losing one or more teeth
Iowa	18 months	21%
	5 years	39%
North Carolina	18 months	19%
	3 years	29%
Ontario	3 years	28.5%
South Australia	2 years	19.5%

(*Hunt et al., 1988; Hand et al., 1991; Drake et al., 1995; Hunt et al., 1995; Locker et al., 1996; Slade et al., 1997*)

Tooth loss incidence, in longitudinal studies, was approximately 20% during the first 18 months and approximately 29% at 3 years. In the one study reporting 5 year data, tooth loss incidence was reported as 39% (Table 2) (*Hunt et al., 1988; Hand et al., 1991; Drake et al., 1995; Hunt et al., 1995; Locker et al., 1996; Slade et al., 1997*).

Table 3. Tooth loss and edentulism incidence

Tooth loss incidence	Iowa	0.4 teeth/18 months
	South Australia	0.4 teeth/2 years
Annualised incidence edentulism (very low)	Ontario	1.2%
	South Australia	0.7%

In these longitudinal investigations, similar patterns of tooth loss have been found (Table 3). The mean incidence of tooth loss was 0.4 teeth/18 months in Iowa and 0.4 teeth/2 years in South Australia. The annualised incidence of edentulism was very low, approximately 1% of subjects. Thus, although tooth loss occurred in many subjects, the number of teeth lost per subject was small and few subjects lost all of their teeth (*Hunt et al., 1988; Locker et al., 1996; Slade et al., 1997*).

Caries

Cross-sectional and longitudinal studies have demonstrated a substantial burden of cumulative disease from dental caries among community-dwelling older adults, with coronal and root caries evident in all age groups.

Cross-sectional studies have reported:

1. coronal caries prevalence ranging from 20–30% of subjects;
2. the minority of subjects had the majority of disease (*McGuire et al., 1993*);
3. among decayed teeth, recurrent coronal decay ranged from 14–22%; and
4. caries experience was higher for molars and premolars, with up to 80% of these teeth having restorations on two or more surfaces (*Dolan & Atchison, 1993*).

Table 4. Caries incidence (from longitudinal study data)

Study	Time period	Coronal caries	Root caries
Iowa	36 months	30.6% both coronal and root 47.5% coronal or root	
North Carolina	18 months	43% whites 30% blacks	
Tufts	18 months		50%

Caries incidence rates are shown in Table 4, and have ranged from:

1. 30.6% developing both coronal and root caries and 47.5% developing one or the other over 36 months in the Iowa study (Hand et al., 1988);
2. 43% of North Carolina whites and 30% of blacks developing coronal caries (Drake et al., 1994); and
3. 50% of subjects in the Tufts study developing root caries (Joshi et al., 1993).

In Iowa, the combined 18 and 36 month net coronal and root caries annualised incidence was 1.2 surfaces, with only 14% due to recurrent caries, suggesting that community-dwelling functionally independent older adults do continue to develop new carious lesions.

Periodontal disease

Loss of periodontal attachment is now used to measure the cumulative effects of periodontal diseases.

$$\text{Loss of Attachment} = \text{recession from cemento-enamel junction} + \text{probing depth.}$$

Mild gingivitis and also mild to moderate loss of periodontal attachment are common in older adults; however, severe periodontal disease is not common. Longitudinal and cross-sectional studies have revealed that deep probing depths of >6mm are no more extensive in adults aged 65+ than in middle-aged adults and have occurred in no more than 9–20% of the populations studied (Burt, 1994).

In the Iowa study, periodontal diseases were found to be weak predictors of tooth loss. Also, the need for routine scaling and cleaning for mild gingivitis and mild to moderate periodontitis was found to be very high (in approximately 90% of dentate subjects), compared to only 15% requiring more complex periodontal treatment for severe loss of attachment.

Oral mucosal lesions

The prevalence of oral mucosal lesions in community-dwelling older adults is high, having been found in up to two-thirds of the subjects in some investigations (Galan et al., 1995). In the Iowa study, nearly one-quarter of all subjects had oral mucosal lesions, with 27.0% of denture wearers having denture-related lesions. Lesions were more commonly found on the palate and then on the lips. Risk predictors for denture-related lesions were: less education, use of tobacco, use of alcohol and increased time since last dental visit (Hand & Whitehill, 1986).

Dentures

A large percentage of community-dwelling denture-wearers have been evaluated by examiners as having denture-related problems, with up to 40% of those with complete maxillary dentures and up to 60% of those with mandibular dentures in the Iowa study presenting problems. The risk of problems and the need for prosthodontic treatment was greater for:

1. complete dentures than for partial dentures; and
2. for mandibular dentures than for maxillary dentures.

Also, perceived prosthodontic treatment need by subjects has been lower than the observed need reported by dental examiners (Hunt et al., 1985).

Institutionalised functionally dependent older adults (residents of nursing facilities)

There is little national-level or longitudinal information available concerning the oral health of nursing facility residents. Most investigations have presented descriptive data and used small cross-sectional convenience samples of single or several nursing facilities. They have also excluded residents that are deemed 'behaviourally difficult' or 'uncommunicative', such as those with dementia. This is problematic, as often many nursing home residents have cognitive impairment. However, from the several more comprehensive investigations conducted, we can gain some insights into the oral diseases found in nursing home residents (Empey et al., 1983; California Dental Association, 1986; Homan et al., 1988; Vigild, 1988; Veteran's Administration, 1989; Kiyak et al., 1993; MacEntee et al., 1990; Thomson et al., 1991 and 1992).

Table 5. Prevalence of oral diseases and conditions in nursing facility residents

Disease or condition	Percentage of residents
Edentulism	45–71
Coronal caries	13–70
Root caries	up to 85
Poor oral hygiene	nearly all
Probing depths ≥ 4 mm	11–27
Oral mucosal lesions	33–45
Denture treatment	67–75

In Table 5, the prevalence of oral diseases and conditions in nursing facility residents is presented. Edentulism rates in these populations were high, ranging from 45–71%. Clinical examinations revealed that the great majority had dental diseases, oral problems and treatment needs (Dolan & Atchison, 1993). The prevalence estimates of coronal caries ranged from 13–70% of residents, with one longitudinal study finding new carious lesions appearing in 33% of subjects at 1 year and in 78% of subjects at 2 years (MacEntee et al., 1990). Evidence of root caries was found in the majority of residents. Poor oral hygiene of natural teeth and dentures was found in the great majority of both dentate and edentulous residents. Periodontal probing depths of >4 mm were found in 11–27% of dentate residents, and in one study, 25% of residents had spontaneous gingival bleeding (Vigild, 1988). Oral mucosal lesions were observed in 33–45% of those examined. Most lesions were related to dentures, with denture stomatitis the most prevalent condition observed. Prosthodontic treatment needs were high, ranging from 67–75%.

4. Identification of older adults at high risk for dental diseases and conditions

Identification is needed of those older adults who are at high-risk for developing oral diseases and conditions. Some research has been conducted in longitudinal investigations to identify specific risk factors for tooth loss and caries, while cross-sectional data has been used to identify risk indicators for caries and periodontal disease. There have been very few reports concerning risk indicators or risk factors for oral diseases and conditions in nursing facility residents; this discussion of risk will therefore focus on community-dwelling functionally independent older adults.

Community-dwelling functionally independent older adults

Tooth loss

In four longitudinal investigations, risk factors identified for tooth loss were:

1. clinical indicators of existing disease (root caries, tooth mobility, >4mm probing depths, >4mm recession, retained roots);
2. a history of tooth loss; and
3. other factors such as smoking, race, marital status, and education (Locker et al., 1996; Slade, 1997; Drake et al., 1995; Hunt et al., 1995).

Table 6. Risk factors and indicators for coronal caries

(Locker et al., 1993a) Ontario	(McGuire et al., 1993) New England	(Drake & Beck, 1992) North Carolina	(Drake et al., 1994) North Carolina	
			blacks	whites
Less education	Less education	Race (black) and financial status poor		Lower socioeconomic index score
No regular annual preventive visits		Irregular dental care attendance	Increased baseline coronal caries	Tooth sensitivity
Increased number of teeth		Presence of decayed roots	More previously filled coronal surfaces	Antihistamine medication at baseline
Born in Canada	Sex (males)	Decreased salivary flow rate (<1.5 ml/min)	Higher counts lactobacillus	Perception of more problems than before

Caries

In the longitudinal and cross-sectional data collected, a range of risk factors and risk indicators for caries have been identified (Table 6). People at high risk for coronal caries included those of lower socioeconomic status and educational level, less regular attenders for dental care, and those who had more previous experience of dental caries.

Table 7. Risk factors and indicators for root caries (RC)

(Graves et al., 1992) North Carolina	(Joshi et al., 1993) Tufts	(Locker et al., 1993a) Ontario	(Joshi et al., 1994) New England	
<i>(blacks & whites)</i>			RC experience	RC present
>1 year since last dental visit		Sex (males)		No regular dental visits
Higher rates of extraction	Higher number of teeth	Increased number teeth	Increased number teeth	
Decayed coronal surfaces	Past root caries experience	Increased coronal decayed and filled surfaces		
Higher CPITN scores		Increased number teeth with recession	Increased number teeth with recession	Increased number teeth with recession
Worst LOA \geq 7mm	Higher plaque score	Currently smoking		Poor oral hygiene

People at high risk for root caries included those who were less regular attenders for dental care, those with more previous experience of dental caries, and those who had poor oral hygiene and an increased number of teeth with gingival recession (Table 7).

Periodontal Disease

Cross-sectional data has been used to investigate risk indicators for periodontal disease (Table 8). Age, sex, race, socioeconomic status, smoking and diabetes have been investigated previously, and more recently general health status, and behavioural, psychosocial, and oral health variables have been used. This table presents indicators identified for severe periodontal disease, with those smoking, those with fewer teeth and those with irregular dental attendance being identified most frequently.

Table 8. Risk indicators for severe periodontal disease

(Levy et al., 1987) Iowa	(Beck et al., 1990) North Carolina	(Locker et al., 1993) Ontario
Number cigarettes smoked and pipe smoking	Tobacco use	Currently smoking
	Irregular attendance for dental visits	Irregular attendance for dental visits
Fewer teeth remaining		Fewer number teeth remaining
Increased number teeth with calculus		Age (cumulative disease experience)
Previous periodontal involvement (recession)	Biological indicators	Less education

Summary

As a consequence of demographic and oral health status changes, there will be a marked growth in the number of older adults retaining their natural teeth. The focus of oral diseases and conditions will move from dentures to natural teeth. High levels of oral diseases and conditions have been identified in specific geriatric populations, such as:

1. those functionally dependent, residing in nursing homes;
2. the functionally dependent with neurological conditions; and
3. sub-groups of community-dwelling functionally independent older adults, for example the socioeconomically disadvantaged, tobacco and alcohol users, those with greater experience of caries and periodontal diseases, and those who do not attend regularly for dental care.

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Clinical dental care for older adults

Professor Ron Ettinger

ABSTRACT

In dentistry, for treatment purposes it is possible to divide the aging population into three broad groups based upon their functional status.

This presentation will use longitudinal case histories to explore the decision-making process required to develop a treatment plan which adequately addresses the oral health needs of functionally independent older adults, frail older adults and functionally dependent older adults.

In the recent past, older adults utilised dental services infrequently because they were edentulous and felt 'no need' to seek care. In the last decade a new dentate elderly consumer has evolved. These older adults tend to have extensive dental problems which are complicated by their chronic diseases and varied pharmacotherapies. Many of these persons, even when faced with bone loss through periodontal disease, caries or unresolved periapical pathology, will no longer accept the simple solutions of the past, such as the extraction of their remaining natural dentition and the construction of complete dentures.

PRESENTATION

Introduction

Although the number and the percentage of adults over the age of 65 is growing dramatically, (Davies, 1985; United Nations, 1991; Ettinger, 1993a; Department of Commerce, Bureau of Census, 1994) it is important to remember that heterogeneity among persons aged 65 years and older is probably greater than at any other time period in the life span (Nelson & Dannefer, 1991). It has been common practice for all age groups older than 65 years to be grouped together when planning programs or analysing data. However, elderly persons are a complex combination and expression of their individual genetic predispositions, lifestyles, socialisation and environments. All of these factors influence their health beliefs and, therefore, their health behaviour. In order to understand a patient's attitudes, the dentists must evaluate the cultural, psychological, educational, social, economic, dietary and chronologically specific cohort experiences which may have influenced that patient's life. Similarly, oral status is also affected by these same factors, as well as including an individual's life experience with dental care, with caries, periodontal disease and iatrogenic disease. Consequently, oral status reflects the history of the person's behavioural attitudes and expectations for their own oral health. Finally, the skills, attitudes and philosophies of the various dentists that people have encountered during their life must also affect their oral status (Ettinger, 1990).

In the not-so-recent past, the elderly population comprised a relatively small proportion of the total population and the majority of these older adults were edentulous. They utilised dental care infrequently and then only when their previously unmet needs could no longer be ignored (Burt, 1978; Ettinger, 1971). However, there is now ample evidence to show that a new elderly dental consumer has emerged. These older adults are better educated, more politically aware and most importantly many of them have some remaining teeth. As patients, these older people have a wider range of needs and expectations, and are demanding a greater variety of services than the past emphasis on complete dentures by previous cohorts (Ettinger & Beck, 1982).

The elderly have been defined as a cohort of people aged 65 years or older. It became clear to us that a chronological definition of the aging population was not particularly useful in dentistry. Thus, Ettinger and Beck (1984) developed a functional definition which categorised the aging population into three distinct groups based upon their ability to seek services. The groups were identified as:

- a. the functionally independent older adult;
- b. the frail older adult; and
- c. the functionally dependent older adult.

It also became apparent that different older adults had different needs and that their functional disabilities affected their ability to accept and receive dental treatment. In this paper a case history of a frail older adult will be presented to illustrate some specific oral needs, problems and issues in clinical geriatric dentistry.

Case history

Mrs J.M. was a 76-year-old married woman who lived at home with her husband, some 20 miles away. Mrs J.M. was of Bohemian origin, spoke English poorly, had less than a high school education and worked as a cook's assistant in a restaurant in her youth. She needed the aid of a walking stick to walk independently. Her husband had brought her to our clinic because several local dentists, after examining her, told her that they could not treat her. Her chief complaint was that she had a lot of oral discomfort and could not eat hard foods and that she wanted to be comfortable.

Medical history

After talking to her husband we found that she had a history of hypertension, osteoarthritis, especially of the knees, and a history of psychiatric disease, including depression for which she had been hospitalised in the past and had received electroconvulsive therapy (ECT). She also had a history of pernicious anaemia.

Drug history

She carried a little card on which her physician had written her medications:

Elavil	50 mg bid
Restoril	20 mg hs.
Moduretic	1 tab/day (with food)
K-Tabls	20 mEq tid
Tylenol #3	1 tab q 6 h
Vitamin B12	(injection: 1/month)

Oral examination

The patient had uncontrolled rhythmic movements of the mouth and tongue, suggestive of extra-pyramidal symptoms. She could control the movements for brief seconds, thus suggesting that it was tardive dyskinesia (Kamen, 1975; Asnis et al., 1977; Bell & Smith, 1978; Blair & Dauner, 1993). Intraorally, her mouth was very dry. The following teeth were present:

R								L							
X	X	6*	5	4*	3*	2	X	1 ¹	2	3	X	5	X	X	X
X	X	X	X	X	3	2	X	X	2*	3*	4*	X	X	X	

* caries

¹ root only

The teeth had the lower 1/3 covered with plaque and there was subgingival calculus, but no teeth except the upper left premolar had probing depths greater than 3mm. There were no occluding pairs of teeth in the retruded position, and the patient functioned by protruding her jaw to find contact with the remaining lower teeth.

Treatment plan

To develop a treatment plan we needed to answer the following questions:

1. What were patient's desires and expectations?
2. What were her dental needs and how complex would her treatment need to be?
3. What would be the impact of her dental needs on her quality of life?
4. How would her medical problems impact on her treatment?
 - a. How stable was her hypertension and could we use vasoconstrictor in her local anaesthetic?
 - b. How severe was her osteoarthritis and how long could she sit in a dental chair?
 - c. Was her depression under control and could she take responsibility for her daily oral hygiene?
 - d. When was the last episode of her psychiatric disease and what medication had caused the tardive dyskinesia?
 - e. How severe was her tardive dyskinesia and would it limit our ability to deliver clinical dental care?
5. Could we discuss her medications with her physician with regard to her dry mouth?
6. How compliant would she be with any oral health care regimen?
7. What would be her ability to tolerate the stress of treatment? How tolerant would her soft tissues be of the physiological trauma created by dentures, especially a mandibular denture?
8. Were there any financial limitations on her being able to receive treatment?

Patient management issues

Patient's desires and expectations

The patient wanted to be comfortable and to be able to chew. She was prepared to do what was necessary and had the support of her family.

Communications

Mrs J.M.'s English was so poor that we needed to make sure her husband was with her when we presented any treatment plan. If he did not seem to understand the informed consent, then we needed to have her daughter, who lives near to the parents, come to the appointment as well.

Dental needs

She had no opposing pairs of teeth and so had poor masticatory function which would require a maxillary and mandibular prosthesis. As she had difficulty chewing and pain when she did, we would need to remove some teeth and restore the remaining teeth.

An evaluation of her radiograph showed caries on most of the teeth on the upper right quadrant and lower left quadrant. There was a broken central incisor on the left side with only the root left.

Quality of life

Her current oral status impacted on the quality of her life in that she was uncomfortable and had difficulty chewing. Any improvement would also improve the quality of her life.

Medical consultation

- a. We recorded her vital signs: her blood pressure was 155/90 mm Hg, with a pulse of 72. It seems her hypertension was controlled by her medications. Even if her blood pressure was controlled by medication, the blood pressure should be monitored and recorded prior to and at the end of every dental appointment, especially if any invasive procedures were to be used (Malamed, 1980). The accepted norm for blood pressure for an older adult is 160/95 mm Hg and a protocol for treatment is shown in Figure 1 (Ettinger, 1993b).

The American Heart Association guidelines for use of epinephrine as a vasoconstrictor in local anaesthetic is not more than 0.04 mg (Mulligan, 1985). This translates to not more than 2½ carpules of 1.8 ccs of lidocaine 2% with $\frac{1}{100,000}$ epinephrine at any one time, making sure that it is not placed in a blood vessel by deliberate aspiration (Jastak & Yagiela, 1983).

- b. She had severe osteoarthritis of the knees and some problems with her neck. However, her hands and fingers were not severely affected. We felt that if we could get her in a comfortable position, sitting in a dental chair was not going to be a problem.
- c. We found out that Mrs J.M. had been treated with chlorpromazine for several years and she had had an acute episode of depression with psychotic features and been hospitalised 15 years ago. The treatment was ECT. The follow-up treatment for the depression was with amitriptyline. Because amitriptyline is so drying, we asked the physician to change her to another tricyclic, desipramine, which is much less xerogenic (Sreebny & Schwarz, 1986; Atkinson & Wu, 1994;

Ettinger, 1996). According to her physician, Mrs J.M.'s depression has been stable for the last few years.

- d. There is an increased risk of myocardial infarction and stroke between 6 a.m. and 9 a.m., so we do not want to see her before 9 a.m. This risk is due to a diurnal increase in platelet aggregability which increases the risk of thrombus formation (Willich et al., 1987; Ridker et al., 1990; Panza et al., 1991).

Daily medications

The influence of her daily medications on Mrs J.M.'s oral condition and on her dental management is shown in Table 1.

Ability to maintain oral hygiene

This is a key factor in decision making as plaque control is essential to maintenance of any teeth within the arch (Berkey et al., 1996). The compliance with this preventive behaviour depends upon the patient having:

- a. *Adequate knowledge* on why she needs to clean her teeth, and understanding that her dry mouth puts her into the high risk category for caries and periodontal disease. Because of the language problems we need to keep the explanations as simple and as practical as possible.
- b. *Adequate motivation* is needed if people are to change behaviours. In Mrs J.M.'s case, she stated that she wanted to keep as many teeth as possible so the prognosis for her cooperation is good.
- c. *Adequate neuromuscular skills* are necessary to hold a toothbrush. One must have adequate vision to see and enough fine hand-eye coordination to be able to put the brush where it will be most effective. The tardive dyskinesia seems to only affect her oral cavity, her hand-eye coordination seems to be relatively good as she crochets while sitting in the dental chair.

As Mrs J.M. has such a dry mouth, we wanted to put her on a home care regimen for persons with a high risk of caries. That is, we suggested that she try an artificial saliva and used a fluoride toothpaste and to begin with a neutral fluoride rinse before going to bed. The one we prescribed was a 0.2% sodium fluoride rinse. We would have liked to use a chlorhexidine rinse but none was available which did not have an alcohol base. Alcohol is contraindicated for patients who have a very dry mouth. We will have Mrs J.M. on 3-month recall; if we see any new carious lesions we will prescribe a neutral sodium fluoride brush-on gel with 5,000 ppm fluoride.

Tardive dyskinesia

It is our experience that with patients with neurological problems such as Parkinson's disease or myasthenia gravis, movement disorders such as tardive dyskinesia, etc., or cognitive disorders such as Alzheimer's disease and other dementias, it is imperative to try and prevent them becoming edentulous in the mandibular arch. One can make a complete maxillary denture or a maxillary removable partial denture (RPD) with very little cooperation from the patient; however, that is not true for the mandible. Therefore, it is important to maintain some key teeth in these at-risk patients.

Moreover, there are a group of individuals who do not accommodate well to a complete mandibular denture because their tissues are very fragile. These persons include those:

1. whose soft tissue has degenerated with extensive denture wearing;
2. with significant reduction in salivary flow rates;

3. whose pain threshold has been altered;
4. whose neuromuscular skills have deteriorated;
5. whose cognitive skills have deteriorated;
6. whose physical health has deteriorated and who are physically frail.

To do restorative care in Mrs J.M.'s mouth we used a mouth prop made out of cotton rolls and taped together to keep her mouth open, and to protect her tongue we used a suction tip with a large metal tongue deflector.

Probability of success

Provided the patient's health remains stable at the present level, then she can cooperate and we can treat her, however:

- a. Communication may be a problem.
- b. Transportation will not be a problem as she has a good support system.
- c. Her xerostomia will increase the risk of caries and periodontal disease and cause problems with wearing dentures. It is important to avoid a complete denture especially on the mandible.
- d. Her tardive dyskinesia will be a management problem and the clenching may hinder her ability to wear a mandibular denture. Also, the ability to record vertical dimension of occlusion and centric relation will be a problem. The use of interim RPD's will help diagnostically.
- e. Her motivation seems to be good and her hand-eye coordination adequate.

The overall probability of success is fair to good and since the patient is in pain it is imperative to deliver emergency care as soon as possible.

The treatment plan

Initial

After evaluating all the modifying factors the following treatment plan was offered to Mrs J.M.:

Maxilla:

Extractions: right side: 1st molar, 1st and 2nd premolar
left side: central incisor and 2nd premolar

Restorations: right side: canine

Mandible:

Extractions: left side, 1st premolar and lateral incisor

Restorations: canine cut down as a vital overdenture abutment

Construction of interim transitional RPD's for the maxilla and mandible to determine vertical dimension of occlusion, neuromuscular skills and home care regimen. After delivery and adjustments the patient was placed on 3-month recall.

At 3-month recall

Oral hygiene was much improved, no caries were seen and Mrs J.M. was functionally comfortable with the dentures. Her husband had suffered a stroke and was in a nursing home; however, Mrs J.M. had excellent community support including neighbours who were prepared to drive her.

Treatment plan (after 3-month recall)

Because Mrs J.M. was doing so well we suggested the following treatment plan:

Maxilla:

surveyed crowns on the left and right canines
restore the incisal of left lateral with composite resin
cast chrome cobalt RPD to restore aesthetic and occlusal contacts

Mandible:

a surveyed crown on the right canine, cast chrome cobalt RPD to restore the dentine cast chrome cobalt RPD to restore occlusal contacts

The patient accepted this treatment plan but during its early phase her husband died which delayed the treatment. However, the treatment was completed and Mrs J.M. was placed on 4-month recall. Because she had no occluding pairs of teeth she was given a night guard to wear on the mandibular arch. She was asked to place some neutral sodium fluoride gel in the night guard each evening.

Conclusions

This case history illustrates that it is possible to do extensive restorative work for an at-risk patient if one understands the influence the social and medical problems have upon the oral cavity and dental treatment. It is imperative that a step-wise approach is used and that no irreversible step is taken until an adequate risk-assessment of potential for success has been made. The key to successful treatment is to understand how the patient functions in his/her environment and how dentistry fits into his/her overall needs.

Table 1: Mrs JM – Influence of daily medication on oral condition and her dental management

Disease	Drug generic name	Potential oral side effects	Management issues
Depression	Amitriptyline (Antidepressive)	Xerostomia Changes in taste Swelling of the tongue Parkinson's-like movement	1. Caries prevention 2. Artificial saliva 3. Potential effect on epinephrine 4. Poor healing 5. Orthostatic hypotension 6. Avoid alcohol
Insomnia	Temazepam (Sedative-hypnotic)	Xerostomia	1. Drowsiness 2. Risk of falling
Hypertension	Amiloride HCL 5 mg With hydrochlorothiazide 50 mg (Diuretic)	Xerostomia	1. Caries prevention 2. Postural hypotension 3. Poor healing 4. Limit saline products 5. Avoid alcohol
Hypokalemia	Potassium chloride (Anti-hypokalemic)	None	Cold extremities
Osteoarthritis	Acetaminophen 300 mg with codeine phosphate 30 mg (Analgesic)	Gingival bleeding Xerostomia	1. Bleeding with extractions or deep scaling 2. Risk of falling 3. Orthostatic hypotension 4. Caries prevention
Pernicious anaemia	Vitamin B12	None	None

Figure 1. Guidelines for treatment decisions regarding persons who have blood pressure readings greater than 160mm Hg systolic or 95mm Hg diastolic

(Modified from: Ettinger, RL 1993. Management of elderly patients in the private practice system. *Int Dent J* 43:29–40.)

• Complete examination and contact physician

- Carotid pulsation
- Headaches (frequent)
- Dizziness
- Vertigo
- Palpitations

- Refer immediately
- No treatment

- No symptoms

HISTORY OF HYPERTENSION

**MANOMETRIC
READING
> 160/95 mm Hg**

NO HISTORY OF HYPERTENSION

**SYSTOLIC / DIASTOLIC
165 to 190 / 90 to 105**

- Complete examination and treatment plan
- Emergency care only
- Check blood pressure at next appointment; if BP still high, refer to physician for evaluation

**SYSTOLIC / DIASTOLIC
190 to 220 / 105 to 120**

- Examine
- Emergency care only
- Reappoint to complete treatment plan after consultation with physician

**SYSTOLIC / DIASTOLIC
> 220 / > 129**

- No treatment
- Call physician & refer immediately

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Medications and oral health

Dr W Murray Thomson

ABSTRACT

PURPOSE – The purpose of the presentation is to examine occurrence of dry mouth and the medication – dry mouth findings from a cohort study of older people which is the first study to use longitudinal medication-exposure data.

METHODS – The presentation uses data from the South Australian Dental Longitudinal Study at baseline in 1991 and again five years later in 1996. At the five-year data collection, resting whole salivary flow rates were measured and xerostomia was estimated using (1) the Xerostomia Inventory and (2) the standard single item ‘How often does your mouth feel dry?’, with the response options ‘never’, ‘occasionally’, ‘frequently’ or ‘always’. For the 20 most prevalent classes of medication, participants were divided into continuous users, starters, stoppers and non-users according to whether each medication type was taken at baseline and five years. The groups’ salivary flow-rates and Xerostomia Inventory scores were compared using analysis of variance and linear regression modelling.

RESULTS – The prevalence of xerostomia in the sample was 20.5%, and that of salivary gland hypofunction (SGH) 22.1%. Some 65% of the sample suffered neither xerostomia nor SGH, and the two conditions coincided in only 5.7% of individuals. The multivariate analyses showed that salivary flow rates were significantly reduced in participants who were on (or who had been on) antidepressants, and were higher in those who were taking hypolipidaemic drugs. Xerostomia Inventory scores were higher in those who were continuous users of narcotic analgesics or anginals, or who had started or stopped taking hormone replacement therapy (HRT) in the preceding five years. The findings of this study suggest: (1) that xerostomia and SGH are discrete conditions and usually occur independently; (2) that current concepts of the association of medication and dry mouth need to be modified; and (3) that dentate individuals taking certain classes of medication may be at higher risk of oral diseases.

PRESENTATION

Older people are thought to be more susceptible to medications which may produce dry mouth. The purpose of this paper is to examine the relationship between dry mouth and particular classes of medication in the first study to use longitudinal medication-exposure data.

Dry mouth

Dry mouth is common among older populations, with a reported prevalence of between 10 and 38%, depending upon the group being studied; around 20% is the most frequently reported estimate. While it is known to be more prevalent in the ‘older old’ and in females, there is no evidence to suggest that this is a feature of the aging process itself; rather, it is thought that older people’s salivary systems are more vulnerable to exogenous factors which may act to reduce salivary flow. Examples of these factors are: certain medications, some chronic inflammatory conditions, and radiation therapy for head and neck tumours.

Should we be concerned about dry mouth? The answer is *definitely yes*: it can significantly affect the quality of life for affected individuals, and there is also the suggestion from prevalence studies –

as yet unsubstantiated by cohort studies – that it is associated with an increased occurrence of dental caries, and can also affect denture function. Locker (1995) has shown that the prevalence of xerostomia in an older population increases over time, and it is imperative that our understanding of the aetiology, epidemiology and natural history of the condition is rapidly improved.

Before proceeding any further in describing the relationship of medications and dry mouth, it is a good idea to examine the two conceptually distinct manifestations of dry mouth.

1. **Salivary gland hypofunction (SGH)**, or hyposalivation, is an observable, chronic reduction in salivary flow rate; as such, it is a *sign*.
2. **Xerostomia** is the subjective feeling of dry mouth, and commonly involves a varied collection of associated *symptoms*.

The relationship between these two manifestations is currently unclear: they may be discrete, occurring separately in the population; they may always occur together in certain affected individuals; or there may be a variable degree of overlap between them. Two circumstances have contributed to the lack of understanding. First, most studies have used either convenience samples of xerostomia clinic patients (Fox et al., 1987), compliant elders (Billings et al., 1996), or dental students (Dawes, 1987); second, the population-based approach has only been used in a small number of studies (Nederfors et al., 1997; Locker, 1993; Gilbert et al., 1993; Osterberg et al., 1984), none of which has measured *both* conditions. It is axiomatic that a comprehensive understanding of the epidemiology and public health significance of a condition requires not only accurate and detailed epidemiological and clinical study, but also unbiased estimates of its occurrence.

1. **Salivary gland hypofunction (SGH)**

SGH is most commonly defined as a resting whole-salivary flow rate of <0.1 ml/min, or a reduced stimulated flow of <0.5 ml/min. Flow rate is estimated by using sialometry; there is the choice of collecting resting or stimulated flows, or whole or glandular saliva. It is thought that the resting whole-saliva flow is probably most important in the long-term protection of the dentition. There are a number of ways in which saliva can be collected, ranging from the relatively unsophisticated 'spit' or 'drain' methods, through to cannulating individual glands and using negative pressure to withdraw secretions (Navazesh & Christensen, 1982).

2. **Xerostomia**

The measurement of xerostomia is more problematic, as the only way to find out about symptoms is to ask the individual concerned. Two approaches have been used to date: (1) the single global question; and (2) a mix of questions covering various experiential and behavioural aspects of dry mouth. The former has been more common and is easier to interpret, while the latter approach has been faced with the problem of analysing the responses to the different questions separately and finding that each gives a different prevalence estimate.

In the past, the single-item approach has been most commonly used, employing questions such as:

- Does your mouth feel distinctly dry?
- Do you sip liquids to aid in swallowing dry foods?
- Does your mouth feel dry when eating a meal?
- Do you have difficulties swallowing any foods?

Does the amount of saliva in your mouth seem to be too little, too much, or you don't notice it?

Do you feel dryness in the mouth at any time?

Do you have mouth dryness?

Is your mouth sometimes dry?

How often does your mouth feel dry?

Does your mouth feel dry?

Each of the population-based studies of xerostomia has used the single global question approach. Osterberg et al. (1984) used the question 'Does your mouth feel distinctly dry?' (binary response option 'yes', 'no'), and conducted measurements of salivary flow on only a small subsample of their study participants. Locker (1993) used the single question 'During the last four weeks have you had any of the following - dryness of mouth?' (binary response option 'yes', 'no') but did not measure salivary flow. Nederfors et al. (1997) used the question 'Does your mouth usually feel dry?' (binary response option 'yes', 'no'), and did not measure salivary flow either. None of those studies provided evidence for the validity of the questions used. Gilbert et al. (1993) reported from a study of a stratified random sample of community-dwelling older Florida residents, which used a number of questions on mouth dryness, but did not measure salivary flow. Their main outcome measure was the question 'Is your mouth sometimes dry?', to which 39% of respondents answered affirmatively. The latter question can be criticised on the grounds that it is probably too inclusive for use as a tool for categorising individuals as 'xerostomic'; certainly, the obtained prevalence estimate is unusually high in comparison to those from the other studies, and indicates that perhaps the word 'often' should have been substituted for 'sometimes'.

There are a number of problems with these past approaches: (1) they have not been used in a multi-item inventory approach to date - the user of any single item must face the inevitable problem that what he/she thinks is being measured actually isn't; and (2) qualitative work has shown that xerostomia has both experiential and behavioural dimensions. A method is needed which will take both types of symptom into account. The Xerostomia Inventory (Thomson et al., 1999) was developed to answer this need, and to enable measurement of the severity of xerostomia symptoms on a continuous scale.

Medications and dry mouth

Almost every dentist is aware of the association between certain medications and dry mouth. However, most of the 'evidence' for the relationship is anecdotal and based largely upon case reports. That which is available from systematic science comes to us mostly from studies of particular subgroups of older people, or from convenience samples of attenders at dry mouth clinics. Lists of xerogenic ('dry-mouth-causing') drugs are available: three which have been widely cited are those by Grad et al. (1985), Handelman et al. (1986) and Sreebny & Schwartz (1986). The list produced by Sreebny & Schwartz (1986) has recently been updated (Sreebny & Schwartz, 1997). These were so inclusive as to be almost useless to anyone wishing to conduct systematic investigation into the relationship between drugs and dry mouth; for example, the Sreebny list alone held 400 different preparations. The utility of such classifications is limited for a number of reasons. First, there is no indication of whether the medications listed are purported to cause xerostomia or SGH, when it is now realised that distinguishing between the two is becoming increasingly important in studying the natural history of those conditions. Second, the variation manifested across such classifications is itself testimony to their arbitrary nature and shaky empirical foundations. Third, even if such a classification is successfully used in a research project,

the question which the researcher will ultimately be obliged to answer is: *which specific medications were associated with the occurrence of xerostomia/SGH?*

In recent years, a number of prevalence studies have provided circumstantial evidence for an association of certain medication types and dry mouth in populations. These are listed in Table 1.

Table 1: Medication types reported to be associated with xerostomia and/or SGH

Medication type	Associated with xerostomia	Associated with SGH
Antihypertensives	Narhi et al. (1992)	Streckfus et al. (1994)
Antipsychotics	Osterberg et al. (1984)	
Antidepressants	Loesche et al. (1995)	ohnson et al. (1984) Loesche et al. (1995)
Antihistamines	Osterberg et al. (1984)	ohnson et al. (1984)
Anticholinergics	Osterberg et al. (1984) Thomson et al. (1993)	
Anxiolytics	Persson et al. (1991) Osterberg et al. (1984)	oesche et al. (1995)
Diuretics	Atkinson et al. (1989)	ohnson et al. (1984) Persson et al. (1991) Osterberg et al. (1984)
Analgesics	Narhi (1994)	
Cardiac agents (including angina medications)	Narhi et al. (1992) Loesche et al. (1995)	
Bronchodilators	Loesche et al. (1995) Narhi (1994)	
Antiulcer drugs	Loesche et al. (1995)	oesche et al. (1995)

The cross-sectional nature of these studies – with exposure and outcome being measured simultaneously – means that their evidence must be regarded as hypothesis-generating, at best; the current state of knowledge on drugs and dry mouth in older populations was most appropriately summarised by Atkinson and Wu (1994), who wrote: ‘the relationship of salivary function and individual medications in the unhealthy elderly is largely untested’.

Nonetheless, there is some evidence beginning to emerge from longitudinal studies that medications are determinants of dry mouth. Locker (1995) examined the predictors for the development of xerostomia over a five-year period in older Toronto people (aged 50 or more), and found that poorer self-rated health status and a greater number of medications being taken at the five-year follow-up predicted the development of xerostomia. Unfortunately, that study looked only at the total number of medications taken, and did not examine particular medication categories.

So what is needed to ensure an adequate investigation of the relationship between medications and dry mouth?

First, we need to be able to adequately capture and analyse the medication data. A numeric, hierarchically based classification such as the recently published MedCap system (Thomson, 1997) has greatly simplified this task. Second, we need a method of measuring xerostomia – preferably as a continuous variable – which takes its multidimensional nature into account. Third, we need a longitudinal design, in which repeated observations are made of participants – this allows the characterisation of exposure *prior to* the measurement of the outcome which is of interest. Fourth, we need a sufficiently large sample to provide enough numbers in medication subgroups for statistical efficiency. Finally, the requisite degree of scientific scepticism is *essential*: an evidence-based approach demands nothing less.

The South Australian Dental Longitudinal Study

The South Australian Dental Longitudinal Study (SADLS) is a cohort study of older people who are living in Adelaide and Mount Gambier. It commenced in 1991 with the recruitment of 1645 participants, and the five-year data collection was completed in 1996, with 939 (57.1%) of the original sample still involved.

Methods

Dry mouth in the SADLS study was measured in three ways:

1. Sialometry was used to estimate resting whole-salivary flow rate, using the spit method.
2. A standard dry mouth question was included as part of the household questionnaire which was administered by telephone. The question was *How often does your mouth feel dry?* and had the response options ‘never’, ‘occasionally’, ‘frequently’ and ‘always’.
3. The multidimensional, 6-item Xerostomia Inventory (XI)¹ was used to obtain a point estimate on an ordinal scale of each individual’s symptoms of dry mouth. It was mailed to each participant for completion before the dental examination.

Scores for the XI’s six items were summed to give a single XI score, with a theoretical range from 6–30.

At five years in SADLS, the mean score among the 649 individuals who supplied XI data was 9.89 (sd, 4.13), and scores ranged from 6 to 27. There were no sex differences in scores, and they were only weakly correlated with age. The correlation of XI scores with responses to the standard question was moderate, but significant.

Medication data in SADLS were collected at both baseline and at five years, thus giving the opportunity for an unprecedented look at their longitudinal effects. At both stages, medication information was coded into numeric, analysable form using the hierarchical MedCap system (Thomson, 1997).

¹ The version of the XI used in this paper was a 6-item precursor to the full 19-item inventory which has been accepted for publication in *Community Dental Health*. The associations with medications are similar for both versions.

The approach of Psaty et al. (1995) was used to allocate participants into one of four groups for each medication category:

- *Continuous users* of a particular category were those who were taking it at baseline and at five years; the assumption was made that exposure between those two times was in fact continuous and not intermittent.
- *Starters* were those who were not taking it at baseline but were at five years.
- *Stoppers* were those who were taking it at baseline but were not at five years.
- *Non-users* were those who were taking it on neither occasion.

No previous analyses of medications and dry mouth have used this longitudinal approach to exposure classification.

Results

The mean resting flow rate among the sample was 0.27 ml/min (sd, 0.22), and 22.2% had a flow rate of less than 0.1 ml/min. These people would normally be labelled as ‘SGH cases’. The flow rate was negatively correlated with the number of chronic medical conditions, and was higher in males than in females (0.29 and 0.25 ml/min respectively).

The mean XI score was 9.89 (sd, 4.13). The XI score was positively correlated with the number of chronic medical conditions. Some 20.4% of individuals answered ‘frequently’ or ‘always’ to the standard question and were thus defined as ‘xerostomic’. This raised the interesting question of how much overlap there was between the SGH and xerostomia cases: traditionally, the two conditions have not been viewed as being different at all. However, there was almost no correlation between flow rate and either the standard question responses or the XI scores, and it was therefore highly likely that the two conditions would be shown to be largely distinct (Table 2).

Table 2: Concurrence between xerostomia and salivary gland hypofunction (SGH)

		Salivary gland hypofunction ^b		Total
		Yes	No	
Xerostomia ^a	Yes	39 (5.7%)	101 (14.8%)	140 (20.5%)
	No	112 (16.4%)	431 (63.1%)	543 (79.5%)
	Total	151 (22.1%)	532 (77.9%)	683 (100.0%)

^a Case definition: standard question response ‘frequently’ or ‘always’

^b Case definition: SGH resting flow rate <0.1 ml/min

This was the case, with only 5.7% of individuals experiencing *both* conditions – this equates to approximately 15% of those who have *either* condition. It is interesting that, regardless of what approach is taken to estimating dry mouth prevalence, an estimate of just over 20% is obtained; perhaps this has contributed to some of the terminological confusion which has been apparent to date.

The 20 most prevalent medication categories were examined for their association with dry mouth. Among the individuals (n = 700) for whom both medication and flow rate data were available,

three categories were associated with changes in flow: the antidepressants, the ACE inhibitor subclass of antihypertensives, and the hypolipidaemic drugs (Table 3).

The antidepressants showed a clearly lower flow rate in the continuous users than in the non-users, with the starters and stoppers in between them. Continuous users of the ACE inhibitors had a markedly higher flow rate than either the starters or the non-users. As an aside, the emergence of these preparations in the 1990s is reflected here in the large number of starters. With the hypolipidaemics, it was apparent that chronic exposure was associated with increased flow rate, with substantially higher mean values in both the continuous users and the starters. This was a totally unexpected finding which has interesting implications for the prevention and treatment of SGH if it can be confirmed in other studies.

Table 3: Mean resting flow rates among medication exposure groups

Medication category	Number	Mean flow rate (sd)
Antidepressants		
<i>Continuous users</i>	12	0.12 (0.08) ^a
<i>Starters</i>	24	0.21 (0.15)
<i>Stoppers</i>	9	0.20 (0.18)
<i>Non-users</i>	654	0.28 (0.25)
ACE Inhibitors		
<i>Continuous users</i>	4	0.57 (0.46) ^b
<i>Starters</i>	122	0.27 (0.19)
<i>Stoppers</i>	0	– (–)
<i>Non-users</i>	573	0.27 (0.25)
Hypolipidaemics		
<i>Continuous users</i>	23	0.36 (0.57)
<i>Starters</i>	35	0.37 (0.26)
<i>Stoppers</i>	12	0.25 (0.16)
<i>Non-users</i>	629	0.27 (0.22)

^a Oneway ANOVA: continuous users and non-users differ

^b Oneway ANOVA: continuous users differ from starters and non-users

The significant associations – together with age, gender and the number of chronic medical conditions – were entered into a linear regression model (Table 4) with flow rate as the dependent variable. This suggested the independence of the medication effects from those of the total number of chronic medical conditions, and indicated that the use of hypolipidaemic drugs in the prevention of SGH might be worth pursuing. The model explained 4.1% of the variance around the mean flow rate.

Table 4: Multivariate model of flow rate

	B	T	Signif. of T
Antidepressants (continuous users)	-0.16	-2.29	<0.05
Hypolipidaemics (continuous users)	0.22	3.30	<0.05
Hypolipidaemics (starters)	0.12	2.77	<0.01
ACE inhibitors (continuous users)	0.31	2.59	<0.05
Female	-0.04	-2.25	<0.05
No. of chronic medical conditions	-0.01	-2.01	<0.05
Constant	0.35	11.27	<0.01

Turning now to xerostomia, two approaches were used. The association of a particular medication with the continuous XI score was examined using ANOVA, and its association with the standard question responses was examined using the Chi-square test. The former can be regarded as examining the *severity* of xerostomia, while the latter examines the *prevalence* of the condition, albeit using a largely unsubstantiated case definition. In the initial stages of the investigation at least, an association was deemed to be an important one if it was confirmed by *both* approaches. Only three categories emerged using this method (Table 5): the diuretics, anginals and the bronchodilators. With the diuretics, those who had started taking them since baseline differed from the non-users. Only the anginals showed the anticipated gradient, with those with higher chronicity of exposure also showing the higher scores. Bronchodilators also showed increased xerostomia with increased exposure, but, with the highest scores among the stoppers, there is the suggestion of either some rebound effect, or that perhaps those who had stopped using those preparations were having to work harder in breathing, and this was manifested in more frequent symptoms of dry mouth.

Table 5: Xerostomia Inventory scores among medication exposure groups

Medication category	Number	Mean XI score (sd)
Diuretics		
<i>Continuous users</i>	78	10.50 (5.05) ^a
<i>Starters</i>	76	10.89 (4.61)
<i>Stoppers</i>	37	9.54 (3.54)
<i>Non-users</i>	433	9.63 (3.90)
Anginals		
<i>Continuous users</i>	20	13.20 (5.69) ^b
<i>Starters</i>	29	11.52 (5.52)
<i>Stoppers</i>	39	10.36 (4.28)
<i>Non-users</i>	536	9.64 (3.92)
Bronchodilators		
<i>Continuous users</i>	18	11.72 (3.63) ^c
<i>Starters</i>	30	11.07 (5.85)
<i>Stoppers</i>	7	14.43 (6.40)
<i>Non-users</i>	569	9.71 (3.98)

^a Oneway ANOVA: starters and non-users differ

^b Oneway ANOVA: continuous users differ from stoppers and non-users; starters differ from non-users

^c Oneway ANOVA: non-users differ from continuous users and stoppers; starters and stoppers differ

The criteria for inclusion were then loosened, so that medications which showed a significant association with the XI but not with the standard question could be included in the model. There were three such medication categories: the antigout preparations, the narcotic analgesics, and thyroxine. Chronic exposure to the antigout drugs was associated with increased XI scores. The narcotic analgesics may have increased xerostomia, but this was not clear-cut, and there was a suggestion of a rebound effect, with stoppers having higher XI scores. Finally, chronic exposure to thyroxine was associated with greater XI scores. Unfortunately, there were insufficient numbers to allow investigation of commonly implicated medications such as the antihistamines, anticholinergics or the antipsychotics.

Along with age, sex and the number of chronic medical conditions, the significant associations were entered into a linear regression model using the XI score as the dependent variable (Table 6).

Table 6: Multivariate model of xerostomia severity (XI score)

	B	T	Signif. of T
Anginals (continuous users)	2.33	2.56	<0.05
Bronchodilators (stoppers)	3.38	2.39	<0.05
Narcotic analgesics (stoppers)	3.49	2.89	<0.01
No. of chronic medical conditions	0.63	5.70	<0.01
Constant	8.29	28.76	<0.01

Continuous use of anginals was associated with more severe dry mouth symptoms, as was having ceased taking bronchodilators or narcotic analgesics since baseline. As with the model for flow rate, the number of chronic medical conditions was a significant predictor.

Significance

This is the first study to report from a longitudinal analysis of individuals' medication exposure and the occurrence of dry mouth; it is argued therefore that the reported associations are all the more compelling for that fact. Moreover, the decision at the design stage to measure xerostomia and hyposalivation separately has been vindicated by the surprisingly clear-cut distinction between the two conditions and their dissimilar associations with the examined medication types. Clearly, more terminological precision is needed in the study and description of dry mouth.

That certain medications *were* associated with dry mouth came as no surprise; rather, what was surprising was the medication types themselves, particularly those which were associated with increases in flow. However, a word of warning is appropriate: it should always be borne in mind that what is being observed may actually be the effect of the underlying chronic medical condition (or conditions), notwithstanding the fact that the medication effects in *both* multivariate models emerged independently of the number of chronic medical conditions. It may yet be that the measurement of these was inappropriate.

So what of the dental profession's clinical advice for the individuals on these medication types? It is apparent that its past inclination to give preventive advice to those on antidepressants was correct all along, given current understanding of the role of saliva in the protection of the dentition. Regarding the somewhat serendipitous finding that the hypolipidaemics may actually enhance salivary flow, there *may* be a role for these agents in the treatment (or prevention) of salivary gland hypofunction. Clearly, further clinical, pharmacological and epidemiological investigation of these

agents is warranted. A final proposition is that individuals who are on xerostomic medications (such as anginals) may face at *least* the same degree of caries risk as those on hyposalivatory medications, as their more severe symptoms of dry mouth are likely to drive them to indulge in xerostomia-alleviating behaviours such as sucking sweets or having frequent sips of sugary or erosive liquids. Perhaps it is these agents about which dentists should be far more concerned than those which reduce salivary flow, not least because of the much lower prevalence of the latter. There is therefore a need to direct intensive preventive advice and efforts to those individuals as well.

Acknowledgements

Dr Mohammad Ketabi is thanked for his assistance with the study. The SADLS study was funded by the National Health and Medical Research Council of Australia, and by the United States National Institute of Dental Research Grant RO1-DE09588.

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Dental services for older adults

Professor John Spencer

ABSTRACT

PURPOSE – The purpose of the presentation is to identify different risk groups among older adults; to examine their access to dental care; and to explore alternatives for addressing their requirements for dental care.

METHODS – The presentation draws on data from the National Oral Health Survey of Australia 1987/88, the National Dental Telephone Interview Surveys 1994/95/96, the Adult Dental Programs Survey 1995/96 and the South Australian Dental Longitudinal Study 1991/93/96. Living arrangements, functional and financial independence, and dentate status are used as the key parameters to identify the diversity in oral health status and dental care needs among older adults.

RESULTS – A range of dental treatment programs are required for the different risk groups formed from these parameters. At the simplest level this includes hygiene and maintenance care, but there must also be a capacity to provide palliative and more complex care. Consequently there is a need for specific and novel dental health programs for older adults. While the historical circumstances of most of the old (in relation to social and economic cycles, and the development of skills and technology within dentistry) have caused high levels of edentulism and tooth loss, subsequent cohorts of older adults present a substantial public dental health challenge both because of their increasing numbers and their retention of natural teeth. Recommendations have been supported for addressing the challenge: improving advocacy; establishing new dental health targets and monitoring; establishing and evaluating demonstration programs applying preventive strategies; and focusing dental education toward the empathy, understanding and skills required to improve dental services for older adults.

PRESENTATION

The provision of dental services to older adults has lacked attention. Need and demand for dental services has been low, leading to widespread neglect of the oral health of older adults. The high rates of edentulism of the past led to low rates of dental visits, and limited percentages of older adults faced dental expenditures, which were usually not catastrophic or continuing. There has, therefore, been a tendency to under-estimate the challenge presented in the provision of dental services for older adults.

This situation is rapidly changing. A combination of demographic, oral epidemiologic and social factors are creating a significant challenge to dental and health personnel in the provision of dental services for older adults (NHMRC, 1994). These factors include:

- increasing numbers and proportion of older adults in the population;
- decreasing prevalence of edentulism;
- widespread and extensive experience of dental diseases and disorders;
- improved self-image and attitudes toward oral health;
- increasing infrastructure and political influence of representative groups;
- improved attitudes of the community toward older adults.

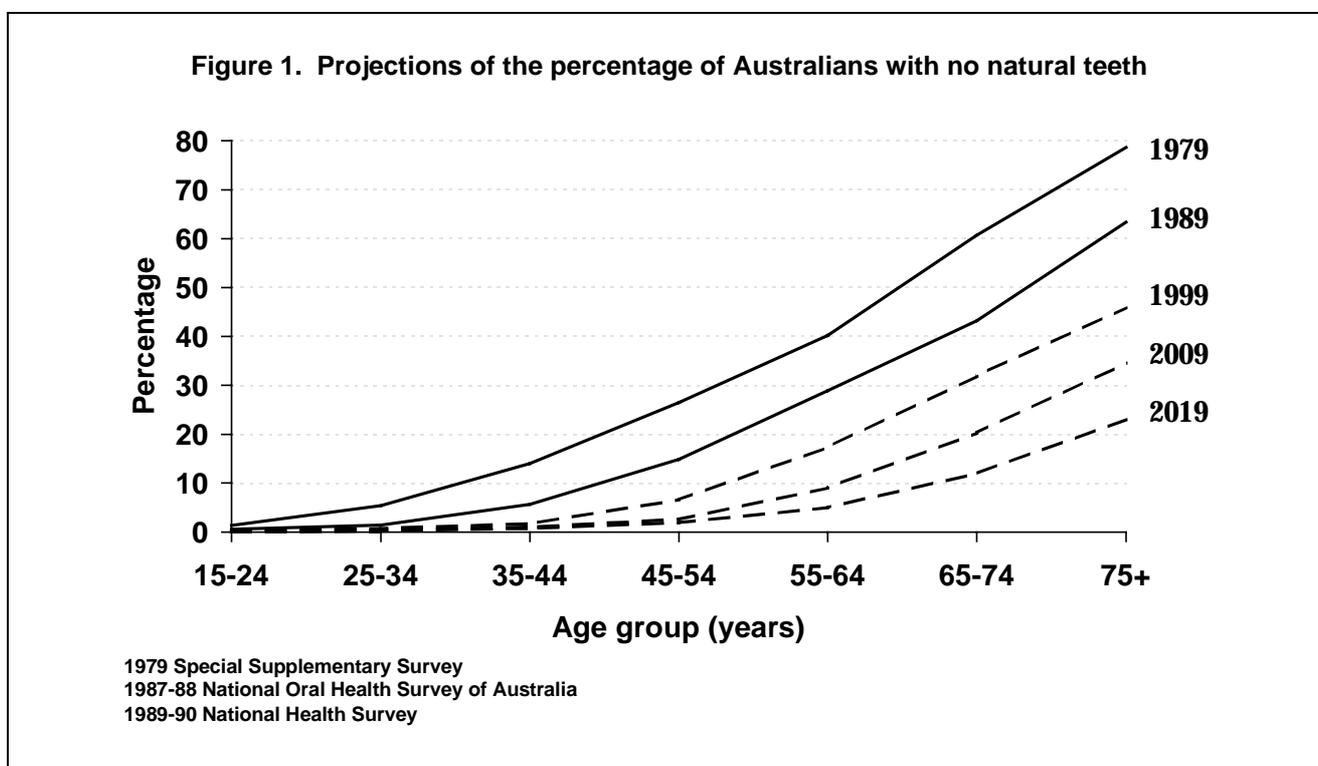
Together these factors are building a significant new challenge – the equitable provision of dental services so as to optimise the oral well-being of older adults.

The purposes of this presentation are:

- to identify changes in risk and different risk groups among older adults;
- to examine their access to dental care; and
- to explore policy responses for addressing their requirements for dental care.

Changes in risk and risk groups among older adults

Dental caries, whether coronal, root, or secondary caries, and periodontal diseases are the oral diseases which have the most extensive impact among older adults (NHMRC, 1993). In the past, the burden of their impact in older adults was reduced by edentulism and missing teeth, but the retention of teeth is increasing (National Health Strategy, 1992).



Edentulism is decreasing rapidly. It has gone from being the predominant oral presentation to being the status of a minority of older adults. Importantly, the prevalence of edentulism is projected to decrease further across the next two decades (Figure 1).

Edentulous and dentate individuals have quite different oral health needs (Table 1).

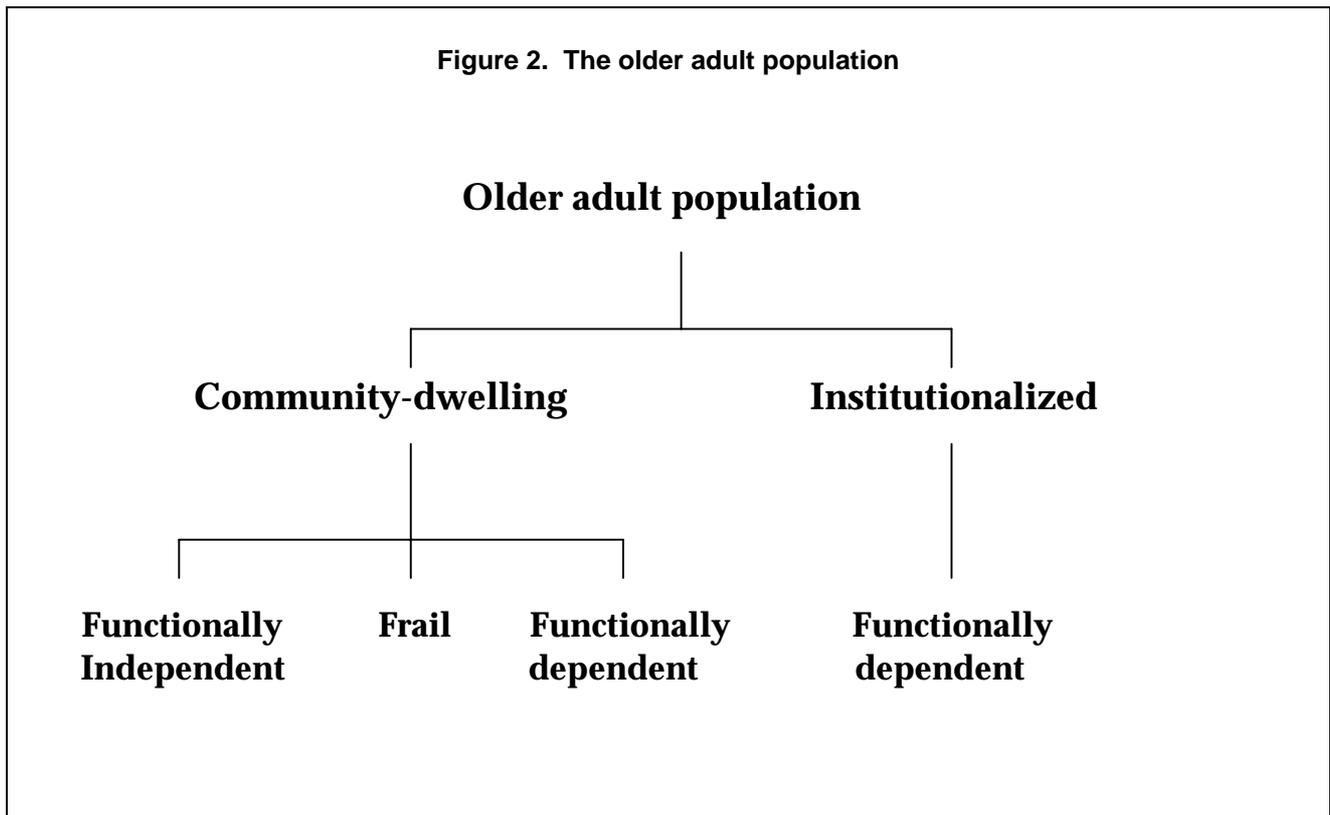
Table 1. Oral health needs of dentate and edentulous individuals

Dentate Status	Dental needs	Incidence	Skill, intensity, duration of services
Edentulous	Replacement	Low	Low
Dentate	Prevention/maintenance	High	High
<p><i>Resource requirements = Incidence x Skill, intensity, duration of services</i></p>			

The edentulous require replacement of natural teeth with dentures and maintenance of oral hygiene. The incidence of this need is low and while the skill level required can vary, the intensity and duration of dental services required is low. This is in contrast to the dentate, who require prevention of oral disease and maintenance of oral function. There is a high incidence of these needs and the skill, intensity and duration of the dental services required to satisfy them is high. The product of the incidence of need, and the skill, intensity and duration of services required determines the resources required for dental services. The decreasing prevalence of edentulism is creating an increasing requirement for resources to satisfy the dental needs of older adults.

These dental needs are unevenly distributed, adding to the heterogeneity of the older adult population.

Figure 2. The older adult population

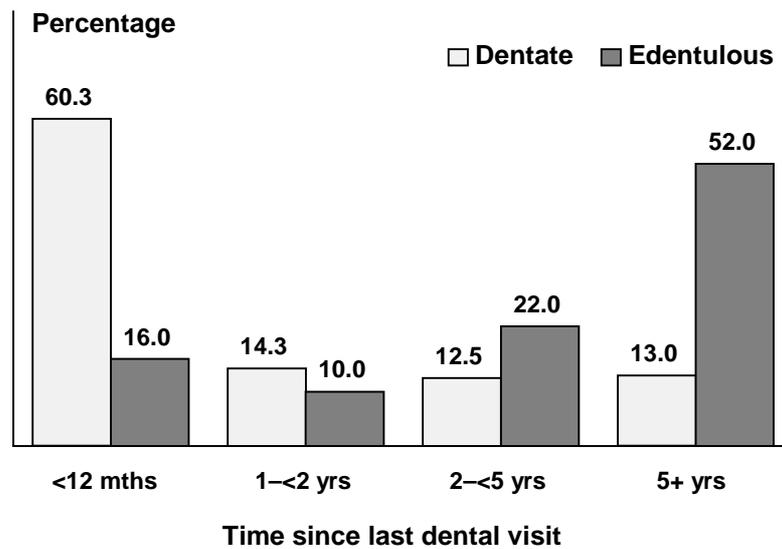


The older adult population can be divided into the community-dwelling and the institutionalised, and subsequently into the functionally independent, the frail who require support, and those who are functionally dependent (Ettinger & Beck, 1984a) (Figure 2). The risk of dental diseases and disorders increases across these groups as dependency increases. The nature and balance of dental services required to promote oral health, relieve symptoms, and restore and maintain oral function, and the educational focus for patients or caregivers, will also vary by the dentate status of older adults in each group.

Access to dental services

The requirements for dental services should be managed by the equitable access to dental services. Dental services must be available, obtainable and appropriate to the needs of the older adult (Lewis et al., 1976).

Figure 3. Use of dental services by community-dwelling older adults (65+ years)



NDTIS 1994; community-dwelling older adults

Among dentate older adults, 60% have visited in the last 12 months and a further 14% in the last two years. In contrast, only 18% of the edentulous have visited in the last 12 months and a further 10% in the last two years (Carter et al., 1995) (Figure 3).

The decline in edentulism is, therefore, expected to be associated with an increase in the use of services. However, this will only occur if the factors associated with edentulism are not replaced by concomitant individual, dentist or structural barriers to accessing dental services (Cohen, 1987; FDI, 1986; Kiyak, 1989; Berkey et al., 1988; Dolan & Atchison, 1993).

For the patient, the potential barriers to accessing dental services include:

- unawareness of need for dental services because they
 - feel that they have no problems
 - think the problem is one of aging
 - think the problem is not important;
- lack of transportation, or restrictions on mobility;
- co-morbidity;
- caregiver unavailability;
- expense of dental services; and
- dental fear.

At the dentist level, the potential barriers to accessing dental services include:

- concerns about adequacy of education and conflicting practice pressures and demands;
- lack of empathy; and
- low rate of return/reimbursement through longer times needed to provide services.

At the structural level, the potential barriers to accessing dental services include:

- lack of interest by carers or nursing staff;
- transportation difficulties;
- difficulty in finding dentists to attend the functionally dependent;
- lack of portable equipment; and
- poor working conditions in homes or institutions.

These potential barriers are important in shaping the policy responses to the emerging challenge of dental services for older adults.

Policy responses

The dental requirements of older adults cannot be met through existing arrangements for adult dental services. Such services fail to address the needs of significant groups among older adults, such as the 10% of older adults who are functionally dependent, with approximately 5% community-dwelling and 5% institutionalised; or the 20% of older adults who are frail and need considerable long-term support (Ettinger & Beck, 1984b). Even among the 70% of older adults who are functionally independent, many face potential barriers that will not be overcome without purposeful program development. For example, nearly two-thirds of functionally independent older adults are financially disadvantaged, creating affordability and financial hardship issues in the use of the predominant private practice mode of service delivery.

The first requirement for any effort to address the challenge of providing dental services to older adults is advocacy: pleading and supporting calls for more readily available and flexible dental services. Such advocacy needs to be built upon a knowledge of the demography, oral epidemiology and social circumstances surrounding older adults (WHO, 1986; Oral Health Working Group, 1988).

Specifically, there is a need to document and analyse (Brown, 1991):

- the extent and combinations of oral diseases/disorders;
- co-existing medical or psychosocial factors;
- the extent of oral dysfunction; and
- the barriers to existing dental services.

Advocacy based on such documentation and analysis needs to be followed and supported by:

- establishing new dental health targets for older adults;
- monitoring progress toward them; and
- establishing standards of care.

Such targets and standards help define the priorities and provide leverage for obtaining funds (Horowitz, 1995). Targets and standards provide a focus for the efforts of community groups, dentists, researchers, administrators and policy-makers. That focus needs to be directed toward building a range of programs that provide equitable access to appropriate dental services so as to optimise the well-being of older adults.

The high incidence of dental caries and periodontal diseases in the vast majority of now dentate older adults calls for much greater emphasis on disease prevention (Brastiris, 1987). Preventive

programs need to be inclusive of older adults (Gift, 1988). This includes population strategies like water fluoridation and individual strategies like the use of fluoride toothpastes and mouthrinses, as well as dietary control of the frequency of sugary food or acidic drink consumption.

Programs for dental services need to recognise the heterogeneity of the older adult population. Specific interventions need to be tailored to the needs and circumstances of the major subgroups among older adults. Among the functionally dependent there is a hierarchy of needs. All functionally dependent older adults should have access to all levels of intervention, but the intensity of maintenance care provided should be the result of rational treatment planning for the individual patient. The provision of services needs to be a cooperative effort by caregivers, dental auxiliaries like dental hygienists practising under only general supervision, and formal domiciliary dental services.

For the frail aged, education and support needs to be provided to maximise their own capacity to maintain their oral health. Preventive aids and transportation assistance when seeking routine dental care are essential. Such activities require an involvement of aged-care services in the identification and provision of support for the frail aged.

The functionally independent should be encouraged to maintain periodic use of routine dental services. Such encouragement needs to be backed, as with the other groups, by an assurance of access through government financial support, where appropriate, for care sought in the private sector, or the provision of free public dental services (Spencer, 1993).

Such program directions might be pursued initially through demonstration projects for dental services for older adults. Demonstrations are projects carried out primarily to test or extend the applicability of already existing knowledge (Sechrest, 1985). Much needs to be learnt, or where there have been existing services, documented, about the applicability of alternative arrangements in effectively and efficiently providing the required dental services.

It is only after such demonstration projects have been conducted that access to dental services should be assured by implementation of wider programs.

An increasing emphasis on delivery of dental services to older adults needs to be matched by changes in dental education and research (Ettinger & Beck, 1984). Dental education should provide a greatly improved understanding of and competency in the provision of geriatric dental services. To do so there needs to be:

- an adequate and integrated curriculum in geriatric oral health within both dentist and dental auxiliary education;
- specific clinical exposure to provision of dental services to the homebound and institutionalised;
- identifiable teaching units that can give focus to teaching and research, and provide professional leadership; and
- opportunities for postgraduate training, leading to specialisation.

While much of the necessary clinical understanding and competency for provision of geriatric dental services can be obtained in broader curriculum areas, there is a need to give focus to geriatric oral health through the establishment of academic posts specifically in this discipline. This would not only provide the necessary focus for the responsibility of providing an adequate undergraduate experience, but it also opens up the possibility of postgraduate training and systematic research programs. The range of research is potentially broad, leading naturally to a degree of segmentation of research interests across the university sector.

Summary and conclusion

Changing demographics and oral health are creating a significant challenge for the equitable and efficient provision of dental services to older adults. A consequence of the increased retention of teeth is an expanded pool of people and teeth at risk of dental diseases and disorders among older adults. However, this fundamental change in the dental needs of older adults is yet to be addressed.

In examining the challenge, the heterogeneity of the older adult population offers a necessary starting point. Variation in access to dental services and the range of individual, dentist and structural barriers give direction to the possible policy responses. Advocacy, based on documentation and analysis of oral health and needs, supported by the establishment and monitoring of oral health targets and standards of care, could lead to a range of demonstration projects from which much could be learnt about what works for whom. Such programs should be tailored to the circumstances of subgroups of older adults. At the same time dental education needs to focus on the understanding and competency required to prepare dental personnel for the delivery of dental services to older adults.

Such policy responses can sustain an informed environment for meeting the challenge of achieving equitable provision of dental services so as to optimise the oral well-being of older adults.

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