



The Adelaide Dental Study of Nursing Homes Baseline Data Collection Report 1998

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AUSTRALIAN INSTITUTE OF
HEALTH & WELFARE



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THE UNIVERSITY OF ADELAIDE

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Suggested citation

Chalmers JM, Hodge CP, Fuss JM, Spencer AJ, Carter KD (1999). *The Adelaide Dental Study of Nursing Homes Baseline Data Collection Report 1998*. AIHW Dental Statistics and Research Unit, The University of Adelaide.

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Table of Contents

List of Tables	v
List of Figures	vi
Acknowledgements.....	viii
1 Introduction.....	1
1.1 Background	1
1.2 Aims of the study	6
1.3 Study components.....	6
2 Questionnaires to all practising Adelaide dentists and all Adelaide Directors of Nursing	8
2.1 Pilot study	8
2.2 Methods.....	13
Ethical considerations.....	13
Timeline, study design, sample size and sampling.....	13
Measurement of variables, instruments of measurement and collection of data.....	14
Database maintenance and analysis of data.....	14
2.3 Response rates.....	16
2.4 Results	16
Directors of Nursing.....	16
Dentists' practice characteristics and training.....	16
Dental care provision	17
Attitudes of dentists and Directors of Nursing.....	18
Problems with the organisation and provision of dental care for nursing home residents	19
Comments.....	31
Directors of Nursing	31
Dentists	32
2.5 Discussion	34
Dental care provision	34
Attitudes toward nursing home dentistry.....	35
Problems encountered with the organisation and provision of dental care for residents	37
Study limitations.....	39
3 Clinical dental inspections of residents from randomly selected Adelaide Nursing Homes.....	40
3.1 Methods.....	40
Ethical implications of the clinical dental inspection component	40
Timeline, study design, sample size and sampling.....	40
Measurement of variables, instruments of measurement and collection of data.....	41
Database maintenance and analysis of data.....	44
3.2 Response rates.....	45
3.3 Results	46
Dentate status and related characteristics	46

List of Tables

Table 1:	Australian Geriatric Dental Research Investigations	3
Table 2:	Pilot Study – Dental service provision in South Australian country nursing homes	10
Table 3:	Pilot Study – Respondents’ ratings of barriers to providing adequate dental care for residents (%) (n=24 dentists; n=31 DONs/Administrators)	11
Table 4:	Pilot Study – Respondents’ selection of the most important barriers to providing adequate dental care for residents (%) (n=24 dentists; n=31 DONs/Administrators)	12
Table 5:	Response rates for mailed questionnaires	16
Table 6:	Directors of Nursing – age group by sex (n=86)	16
Table 7:	Dentists’ practice characteristics and provision of dental care for nursing home residents by sex (%)	22
Table 8:	Dental service provision in nursing homes as reported by dentists and Directors of Nursing	24
Table 9:	Attitudes toward nursing home dentistry as reported by dentists and Directors of Nursing	25
Table 10:	Respondents’ ratings of frequency of problems encountered with the organisation and provision of dental care for residents (%) (n=318 dentists*; n=97 Directors of Nursing)	27
Table 11:	Respondents’ selection of the three most frequent problems encountered with the organisation and provision of dental care for residents (%) (n=318 dentists*; n=97 Directors of Nursing)	28
Table 12:	Differences in standardised mean scores from ratings of problems by dentists and DONs (n=318 dentists; n=97 DONs)	29
Table 13(a):	Logistic regression – Dentists’ and DONs’ ratings of problems encountered with the organisation and provision of dental care for residents	30
Table 13(b):	Logistic regressions – Dentists who provided care at nursing homes during the previous year	30
Table 14:	Participation and response rates for individual nursing homes	45
Table 15:	Dentate status – maxilla by mandible (n=224)	46
Table 16:	Demographic and medical characteristics by dentate status (n=224) (%)	50
Table 17:	Weight change and chewing ability by dentate status (n=224) (%)	52
Table 18:	Dental history by dentate status (n=224) (%)	53
Table 19:	Oral hygiene care by dentate status (%)	54
Table 20:	Reasons why MMSE not completed (n=23)	55
Table 21:	Dental history by MMSE score (n=201) (%)	57
Table 22:	Oral hygiene care by MMSE score (n=201) (%)	58
Table 23:	Difficulties staff encountered with oral hygiene care by MMSE score (n=201) (%)	59
Table 24:	Dental history by ADL score (n=224) (%)	61
Table 25:	Oral hygiene care by ADL score (n=224) (%)	62

List of Tables (cont.)

Table 26:	Difficulties staff encountered with oral hygiene care by ADL score (n=224) (%)	63
Table 27:	Dentate status by denture status – maxilla (n=224).....	64
Table 28:	Dentate status by denture status – mandible (n=224)	64
Table 29:	Types of dentures worn by participants (n=224) (%)	65
Table 30:	Denture wearers – denture problems by dentate status (%)	66
Table 31:	Prevalence of oral mucosal lesions/conditions (%)	67
Table 32:	Tooth status (n=76).....	68
Table 33:	Coronal caries (n=76)	69
Table 34:	Root caries (n=76)	70
Table 35(a):	Nursing home size by residents’ characteristics (%) (n=76).....	71
Table 35(b):	Nursing home size by oral diseases (%) (n=76)	72
Table 36(a):	Retained roots (n=76)	73
Table 36(b):	Retained roots (n=76)	74
Table 37:	Dentate residents – attrition (n=76)	75
Table 38:	Residents’ conditions precluding periodontal inspection (%)	75
Table 39:	Dentate residents – Mean Plaque Index Scores (weighted) (n=76)	77
Table 40:	Prevalence of periodontal disease (n=18)	78
Table 41:	Tooth status by residents’ characteristics (n=76)	79
Table 42:	Coronal caries by residents’ characteristics (n=76).....	81
Table 43:	Root caries by residents’ characteristics (n=76).....	83
Table 44:	Denture treatment needed and wanted – upper denture.....	84
Table 45:	Denture treatment needed and wanted – lower denture	84
Table 46:	Participants’ perceived dental need by dentate status from interview (n=224).....	85
Table 47:	Dentate residents – normative treatment needs (n=76)	85

List of Figures

Figure 1:	Geriatric dental research.....	5
Figure 2:	Dentists' awareness of ADA scheme by age group (n=394)	26

Acknowledgements

The baseline data collection for the Adelaide Dental Study of Nursing Homes was funded by the Australian Dental Association (SA Branch) and the AIHW Dental Statistics and Research Unit (DSRU). Many thanks to Dr Chris Hodge and Dr Janet Fuss who gave their time, knowledge and skills to conduct the dental inspections for the nursing home residents. The assistance provided by the interviewers/recorders – Ms Marilyn Jolly and Dr Rachel Mathew – the collection of data is acknowledged and greatly appreciated. The assistance of Mrs Judy Stewart and Mr Knute Carter from the AIHW DSRU with computing support and statistical analysis was invaluable, as was the administrative and publication assistance provided by Mrs Lorna Lucas of the AIHW DSRU.

Many thanks also to the Directors of Nursing and nursing home staff who assisted so enthusiastically with this study, and to the nursing home residents and their families/guardians who kindly participated.

The contributions of dental products from the Colgate and Auspharm companies are acknowledged and these products were greatly appreciated by the nursing home residents and their carers.

1 Introduction

1.1 Background

Along with the increase in size and changing composition of older adult populations in industrialised countries, there has been a recent growth in the amount of research focusing on the oral health of these older adult populations (Berkey, 1990; Dolan & Atchison, 1993; Warren et al., 1997). This growth in research has also occurred in Australia (Vowles et al., 1979; Crack et al., 1980; Walker, 1984; Widdop, 1986; Stockwell, 1987; Homan et al., 1988; Kirk, 1988a and 1988b; ADA, 1991; Bergman et al., 1991; Chapman, 1991; Vinczer & Spencer, 1991; Slade et al., 1993; Slade & Spencer., 1994; Slade & Spencer, 1995; Slade et al., 1996; Slade & Spencer, 1997; Thomson et al., 1995; NHMRC, 1994; Chalmers & Kingsford Smith, 1998b), where the decreasing prevalence of edentulism and the increasing numbers of functionally dependent and disabled older adults are producing a population of dentate older Australians with dental needs that are very different from those of older adults in past years (AIHW, 1995; Carter, 1997). However, the magnitude of oral health problems in older Australians is yet to be accurately researched and quantified (Kirk, 1988a; NHMRC, 1994).

In the field of Geriatric Dentistry, the most useful way to describe older adults entails using their residential location and the status of their functional abilities (Chalmers, 1998a). Compared with using residential location alone, the additional use of functional status in geriatric medical and aging research makes it possible to more accurately quantify the abilities, needs and health status of sub-groups of older adults. Functional status is measured using scales to assess the Activities of Daily Living (ADLs) (Katz et al., 1963) and the Instrumental Activities of Daily Living (IADLs) (Lawton & Brody, 1969) that an older adult is able to complete, such as feeding, toileting, dressing and managing medication, shopping and handling finances. Older adults can then be described (Ettinger & Beck, 1984) as being:

- functionally independent (they do not require assistance with ADLs or IADLs);
- frail (they require assistance with some ADLs and/or IADLs);
- functionally dependent (they require assistance with most or all ADLs and IADLs).

Also, it should be noted that these functional status designations are not static; an individual's functional status may change, for example, with their rehabilitation, further illness or change in carer status (Ettinger & Beck, 1984).

The importance of assessing functional status in older adults is highlighted by recent data concerning nursing home residents, as reported by the Australian Institute of Health and Welfare (AIHW), in which the heterogeneity and diversity among nursing home residents including their functional abilities is described (AIHW, 1998). Functional dependence was found to be one of the main indicators of need for care for nursing home residents, with variation evident in the levels of residents' functional dependence (AIHW, 1998).

The bulk of Australian geriatric dental research has generally been conducted with two sub-groups of older adults, who were chosen solely on the basis of their

residential location: the community-dwelling older adults, and institutionalised older adults residing in nursing homes, hospitals and hostels (Table 1). Indeed, there has often been an inaccurate assumption made in this dental research that these groups have an associated static functional classification. For example, that all 'nursing home, hospital and hostel residents were functionally dependent' and that all 'community-dwelling older adults were functionally independent', without any comprehensive assessment being made of participants' functional abilities.

Only one of the Australian dental investigations presented in Table 1 used a comprehensive assessment of participants' functional status (Gibson et al., 1984). However, no clinical dental inspection was completed for participants in that study, with self-reported dentate status the only oral health data collected (Gibson et al., 1984). Several studies did ask one or two questions related to functional status (Table 1). These questions included investigating participants' use of transport (to travel to receive dental treatment), their degree of 'dependency' (partial or total), their mobility (ability to walk, and capacity to be treated in a dental chair, wheelchair, or bed), their use of home-help services and their ability to do shopping (Vowles et al., 1979; Stockwell, 1987; Homan et al., 1988; Slade et al., 1993). It is essential that more comprehensive assessments of functional status, in addition to medical, cognitive, social and financial status, are included in geriatric dental research investigations to accurately describe and quantify the oral health status and needs of older Australians.

Traditionally, Australian geriatric dental research has been cross-sectional in nature and has focused on the assessment of oral health status using dental indicators of oral diseases and conditions, and general demographic characteristics (Table 1; Figure 1). All studies have collected general demographic information using an interview combined with an audit of records and/or consultation with carers. In addition, many of the studies asked questions concerning participants' dental pain, dental treatment needs and general dental history. A few studies did collect information concerning medical history, medications and length of time in institution (nursing home). No studies completed cognitive testing procedures for participants. Several studies made an assessment of participants' 'treatability' for dental care, including urgency of care required, type of care and location of care. Several studies used non-dental personnel to conduct the dental inspections, or completed them only for dentate residents. Nearly all assessed oral hygiene status, dentate status, and dental needs, but did not complete a comprehensive dental charting of teeth, dentures and oral soft tissues. Only recently have investigations collected surface level caries data for dentate participants, and used epidemiological criteria to assess dentures and oral soft tissues (Slade, 1992; Chalmers, 1998b). The collection of longitudinal oral health data concerning the incidence of dental conditions and diseases in specific groups of older adults has been limited to The South Australian Dental Longitudinal Study of community-dwelling older adults (Slade et al., 1993, 1995, 1997), and a study of a population of cognitively and mentally impaired older adults in Central Sydney (Chalmers, 1998a).

To target dental services and programs appropriately and effectively, more comprehensive longitudinal data is needed concerning the onset and progression of oral diseases and conditions, so that those older adults at highest risk can be identified. Also, more information is needed concerning Australian geriatric dental service provision and utilisation, as well as barriers and problems accessing geriatric dental services, and the influence of these on older adults' oral health status (Gibson et al., 1984; NHMRC, 1994). Figure 1 illustrates the relationships among these areas involved in geriatric dental research.

Table 1: Australian Geriatric Dental Research Investigations

Author and year	State	Information collected			Functional status assessment		Participant sub-groups of older adults					
		Interview	Dental inspection	IADL/ADL scales used	No. of questions asked	Community-dwelling	Homebound	Hospital	Hostel	Nursing home	Handi-capped	Cognitive/mental/neurological disorders
Vowles 1979	SA	Yes	No	No	2		•			•		
Crack 1980	Vic	Yes	Yes	No	3		•		•	•		•
Gibson 1984	NSW	Yes	No	Yes (IADL)	7	•						
Walker 1984	SA	Yes	Yes#	No	0			•	•	•		
Homan 1986	Qld	Yes	Yes	No	1			•	•	•		
Stockwell 1987	WA	Yes	Yes	No	1			•	•	•		
Bergman 1991	Vic	Yes	Yes (dentate)	No	0	•		•				
Chapman 1991	Qld	Yes (carers)	No	No	0							•
King 1992	NSW	Yes (carers)	No	No	0					•		
Slade 1992*	SA	Yes	Yes**	No	2	•						
Lau 1994	NSW	Yes	No	No	0	•						
Chalmers 1998b*	NSW	Yes	Yes**	No	1							•
King, personal communication, 1998	NSW	Yes	No	No	1	•			•			
Chalmers, personal communication, 1999*	SA	Yes	Yes**	Yes (ADL/IADL)	12	•						•

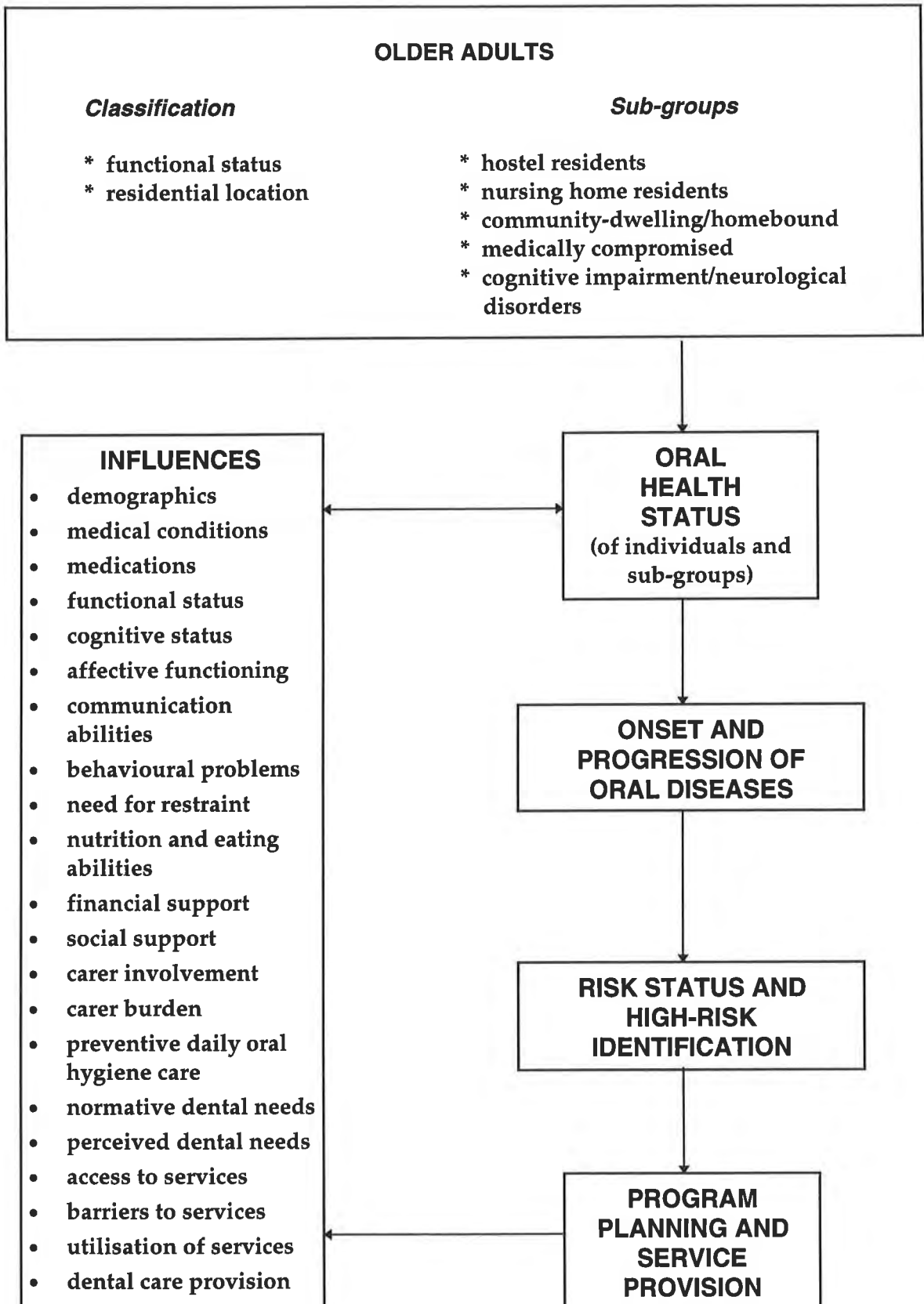
* Longitudinal Studies

** Surface level epidemiological data collected

Dental inspection conducted by nursing sister for edentulous participants

The Adelaide Dental Study of Nursing Homes was instigated by the ADA (SA Branch) and the AIHW Dental Statistics and Research Unit in 1997 to provide comprehensive information concerning the incidence of oral diseases and conditions in those older South Australians who reside in nursing homes. This information will assist the ADA (SA Branch) with the evaluation and improvement of its Nursing Home Dental Scheme linking private dentists with local nursing homes. The study was also needed to provide current information concerning dental service provision to Adelaide nursing homes, and the attitudes of dentists and Directors of Nursing toward nursing home dentistry. There are nearly 7000 nursing home residents in South Australia and approximately 5000 in Adelaide (AIHW, 1998). With the substantial changes to the Australian aged care system in recent years, the need to update and expand the information obtained in two previous cross-sectional investigations of South Australian nursing home residents was apparent (Vowles et al., 1979; Walker, 1984). To improve the comprehensiveness and usefulness of the information available, the Adelaide Dental Study of Nursing Homes collected data concerning residents' medical, functional, cognitive, social and financial status as well as general demographic and oral health data. Data from this study, together with similar comprehensive incidence data from The South Australian Dental Longitudinal Study and a study of community-dwelling older adults with dementia, will assist with the quantification of oral health problems and the onset and progression of oral diseases in older adults, as well as the identification of groups of older Australians at high risk for developing oral diseases.

Figure 1: Geriatric dental research



1.2 Aims of the study

The purpose of this longitudinal study, the Adelaide Dental Study of Nursing Homes, is to investigate the oral health status of a randomly selected sample of institutionalised older adults residing in nursing homes in Adelaide, South Australia.

The study aims to:

1. quantify the dental care provided for Adelaide nursing home residents by Adelaide dental professionals in the 12 months prior to baseline data collection;
2. investigate the attitudes of Adelaide dentists and Directors of Nursing toward dental care for nursing home residents;
3. identify the problems most frequently encountered with the organisation and provision of dental care for residents of nursing homes, as reported by dentists and Directors of Nursing;
4. determine the dentate status of Adelaide nursing home residents and to identify any demographic, medical, functional, cognitive, weight change, chewing ability, dental history or oral hygiene care characteristics distinguishing dentate and edentulous residents;
5. identify dental history and oral hygiene care characteristics that are associated with more severe cognitive impairment and higher functional dependency;
6. determine the prevalence of oral diseases and conditions (e.g., coronal caries, root caries, periodontal diseases, attrition, oral mucosal lesions, and denture problems) in residents of Adelaide nursing homes;
7. identify characteristics of medical status, functional status, cognitive status, weight change, and chewing ability that are associated with oral diseases and conditions in Adelaide nursing home residents;
8. compare normative and perceived needs for dental treatment among Adelaide nursing home residents;
9. develop specialised epidemiological dental inspection procedures for nursing home residents; and
10. determine the incidence of oral diseases and conditions (e.g., coronal caries, root caries, periodontal diseases, attrition, oral mucosal lesions, and denture problems) in residents of Adelaide nursing homes one year after the baseline dental inspections.

1.3 Study components

This report will present the study methods, results and discussion for each of the following two components of the baseline data collection for The Adelaide Dental Study of Nursing Homes:

- questionnaires to all practising Adelaide dentists and all Adelaide Directors of Nursing (Aims 1–3);
- clinical dental inspections of residents of randomly selected Adelaide nursing homes (Aims 4–9).

Conclusions and recommendations from each of these components will be presented at the end of the report.

Aim 10 will be addressed in 1999 by the collection of data at one year from baseline. This one year follow-up data collection will be funded by an Australian Dental Research Fund Grant and by the ADA (SA Branch) and AIHW DSRU.

2 Questionnaires to all practising Adelaide dentists and all Adelaide Directors of Nursing

2.1 Pilot study

A pilot study was conducted in late 1997, involving all 24 SA country dentists registered with the ADA (SA Branch) Nursing Home Scheme and the Directors of Nursing (DONs) and Administrators of the 31 SA country nursing homes listed with the Aged Care Division of the Commonwealth Department of Health and Family Services.

Questions included in the pilot questionnaire covered the following topics:

- dental services that had been provided by dental staff for nursing home residents in the previous 12 months;
- attitudes toward dental care for nursing home residents;
- awareness of changes to hygienist regulations;
- awareness of the ADA Nursing Home Dental Scheme;
- age and sex of the respondent; and
- barriers to providing adequate dental care for nursing home residents.

A group of 19 randomly ordered questions concerning barriers to providing adequate dental care for nursing home residents were developed from:

- a review of literature concerning the topic (especially focusing on the studies by Berkey et al., 1988; MacEntee et al., 1991, 1992; Weiss et al., 1993; and Chalmers et al., 1996);
- consultation with and experiences of Directors of Nursing and nursing home staff in Australia and the USA; and
- consultation with several Australian dentists who have extensive clinical and research experience in the fields of Special Care and Geriatric Dentistry.

Questionnaires were mailed with a cover letter and a reply-paid envelope enclosed. One follow-up questionnaire was mailed at two weeks to non-respondents. A thank-you note was mailed to all participants who completed and returned questionnaires. All 24 dentists completed and returned the questionnaires. Thirty-one questionnaires were completed and returned out of the 62 mailed to DONs and Administrators (DONs/Administrators), with all but five nursing homes returning at least one questionnaire. The pilot study provided valuable information concerning dental services for nursing home residents in rural areas, and therefore the results are presented.

Table 2 presents responses concerning dental service provision in country SA. All dentists that participated were male, with the great majority of DONs/Administrators

being female. The mean age of both dentists and DONs/Administrators was similar, in the mid-forties. Over three-quarters of these country SA dentists were providing dental care for nursing home residents, mainly at their private practice location. Dentists were providing care for a mean of 1.8 nursing homes, but were spending little time at nursing home premises (mean = 1.0 hour per month). This finding was supported by the DONs/Administrators' responses. There were no dental practices with a dental hygienist providing care at nursing home premises, and only one-fifth of the dentists were aware of the change to the hygienist legislation permitting hygienists to work unsupervised in nursing homes. Few of the DONs/Administrators were aware of the legislative change concerning hygienists.

Although these dentists were accessed for the pilot study via their listing on the ADA Nursing Home Scheme, not all indicated their awareness of the scheme. Only 29% of DONs/Administrators were aware of the scheme. The majority of respondents indicated that residents required a regular dental examination; approximately one-third of both dentist and DON/Administrator respondents felt that residents should be examined when admitted to the nursing home. The majority of respondents indicated that an additional annual dental examination was required. Few dental practices were assisting the nursing homes with the education of their staff concerning dental issues.

Tables 3 and 4 present the data relating to 'barriers' to providing and obtaining adequate dental care for residents. Dentists and DONs/Administrators both reported that the most important barriers were residents' medical problems, residents' financial constraints, dentists' lack of portable equipment and dentists' preference to treat residents at their dental practices. Other notable barriers reported by dentists were related to care provision issues, such as low financial reimbursement, lack of priority given to dental care by nursing home administrative staff, and no suitable area for dental treatment at the nursing home. DONs/Administrators reported barriers that were related more to residents' disabilities, such as difficulty arranging transport and residents' behavioural and cognitive problems. Neither dentists nor DONs/Administrators indicated that the nursing home staff's dislike of oral care provision was an important barrier. The comments provided by respondents overwhelmingly indicated difficulty with the provision of care for eligible public dental patients, and problems with reimbursement procedures for country dentists.

From comments written on the returned questionnaires and from telephone discussions with participants, it was discovered that in many SA nursing homes the Director of Nursing and the Administrator are often the same individual. Thus, after further consultation, it was decided that questionnaires would only be sent to Directors of Nursing in the Adelaide study. Further feedback also resulted in the modification of the phrase 'barriers to providing and obtaining adequate dental care' to 'problems encountered with the organisation and provision of dental care for residents'.

Table 2: Pilot Study – Dental service provision in South Australian country nursing homes

	Dentists (n=24)	DONs/Administrators (n=31)
Age (mean years)	47.4	45.9
Sex		
Female	0.0	83.9
Male	100.0	16.1
Provided dental care for nursing home residents in last 12 months (%)	78.3	
Can obtain the quality of dental care needed for residents (%)		76.7
Dental staff providing dental care at nursing homes (%)		
Technician		36.7
Hygienist		3.3
Dentist – private		70.0
Dentist – public		36.7
Dental services provided at nursing home (%)		
0%	27.8	26.7
1–50%	33.3	33.3
51–90%	33.3	33.3
91–100%	5.6	6.7
Dental services provided at dental surgery/clinic (%)		
0%	5.6	6.7
1–50%	44.4	39.9
51–90%	22.2	26.7
91–100%	27.8	26.7
Number of nursing homes provided dental services for (mean)	1.8	
Hours per month spent providing care at nursing homes (mean)	1.0	
Practices with a dental hygienist providing care at nursing homes (%)	0.0	
Awareness of change to dental hygienist regulations (%)	21.7	16.1
Awareness of ADA nursing home dental scheme (%)	87.5	29.0
Residents do need a regular dental examination (%)	83.3	67.7
Frequency needed for regular dental examination (%)		
When admitted	31.8	35.0
Every 3 months	13.6	10.0
Every 6 months	4.5	45.0
Every 12 months	81.8	40.0
Dental practice assists nursing homes with staff dental education (%)	17.4	12.9

Table 3: Pilot Study – Respondents’ ratings of barriers to providing adequate dental care for residents (%) (n=24 dentists; n=31 DONs/Administrators)

		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Financial constraints of residents	Dentists	0.0	16.7	29.2	37.5	16.7
	DONs	12.9	29.0	3.2	41.9	12.9
Time for organisation of residents' consent and finances	Dentists	8.3	12.5	33.3	37.5	8.3
	DONs	12.9	22.6	16.1	35.5	12.9
Residents' lack of interest about their dental care	Dentists	0.0	20.8	12.5	50.0	16.7
	DONs	6.5	19.4	25.8	38.7	9.7
Dentists prefer to treat residents at their dental practice	Dentists	0.0	12.5	8.3	37.5	41.7
	DONs	6.5	16.1	6.5	32.3	38.7
Dental care not given priority by nursing home administration	Dentists	0.0	8.3	20.8	45.8	25.0
	DONs	22.6	41.9	25.8	9.7	0.0
Nursing home staffing and time constraints	Dentists	0.0	25.0	20.8	41.7	12.5
	DONs	9.7	64.5	3.2	19.4	3.2
Residents' behavioural problems	Dentists	0.0	12.5	20.8	54.2	12.5
	DONs	0.0	6.5	16.1	35.5	41.9
Nursing home staff are not educated about dental care	Dentists	0.0	0.0	33.3	54.2	12.5
	DONs	3.2	35.5	29.0	25.8	6.5
Difficulty arranging transportation for residents	Dentists	0.0	29.2	25.0	37.5	8.3
	DONs	6.5	19.4	9.7	38.7	25.8
Lack of portable dental equipment	Dentists	0.0	8.3	4.2	75.0	12.5
	DONs	3.2	3.2	22.6	41.9	29.0
Dentists are not willing to come to nursing homes	Dentists	8.3	33.3	29.2	25.0	4.2
	DONs	9.7	12.9	38.7	29.0	9.7
Residents' cognitive status	Dentists	0.0	8.3	29.2	50.0	12.5
	DONs	6.5	3.2	3.2	61.3	25.8
No suitable area for dentistry in nursing home	Dentists	0.0	8.3	16.7	37.5	37.5
	DONs	9.7	29.0	19.4	29.0	12.9
Families' lack of interest about dental care	Dentists	4.2	25.0	25.0	37.5	8.3
	DONs	9.7	29.0	25.8	29.0	6.5
Nursing home staff dislike providing dental care for residents	Dentists	8.3	29.2	41.7	12.5	8.3
	DONs	35.5	45.2	12.9	6.5	0.0
Residents' medical problems	Dentists	0.0	12.5	37.5	41.7	8.3
	DONs	6.5	22.6	12.9	48.4	9.7
Dentists do not have adequate training in geriatric dentistry	Dentists	8.3	20.8	20.8	45.8	4.2
	DONs	6.5	22.6	48.4	16.1	6.5
Low financial reimbursement for nursing home dentistry	Dentists	0.0	12.5	25.0	37.5	25.0
	DONs	3.2	16.1	54.8	12.9	12.9

Table 4: Pilot Study – Respondents’ selection of the most important barriers to providing adequate dental care for residents (%) (n=24 dentists; n=31 DONs/Administrators)

	Dentists	DONs/Administrators
Financial constraints of residents	12.5	25.8
Dentists prefer to treat residents at their dental practice	41.7	32.3
Dental care is not given priority by nursing home administration	33.3	3.2
Residents’ behavioural problems	25.0	45.2
Difficulty arranging transport for residents	0.0	32.3
Lack of portable dental equipment	37.5	25.8
Residents’ cognitive status	12.5	35.5
Lack of suitable area for dental work in nursing home	33.3	19.4
Low financial reimbursement for nursing home dentistry	25.0	6.5

2.2 Methods

Ethical considerations

Approval for the study was obtained from The University of Adelaide Human Ethics Committee. A cover letter explaining the study was included with each questionnaire. Completion and return of the questionnaire was deemed adequate consent for participation. Confidentiality was maintained using a 4-digit identification number. Dr Chalmers discussed the ethical implications of the study, in addition to the study content and design, with representatives of the ADA (SA Branch), Social and Preventive Dentistry, The University of Adelaide, and the three Adelaide Director of Nursing Groups. As a result of these discussions, DONs were reassured that no individuals or nursing homes would be identified in the study reports and that no media releases concerning the study findings would be made without further consultation with the above-named groups.

Timeline, study design, sample size and sampling

The Dentist and DON questionnaire data was collected over a two month period in early 1998. A list was obtained from the Dental Board of South Australia of all practising dentists, excluding registered specialists. All 531 dentists listed as currently practising were included in the initial questionnaire mailing. A list of all Adelaide nursing homes was obtained from the Aged Care Division of the Commonwealth Department of Health and Family Services, and questionnaires were addressed and mailed to the 'Director of Nursing' at each of the 114 listed nursing homes.

Measurement of variables, instruments of measurement and collection of data

Both dentist and Director of Nursing questionnaires had the same basic structure and content, and contained close-ended questions concerning:

- dental service provision for nursing home residents by dentists, dental hygienists and dental technicians;
- attitudes of dentists and DONs toward nursing home dentistry:
 - residents' need for regular dental examinations
 - dentists' interest in nursing home dentistry
 - awareness of SA dental hygienist regulations (Appendix 2)
 - awareness of ADA (SA Branch) Nursing Home Scheme
 - dentists and their training in geriatric dentistry (only asked of dentists);
- a block of 19 randomly ordered questions concerning problems encountered with the organisation and provision of dental care for nursing home residents; and
- participants' age and sex, and dentists' number of years in practice and practice location.

An open-ended question for comments was also included. In early 1998 the finalised questionnaires, together with a cover letter and reply-paid envelope, were mailed to:

1. all 531 practising Adelaide dentists registered with the SA Dental Board; and
2. all 114 Adelaide nursing home Directors of Nursing.

Two weeks after the first mailing, a reminder letter was sent to non-respondents and three weeks after this a second reminder with a replacement questionnaire was mailed. All responding Directors of Nursing were sent a personalised thank-you note. Dentists were thanked via an article placed in the ADA (SA Branch) newsletter.

Database maintenance and analysis of data

Maintenance of the participant database, epidemiological data collection and statistical analyses were conducted using SPSS for Windows (Versions 6.1 and 8.0). Univariate statistics were computed to describe the demographic characteristics of the participants and the responses of dentists and DONs concerning residents' need for regular dental examinations, dentists' interest in nursing home dentistry, awareness of SA dental hygienist regulations, use of dental hygienists in nursing homes, and awareness of the ADA (SA Branch) Nursing Home Scheme. Tests of significance (Pearson's chi-square statistic) were used to describe the differences among demographic characteristics with dentists' practice characteristics, dental service provision for nursing homes, and dentists' awareness of the ADA (SA Branch) Nursing Home Scheme.

Univariate statistics and tests of significance (t-test) were also used to describe the problems encountered with the organisation and provision of dental care as reported by dentists and DONs. Logistic regression analysis was used to model these problems. Logistic regression analysis was also used to model the characteristics of dentists who

had provided dental care for residents at nursing homes during the previous 12 months.

All data collected remain the joint possession of the ADA (SA Branch) and the AIHW DSRU, and databases are securely stored, to maintain confidentiality for all subjects, by Dr Chalmers at the AIHW DSRU.

2.3 Response rates

Table 5: Response rates for mailed questionnaires

	Dentists	Directors of Nursing
Questionnaires mailed	531	114
Questionnaires completed and returned	413	97
Response rate	77.7%	85.1%

Table 5 presents the response rates for the mailed questionnaires to dentists and Directors of Nursing (DONs). The response rate for DONs was higher than that of dentists. However, overall a very good response was achieved with more than three-quarters of subjects in both groups returning their completed questionnaires. The analyses presented in this report were based on the responses of 413 dentists and 97 DONs.

2.4 Results

Directors of Nursing

Of the 97 DONs who completed and returned questionnaires, only 8 were male. Four participants refused to give their age and sex. Seventy-five participants were female, and seven of these refused to give their age. As seen in Table 6, all eight males were aged 25–44 years, and the majority of females (62.8%) were aged 45–64 years.

Table 6: Directors of Nursing – age group by sex (n=86)

	Total		Male		Female	
	n	%	n	%	n	%
Age group (years)						
≤ 24	0	0	0	0	0	0
25–44	36	41.9	8	100	28	35.9
45–64	49	57.0	0	0	49	62.8
65+	1	1.1	0	0	1	1.3
Total	86	100	8	100	78	100

Dentists' practice characteristics and training

Table 7 presents dentists' practice characteristics and provision of dental care for nursing home residents, by sex. The overwhelming majority of dentists who participated were male and were evenly distributed among the age groups 25–44 years and 45–64 years (chi-square test, sig. $p < 0.01$). Three-quarters of the female dentists were aged 25–44 years. This age/sex distribution reflects that presented for practising South Australian dentists in the publication *Dental Practitioner Statistics Australia, 1994* (Szuster & Spencer, 1997). The majority of dentists practiced in the private sector only (chi square test, sig. $p < 0.01$), although 29.3% of females compared with 8.3% of males practiced in the public sector only. Eleven per cent of females and 5.2% of males practiced in both the private and public sector. The 7% of dentists who indicated that they practiced in an area other than private or public dentistry included those who were undertaking postgraduate studies, those in academic positions, and those in the armed forces. Male dentists had been in dental practice longer than had females;

approximately 85% of males had been in practice for 11 or more years, while nearly 50% of females had been in practice for 10 years or less (chi-square test, sig. $p < 0.01$).

Variation in dentists' adequacy of training in several areas of geriatric dentistry is evident in Table 7. Dentists were asked if they had received adequate training in the following three areas of geriatric dentistry:

1. undergraduate theory/lectures in geriatric dentistry;
2. clinical care of medically compromised older adults; and
3. clinical care of nursing home residents.

Overall, 40% or more of dentists did not believe that they had adequate training in each of the three areas. Approximately 60% of dentists indicated they had adequate training in clinical care of medically compromised older adults. However, the dentists felt they had less adequate training concerning the clinical care of nursing home residents. More females felt they had less than adequate training in clinical care of medically compromised older adults. In total, 70% of females compared with 60% of males did not have adequate training in the clinical care of nursing home residents (chi-square test, sig. $p < 0.01$). Although there has been very little undergraduate theory specifically taught in the field of geriatric dentistry in Australia, nearly half of both male and female dentists reported they had received adequate undergraduate theory/lectures in geriatric dentistry.

Dental care provision

Just under 50% of dentists had provided dental treatment for residents of nursing homes (at any location) in the previous 12 months. However, the quantity of care actually provided was small, especially at nursing home premises. It is interesting to note that many of the dentists who did not provide dental care for residents of nursing homes indicated on the questionnaire that they did not have the experience to answer many of the questions.

Of those 191 dentists who reported that they had provided care for nursing home residents, 49.7% had provided care for one nursing home, 36.1% for two–three nursing homes, and 12.0% had provided care for more than four nursing homes (Table 7). Only the public domiciliary service dentists had provided care for a large number (>20) of nursing homes. Males provided care for a greater number of nursing homes than did females (chi-square test $p < 0.05$). There were no significant differences between different age groups of dentists in terms of dentists' provision of care for residents or number of nursing homes care was provided for.

Overall, 122 dentists (29.5%) had provided care for residents at nursing home premises. As seen in Table 7, of the 191 dentists who had provided care for residents, just over one-third of male dentists and 50% of female dentists had not provided care at nursing home premises. Of those who had visited nursing homes to provide treatment, approximately one-third had spent less than half-an-hour per month doing so. Another 25% of males and 10% of females spent 1–5 hours/month, with only 3% of males and 6% of females spending 6–10 hours/month providing treatment at nursing home premises.

Results presented in Table 8 from DONs responses indicated that service provision for nursing home residents was carried out at dentists' private practice locations rather

than at nursing home premises. Most services were provided at a combination of locations, and not solely at nursing homes. DONs reported frequent use of public dental services in addition to private sector services. In terms of provision of treatment for residents at nursing homes in the previous 12 months, 58.8% of DONs reported treatment from the public dental domiciliary service, and 21.6% reported treatment by dentists from public dental clinics.

Directors of Nursing were asked if they could obtain the quality of dental services needed for their dentate and edentulous residents (Table 8). Responses were 70% answering yes for dentate residents and 78.4% answering yes for edentulous residents.

The use of dental hygienists to provide care for residents of nursing homes was extremely low. As seen in Table 7, only 25 dentists reported that their dental practice had a hygienist who had provided care for nursing home residents during the previous 12 months. The eight hygienists who had provided care at nursing homes generally spent two hours or less per month doing so. Only two hygienists spent 30 hours per month at nursing homes. Twelve per cent of DONs reported that a dental hygienist had attended their nursing homes during the past 12 months to provide treatment; this was lower than the 23% who reported a dental technician attending the nursing home (Table 8). There was a low level of knowledge concerning the 1997 change to South Australian dental hygienist regulations allowing hygienists to work unsupervised to a dentist's prescribed treatment plan for a resident at nursing home premises (Table 9): 60% of dentists and 76% of DONs were not aware of this regulatory change. There were no significant differences among dentists or DONs by age group or sex concerning their awareness of the change to the hygienist regulation. Many respondents commented that they were interested in obtaining more information about this regulation.

A minority of nursing homes received assistance from dental professionals with the education of their staff about oral care for residents (Table 8): 18% of dentists reported that they did provide this assistance to nursing homes, and 31% of DONs reported that their nursing home received educational assistance from dentists or dental hygienists.

Attitudes of dentists and Directors of Nursing

Nearly two-thirds of dentists and DONs were not aware of the existence of the ADA Nursing Home Scheme linking private dentists with specific nursing homes (Table 9). There were no significant differences among DONs by age group or sex concerning their awareness of the ADA Nursing Home Scheme. Figure 2 presents dentists' awareness of the ADA scheme by age group. Older dentists were significantly (chi-square $p < 0.01$) more aware of the scheme than were younger dentists.

The distribution of responses to the question concerning the interest of dentists in providing nursing home dentistry was similar for both dentists and DONs. Few indicated that dentists were very interested or extremely interested in providing dental care for residents. One-quarter of dentists and one-fifth of DONs responded that dentists were not interested in providing care for residents, with another 50–60% answering that dentists were somewhat interested or interested. There were no significant differences among dentists or DONs by age group or sex concerning dentists' interest in nursing home dentistry. Dentists' interest in nursing home dentistry did not differ significantly by (or according to) years in practice (chi-square test, sig. $p < 0.01$). Dentists who had provided care for nursing home residents during

the past year were more interested in nursing home dentistry (chi-square test, sig. $p < 0.01$).

Table 9 also presents the responses to a question asking about the frequency of dental examinations needed for dentate and edentulous nursing home residents. Both dentists and DONs indicated that edentulous residents did not require dental examinations as frequently as did dentate residents: 11% of DONs did not think that edentulous residents needed a dentist to conduct a regular dental examination, and nearly one-third of DONs answered that edentulous residents needed an examination only as required and not on a regular basis. By comparison, over 90% of dentists indicated that edentulous residents required a regular dental examination, including an examination at the time of admission. Dentists' and DONs' opinions were more consistent concerning dental examinations for dentate residents. Approximately half of both the dentists and DONs responded that dentate residents require a regular examination, including when the resident is admitted to the nursing home.

Problems with the organisation and provision of dental care for nursing home residents

Responses to the 19 questions concerning problems with the organisation and provision of dental care for nursing home residents varied greatly between the dentists and the DONs (Tables 10 and 11). Of the dentists, 23% had written on the questionnaire that they did not feel they had sufficient experience or knowledge to answer this section of the questionnaire. The percentages presented in Tables 10 and 11 and the following text do not include this 23% of dentists with insufficient experience.

More than 70% of dentists responded that the following problems were encountered always or frequently (in descending order):

- no portable dental equipment for use in nursing homes;
- increased time needed to provide dental treatment at nursing homes;
- no suitable area for dentistry in nursing home;
- low financial reimbursement for nursing home dentistry.

Between 50 and 70% of dentists responded that the following problems were encountered always or frequently (in descending order):

- low priority given to dental care by nursing home staff;
- insufficient knowledge about dental care by nursing home staff;
- dentists prefer to treat residents at their dental practice/clinic;
- disinterest of residents about their dental health;
- transportation of residents to a dental practice/clinic;
- dislike of providing regular oral hygiene care for residents by nursing home staff;
- financial constraints of residents;
- disinterest of dentists in nursing home dentistry;
- residents' medical problems.

More than 50% of DONs responded that the following problems were encountered always or frequently (in descending order):

- residents' cognitive status;
- residents' behavioural problems;
- no portable dental equipment for use in nursing homes.

Between 30 and 50% of DONs responded that the following problems were encountered always or frequently (in descending order):

- transportation of residents to a dental practice/clinic;
- financial constraints of residents;
- no suitable area for dentistry in nursing home;
- low financial reimbursement for nursing home dentistry;
- dentists prefer to treat residents at their dental practice/clinic;
- nursing home staffing and time constraints;
- disinterest of residents about their dental health;
- increased time needed to provide dental treatment at nursing homes;
- insufficient training for dentists in geriatric dentistry;
- disinterest of dentists in nursing home dentistry.

Table 11 presents the respondents' selection of the three most frequently encountered problems with the organisation and provision of dental care for residents.

Problems most frequently reported for dentists were:

- no portable dental equipment for use in nursing homes;
- increased time needed to provide dental treatment at nursing homes;
- no suitable area for dentistry in nursing home;
- low financial reimbursement for nursing home dentistry;
- low priority given to dental care by nursing home staff;
- dentists prefer to treat residents at their dental practice/clinic;
- transportation of residents to a dental practice/clinic.

Problems most frequently reported for DONs were:

- residents' cognitive status;
- residents' behavioural problems;
- financial constraints of residents;
- transportation of residents to a dental practice/clinic;
- increased time needed to provide dental treatment at nursing homes;
- no portable dental equipment for use in nursing homes;
- disinterest of dentists in nursing home dentistry.

In Table 12, the bivariate analyses presented used dentists' and DONs' standardised mean scores for responses to the individual problems. The DONs rated problems consistently more frequently than did dentists, thus scores were standardised to allow for more accurate comparison between dentists and DONs. Significant differences (t-test, $p < 0.01$) in standardised mean scores were evident for eight of the problems. DONs rated the following problems more frequently: residents' cognitive status, residents' behavioural problems, residents' financial constraints and obtaining consent for residents' dental care. Dentists rated the following problems more frequently: increased time needed to provide dental treatment at nursing homes, low priority given to dental care by nursing home staff, dislike of providing regular oral hygiene care for residents by nursing home staff and no suitable area available for dental treatment at nursing homes. The magnitude of the standardised mean scores for the remaining 11 problems rated similarly by dentists and DONs provided an indication of their ranking. Dentists and DONs both responded that no portable dental equipment for use in nursing homes, dentists preferring to treat residents at their dental practice/clinic, transportation of residents to a dental practice/clinic, nursing home staffing and time constraints, and low financial reimbursement for nursing home dentistry were the most frequent of the remaining problems.

Table 13(a) presents a logistic regression model (backward elimination) for dentists' and DONs' ratings of problems encountered with the organisation and provision of dental care for residents. Responses were dichotomised into always/frequently a problem and occasionally/seldom/never a problem. Responses to all 19 questions concerning problems were initially entered into the model. Only those presented in Table 13(a) remained in the model at a significance level of $p < 0.05$. Participants who answered that nursing home staffing and time constraints (OR=2.57), behavioural problems of residents (OR=3.15), and/or cognitive status of residents (OR=4.23) were always/frequently a problem were more likely to have been DONs. Participants who answered that increased time needed to provide dental treatment at nursing homes, low priority given to dental care by nursing home staff, no suitable area for dentistry in nursing home, dislike of providing regular oral hygiene care for residents by nursing home staff and/or medical problems of residents were always/frequently a problem were more likely to have been dentists.

Table 13(b) presents two logistic regression models (backward elimination) for dentists who provided dental care for residents at nursing homes in the previous 12 months. The first model includes all dentists ($n=407$) with the exception of six dentists who did not provide their sex. Responses concerning dentists' age, sex, interest in nursing home dentistry, awareness of ADA Nursing Home Scheme and awareness of hygiene regulations were entered into the model. Only those characteristics presented in Table 13(b)(i) remained in the model at a significance level of $p < 0.05$. Male participants (OR=1.84), those who were very/extremely interested in nursing home dentistry (OR=1.72) and those who were aware of the ADA scheme (OR=2.82) were more likely to have provided care at nursing homes.

When a group of responses to the 19 questions concerning problems ($n=313$; dentists who stated they could not answer these 19 questions because of a lack of experience were not included) were also entered into a logistic regression model, males (OR=1.98), those who were aware of the ADA scheme (OR=2.30), those who were aware of the hygienist regulation (OR=1.77) and dentists who occasionally/seldom/never found that nursing home staff giving low priority to dental care was a problem were more likely to have provided care at nursing homes. Only those characteristics/problems presented in Table 13(b)(ii) remained in the model at a significance level of $p < 0.05$.

Table 7: Dentists' practice characteristics and provision of dental care for nursing home residents by sex (%)

	Total	Male	Female
Age group (years)*	n=400	n=321	n=79
≤ 24	1.3	1.3	1.3
25–44	52.0	45.8	77.2
45–64	42.5	48.0	20.2
65+	4.2	4.9	1.3
Practice type*	n=407	n=325	n=82
Private only	74.2	79.4	53.7
Public only	12.5	8.3	29.3
Public and private	6.4	5.2	11.0
Other	6.9	7.1	6.0
Years in practice*	n=402	n=321	n=81
1–5	9.5	6.9	19.7
6–10	11.7	7.8	27.2
11–20	35.6	34.9	38.3
21–30	32.3	37.0	13.6
30+	10.9	13.4	1.2
Received adequate training in			
1. Undergraduate theory/ lectures in geriatric dentistry	n=384 47.9	n=306 49.3	n=78 42.3
2. Clinical care of medically compromised older adults	n=389 58.9	n=310 58.1	n=79 62.0
3. Clinical care of nursing home residents**	n=382 38.2	n=304 40.5	n=78 29.5
Provided dental care for residents of a nursing home during past 12 months	n=407 46.9	n=325 48.9	n=82 39.0
Number of nursing homes dental care provided for during past 12 months*			
1	n=191 49.7	n=159 45.9	n=32 68.7
2	22.5	25.8	6.3
3	13.6	15.7	3.1
4	5.2	5.0	6.3
5	2.1	1.9	3.1
6–10	4.7	5.0	3.1
11–20	1.1	0.7	3.1
20+	1.1	0	6.3
Hours per month, during past 12 months, spent at nursing homes providing dental treatment for residents	n=191	n=159	n=32
0	36.7	34.0	50.0
0.1–0.5	32.5	33.3	28.0
0.6–1.0	0	0	0
1.1–2.0	14.1	15.7	6.3
2.1–5.0	11.5	13.2	3.1
6–10	3.7	3.2	6.3
11+	1.5	0.6	6.3

Table 7: Dentists' practice characteristics and provision of dental care for nursing home residents by sex (%) (cont.)

	Total	Male	Female
Practice has a hygienist who provides care for nursing home residents**	<i>n=407</i> 6.1	<i>n=325</i> 7.1	<i>n=82</i> 2.4
Hours per month, during past 12 months, spent by hygienist at nursing homes providing dental treatment for residents	<i>n=25</i>	<i>n=23</i>	<i>n=2</i>
0	68.0	69.6	50.0
0.5	4.0	4.3	0
1	8.0	8.7	0
2	12.0	8.7	50.0
30	8.0	8.7	0

* chi-square test sig. $p < 0.01$

** chi-square test sig. $p < 0.05$

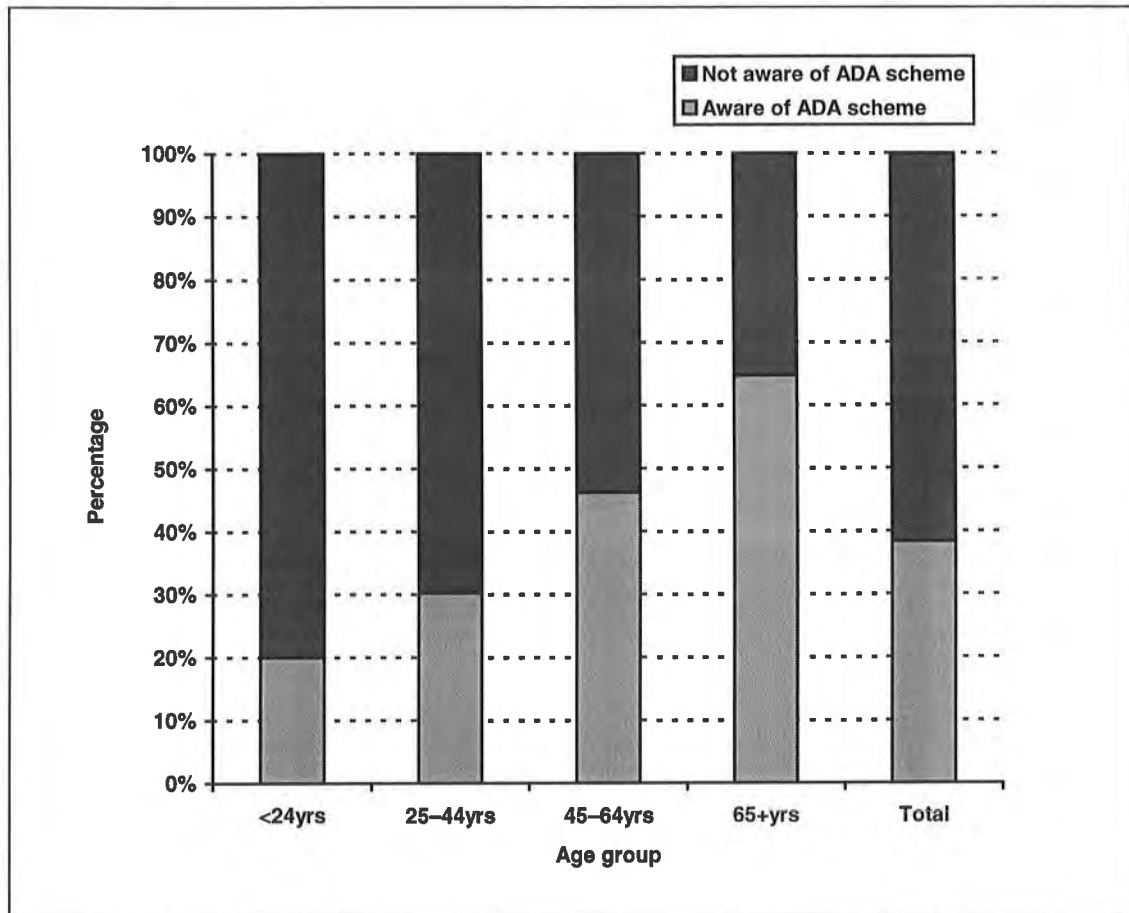
Table 8: Dental service provision in nursing homes as reported by dentists and Directors of Nursing

	Dentists (n=413) %	Directors of Nursing (n=97) %
Dental practice assists nursing home/s with staff dental education	18.4	30.9
Nursing home can obtain quality of dental services needed for their		
Dentate residents	n/a	70.1
Edentulous residents		78.4
Dental staff who provided treatment at nursing homes during the past 12 months		
Dental technician	n/a	22.7
Dental hygienist		12.4
Dentist – private practice		57.7
Dentist – public domiciliary service		58.8
Dentist – public dental clinic		21.6
Location where dental care was provided for residents		
Nursing home only	8.7	15.5
Private dental practice only	15.3	2.1
Public dental clinic only	1.5	1.0
Hospital only	1.0	0.0
Nursing home, private dental practice and public dental clinic	0.0	29.9
Nursing home, private dental practice and hospital	1.5	3.1
Nursing home, public dental clinic and hospital	0.0	5.2
Private dental practice and public dental clinic	0.0	3.1
Private dental practice and hospital	0.5	0.0
Nursing home and public dental clinic	0.0	10.3
Nursing home and hospital	1.0	2.1
Nursing home and private dental practice	17.2	26.8
No dental care was provided for any nursing home residents	53.5	1.0

Table 9: Attitudes toward nursing home dentistry as reported by dentists and Directors of Nursing

	Dentists (n=413) %	Directors of Nursing (n=97) %
Interest of dentists in providing dental care for nursing home residents		
Extremely interested	5.6	2.0
Very interested	10.9	10.3
Interested	26.8	28.9
Somewhat interested	30.8	39.2
Not interested	25.9	19.6
Were aware of change to dental hygienist regulations	39.9	24.0
Were aware of ADA nursing home dental scheme	38.7	38.1
Frequency needed for regular dental examination required for edentulous residents		
When resident admitted to nursing home	7.6	3.1
Every 3 months	0.0	1.0
Every 6 months	3.7	3.1
Every 12 months	36.2	15.5
Every 24 months	4.4	0.0
When admitted + regular interval (3–12 months or as required)	38.8	37.1
As required only	6.8	28.9
Exam by dentist not needed	2.5	11.3
Frequency needed for regular dental examination required for dentate residents		
When resident admitted to nursing home	3.9	4.1
Every 3 months	4.1	1.0
Every 6 months	28.2	10.3
Every 12 months	10.6	25.8
When admitted + regular interval (3–12 months or as required)	48.8	50.5
As required only	4.4	7.3
Exam by dentist not needed	0.0	1.0

Figure 2: Dentists' awareness of ADA scheme by age group (n=394)



(chi-square test sig. $p < 0.01$)

Table 10: Respondents' ratings of frequency of problems encountered with the organisation and provision of dental care for residents (%) (n=318 dentists*; n=97 Directors of Nursing)

		Frequency of problem				
		Always	Frequently	Occasionally	Seldom	Never
Financial constraints of residents	Dentists	9.1	42.5	29.9	10.4	8.2
	DONs	13.7	32.6	33.7	17.9	2.1
Disinterest of dentists in nursing home dentistry	Dentists	8.7	42.4	31.4	11.0	6.5
	DONs	7.3	22.9	32.3	21.9	15.6
Nursing home staffing and time constraints	Dentists	10.2	33.0	36.6	16.5	3.6
	DONs	11.7	28.7	25.5	18.1	16.0
Dentists prefer to treat residents at their dental practice/clinic	Dentists	16.9	38.7	31.3	10.5	2.6
	DONs	13.5	27.1	34.4	16.7	8.3
Obtaining consent for dental care	Dentists	1.3	11.7	43.8	30.5	12.7
	DONs	0.0	11.3	38.1	37.1	13.4
Increased time needed to provide dental treatment at nursing homes	Dentists	31.3	41.9	17.3	7.3	2.2
	DONs	12.6	21.1	32.6	18.9	14.7
Residents' behavioural problems	Dentists	5.1	35.7	46.6	10.9	1.6
	DONs	9.3	51.5	29.9	7.2	2.1
Insufficient knowledge about dental care by nursing home staff	Dentists	16.3	42.2	33.2	7.7	0.6
	DONs	8.2	17.7	46.4	24.7	3.1
Transportation of residents to a dental practice/clinic	Dentists	10.3	43.6	33.9	10.7	1.6
	DONs	14.4	32.0	30.9	17.5	5.2
No portable dental equipment for use in nursing homes	Dentists	41.2	36.7	13.6	5.5	2.9
	DONs	32.3	22.6	23.7	11.8	9.7
Low priority given to dental care by nursing home staff	Dentists	18.5	43.8	31.6	5.1	1.0
	DONs	4.2	18.9	34.7	23.2	18.9
Residents' cognitive status	Dentists	3.2	42.9	48.7	4.5	0.6
	DONs	14.4	54.6	25.8	4.1	1.0
No suitable area for dentistry in nursing home	Dentists	26.1	46.3	19.5	6.5	1.6
	DONs	23.7	17.5	25.8	11.3	21.6
Families' disinterest about residents' dental care	Dentists	2.2	27.1	44.6	21.3	4.8
	DONs	1.0	13.4	46.4	32.0	7.2
Dislike of providing regular oral hygiene care for residents by nursing home staff	Dentists	15.7	38.7	35.7	7.9	2.0
	DONs	0.0	6.2	39.2	34.0	20.6
Residents' medical problems	Dentists	3.8	47.4	40.4	7.1	1.3
	DONs	3.1	19.6	52.6	21.6	3.1
Insufficient training for dentists in geriatric dentistry	Dentists	6.5	35.0	38.8	16.8	2.9
	DONs	6.9	26.4	29.9	23.0	13.8
Low financial reimbursement for nursing home dentistry	Dentists	24.8	45.2	21.3	5.8	2.9
	DONs	22.1	20.6	29.4	19.1	8.8
Disinterest of residents about their dental health	Dentists	7.0	47.8	37.9	7.0	0.3
	DONs	6.3	33.7	38.9	17.9	3.2

* 23% of the 413 participating dentists stated that they had insufficient knowledge about nursing home dentistry and so could not complete this question; these dentists have not been included in this table

Table 11: Respondents' selection of the three most frequent problems encountered with the organisation and provision of dental care for residents (%) (n=318 dentists*; n=97 Directors of Nursing)

	Dentists	Directors of Nursing
Preference of dentists to treat residents at their dental practice	16.3	21.6
Increased time needed to provide dental treatment at nursing homes	29.9	17.5
Transportation of residents to a dental practice/clinic	14.5	19.6
No portable dental equipment for use in nursing homes	36.0	15.5
Low priority given to dental care by nursing home staff	21.8	7.2
No suitable area for dental treatment at nursing homes	29.6	12.4
Low financial reimbursement for nursing home dentistry	26.1	7.2
Financial constraints of residents	19.4	30.9
Behavioural problems of residents	13.2	39.2
Cognitive status of residents	7.7	37.1

* 23% of the 413 participating dentists stated that they had insufficient knowledge about nursing home dentistry and so could not complete this question; these dentists have not been included in this Table.

Table 12: Differences in standardised mean scores from ratings of problems by dentists and DONs (n=318 dentists; n=97 DONs).

Problem encountered with the organisation and provision of dental care for nursing home residents	Standardised mean score for dentists (1=always a problem; 5=never a problem)	Standardised mean score for DONs (1=always a problem; 5=never a problem)
Problems rated more frequently by DONs		
Resident-related problems		
Cognitive status of residents*	2.67	1.89
Behavioural problems of residents*	2.78	2.08
Financial constraints of residents*	2.76	2.29
Obtaining consent for residents' dental care*	3.52	3.19
Problems rated more frequently by dentists		
Nursing home/dental practice-related problems		
Dislike of providing regular oral hygiene care for residents by nursing home staff*	2.52	3.36
Low priority given to dental care by nursing home staff*	2.36	3.00
Increased time needed to provide dental treatment at nursing homes*	2.17	2.69
No suitable area available for dental treatment at nursing homes*	2.21	2.56
Problems rated similarly by dentists and DONs		
Nursing home/dental practice-related problems		
Nursing home staffing and time constraints	2.80	2.64
Insufficient knowledge about dental care by nursing home staff	2.44	2.63
Transportation of residents to a dental practice/clinic	2.59	2.34
Preference of dentists to treat residents at their dental practice/clinic	2.53	2.46
No portable dental equipment for use in nursing homes	2.02	2.11
Problems rated similarly by dentists and DONs		
Resident-related problems		
Families' disinterest about residents' dental care	3.09	2.97
Medical problems of residents	2.64	2.67
Disinterest of residents about their dental health	2.56	2.44
Problems related to professional dental issues		
Disinterest of dentists in nursing home dentistry	2.74	2.82
Insufficient training for dentists in geriatric dentistry	2.85	2.77
Low financial reimbursement for dentists who provide dental treatment in nursing homes	2.27	2.39

* t-test $p < 0.01$

N.B. Mean scores were standardised for dentists and DONs prior to analysis

Table 13(a): Logistic regression – Dentists’ and DONs’ ratings of problems encountered with the organisation and provision of dental care for residents

	Significance	Odds Ratio
Nursing home staffing and time constraints**	0.0153	2.57
Increased time needed to provide dental treatment at nursing homes*	0.0000	0.23
Behavioural problems of residents*	0.0042	3.15
Low priority given to dental care by nursing home staff**	0.0398	0.42
Cognitive status of residents*	0.0004	4.23
No suitable area available for dental treatment at nursing homes**	0.0126	0.41
Dislike of providing regular oral hygiene care for residents by nursing home staff*	0.0000	0.10
Medical problems of residents*	0.0001	0.21

* sig. p<0.01

** sig. p<0.05

Table 13(b): Logistic regressions – Dentists who provided care at nursing homes during the previous year

	Significance	Odds Ratio
(I) Dentist characteristics		
Very/extremely interested in nursing home dentistry**	0.0165	1.72
Aware of ADA scheme*	0.0000	2.82
Male**	0.0507	1.84
(II) Dentist characteristics and problems		
Aware of hygienist regulation**	0.0308	1.77
Aware of ADA scheme*	0.0014	2.30
Male**	0.0487	1.98
Low priority is given to dental care by nursing home staff*	0.0046	0.48

* sig. p<0.01

** sig. p<0.05

Comments

The majority of participants made one or more comments concerning nursing home dentistry. Comments made by participants are italicised in the following text.

Directors of Nursing

DONs made several comments concerning the public dental domiciliary service. Twenty-eight DONs emphasised their appreciation for the domiciliary dental service and how *'caring, good and helpful'* the domiciliary dentists were. However, they indicated that waiting times for the dental domiciliary service were too long and were increasing. They felt that it was difficult to obtain urgent appointments and there were some who expressed problems contacting the domiciliaries *'as it was a part-time service'*. Two of the DONs were unaware of the service and asked if such a public dental service existed. Others stated that the domiciliary services required more promotion in Adelaide nursing homes.

'The dom dentists are very helpful and effective.'

'We have a motivated and cooperative public domiciliary dentist, but with more elderly retaining teeth I don't think that the current service will be adequate in the future.'

'The public domiciliary dentists are extremely kind, gentle and caring for residents, but they have to be realistic about what they can cope with.'

'The dentist and staff from the public domiciliary provide excellent services and caring treatment, however their waiting times are greatly increasing.'

'The public dental domiciliary services are excellent support, so please don't reduce this service as we have just established yearly visits and would not survive without them.'

'Some residents consume large amounts of analgesics while waiting for doms.'

'Dom care is given only when requested.'

DONs also made many comments concerning private dentists. Some DONs felt that private dentists were not prepared to come to the nursing home and that it was difficult to find dentists who would come to see residents at the nursing home. Many DONs wanted to know how they could find dentists who would come to nursing homes. They emphasised the difficulties involved with transporting residents to private dental surgeries. The financial difficulties involved with the use of private dentists were a problem for residents and their families. DONs commented that dentists needed specialised skills to care for residents with dementia and behavioural problems, especially kindness, compassion and patience. They felt that many dentists did not have these skills. Most comments made concerned residents with dementia, behavioural problems and/or resistive behaviour and the many difficulties involved with their dental care.

'Dentists now seem to want residents to come to their surgeries which is not always possible.'

'Transport to facilities outside the nursing home is difficult because of residents' extreme frailty (mentally and physically).'

'Private dental care is too expensive for most residents.'

'Dentists have a lack of insight and high expectations of nursing home residents and staff.'

'We never receive any information about dental services.'

'Dentists won't see residents that are very dependent.'

'Would like more dentists to visit nursing homes.'

'When you persuade private dentists to come, they don't have equipment.'

'Dentists are unfamiliar with residents with dementia.'

'To care for debilitated patients takes specific skills – patience and kindness and ability to cope with confused/dementia patients; these patients can't be placed in a dental chair or be expected to sit.'

Dentists

Dentists commented that the increasing numbers of dentate older adults and nursing home residents was *'a potential time bomb if not addressed in a timely manner'* and *'one of the biggest problems/challenges for dentistry'*. The most frequently made comment by dentists concerned the need for a coordinated, centralised plan/approach to dental care for nursing home residents, with regular dental examinations and government funding to all nursing homes. Suggestions included:

'Nursing homes should be responsible for the cost of regular dental screenings and residents then pay only for treatment' and

'A certification of dental health and specific preventive care instructions should be issued upon admittance to the nursing home.'

Other issues frequently commented upon are noted below.

- Working conditions in nursing homes, the lack of availability of portable equipment, and the lack of availability of dental chairs/clinics in nursing homes:
'Performing dentistry in a non-clinical treatment room is unsatisfactory'
'It is a time-wasting exercise to treat patients at the nursing home – I gave it up years ago'
'Restorative treatment at nursing homes is impossible'
'Usually can only do extractions and denture repairs at the nursing home'
'Would help if we could hire portable equipment (from the ADA)'
'Wheelchair headrests work well'.
- Difficulties involved with the transportation of residents to dental practices/clinics, the preference of dentists to treat residents at their practices, the difficulty finding the time needed for nursing home dentistry, the financial loss to dentists for nursing home dentistry, the problems associated with Pensioner Denture Scheme and Department of Veterans' Affairs rebates, and the attitude that nursing home dentistry was 'community work':
'If they organise transport to my surgery it isn't a problem'
'Where patients are unable to be transported the ability to provide any realistic treatment at the nursing home is severely limited and unrealistic'

'Nursing home dentistry should be promoted as a practice builder'

'Better remuneration is needed'

'An equity problem exists among the different residents and care they are eligible for'

'I do this out of a sense of duty at little or no fee'

'It is a labour of love'

'It is a favour to old patients mostly'.

- Problems with instituting preventive care procedures in nursing homes, the very poor oral hygiene of many residents, and the lack of knowledge of nursing home staff about preventive oral care:
 - 'Dental staff need to train nursing home staff about oral care'*
 - 'Poor oral hygiene in the nursing home makes our dental treatment useless'*
 - 'I have shifted my treatment for geriatric patients from 'saving and filling teeth' to 'preventive care'; fluoride is very important'.*
- Need to increase the use of dental auxiliaries in nursing home dentistry:
 - 'Need regular visits from a pool of hygienists'*
 - 'Hygienists are the key and could do simple ART and preventive care'.*
- Dentists' lack of training in nursing home dentistry needs to be addressed and there is a need to increase dentists' interest in nursing home dentistry:
 - 'Undergraduate course had minimal instruction on how to handle patients outside the dental surgery, for demented, terminally-ill, immobile and elderly patients'*
 - 'I have problems accessing the oral cavity in many residents'*
 - 'How do I treat bed-ridden and wheelchair patients without causing myself a back injury?'*
 - 'Dentures for nursing home residents are very difficult'*
 - 'The treatment of rampant root caries is difficult in nursing homes'.*
- Unreasonable expectations from families, carers and residents:
 - 'I am often called to the nursing home for no reason which leaves me having taken time off, travelled to the nursing home, and I get no remuneration'.*
- Need to improve the ADA Nursing Home Scheme:
 - 'Many dentists do not know about it'.*

Other interesting and significant comments made by dentists included:

- *'Nursing home staff are usually very cooperative'*
- *'Dental is placed in the too-hard basket'*
- *'It would be useful to find out from nursing homes what they believe they require'*
- *'Most nursing home staff are already too busy and stressed'*
- *'More liaison is needed between hygienists, dentists, administrators and nursing staff'*
- *'Each nursing home needs to appoint one person to coordinate and manage dental needs and treatment'*
- *'A thankless job; training gained by experience only'.*

2.5 Discussion

The good response rates achieved in this study send a positive message that there is some interest in and acknowledgement of the importance of dental care for Adelaide nursing home residents. These good response rates may also have been attributable to the team efforts of both the dental professionals and researchers in liaison with Adelaide Directors of Nursing.

Dental care provision

Dental care provision for Adelaide nursing home residents, as reported by dentists and DONs in this study, was very low. Although it appeared that many dentists did have some links with one or more nursing homes, they were spending very little time providing care for nursing home residents. When dentists did provide care, a clear pattern emerged from the study results, with a distinct preference by dentists to treat nursing home residents at their dental practices/clinics and not in nursing homes. The small amount of time spent by dentists at nursing home premises suggests that either few residents were cared for and/or comprehensive dental treatment was not provided on-site. In the 0.5–2 hours per month spent on-site by the majority of dentists providing care, it seems likely that only screening and emergency type procedures were performed. The type of services provided at nursing homes were not investigated but would be valuable information to obtain in future investigations.

From the questionnaire results it is apparent that both the public and private dental sectors are needed to provide dental services for Adelaide nursing home residents; the public domiciliary services are an important source of dental care for residents, as are private dentists. With DONs from nearly all Adelaide nursing homes returning completed questionnaires, the information provided revealed that there are many (just over 40%) nursing homes that either do not have access to, or are not aware of, the public dental domiciliary services. The favourable comments made by many DONs supporting the dental domiciliary service staff are very encouraging. However, their concerns about the domiciliary waiting times and care availability need to be addressed. Increased administrative and financial support for the dental domiciliaries is required to upgrade the current services. Public dental clinic staff were also reported to be an important source of dental care for residents, and further investigation of their service provision would be helpful for future service planning and provision.

Also, in just over 40% of Adelaide nursing homes a private dentist had visited the nursing home to provide dental care for residents during the previous 12 months. DONs' comments highlight their concerns with the difficulty of finding private dentists who will come to their nursing homes, and they requested assistance to find dentists who would do so. DONs also recognised a trend of private dentists preferring to treat residents at their dental practices/clinics and discussed the associated difficulties. With residents requiring a combination of private and public sector care in most nursing homes, the increased involvement of both sectors in nursing home dentistry is urgently needed, with an improved focus on treatment provision at nursing home premises.

Of concern is the low number of hygienists reportedly involved in nursing home dentistry. The dental profession recognised the need to involve hygienists in nursing home dentistry by changing the South Australian hygienist regulations in January 1997, to allow hygienists to work unsupervised to a dentists' prescribed treatment plan

in nursing homes (SA Dental Board, 1997). However, the results of this study suggest that there has been little impact of this legislation on service provision.

Research conducted in nursing homes has emphasised the importance of ongoing, 'hands-on' educational interventions with nursing home staff to assist them to overcome the difficulties encountered when providing daily oral care for residents, especially residents with cognitive and behavioural difficulties (Chalmers et al., 1996). DONs in this study made many requests for increased educational support from dental professionals. Dental hygienists play an important role in the delivery of this educational assistance to nursing home staff. They currently receive appropriate training in South Australia to provide this educational assistance (Chalmers, 1998d). Also, in South Australia, ongoing support for qualified dental professionals interested in delivering educational programs to nursing homes is provided by the Alzheimer's Association of South Australia Dental Group (Chalmers et al., 1997). From the information collected in this study, Adelaide nursing home staff are clearly receiving minimal educational assistance from either Adelaide dentists or dental hygienists. One major source of assistance was the annual carer workshops in oral care held by the Alzheimer's Association Dental Group.

Of interest is the high percentage of DONs who indicated that they could obtain adequate dental services for their dentate and edentulous residents. It may be that DONs do feel that the dental profession provide adequate access to dental services for their residents, although DON's seemingly contrary responses to other questions make this response somewhat difficult to interpret. However, it is possible that this question may have been misinterpreted as it was not made clear in the question who the provider of the dental services was – dental professionals or nursing home staff.

Attitudes toward nursing home dentistry

Research conducted into US geriatric dental educational programs has revealed the importance of comprehensive undergraduate theoretical and clinical experiences in nursing home dentistry to improve both the attitudes of dentists toward nursing home dentistry and the dental services provided to residents (Ettinger & Beck, 1994; Ettinger, 1997).

Traditionally, the education of Australian dentists in the field of geriatric dentistry has not received a continuous or high profile, with very few clinical or theoretical courses being available to undergraduates or postgraduates (Chalmers et al., 1998c). The University of Adelaide undergraduate dental course has in previous years included some geriatric dental subjects and is currently being reviewed and upgraded (Chalmers et al., 1998c). The results from dentists' questionnaire responses in this study indicated that there are a great many practising Adelaide dentists with inadequate training in geriatric dental theory and the clinical care of geriatric dental patients. Specifically, 70% of female dentists and 60% of male dentists did not have adequate training in the clinical care of nursing home residents. Dentists' low levels of interest in nursing home dentistry – one-quarter of dentists were not interested and another 30% were only somewhat interested – reflect dentists' perceptions about the inadequacy of their training in the field. These results, in combination with the low levels of dental services being provided by Adelaide dentists for nursing home residents, illustrate the urgency and importance of upgrading undergraduate, postgraduate and continuing geriatric dental education for current and future dental professionals.

Several dedicated South Australian dental professionals have attempted in past years to improve their colleagues' attitudes toward and involvement in nursing home dentistry, via the development of the ADA (SA Branch) Nursing Home/Hostel Scheme and via the recent changes to SA dental hygienist regulations (Appendix 2). It was disheartening to find that the participants from both the dental profession and from nursing homes had such low levels of awareness of the ADA scheme and hygienist regulations. Indeed, comments made by dentists and DONs indicated a degree of confusion about the ADA scheme; dentists were waiting for nursing homes to initiate contact and nursing homes were waiting for dentists to initiate contact. Dentists also commented that they felt many of their colleagues were unaware of the ADA scheme. Thus, it appears that urgent publicity and discussion among dental professionals and nursing home staff is needed to reduce this confusion. The implementation and distribution of brochures or information sheets could be useful, as could the publication of items in professional dental groups' and nursing home staff groups' newsletters. Very few younger dentists were aware of the ADA scheme, and encouragement of their participation is needed. Perhaps a mentorship-type program linking younger dentists with colleagues with more experience in nursing home dentistry may provide better support for dentists.

Recent changes to the Australian aged care system included the introduction of standards and guidelines for residential facilities. One of the standards involves 'Oral and dental care' for residents. Thus, the attitudes of dentists and DONs concerning dental examinations for residents is a topical issue (Commonwealth Department of Health and Family Services, 1998) (Appendix 1). The dental profession has long recognised the need for regular dental examinations for residents of nursing homes. In most industrialised countries the dental profession has been working toward the inclusion of regular dental examinations by dental professionals into nursing home protocols (Special Care in Dentistry, 1996). For example, the US OBRA 87 nursing home reform law introduced the requirement for a dental assessment to be conducted by a registered nurse on admission to the nursing home and annually. Specific triggers are set in place in the Minimum Data Set to then involve dental professionals for intervention (US Congress, 1987). However, US dental professionals are campaigning further to have the dental assessment conducted by a dentist (Special Care in Dentistry, 1996; Ettinger, 1997).

In late 1997, a working group of Australian and international dental professionals, coordinated by the federal ADA, assisted the commonwealth with the development of the nursing home dental standard and guidelines. This working group recommended that one of the important issues to be included in the dental standard was the need for a dental examination upon admission to an aged care facility and regular dental examinations to be conducted by a dental professional. However, this recommendation was not incorporated into the 1998 Aged Care Standards by the Commonwealth Government (Commonwealth Department of Health and Family Services, 1998) (Appendix 1). It would be valuable for policy makers to be aware of the concerns and attitudes of the main professionals involved with the provision of dental care for residents – dentists and DONs. This study provides information about such attitudes and concerns. The most frequent comments made by dentists related to the need for a coordinated, centralised approach for nursing home dentistry, with financial support from government. The majority of Adelaide dentists and DONs supported the examination of a resident by a dental professional when the resident is admitted to the nursing home as well as on a regular basis.

There were some differing attitudes for edentulous versus dentate residents that may need to be considered further. The reported need for regular examinations was not as high for edentulous residents, with 11% of DONs responding that dentists were not required to perform the dental examination for edentulous residents. DONs commented on the questionnaire that medical practitioners or registered nurses were thought to be suitable to conduct the dental examinations for edentulous residents. It is of concern that nearly 30% of DONs thought that edentulous residents should only have a dental examination when required and not at a regular interval. There are many acute oral conditions, various types of oral mucosal lesions, and denture problems occurring in edentulous older adults that may affect a resident's speech, eating abilities and quality of life. Dental professionals recommend regular examinations for all edentulous adults to ensure that these conditions and problems are treated and monitored. It appears that dental professionals need to implement educational strategies for nursing home staff concerning the dental care of edentulous residents.

Problems encountered with the organisation and provision of dental care for residents

Experiences in clinical care and previous geriatric dental research (Berkey et al., 1988, 1990; Berkey & Atchison, 1990; Dolan et al., 1993; Weiss, 1993) have elucidated many of the 'barriers' or 'problems' encountered with the provision of dental care for nursing home residents. Knowledge of barriers/problems is essential for dentists and administrators in order for them to develop and implement effective strategies to improve residents' utilisation of dental services. Berkey, in his landmark 1988 study, identified barriers that inhibited satisfactory dental care for nursing home residents in Colorado, USA. That study established that nursing home staff and dentists held some common but many differing perceptions concerning barriers.

Further investigation of these barriers/problems was undertaken in this Adelaide Dental Study of Nursing Homes. Again dentists and DONs were found to have some common perceptions but also distinctive and differing perceptions concerning these barriers/problems. In bivariate and multivariate analyses, DONs identified more resident-related issues as the most frequently occurring problems: residents' cognitive and behavioural problems, residents' financial constraints and obtaining consent for dental care were by far the most frequent problems. By comparison, the most frequent problems reported by dentists were nursing home/dental practice-related issues such as the increased time needed to provide dental treatment at nursing homes, low financial reimbursement, dislike of providing regular oral hygiene care for residents by nursing home staff, and low priority given to dental care by nursing home staff.

Adelaide dentists and DONs held common perceptions concerning several problems related to providing care at nursing homes: no portable dental equipment for use in nursing homes, no suitable area for dentistry in nursing homes, preference of dentists to treat nursing home residents at their practices/clinics and transportation of residents to a dental practice/clinic. These four problems highlight the key issue to be addressed in nursing home dentistry – the inability of Adelaide dental professionals to provide clinical dental care on-site at nursing homes, resulting in the need for transportation of residents off-site to dental practices/clinics. DONs and dentists made many comments about this issue and identified several solutions, such as the hiring of portable dental equipment by dental professionals, the increased availability and use of portable wheelchair headrests, and the improvement of clinical undergraduate, postgraduate and continuing education for dental professionals.

DONs' comments highlighted how residents' cognitive and behavioural problems often make the utilisation of off-site dental premises a difficult, if not impossible, task for nursing home staff and residents' relatives. Dentists' inadequate awareness of and training in these resident-related problems complicate the situation even further. As previously discussed, Australian dentists have had little formal training concerning geriatric general and dental issues, such as the management of cognitively impaired and behaviourally difficult older adults. DONs commented frequently about dentists' lack of skills when communicating with and treating cognitively impaired, behaviourally difficult and/or resistive residents. Adelaide dentists themselves indicated in this study that they had inadequate training in nursing home dentistry. Many dentists commented on the general lack of training in nursing home dentistry and had specific questions relating to accessing the oral cavity of difficult residents, management of rampant caries, difficulties with denture construction, and experienced frustration in association with their perception of the treatment of bed-ridden and wheelchair residents.

Dentists were concerned with nursing home/dental practice-related problems and were frustrated by their perception of the low profile of dentistry in nursing homes. This was highlighted in the bivariate and logistic regression analyses (Tables 13(a) and 13(b)) which revealed that dentists were more likely to have answered that increased time needed to provide dental treatment at nursing homes, low priority given to dental care by nursing home staff, no suitable area for dentistry in nursing home, and/or dislike of providing regular oral hygiene care for residents by nursing home staff were always/frequently a problem.

Dentists' concern with nursing home/dental practice-related issues indicated the financial and time-management difficulties associated with their provision of dental care at nursing homes versus practice/clinic locations. Comments made by dentists highlight their concerns: time spent at nursing homes and travelling between locations means less time spent at practices; if dentists are not well organised and are only caring for one or a few residents at a visit, there are productivity and financial ramifications; it is easier and more productive for dentists to treat nursing home residents at their dental practices; many nursing home residents do not wish to pay private dental fees so dentists charge them lower rates and class this care as charitable/community work; and dentists must compromise themselves financially and make a loss to provide this kind of dentistry.

Perhaps the DONs' responses provide clues to resolving the dentists' frustrations associated with their perception of the low prioritisation of dental care by nursing home staff. As commented by one DON, *'Dentists have a lack of insight and high expectations of nursing home residents and staff'*. Also, as already stated, residents' cognitive and behavioural problems are poorly understood by many dental professionals, but as the DONs high rating of these problems indicated, these problems often dictate how residents' needs and care are prioritised in the nursing home. As reported by the DONs, staffing and time constraints also interfere with dental care. Dentists' acknowledgement, better understanding and management of these problems will assist their successful integration into the nursing home environment. In addition, if dental professionals increase the time they spend in the nursing home environment, communication with nursing home staff and the staff's awareness of dental issues should improve.

Some possible solutions that may increase dentists' interest in nursing home dentistry, and encourage dentists to spend more time in nursing homes, are:

- hiring of dental hygienists to implement ongoing staff educational programs;
- the appointment of a dental coordinator at each nursing home;
- increased availability and use of portable dental equipment;
- better working areas in nursing homes;
- development of clinical undergraduate experiences in geriatric and nursing home dentistry; and
- postgraduation 'hands-on' clinical experience with mentors.

Study limitations

This study questioned only Adelaide DONs and dentists and thus its results cannot be directly extrapolated to other Australian cities or overseas situations. However, there were many similarities found between the Colorado (Berkey et al., 1988), Canadian (Weiss et al., 1993) and Adelaide study results concerning barriers to/problems with dental care provision for nursing home residents; greater awareness of these may assist other dental care providers and nursing home staff to better understand and improve dental care provision for their nursing home residents. This study also provides a study framework for replication with dental and nursing professionals in other areas of Australia.

Several areas of questioning not included in the questionnaire could be addressed in future studies:

- possible arrangements/contracts between dentists and nursing homes;
- types of dental services provided at dental practices versus at nursing home premises;
- types of portable dental equipment used in nursing homes;
- actual numbers of residents cared for at each nursing home; and
- influence and use of the nursing home dental standard and guidelines in nursing homes.

The questionnaire was not sent to dental technicians or dental hygienists. Quantification of their involvement in service provision for nursing home residents and their attitudes toward nursing home dentistry would be useful.

3 Clinical dental inspections of residents from randomly selected Adelaide Nursing Homes

3.1 Methods

Ethical implications of the clinical dental inspection component

Approval for the study was obtained from The University of Adelaide Human Ethics Committee. An information summary of the study was given to all nursing home residents/guardians, and a consent form was completed and signed for each participant before the collection of questionnaire information, interview and dental inspection. Confidentiality was maintained in the field, and all paper and electronic documents securely stored using a subject 4-digit identification number. Where appropriate, carers deemed the 'person responsible' or 'guardian' for the participant signed the consent form. The Office of the Public Advocate SA provided advice concerning the procedures to be followed to obtain consent from a third party. To ensure confidentiality was maintained for all nursing home residents, the Directors of Nursing of all nursing homes were contacted and approval was sought for participation of the nursing home before any personal contacts with residents were initiated. All initial contacts with residents/'persons responsible' were coordinated with the assistance of a liaison person from the nursing/administrative staff of each nursing home. Residents' personal information was only given to the researchers after the resident and/or 'person responsible' had agreed to the resident participating in the study. The risks involved in the study's dental inspection were no greater than those associated with a standard dental examination. High quality equipment and procedures for oral inspections and cross-infection control were used in the study. Medical risks involved with periodontal probing were fully assessed and no probing was undertaken for at-risk participants. Written reports of the findings from the dental inspection were given to nursing home staff for placement into residents' records, and staff were advised of any treatment needs or problems. Any participants with life-threatening or serious disorders were referred to the ADA-nominated dentists or the South Australian Dental Service for urgent assessment of their disorder. If required or requested, participants were assisted with referral to the most appropriate public dental clinic or to the ADA-nominated private dentist for that nursing home for any treatment required.

Timeline, study design, sample size and sampling

The Adelaide Dental Study of Nursing Homes is a longitudinal study with baseline data collection conducted during 1998 and a one-year follow-up data collection being conducted in 1999. Interviews and dental inspections were conducted at baseline over an eight-month period using a staggered approach between the nursing homes. After consent was obtained, interviewers conducted nursing home record audits and held discussions with nursing home staff, family members and/or residents to complete the questionnaires. The dental inspections were then conducted by a dentist and recorder.

For the collection of one-year follow-up data in 1999, all nursing homes will again be approached, and all residents seen at baseline will be invited to participate. For ethical reasons, any residents new to the nursing home will also be offered a dental inspection. Information will also be collected concerning any baseline participants who are no longer resident at the nursing home in 1999.

The study used a random sample from the list of Adelaide nursing homes provided by the Aged Care Division of the Commonwealth Department of Health and Family Services. The 114 Adelaide nursing homes listed with the Commonwealth were grouped by number of beds (small-medium and large), and seven nursing facilities (five small-medium and two large) were randomly selected for participation in the study. The first seven nursing homes approached all agreed to participate in the study. The time and labour intensive approach needed for the study limited the number of nursing homes selected. All residents of the seven nursing facilities were asked to participate in the study. As an incentive for participation, a free dental 'in-service' training session was offered to the staff of each nursing home. This dental 'in-service' was only conducted after the dental inspections were completed at each nursing home. Three nursing homes did not want the dental 'in-service' conducted.

The sampling strategy was based on previous studies conducted in Australia (Vowles et al., 1979; Walker, 1984; Stockwell, 1987), New Zealand (Thomson et al., 1992a, 1992b) and the US (Weyant et al., 1993). Sample size calculations also took into account the changing pattern of edentulism in older Australians (Carter, 1997). In previous Australian studies and from AIHW DSRU data, 1970s–80s edentulism rates in these populations were as high as 74–90%. When planning the study, data indicated that approximately 60% of participants in a 1998 study would be edentulous. Approximating participation rates to those found in the other studies, it was projected that from the initial sample approximately 40% would refuse to participate. As specific strategies would be employed for the examination of cognitively impaired and behaviourally difficult residents, and dentists experienced in caring for nursing home residents would be used, loss of subjects for dental inspections because of 'non-cooperation' would be minimal. Of the dentate subjects, it was projected that approximately 30% would not participate in the periodontal probing section of the examination because of the need for medication adjustment if they were on anticoagulants or long term steroids, and for antibiotic prophylaxis for medical conditions such as joint replacement or rheumatic fever.

Measurement of variables, instruments of measurement and collection of data

To ensure that confidentiality was maintained for all nursing home residents, the Directors of Nursing of all nursing homes were contacted and approval was sought before any contacts with residents were initiated. Dr Chalmers attended each of the three Adelaide meetings for nursing home Directors of Nursing to inform them about the study. All initial contacts with residents/'persons responsible' were coordinated with the assistance of a liaison person from each nursing home, using a primary approach letter. One follow-up 'reminder' mailing was sent and/or a telephone call was made by the interviewer two weeks after the initial mailing. Arrangements were made for residents/'persons responsible' to discuss the study with the liaison person or an interviewer if requested. Each resident's personal information was only given to the researchers after the resident and/or 'person responsible' had agreed to the resident participating in the study.

All questionnaire information was obtained from an audit of the nursing home records and from interviews held with the nursing home staff, family members and residents prior to the dental inspection. The questionnaire used close-ended questions to collect information concerning the resident's oral hygiene practices and assistance required with oral hygiene, problems encountered providing oral care for the resident, time since, reason for, and treatment provided at last dental visit, location of the last dental visit, smoking and alcohol consumption, medical history, current prescription and over-the-counter medications, chewing abilities, and educational and economic status. Many of these interview questions had been developed and used in the South Australian Dental Longitudinal Study (SADLS) of older adults. Assessment of functional status was conducted using the Katz et al., (1963) Index of Activities of Daily Living (ADL) and the Lawton & Brody (1969) Instrumental Activities of Daily Living (IADL) scales. The ADL scale assesses residents' abilities to complete the following activities: bathing, dressing, toileting, transfer, continence and feeding. The IADL scale assesses residents' abilities to complete the following activities: use of the telephone, shopping, transportation, medication responsibility, management of finances, and for females only, food preparation, housekeeping and laundry.

The National Institute of Dental Research (NIDR) (1987) protocol was used for the dental inspections in the study. The calibrated dentists examined subjects under standardised lighting conditions and used visual and tactile criteria to assess tooth status, coronal and root caries experience, tooth attrition, accumulation of debris/plaque, presence of gingivitis, loss of periodontal attachment (recession and probing depths), oral mucosal lesions and dental treatment needs. Tooth status was categorised as one of the following: present, sound, missing-replaced with fixed/removable appliance, missing-no space, missing-not replaced, crown, retained root-sound, or retained root-decayed. A retained root had only one-quarter or less of the crown remaining. Coronal caries data was recorded for five surfaces for molars and premolars and four surfaces for canines and incisors. Four root surfaces were coded for each tooth. Surfaces of tooth crowns and roots were categorised as: sound, decayed, recurrent decay, filled, or filled unsatisfactory. For root surfaces, an additional category of 'not exposed' was available for surfaces with no gingival recession apical to the cemento-enamel junction (CEJ). For root surfaces to be scored as sound, the root surface must have been visible. When a crown or root surface could not be physically or visually accessed, an 'excluded' category was scored. When a crown or root surface could not be accessed because of abundant deposits of debris, calculus and/or plaque, a 'plaque' category was scored.

If both the coronal and root surfaces were affected by caries or a restoration, it was necessary to determine the lesion's origin. If more than half of the lesion was above the CEJ, it was regarded only as a coronal lesion; if more than half of the lesion was below the CEJ it was regarded only as a root surface lesion. When scoring multiple surfaces on crowns or roots, the 'ONE-THIRD RULE' was used for restorations or carious lesions which were continuous over one or more of the mesial, buccal, distal or lingual surfaces. The restoration or lesion must have extended at least one-third of the circumferential distance across the surface. If a restoration or lesion extended less than one-third the circumference around both surfaces, the surface which had the majority of the circumferential distance was selected. For restorations or lesions which extended beyond the occlusal surface (ie over the marginal ridge), the other surface(s) were always included. The normatively assessed tooth treatment needed was scored: number of surfaces (1-5, crown) requiring restoration, need for preventive treatment,

extraction due to caries, extraction due to periodontal disease, or extraction for prosthetic reasons.

Tooth attrition was scored as one of four categories: *no attrition, enamel* when the occlusal or incisal enamel was worn so that dentine was exposed, *dentine* when the entire occlusal or incisal enamel was obliterated, leaving an enamel ring surrounding a central core of dentine, or *severe* when the tooth had worn to the gingival margin (one-third of crown was present). The World Health Organization (WHO) (1987) 'Oral Health Surveys; Basic Methods' was used to assess oral mucosal lesions. Presence, condition and need for replacement of prosthetic appliances were assessed using the criteria developed by Rise (1979).

Presence or absence of plaque was scored using Silness and Loe (1964) criteria:

Score Plaque	Index Criteria
0	No plaque
1	A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be seen <i>in situ</i> only after application of disclosing solution or by using the probe on the tooth surface.
2	Moderate accumulation of soft deposits within the gingival pocket, or on the tooth and gingival margin which can be seen with the naked eye.
3	Abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin.

Six buccal surfaces were assessed: the buccal surface of the most anterior molar in each quadrant; the buccal surface of 11; and the buccal surface of 31. Hence, the first molar was used or, in its absence, the second molar, or in the absence of both, the third molar. However, there was no substitution for either of the incisors. When an index tooth was not available (missing), the appropriate sextant was scored as 'X'.

Periodontal disease was assessed at three sites per tooth: mesiobuccal, buccal and distolingual. At each site, recession, probing depth, presence of calculus, and presence of bleeding after probing were scored.

No radiographs were taken and no dental treatment was provided for participants. Residents were advised in writing that they should also have a regular dental check-up in addition to the dental inspection provided by the study. The dental inspections were conducted by one of two calibrated dentists (one AIHW DSRU dentist and one ADA dentist) within two weeks of the interview. Duplicate dental inspections were conducted on 10% of the participants during the study to check for reliability. The dental inspections were conducted over several weeks at each nursing home, so that specialised dental inspection procedures could be used. For participants with dementia and behaviourally 'difficult' residents, these procedures allowed for individual variation:

- clinical dental inspections for an individual participant could be conducted over several sessions if required;

- clinical inspections were conducted at times of the day suitable to the resident, any 'persons responsible' and the nursing home staff;
- the presence of a caregiver was sought at clinical inspections to assist with communication;
- 'task-breakdown' strategies were used when conducting the inspections;
- specialised behavioural and communication strategies developed for adults with dementia were used (such as bridging, distraction, chaining, rescuing and hand-over-hand techniques); and
- the interview or inspection was attempted on three separate occasions for each resident, if the resident was absent or involved in another activity at the time when the clinical inspection/interview was to be conducted.

Following the completion of the dental inspection, a Mini Mental State Exam (MMSE) (Folstein et al., 1975) was conducted. If the subject had completed an MMSE test recently, those results were accepted. The dentist or recorder conducted the MMSE, and was trained by Dr Chalmers to administer the MMSE. The MMSE scores were categorised using the system developed by Mungas (1991). Those participants scoring 26 or greater (out of 30) were categorised as within normal cognitive range, those scoring from 21 to 25 had mild dementia, those scoring from 11 to 20 had moderate dementia and those scoring 10 or less had severe dementia.

Database maintenance and analysis of data

Maintenance of the participant database, epidemiological data collection and entry, and statistical analyses were conducted using SPSS for Windows (Versions 6.1 and 8.0). Univariate statistics were computed to describe:

- residents' participation and response rates;
- participants' dentate status, cognitive status (MMSE score), and functional status (ADL score);
- participants' normative and perceived dental needs; and
- prevalence of oral diseases and conditions (denture status, oral mucosal lesions, and attrition).

Where appropriate, tests of significance (Pearson's chi-square statistic) were used to investigate differences between the dentate, cognitive and functional status variables with demographic, medical, weight change, chewing ability, dental history, and oral hygiene care characteristics.

In order to provide population estimates for the prevalence of oral diseases and conditions (tooth status, coronal and root caries, plaque accumulation, and loss of periodontal attachment), the data were weighted by size of nursing home.

Tests of significance were used to investigate differences in prevalence of these weighted oral diseases and conditions for sub-groups, using residents' medical status, cognitive status (MMSE score), functional status (ADL score), weight change, and chewing ability. Analyses used weighted least squares regression, with a Tukey HSD post hoc test.

Inter-examiner reliability was monitored at baseline and this will be continued throughout the study using the Kappa statistic and intra-class correlation analyses.

All data collected remain the joint possession of the ADA (SA Branch) and the AIHW DSRU, and databases are securely stored, to maintain confidentiality for all subjects, by Dr Chalmers at the AIHW DSRU.

3.2 Response rates

Table 14: Participation and response rates for individual nursing homes

Nursing Home	Number of residents	Not included (deceased, ill, hospitalised)	Not Included (discharged before examination)	TOTAL Included	No response	No	Yes	Response rate %
1	70	5	1	64	15	15	34	53.1
2	41	3	0	38	7	10	21	55.3
3	21	0	0	21	0	3	18	85.7
4	175	6	6	163	49	24	90	55.2
5	48	5	0	43	13	9	21	48.8
6	49	3	0	46	7	11	28	60.9
7	22	3	0	19	2	5	12	63.2
Total	426	25	7	394	93	77	224	

The first seven nursing homes approached all agreed to participate in the study. The obtaining of consent from residents/guardians and the collection of questionnaire information were time-consuming exercises. This was due to an extensive follow-up of guardians' consent and to the great diversity of nursing home record-keeping systems. The staff of all seven nursing homes were extremely helpful and cooperative with these aspects of the study. The amount of time required to obtain consent, and audit the nursing home records, in combination with the finite resources available to the study, limited the number of nursing homes that could be included. Approximately 4–6 weeks was required to obtain written consent from guardians by mail (depending upon the size of the nursing home). Up to 30 minutes was needed for auditing each resident's nursing home record.

Table 14 presents the participation and response rates for the seven individual nursing homes. The non-participation/refusal rate of 40% predicted from other studies also occurred in this study. However, in approximately half of the nursing homes the non-participation/refusal rate was closer to 50%. Of the 426 residents on the lists provided by the seven nursing homes, 25 were either too ill/hospitalised to be contacted or had recently died. Another seven residents were not included as they had been discharged from the nursing home prior to the completion of the dental inspections. The number of residents/guardians approached for participation totalled 394, and 224 completed a dental inspection. Of the 170 who did not participate, 77 residents/guardians refused and 93 guardians failed to respond.

Reasons given by residents and guardians for refusal to participate were mainly associated with residents' behavioural and cognitive problems. Three residents did not want to have the dental inspection when approached in the nursing home, although guardians had consented for them to participate. As the questionnaire had been completed for these residents, it was found that all three had moderate dementia and complex behavioural and depressive problems. Fifteen guardians responded that they

were concerned that a dental examination may cause distress to the elderly and severely demented resident. This was especially an issue for the guardians of eight residents with severe combative, aggressive and resistive behaviour. Several residents that did not participate were not able to communicate or were very close to death. Where possible, telephone contact was made with family and guardians to discuss the study and to reassure them that specialised procedures were in place and that experienced dentists would be conducting the dental inspection. Seventeen guardians declined participation as the resident was edentulous and in many cases did not wear dentures. Several residents were seeing their own dentist and so guardians did not wish them to have another dental inspection for the study.

When the distribution of sex and consent characteristics of participants was compared with that of the non-participants, no significant differences were found. Approximately one-third of participants and one-third of non-participants were male. One-quarter of participants and one-quarter of non-participants were noted by the nursing home as able to give consent, the remainder requiring responses from a guardian.

Seventy-three of the residents who were examined gave their own consent, 141 residents required consent from a guardian and 10 required consent from a 'person responsible' such as the Director of Nursing.

3.3 Results

Dentate status and related characteristics

Table 15: Dentate status – maxilla by mandible (n=224)

	Dentate status mandible (%)		
	Dentate	Edentulous	Total
Dentate status maxilla			
Dentate	21.0	0.9	21.9
Edentulous	12.1	66.0	78.1
Total	33.1	66.9	100.0

Table 15 presents participants' dentate status – maxilla by mandible. Sixty-six per cent of participants were edentulous in both the maxilla and the mandible. Thirteen per cent were edentulous in one arch only and dentate in the other arch. More were edentulous in the maxilla (78.1%) than in the mandible (66.9%). Twenty-one per cent were dentate in both arches. Dentate status did not significantly differ by nursing home, nor by consent type (whether consent was given by the resident or by a guardian).

Tables 16–19 present various resident characteristics by dentate status. In Table 16, residents' demographic and medical characteristics are presented by dentate status. There was a significantly higher percentage of females residing in the nursing homes; 56% of dentate and 72.3% of edentulous participants were female. The age distribution of residents who participated was similar for both dentate and edentulous residents, with the majority aged 75–94 years (mean=83.2 years, SE=2.1). Participants in this study were medically compromised. Over 90% had three or more chronic medical conditions and over 95% were taking three or more medications. The distribution of number of chronic medical conditions was similar for both dentate and edentulous

participants, with approximately 50% having 5–8 chronic medical conditions (mean=5.0 chronic medical conditions, SE=0.1). The distribution of number of medications taken was again similar for both dentate and edentulous groups, with 50% taking 7–12 medications (mean=7.4 medications, SE=0.2). All medications, both prescription and over-the-counter (OTC) types, were entered into the nursing home medication records by a medical doctor. A breakdown of medication types indicated that most were those requiring a prescription by a medical doctor (mean=6.4 prescription medications, SE=0.2) rather than being OTC type medications (mean = 1.0 OTC medications, SE=0.1).

A very high percentage of residents participating in this study were cognitively impaired. From residents' medical histories in the nursing home records, just over 60% had a diagnosed dementia. Thirteen per cent had a diagnosis of Alzheimer's disease noted in their medical histories. (Note, this may be under-representing the number of residents with Alzheimer's disease, as the general term of 'dementia' was often used by doctors in the nursing home records without any specific diagnoses evident.) In addition, just over 40% had a history of stroke (which may be associated with multi-infarct type dementia). Use of the Mini Mental State Exam (MMSE) further revealed that 81% of participants had an MMSE score indicative of moderate–severe dementia and another 9.5% had scores indicative of mild dementia. Mean MMSE score was 9.1 (SE = 0.7), which was in the severe dementia category. The distributions of MMSE scores did not differ by dentate status. Only 14.5% of dentate and 6.8% of edentulous participants had MMSE scores in the normal cognitive range of 26–30.

Functional status abilities of participants were assessed using the Independent Activities of Daily Living (IADL) (Lawton & Brody, 1969) and Activities of Daily Living (ADL) (Katz et al., 1963) scales. The IADL scale scores the number of activities that a resident can perform independently. All but 2% of edentulous and 5% of dentate participants were able to perform 0 or 1 independent activities. No residents scored 4–6 IADL activities. The ADL scale scores the number of activities that the resident is dependent upon others for. There was a range of ADL scores among participants, with approximately 50% dependent for all 6 ADLs and only 5% dependent for 0–2 ADLs. The remaining 45% were dependent for 3–5 ADLs (mean=5.1 ADLs, SE=0.9). The pattern of ADL scores did not vary by dentate status. As nearly all participants were able to perform only one or no IADLs, the ADL scores are used as the functional status measure in further analyses.

The prevalence of residents who were currently smoking was low, and did not vary by dentate status. Alcohol consumption was not high – 15% of edentulous and 28% of dentate participants.

Time since the resident was admitted to the nursing home was calculated in months using the date of admission and the date of the dental inspection. Just over 25% of dentate and edentulous residents were admitted less than 12 months prior to the dental inspection. Another approximately 45% were admitted between 12 and 48 months and the remaining 30% more than five years prior to the dental inspection (mean=37.1 months, SE=2.1).

Information concerning residents' highest level of education was not available for 40% of participants. This information was not routinely collected in the nursing home records. Edentulous participants were less well educated than were dentate

participants. Few dentate or edentulous residents had attended trade school or university.

Government card holder status was obtained from nursing home records. Approximately three-quarters of both dentate and edentulous residents held a Pensioner Concession Card. Thirteen per cent held a Veteran's Affairs Card. Nursing home records also supplied information concerning residents' private health insurance status. General health insurance status only was available; no information was available concerning 'extras' health insurance cover, which often includes dental care. Significantly more dentate residents held private health insurance (40.8%) than did edentulous residents (16.9%).

Table 17 presents residents' weight change and chewing ability by dentate status. Weight change was measured as the percentage of body weight change per month. Residents were evenly distributed among the weight change categories. However, edentulous residents lost more percentage body weight than did dentate residents. The majority of dentate and edentulous residents could chew 2-3 of the foods asked about - boiled vegetables, hamburger, meat, carrot, apple (mean=2.3 foods, SE=0.8). Edentulous residents could eat fewer foods than could dentate residents (sig, $p<0.05$). Most dentate and edentulous residents were able to chew boiled vegetables and hamburger. However, very few edentulous participants could chew harder foods (meat, carrot, apple) (sig, $p<0.05$).

Table 18 presents residents' dental history by dentate status. To obtain information concerning residents' dental history, residents and their nursing home carers were interviewed and nursing records were consulted. Sixteen per cent of both dentate and edentulous residents had dental pain or discomfort at the time of the dental inspection. Perceived need for dental treatment was low: 26% of dentate and 18% of edentulous participants indicated a need for dental treatment. Participants were attending the dentist mainly for a dental problem rather than for a regular check-up. More edentulous participants attended for a problem (83.1%) than did dentate participants (75.0%). Very few participants had avoided or delayed visiting the dentist because of the cost. There were no significant differences between dentate and edentulous participants in terms of the above four aspects of dental history.

Reason for last dental visit was determined primarily from nursing home records, but was also discussed with residents and nursing home carers. For approximately one-third of residents, there was no notation in their records of a dental visit. Often carers could not remember a dental visit occurring since the resident had been admitted to the nursing home. Dentate residents had visited the dentist more recently than had edentulous residents; 35.5% of dentate and 19.6% of edentulous participants had visited within the 12 months prior to the dental inspection. Another 10% of dentate and edentulous participants had visited 1-2 years prior to the dental inspection; 25% of edentulous participants had last visited a dentist more than 10 years ago. Mean number of months since last dental visit was 66.9 (SE=7.9). In addition to those residents with no record of a dental visit, there was no record of treatment provided at the last visit for another 7.9% of dentate and 20.9% of edentulous residents. Edentulous residents last attended for new dentures (25.7%) and denture adjustments (11.5%). Dentate residents last attended for a range of procedures. Attendance rates were 15.8% for a check-up and approximately 10% for each of the following: an extraction, a denture adjustment or new dentures. The majority of last dental visits for both dentate and edentulous residents were at a dental surgery/clinic rather than in a nursing home.

Table 19 presents residents' oral hygiene care by dentate status. Frequency of denture cleaning was reported by residents and/or nursing home carers. Of dentate participants who wore dentures, 71.8% had their dentures cleaned once daily. Of edentulous participants who wore dentures, 58.5% had their dentures cleaned once daily and 38.2% twice daily or more. Nearly all residents, dentate and edentulous, required assistance to clean their dentures. Some assistance was required by 20.5% of dentate and 17.7% of edentulous residents. Total assistance was required by 69.2% of dentate and 77.4% of edentulous residents.

Only 42.3% of dentate residents had their natural teeth cleaned twice daily or more; 50.7% had their natural teeth cleaned once daily. Similar percentages of dentate residents required some assistance with cleaning of their natural teeth and of their dentures. However, few dentate subjects required total assistance and nearly one-quarter required no assistance with cleaning of their natural teeth.

Nursing home carers were asked if they had any specific difficulties when providing oral care for each resident. Carers had such difficulties with approximately 40% of both dentate and edentulous residents. More difficulties were noted for dentate residents. Carers had 5 or more difficulties with 22.4% of dentate residents compared with 10.1% of edentulous residents.

Table 16: Demographic and medical characteristics by dentate status (n=224) (%)

	Dentate status	
	Dentate (n=76)	Edentulous (n=148)
Sex**		
Male	43.4	28.4
Female	56.6	71.6
Age group		
≤64 years	9.2	3.4
65–74 years	14.5	6.8
75–84 years	31.6	37.2
85–94 years	38.2	45.9
95+ years	6.6	6.8
Number of chronic medical conditions		
1–2	9.2	8.8
3–4	43.4	31.8
5–6	28.9	35.8
7–8	15.8	16.2
9+	2.6	7.4
Total number of medications		
1–2	2.6	4.7
3–4	14.5	14.2
5–6	28.9	19.6
7–8	26.3	28.4
9–12	23.7	22.3
13+	3.9	10.8
MMSE score		
≤10	55.1	60.6
11–20	21.7	22.7
21–25	8.7	9.8
26–30	14.5	6.8
A diagnosed dementia	61.8	65.5
History of stroke	40.8	43.2
ADL score (number of dependent activities)		
0–2	5.3	4.1
3	11.8	6.8
4	6.6	8.1
5	23.7	33.1
6	52.6	48.0
IADL score (number of Independent activities)*		
0	80.3	85.1
1	14.5	12.8
2	5.3	1.4
3	0	0.7
Currently smoking	3.9	5.4
Currently drink alcohol	27.6	14.9

Table 16: Demographic and medical characteristics by dentate status (n=224) (cont.)

	Dentate status	
	Dentate (n=76)	Edentulous (n=148)
Time since admitted*		
<12 months	28.9	26.4
13–24 months	17.1	17.6
25–36 months	11.8	18.2
37–48 months	14.5	10.1
49–60 months	7.9	9.5
61–120 months	14.5	16.9
121+ months	5.3	1.4
Highest educational level		
Primary school	18.4	35.1
High school	28.9	19.6
Trade school	5.3	3.4
University	6.6	1.4
Don't know	40.8	40.5
Pensioner Concession Card	73.7	77.7
Veterans Affairs Card	13.2	12.8
Private Health Insurance*	40.8	16.9

* chi-square test sig. p<0.01

** chi-square test sig. p<0.05

Table 17: Weight change and chewing ability by dentate status (n=224) (%)

	Dentate status	
	Dentate	Edentulous
Weight change (% body weight change per month)#	n=72	n=135
<-0.5%	22.2	28.9
≥-0.5%&<0%	26.4	25.2
≥-0%&≥0.5%	25.0	18.5
>0.5%	26.4	27.4
Number of foods can eat*	n=76	n=148
0	7.9	5.4
1	9.2	14.9
2	34.2	49.3
3	23.7	21.6
4	7.9	5.4
5	17.1	3.4
Able to chew	n=72	n=148
Boiled vegetables	92.1	94.6
Hamburger	81.6	79.7
Firm meat**	44.7	29.1
Piece of fresh carrot*	25.0	7.4
Piece of fresh apple*	22.4	6.1

* chi-square test sig. p<0.01

** chi-square test sig. p<0.05

subjects who could not be weighed or who were new admissions and only had one weight recorded are not included in this table

Table 18: Dental history by dentate status (n=224) (%)

	Dentate status	
	Dentate (n=76)	Edentulous (n=148)
Any dental pain or discomfort currently		
Yes	15.8	16.9
No	75.0	77.7
Don't know	9.2	5.4
Need dental treatment at present		
Yes	26.3	17.6
No	63.2	73.6
Don't know	10.5	8.8
Attend dentist		
For check-ups	22.4	11.5
For a dental problem	75.0	83.1
Don't know	2.6	5.4
Avoided or delayed visiting dentist because of cost		
Yes	3.9	10.8
No	85.5	76.4
Don't know	10.5	12.8
Last dental visit		
<12 months	35.5	19.6
13–24 months	11.8	10.8
25–36 months	2.6	4.1
37–48 months	0	1.4
49–60 months	2.6	4.7
61–120 months	5.3	15.5
121+ months	5.3	9.5
Don't know	36.8	34.5
Reason for last visit		
Check-up	15.8	4.7
Cleaning	6.5	0
Filling/s	3.9	0
Extraction	9.2	2.7
Denture adjustment	9.2	11.5
New dentures	10.5	25.7
Don't know	44.7	55.4
Location of last dental visit		
Dental surgery/clinic	34.2	29.7
Nursing home	23.7	24.3
Don't know	42.1	46.0

* chi-square test sig. $p < 0.01$

** chi-square test sig. $p < 0.05$

Table 19: Oral hygiene care by dentate status (%)

	Dentate status	
	Dentate	Edentulous
Frequency of denture cleaning	n=39	n=123
Twice dally or more	23.1	38.2
Once daily	71.8	58.5
Several times a week	2.6	1.6
Less than once a week	0	0
Hardly ever	2.6	0.8
Never	0	0
	0	0.8
Assistance needed cleaning dentures	n=39	n=124
Yes – some	20.5	17.7
Yes – total	69.2	77.4
No	10.3	4.8
Frequency of teeth cleaning	n=71	
Twice daily or more	42.3	n/a
Once daily	50.7	
Several times a week	4.2	
Less than once a week	1.4	
Hardly ever	0	
Never	1.4	
Assistance needed cleaning teeth	n=71	
Yes – some	19.7	n/a
Yes – total	57.7	
No	22.5	
Number of difficulties carers have with oral care*	n=76	n=148
0	59.2	64.2
1–2	5.3	16.2
3–4	13.2	9.5
5+	22.4	10.1
Use a fluoride toothpaste when brushing teeth	n=76	
Yes	89.5	n/a
No	10.5	
Use a floss or interdental sticks	n=76	
Yes	5.3	n/a
No	94.7	
Use a mouthrinse (cosmetic, not containing fluoride)	n=76	
Yes	21.1	n/a
No	78.9	

* chi-square test sig. $p < 0.01$

** chi-square test sig. $p < 0.05$

Dental history and oral hygiene characteristics associated with more severe levels of cognitive impairment and higher functional dependency

Table 20: Reasons why MMSE not completed (n=23)

Reason	Percentage
Could not talk	60.9
Refused	30.5
No English	4.3
Could not see well enough/blind	4.3

Table 20 presents the reasons why the MMSE was not completed for 23 of the participants. The main reasons were related to communication problems and residents' difficulties with talking (60.0%), or refusal to do the MMSE (30.5%).

Tables 21–23 present various resident characteristics by MMSE score. In Table 21, dental history is presented by MMSE. Note that residents with lower MMSE scores had more severe cognitive impairment. There were no consistent trends by MMSE score for responses concerning the resident's dental pain or discomfort or need for dental treatment. However, more don't know responses were reported for the severely cognitively impaired group for both of these questions. The severely cognitively impaired residents often could not verbally communicate if they had any dental pain or discomfort or if they wanted dental treatment. If nursing home carers were unsure they gave a don't know response. This pattern was also evident for all other dental history questions. More don't know responses were recorded for the severely cognitively impaired group, especially for questions concerning the timing, reason and location of the resident's last dental visit. The most severely cognitively impaired residents received increased numbers of check-ups at their last dental visit, but fewer cleaning, restorative and prosthodontic services.

Table 22 presents residents' oral hygiene care by MMSE score. There were no significant differences for the frequency of denture cleaning between MMSE score groups. As residents' MMSE scores decreased with more severe cognitive impairment, there was an increase in the reported frequency of cleaning of natural teeth. However, the frequency of oral hygiene care was very difficult to accurately ascertain at an individual resident level. A clear pattern was evident between MMSE groups for the questions concerning the need for assistance with cleaning of dentures and natural teeth. All of the severely cognitively impaired group required assistance. As MMSE decreased with more severe cognitive impairment, higher numbers required total assistance. This was especially evident for natural teeth cleaning. None of the normal cognitive range group (MMSE score 26–30) required total assistance with cleaning teeth, but 83.3% of severely cognitively impaired participants required total assistance.

Table 23 presents difficulties nursing home staff encountered with residents' oral hygiene care by residents' MMSE score. Nursing home carers were asked if they encountered any of 12 difficulties with residents' oral hygiene care. When the number of difficulties for each resident was totalled, the majority of carers encountered one or more difficulties for the severely cognitively impaired residents. Carers had 5+ difficulties with 23.7%, 3–4 difficulties with 17.8% and 1–2 difficulties with 13.6% of the severely cognitively impaired residents. Only 5% of carers for the mildly cognitively impaired and normal groups of residents had any difficulties with oral hygiene care.

A pattern emerged across the MMSE groups for all 12 difficulties with oral hygiene care, with the highest percentages of difficulties occurring in the severely cognitively impaired group of residents. The most frequently reported difficulties were:

- residents not opening their mouth;
- residents not understanding staff's directions about oral care;
- residents refusing oral hygiene care;
- residents kicking/hitting out during oral care;
- residents not being able to rinse/spit; and
- residents' heads facing down toward their chest so that staff could not access the mouth.

Table 21: Dental history by MMSE score (n=201) (%)

	MMSE score			
	≤10	11–20	21–25	26–30
Any dental pain or discomfort currently*				
Yes	11.9	22.2	15.8	42.1
No	76.3	77.8	84.2	52.6
Don't know	11.9	0	0	5.3
Need dental treatment at present*				
Yes	16.1	31.1	10.5	42.1
No	67.8	68.9	89.5	52.6
Don't know	16.1	0	0	5.3
Attend dentist				
For check-ups	16.9	6.7	21.1	15.8
For a dental problem	77.1	88.9	78.9	78.9
Don't know	5.9	4.4	0	5.3
Avoided or delayed visiting dentist because of cost				
Yes	7.6	13.3	0	10.5
No	77.1	80.0	84.2	84.2
Don't know	15.3	6.7	15.8	5.3
Last dental visit*				
<12 months	25.4	13.7	42.1	31.6
13–24 months	12.7	13.3	5.3	10.5
25–36 months	2.5	4.4	10.5	0
37–48 months	0.8	2.2	0	0
49–60 months	5.1	2.2	5.3	5.3
61–120 months	10.2	17.8	15.8	21.1
121+ months	0	13.3	10.5	26.3
Don't know	43.2	31.1	10.5	5.3
Reason for last visit*				
Check-up	10.2	6.7	5.3	5.3
Cleaning	1.7	2.2	5.3	5.3
Filling/s	0	4.4	5.3	0
Extraction	5.9	2.2	5.3	10.5
Denture adjustment	8.5	11.1	21.1	21.0
New dentures	8.5	35.6	26.3	47.4
Don't know	65.3	37.8	31.6	10.5
Location of last dental visit*				
Dental surgery/clinic	18.6	35.6	47.4	68.4
Nursing home	24.6	28.9	21.1	21.1
Don't know	56.7	35.5	31.6	10.6

* chi-square test sig. $p < 0.01$

Table 22: Oral hygiene care by MMSE score (n=201) (%)

	MMSE score			
	≤10	11-20	21-25	26-30
Frequency of denture cleaning (n=144)				
Twice daily or more	39.5	25.0	41.2	26.7
Once daily	59.2	72.2	58.8	60.0
Several times a week	0	0	0	13.3
Less than once a week	0	0	0	0
Hardly ever	0	2.8	0	0
Never	1.3	0	0	0
Assistance needed cleaning dentures* (n=146)				
Yes – some	10.4	27.0	5.9	46.7
Yes – total	89.6	70.3	82.4	26.7
No	0	2.7	11.8	26.7
Frequency of teeth cleaning (n=65)				
Twice daily or more	52.8	35.7	33.3	22.2
Once daily	47.2	50.0	66.7	44.4
Several times a week	0	14.3	0	11.1
Less than once a week	0	0	0	11.1
Hardly ever	0	0	0	0
Never	0	0	0	11.1
Assistance needed cleaning teeth* (n=65)				
Yes – some	16.7	14.3	33.3	11.1
Yes – total	83.3	42.9	33.3	0
No	0	42.9	33.3	88.9

* chi-square test sig. p<0.01

Table 23: Difficulties staff encountered with oral hygiene care by MMSE score (n=201) (%)

	MMSE score			
	≤10	11-20	21-25	26-30
Total number of difficulties*				
0	44.9	80.0	94.7	94.7
1-2	13.6	13.3	0	5.3
3-4	17.8	0	5.3	0
5+	23.7	6.7	0	0
Resident refuses oral hygiene care*	31.4	8.9	5.3	5.3
Resident does not open their mouth*	39.8	6.7	5.3	0
Resident bites toothbrush/swab/nursing staff	12.7	6.7	5.3	0
Resident kicks or hits out during oral care*	25.4	6.7	0	0
Resident does not understand nursing staff's directions about oral care*	34.7	4.4	0	5.3
Resident does not rinse*	22.0	6.7	0	0
Resident spits when trying to clean teeth	5.1	0	0	0
Resident uses offensive language	12.7	8.9	0	0
Resident's dentures can't be taken out of the mouth or can't be put back into mouth**	13.6	0	0	0
Resident moves their head or body around (excessively)*	11.9	2.2	0	0
Resident's head faces down toward their chest so staff can't get to their mouth*	15.3	0	0	0
Resident is tired/sleepy	7.6	2.2	0	0

* chi-square test sig. p<0.01

** chi-square test sig. p<0.05

Tables 24–26 present various resident characteristics by ADL score. Note that residents with higher ADL scores were more functionally dependent. Table 24 presents residents' dental histories by ADL score. There were no consistent trends by ADL scores for questions concerning residents' dental pain or discomfort, need for dental treatment, regularity of dental visits, or delay in visiting the dentist because of the cost. However, for the questions about timing, reason, and location of last dental visit, the pattern found was similar to that for cognitive status. There was an increasing percentage of don't know responses for increasingly dependent residents. For example, timing of last dental visit was not known for 10% of participants with ADL score=0–2. However, the percentage not known increased to 44.1% for residents with ADL score=6. As residents became more functionally dependent the percentage seen at dentists' surgeries/clinics fell. The more dependent residents had received fewer extractions, and less prosthodontic treatment at their last dental visit.

Table 25 presents residents' oral hygiene care by ADL score. There were no significant differences for frequency of denture and natural teeth cleaning among ADL groups. A pattern was evident for the need for assistance with cleaning of dentures and natural teeth among the ADL groups. All of the most functionally dependent participants required assistance in cleaning their dentures and all but 8% required assistance in cleaning their natural teeth. As ADL score increased, a higher percentage required total assistance. None of the less dependent ADL group (score=0–2) needed total assistance with cleaning their teeth. However, 79% of the most dependent ADL group (score=6) required total assistance.

Table 26 presents difficulties staff encountered with residents' oral hygiene care by ADL score. Nursing home carers were asked if they encountered any of 12 difficulties with residents' oral hygiene care. When the number of difficulties for each resident was totalled, 43% of the carers for the most dependent residents (ADL score=6) had one or more difficulties. Carers had 5+ difficulties with 21.6%, 3–4 difficulties with 15.3% and 1–2 difficulties with 0.3% of the most dependent residents.

A pattern emerged across the ADL score groups for all 12 difficulties with oral hygiene care, with the highest percentages of difficulties occurring in the most dependent group of residents. The most frequently reported difficulties were:

- residents not opening their mouth;
- residents not understanding staff's directions about oral care;
- residents refusing oral hygiene care;
- residents kicking/hitting out during oral care;
- residents not being able to rinse/spit; and
- residents' dentures can't be taken out of the mouth or can't be put back into the mouth.

Table 24: Dental history by ADL score (n=224) (%)

	ADL score (number of dependent activities)				
	0-2	3	4	5	6
Dental pain or discomfort currently					
Yes	10.0	21.1	11.8	22.4	22.4
No	70.0	73.7	88.2	74.6	77.1
Don't know	20.0	5.3	0	3.0	9.0
Need dental treatment at present*					
Yes	30.0	26.3	5.9	32.8	13.5
No	50.0	63.2	94.1	61.2	74.8
Don't know	20.0	10.5	0	6.0	11.7
Attend dentist					
For check-ups	0	26.3	11.8	22.4	10.8
For a dental problem	100	68.4	82.4	73.1	84.7
Don't know	0	5.3	5.9	4.5	4.5
Avoided or delayed visiting dentist because of cost					
Yes	20.0	10.5	17.6	7.5	6.3
No	60.0	78.9	76.5	74.6	84.7
Don't know	20.0	10.5	5.9	17.9	9.0
Last dental visit					
<12 months	10.0	36.8	17.6	37.3	18.0
13-24 months	20.0	0	5.9	13.4	11.7
25-36 months	0	5.3	5.9	4.5	2.7
37-48 months	0	5.3	0	0	0.9
49-60 months	20.0	5.3	5.9	3.0	2.7
61-120 months	20.0	10.5	17.6	7.5	13.5
121+ months	20.0	21.1	11.8	4.5	6.3
Don't know	10.0	15.8	35.3	29.9	44.1
Reason for last visit					
Check-up	0	5.3	17.6	9.0	8.1
Cleaning	0	0	0	3.0	0.9
Filling/s	0	0	0	3.0	0.9
Extraction	10.0	21.1	0	3.0	3.6
Denture adjustment	10.0	15.8	5.9	19.4	4.8
New dentures	60.0	31.6	29.4	22.4	12.6
Don't know	20.0	26.3	47.1	38.8	66.7
Location of last dental visit*					
Dental surgery/clinic	80.0	47.4	35.3	37.3	19.8
Nursing home	10.0	21.1	17.6	34.3	20.7
Other	0	0	5.9	1.5	0.9
Don't know	10.0	31.6	41.2	26.9	58.6

* chi-square test sig. p<0.01

Table 25: Oral hygiene care by ADL score (n=224) (%)

	ADL score (number of dependent activities)				
	0-2	3	4	5	6
Frequency of denture cleaning (n=162)					
Twice dally or more	0	26.7	38.5	42.9	33.8
Once daily	70.0	73.3	53.8	53.6	66.2
Several times a week	10.0	0	7.7	1.8	0
Less than once a week	0	0	0	0	0
Hardly ever	10.0	0	0	0	0
Never	10.0	0	0	0	0
Don't know	0	0	0	1.8	0
Assistance needed cleaning dentures* (n=163)					
Yes – some	30.0	33.3	30.8	14.3	14.5
Yes – total	40.0	46.7	53.8	82.1	85.5
No	30.0	20.0	15.4	15.4	0
Frequency of teeth cleaning (n=72)					
Twice daily or more	0	50.0	60.0	23.5	52.6
Once daily	50.0	50.0	40.0	58.8	47.4
Several times a week	25.0	0	0	11.8	0
Less than once a week	0	0	0	5.9	0
Hardly ever	0	0	0	0	0
Never	25.0	0	0	0	0
Assistance needed cleaning teeth* (n=72)					
Yes – some	0	25.0	40.0	29.4	13.2
Yes – total	0	37.5	40.0	41.2	78.9
No	100	37.5	20.0	29.4	7.9

* chi-square test sig. p<0.01

Table 26: Difficulties staff encountered with oral hygiene care by ADL score (n=224) (%)

	ADL score				
	0-2	3	4	5	6
Total number of difficulties*					
0	100	78.9	76.5	58.2	56.8
1-2	0	10.5	11.8	25.4	6.3
3-4	0	0	5.9	9.0	15.3
5+	0	10.5	5.9	7.5	21.6
Resident refuses oral hygiene care	0	10.5	23.5	17.9	26.1
Resident does not open their mouth*	0	10.5	5.9	17.9	35.1
Resident bites toothbrush/swab/nursing staff	0	5.3	5.9	9.1	10.8
Resident kicks or hits out during oral care	0	15.8	5.9	10.4	22.5
Resident does not understand nursing staff's directions about oral care**	0	10.5	5.9	16.4	27.0
Resident does not rinse	0	10.5	0	10.4	18.0
Resident splts when trying to clean teeth	0	0	0	1.5	4.5
Resident uses offensive language	0	10.5	11.8	7.5	10.8
Resident's dentures can't be taken out of the mouth or can't be put back into mouth*	0	5.3	0	3.0	13.5
Resident moves their head or body around (excessively)	0	5.3	0	3.0	10.8
Resident's head faces down toward their chest so staff can't get to their mouth	0	5.3	0	1.5	15.3
Resident is tired/sleepy	0	5.3	5.9	3.0	5.4

* chi-square test sig. $p < 0.01$

** chi-square test sig. $p < 0.05$

Prevalence of oral diseases and conditions

Dentures

Table 27: Dentate status by denture status – maxilla (n=224)

	Denture status (%)			
	Full denture	Partial denture	Denture owned but not worn	No denture
Dentate status				
Dentate (n=49)	0	28.5	16.3	55.1
Edentulous (n=175)	81.7	0	13.7	4.6

Table 28: Dentate status by denture status – mandible (n=224)

	Denture status (%)			
	Full denture	Partial denture	Denture owned but not worn	No denture
Dentate status				
Dentate (n=74)	0	18.9	20.3	60.8
Edentulous (n=150)	74.0	0	20.7	5.3

Dentate status by denture status is presented in Tables 27 and 28 for the maxilla and mandible respectively. Of participants who were edentulous in the maxilla, 13.7% owned a full denture but did not wear it and 4.6% did not have a denture to replace the missing upper teeth. In the mandible, there were higher percentages of participants who owned but did not wear their full lower denture (20.7%) and who did not have a denture to replace the missing lower teeth (5.3%). Of the participants who were dentate in the maxilla, 28.5% wore a partial denture and another 16.3% owned a partial denture but did not wear it. The percentage of participants who were dentate in the mandible and wore a partial denture (18.9%) was lower than for the maxilla. However, a higher percentage (20.3%) owned a mandibular partial denture but did not wear it.

Table 29: Types of dentures worn by participants (n=224) (%)

Denture type		Percentage of participants
Upper denture	Lower denture	
Full	Full	49.1
Full	Not worn	6.7
Full	No denture	5.4
Full	Partial	3.1
Partial	Full	0.4
Partial	Partial	2.7
No denture	Partial	0.4
Partial	No denture	1.3
Partial	Not worn	1.3
Not worn	Not worn	12.5
Not worn	No denture	1.8
No denture	No denture	15.2

Tables 27 and 28 presented participants' dentate status by denture status for individual arches. Table 29 presents the combinations of upper and lower dentures worn by participants. Eighty-five per cent of residents owned a denture for one or both arches. Nearly half of residents (49.1%) wore full upper and lower dentures. Another 6.7% wore their full upper denture only and did not wear their full lower denture, and 5.4% wore a full upper denture and no lower denture. Approximately 6% of residents wore a partial denture in one or both arches. One-eighth of residents owned both upper and lower dentures but did not wear them, and only 15.2% wore no dentures.

Table 30: Denture wearers – denture problems by dentate status (%)

Denture problem	Dentate status (%)	
	Dentate	Edentulous
Upper denture	n=37	n=120
Retention unsatisfactory	34.2	23.3
Stability unsatisfactory	31.6	21.8
Occlusion unsatisfactory	13.2	27.5
Material inadequacies		
Lining	0	6.7
Porosity	0	0.8
Staining	29.7	26.7
Defects		
Small	0	1.7
Large	5.4	0
Multiple	16.2	6.7
Lower denture	n=15	n=110
Retention unsatisfactory	13.3	40.0
Stability unsatisfactory	12.5	28.2
Occlusion unsatisfactory	6.7	26.4
Material Inadequacies		
Lining	6.7	0.9
Porosity	0	0
Staining	26.7	21.8
Defects		
Small	0	0
Large	0	0
Multiple	6.7	4.5

Table 30 presents the denture problems by dentate status of denture wearers. Among denture wearers, the highest percentages of denture problems occurred in relation to dentate participants' upper dentures and edentulous participants' lower dentures. Inadequate retention (34.2%) and stability (31.6%) were the main problems with dentate participants' upper dentures. Inadequate retention (40.0%), stability (28.2%) and occlusion (26.4%) were the main problems with edentulous participants, lower dentures. Staining on the denture surface was the most frequent material inadequacy in upper and lower dentures, being found in over one-quarter of both dentate and edentulous residents. Dentate participants' upper dentures had the highest number of defects, such as broken or missing teeth or fractured denture material.

Oral mucosal lesions and conditions

Table 31 presents the prevalence of oral mucosal lesions/conditions among participants. Denture-related lesions/conditions were prevalent in denture wearers: nearly one-fifth of residents had angular cheilitis and 16% denture stomatitis in the maxilla. The prevalence of other oral mucosal lesions/conditions was low. Actinic keratosis was observed in 5% of participants and non-specific ulcers in 2.2%.

Table 31: Prevalence of oral mucosal lesions/conditions (%)

	Oral mucosal lesion/condition
Denture-related lesions/conditions	<i>n= 157 denture wearers</i>
Angular cheilitis	18.5
Denture stomatitis – maxilla	15.9
Hyperplasia	5.7
Ulceration – mandible	3.8
Ulceration – maxilla	2.6
Denture stomatitis – mandible	1.9
Other lesions/conditions	<i>n=224</i>
Actinic keratosis	4.9
Ulcer, non-specific	2.2
Candidiasis – Pseudomembranous	1.8
Candidiasis – Erythematous	0.9
Cheek/lip biting	0.9
Amalgam tattoo	0.5
Gingival hyperplasia	0.5
Herpes labialis	0.5
Leukoplakia	0.5
Mucocele	0.5
Geographic tongue	0.5
Hairy tongue	0.5

Tooth status (weighted)

Table 32: Tooth status (n=76)

	Number of decayed crowns		Number of missing teeth		Number of filled/crowned crowns		DMFT		Number of retained roots		Plaque#	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Sex												
Male	2.0*	(1.9)	16.7	(7.3)	4.8	(5.5)	23.5	(5.2)	2.1*	(3.4)	0.7	(2.8)
Female	0.6	(1.2)	20.0	(7.1)	3.2	(3.9)	23.8	(4.9)	0.5	(0.9)	0.2	(0.5)
Age												
≤74 years	1.4	(1.8)	14.2*	(6.1)	4.2	(4.8)	19.8*	(5.3)	2.1	(3.7)	0.5	(2.5)
75–84 years	1.1	(1.5)	19.2	(7.0)	4.9	(5.6)	25.1	(3.0)	0.7	(1.4)	0.2	(0.7)
85–89 years	0.4	(1.1)	21.3	(6.3)	3.0	(3.5)	24.7	(3.7)	0.5	(1.0)	0.6	(2.1)
90+ years	1.5	(2.1)	22.6	(7.8)	2.0	(2.3)	26.1	(5.8)	0.9	(1.2)	0.1	(0.4)
Total	1.1	(1.6)	18.9	(7.3)	3.8	(4.5)	23.7	(5.0)	1.1	(2.2)	0.3	(1.7)

* sig. $p < 0.05$ weighted least squares regression; (first category different from remaining categories – Tukey HSD test)

Teeth were present but could not be scored because they were covered in plaque, calculus or other debris.

Table 32 presents dentate residents' tooth status – mean number of teeth (and standard deviation) that were decayed, missing, filled (DMFT), or retained roots. Teeth that were present but could not be scored because they were covered in plaque, calculus or other debris were scored as 'plaque'. Residents had a mean number of 18.9 missing teeth, 1.1 retained roots and 0.3 teeth that could not be scored because of 'plaque'. Older residents had a higher number of missing teeth ($p < 0.05$). Males had more retained roots ($p < 0.05$).

Residents had a mean number of 1.1 decayed teeth and 3.8 filled teeth. Males had many more decayed teeth ($p < 0.05$). There were no significant differences in numbers of filled teeth among sex or age groups. Overall the mean DMFT was 23.7. Residents aged ≤74 years had a much lower DMFT, mainly attributable to the smaller number of missing teeth.

Coronal caries (weighted)

Table 33 presents the mean number of coronal surfaces with caries experience. The mean number of decayed coronal surfaces (1.7) was higher than the number of decayed teeth (1.1), indicating that multiple surfaces were affected on some individual teeth. Males had much greater numbers of decayed coronal surfaces ($p < 0.05$). Mean number of filled surfaces for residents was 8.7. Males had more filled coronal surfaces (not significant) and a much higher coronal DFS ($p < 0.05$) and coronal caries attack rate ($p < 0.05$). Mean coronal DFS was 10.4 and coronal caries attack rate was 17.1%. There were no significant differences in numbers of decayed, filled or 'plaque'-covered surfaces among the age categories. Mean number of 'plaque'-covered coronal surfaces was 1.3, and was higher for males, ≤ 74 -year-olds and 85–89-year-olds (not significant).

Table 33: Coronal caries (n=76)

	Decayed surfaces		Filled surfaces		Coronal DFS		Plaque surfaces#		Attack rate (%)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Sex										
Male	3.3*	(3.4)	11.1	(13.5)	14.5*	(13.5)	2.7	(12.1)	24.4*	(11.8)
Female	0.9	(1.9)	7.5	(11.2)	8.3	(11.8)	0.6	(2.0)	13.7	(13.5)
Age										
≤ 74 years	2.4	(3.3)	9.6	(13.2)	11.9	(13.2)	2.1	(10.7)	16.3	(13.4)
75–84 years	2.0	(2.8)	11.6	(15.6)	13.6	(16.4)	0.5	(2.3)	19.7	(15.4)
85–89 years	0.5	(1.4)	6.3	(7.4)	6.8	(7.6)	2.3	(9.3)	13.1	(11.4)
90+ years	1.9	(2.8)	5.0	(5.0)	6.9	(6.6)	0.1	(0.4)	18.8	(14.5)
Total	1.7	(2.7)	8.7	(12.1)	10.4	(12.6)	1.3	(7.3)	17.1	(13.8)

* sig. $p < 0.05$ weighted least squares regression; (first category different from remaining categories – Tukey HSD test)

Teeth were present but could not be scored because they were covered in plaque, calculus or other debris.

Root caries (weighted)

Table 34 presents the mean number of root surfaces with caries experience. The mean of 1.5 decayed root surfaces for all dentate residents was similar to the mean of 1.7 decayed coronal surfaces. However, an additional 8.6 root surfaces per resident were scored as being covered in 'plaque'. Decayed root surfaces were more frequent in males ($p < 0.05$) and older age groups (not significant). Residents' mean number of filled root surfaces was 1.1, and was higher for males ($p < 0.05$) and older age groups (not significant). The root DFS index was 2.6 for all residents, and was much greater for males ($p < 0.05$). The mean root caries attack rate (=RCI, Root Caries Index) was 19.6%. RCI was higher for males (24.1%) (not significant) and much lower for ≤ 74 -year-olds (7.4%) ($p < 0.05$). Although root DFS was lower than coronal DFS, the attack rate for root caries was higher (19.6%) than that of coronal caries (17.1%).

Table 34: Root caries (n=76)

	Decayed surfaces		Filled surfaces		Root DFS		Plaque surfaces#		RCI (%)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Sex										
Male	2.6*	(3.3)	1.9*	(2.6)	4.5*	(4.4)	7.6	(14.1)	24.1	(21.0)
Female	0.9	(1.7)	0.7	(1.3)	1.6	(2.1)	9.1	(14.7)	17.5	(21.0)
Age										
≤ 74 years	1.3	(2.4)	0.4	(1.4)	1.7	(3.2)	7.6	(15.0)	7.4*	(13.1)
75–84 years	1.3	(2.4)	1.2	(1.8)	2.5	(3.2)	12.6	(18.2)	21.7	(17.7)
85–89 years	1.7	(2.0)	1.6	(2.2)	3.2	(3.0)	4.5	(9.2)	25.2	(23.5)
90+ years	1.9	(3.5)	1.5	(2.5)	3.4	(4.1)	8.1	(10.2)	29.6	(27.4)
Total	1.5	(2.5)	1.1	(1.9)	2.6	(3.3)	8.6	(14.5)	19.6	(21.1)

* sig. $p < 0.05$ weighted least squares regression; (first category different from remaining categories – Tukey HSD test)

Teeth were present but could not be scored because they were covered in plaque, calculus or other debris.

Nursing home size (unweighted)

Data concerning dentate residents' oral diseases (tooth status, coronal caries, root caries and retained roots) and demographic/medical/cognitive characteristics was analysed by size of nursing home (small/medium versus large) (Tables 35(a) and 35(b)). Larger nursing homes had more males and shorter-stay residents ($p<0.05$). In both larger and smaller nursing homes just over 50% of the residents had severe cognitive impairment. However, smaller nursing homes had nearly four times more residents with moderate cognitive impairment ($p<0.05$). Larger nursing homes had three times more residents with mild or no cognitive impairment ($p<0.05$). There were no significant differences in nursing home size among age groups or residents' number of medical conditions. Larger nursing homes had a much greater prevalence of oral diseases – higher numbers of decayed teeth, decayed crowns, decayed roots, 'plaque' covered teeth and surfaces, higher coronal and root DFS, and much higher attack rates for coronal and root caries.

Table 35(a): Nursing home size by residents' characteristics (%) (n=76)

	Nursing home size	
	Small/Medium	Large
Age		
≤74 years	30.3	18.6
75–84 years	33.3	30.2
85–89 years	24.2	23.3
90+ years	12.1	27.9
Number of medical conditions		
1–3	27.3	25.6
4–5	45.5	44.2
6+	27.3	30.2
Sex*		
Male	27.3	55.8
Female	72.7	44.2
MMSE*		
<10	51.7	57.5
10–20	37.9	10.0
21–25	3.4	12.5
26–30	6.9	20.0
Time since admitted		
<12 months	21.2	34.9
1–3 years	12.1	41.9
3–5 years	36.4	11.6
5+ years	30.3	11.6

* sig. $p<0.05$ Pearson chi-square

Table 35(b): Nursing home size by oral diseases (%) (n=76)

	Nursing home size			
	Small/Medium		Large	
	Mean	SD	Mean	SD
Tooth status				
Number of decayed crowns	0.7	(1.3)	2.1	(2.1)
Number of missing teeth	18.8	(7.4)	19.1	(7.0)
Number of filled/crowned crowns	3.8	(4.6)	3.8	(4.6)
DMFT	23.3	(5.2)	25.0	(4.2)
Number of retained roots	1.1	(2.4)	1.0	(1.7)
Plaque or worse	0.1	(0.3)	1.1	(3.3)
Coronal caries				
Decayed	1.3	(2.5)	2.9	(3.1)
Filled	8.3	(11.3)	10.0	(14.4)
Coronal DFS	9.6	(11.7)	12.9	(15.3)
Plaque	0.3	(1.0)	4.3	(14.4)
Attack rate (%)	15.1	(12.4)	23.8	(16.3)
Root caries				
Decayed	1.0	(1.6)	3.1	(3.8)
Filled	0.8	(1.6)	1.9	(2.7)
Root DFS	1.8	(2.2)	5.0	(4.9)
Plaque	7.2	(13.6)	13.0	(16.6)
RCI (%)	15.6	(17.1)	33.4	(27.5)
Retained roots				
Retained root decayed	0.8	(2.1)	0.8	(1.6)
Retained root sound	0.3	(0.6)	0.1	(0.5)

Retained roots (weighted)

Tables 36(a) and 36(b) present types of retained roots (decayed or sound) by residents' demographic and other characteristics. Of the mean 1.1 retained root per resident, there was a mean of 0.8 decayed versus 0.3 sound retained roots. Males had more decayed and sound retained roots ($p < 0.05$). Severely cognitively impaired residents had fewer sound retained roots ($p < 0.05$). Residents taking eight or more medications had higher numbers of decayed retained roots (not significant) and lower numbers of sound retained roots ($p < 0.05$) compared with those taking 1–4 medications. Residents with more decayed retained roots had been in the nursing home longer, had not seen a dentist in the previous 12 months, were more functionally dependent, and could eat fewer foods (not significant).

Table 36(a): Retained roots (n=76)

	Retained root decayed		Retained root sound	
	Mean	SD	Mean	SD
Sex				
Male	1.7*	(3.0)	0.5*	(0.7)
Female	0.3	(0.8)	0.2	(0.5)
Age				
≤74 years	1.7	(3.2)	0.3	(0.6)
75–84 years	0.4	(1.3)	0.2	(0.5)
85–89 years	0.2	(0.8)	0.4	(0.7)
90+ years	0.7	(1.2)	0.1	(0.5)
Total	0.8	(2.0)	0.3	(0.6)

* sig. $p < 0.05$ weighted least squares regression; (first category different from remaining categories – Tukey HSD test)

Table 36(b): Retained roots (n=76)

	Retained root decayed		Retained root sound	
	Mean	SD	Mean	SD
Number of medical conditions				
1-3	0.3	(0.8)	0.4	(0.7)
4-5	1.2	(2.7)	0.3	(0.5)
6+	0.5	(1.0)	0.2	(0.5)
Number of medications				
1-4	0.2	(0.7)	0.6†	(0.8)
5-7	0.6	(1.2)	0.1	(0.4)
8+	1.2	(3.0)	0.4	(0.6)
Time since admitted				
<3 years	0.2	(0.6)	0.2	(0.4)
3+ years	1.2	(2.5)	0.4	(0.6)
Time since last visit				
<12 months	0.2	(0.6)	0.2	(0.6)
Not <12 months	1.1	(2.4)	0.3	(0.6)
Government card				
Yes	0.7	(2.1)	0.3	(0.6)
Don't know/No	1.1	(1.4)	0.4	(0.5)
ADL score (no. of dependent activities)				
0-4	1.3	(3.3)	0.3	(0.6)
5	0.7	(1.6)	0.3	(0.5)
6	0.6	(1.2)	0.3	(0.6)
MMSE score				
≤10	0.7	(1.5)	0.1*	(0.3)
11-30	1.1	(2.6)	0.4	(0.6)
Diagnosed dementia				
Yes	0.6	(1.4)	0.3	(0.5)
No	1.1	(2.7)	0.3	(0.6)
% body weight change per month				
Negative	0.6	(1.4)	0.3	(0.5)
Positive	0.9	(2.5)	0.4	(0.6)
Number of foods can eat				
0-1	1.3	(1.7)	0.0	(0.2)
2-3	0.9	(2.3)	0.3	(0.6)
4-5	0.3	(0.6)	0.3	(0.6)
Total	0.8	(2.0)	0.3	(0.6)

* sig. p<0.05 weighted least squares regression; (first category different from remaining categories – Tukey HSD test)
† sig. p<0.05 weighted least squares regression; (middle category different from remaining categories – Tukey HSD test)

Attrition

Dentate residents had a mean number of 11.88 teeth present. Table 37 presents the attrition status for residents. The majority of residents' teeth showed signs of attrition. Dentate residents had a mean of 4.7 teeth with enamel attrition, 3.5 teeth (29%) with dentine attrition and 0.1 teeth (1%) with severe attrition, leaving 3.6 teeth (30%) with no evidence of attrition.

Table 37: Dentate residents – attrition (n=76)

Attrition status	Mean number of teeth per resident	SD
No attrition	3.63	4.70
Enamel*	4.71	4.51
Dentine**	3.46	4.12
Severe#	0.08	0.32
Total	11.88	6.92

N.B. Excludes crowned teeth and retained roots.

* Enamel = occlusal/incisal enamel was worn so that dentine was exposed.

** Dentine = entire occlusal/incisal enamel was obliterated, leaving an enamel ring.

Severe = tooth has worn to the gingival margin ($\leq 1/3$ crown is present).

Periodontal conditions

Table 38: Residents' conditions precluding periodontal inspection (%)

	Dentate (n=76)
Type of condition	
Rheumatic fever	0
Artificial joints, heart valves or prostheses	19.7
A bleeding problem	5.3
Medications	7.9
Number of conditions	
No conditions	69.7
One condition	27.6
Two conditions	2.6

Table 38 presents residents' conditions (type and number) that precluded a periodontal inspection. Twenty per cent of residents had artificial joints, heart valves or prostheses, 5% had a bleeding problem and 8% would have required further consultation with medical practitioners and possible modification of their medications. Approximately 30% of dentate residents were precluded from the periodontal inspection because they had one or two of these conditions. Another approximately 30% of residents did not have a periodontal inspection completed mainly because of access difficulties, and also in many instances, because the teeth and gingival tissues were grossly covered in plaque and calculus.

Plaque and calculus accumulation

Table 39 presents mean Plaque Index (PI) Scores (weighted) (possible range 0–3) for all 76 dentate residents. Mean PI score for all dentate residents was moderately high (1.75). There were significant differences in mean PI scores for number of medications, time since admitted to nursing home and number of foods resident could eat

(weighted least squares regression, $p < 0.05$). Residents on 1–4 medications had very high plaque scores; there may have been an effect by specific type of medication, however this was not investigated. Residents who had been admitted for more than 12 months to the nursing home had very high PI scores, as did residents who could not eat many foods and had soft diets. Other non-significant differences in PI scores were present: PI scores were higher for males, ≤ 74 -year-olds, pension card-holders, the more functionally dependent and those who had gained weight. Residents with a diagnosed dementia had higher mean PI scores, as did severely cognitively impaired residents (MMSE scores ≤ 10).

Calculus accumulation was high, with 63.1% of the sites assessed for loss of periodontal attachment having calculus present on probing.

Table 39: Dentate residents – Mean Plaque Index Scores (weighted) (n=76)

	Mean PI Score
Sex	
Male	1.81
Female	1.72
Age group	
≤74 years	1.99
75–84 years	1.68
85–89 years	1.64
90+ years	1.46
Number of chronic medical conditions	
1–3	2.05
4–5	1.53
8+	1.64
Number of medications*	
1–4	2.59
5–7	1.63
8+	1.64
Time since admitted*	
<12 months	1.24
1–3 years	1.96
3–5 years	2.00
5+ years	1.74
Government cards	
Pensioner	1.80
DVA	1.54
None	1.53
ADL score (no. of dependent activities)	
0–4	1.45
5	1.71
6	1.88
MMSE score	
≤10	1.92
11–20	1.59
21–25	1.02
26–30	1.76
Diagnosed dementia	
Yes	1.85
No	1.62
Body weight change	
Positive	1.92
Negative	1.63
Number of foods can eat*	
0–1	2.29
2–3	1.67
4–5	1.58
All residents	1.75

* sig. $p < 0.05$ weighted least squares regression; (first category different from remaining categories – Tukey HSD test)

Periodontal disease

Table 40 presents the prevalence of periodontal disease among the 18 dentate residents that a complete periodontal assessment could be completed for. Mild–moderate loss of periodontal attachment was common but more severe disease was only evident in a small percentage (4.4%) of residents. Mean number of sites assessed per person was 37 (SD=20.8). Mean recession per site was 1.6mm (SD=1.2). Mean probing depth per site was 1.9mm (SD=0.5) and overall loss of periodontal attachment per site was 3.5mm (SD=1.3). Disease severity as measured by mean loss of attachment (LOA) for sites 2+mm per resident was 3.7mm (SD=1.2). Extent of disease, as measured by the percentage of sites per resident with LOA, was 87.6% for 2+mm LOA, 46.1% for 4+mm LOA and 4.4% for 7+mm LOA. Worst LOA scores indicated that 45% of residents had one or more sites with a 7+mm LOA and 95% of residents had one or more sites with a 4+mm LOA.

Table 40: Prevalence of periodontal disease (n=18)

	Mean value (mms)	SD
Recession	1.6	1.2
Probing depth	1.9	0.5
Loss of attachment (sites 2+mm)	3.7	1.2

Characteristics of medical status, functional status and cognitive status associated with oral diseases and conditions (weighted)

Tooth status (weighted)

Table 41 presents tooth status by residents' characteristics. Residents with a government pension and those taking 5–7 medications had more missing teeth ($p<0.05$). Residents who did not have a government pension, those taking 8+ medications, and those who could eat nearly all foods, had more filled teeth ($p<0.05$). Residents who had been living at the nursing home for more than three years had a lower DMFT and four times as many retained roots ($p<0.05$). Residents who could not eat many foods had many more teeth covered with plaque that could not be scored. Residents with severe cognitive impairment had more decayed teeth, more missing teeth, fewer filled teeth and many more plaque-covered tooth surfaces (not significant).

Table 41: Tooth status by residents' characteristics (n=76)

	Number of decayed crowns		Number of missing teeth		Number of filled/crowned crowns		DMFT		Number of retained roots		Plaque#	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Number of medical conditions												
1-3	0.7	(1.4)	17.1	(7.2)	4.7	(4.4)	22.6	(5.2)	0.7	(1.0)	1.0	(3.1)
4-5	1.1	(1.6)	19.2	(7.3)	3.7	(4.6)	24.1	(4.5)	1.4	(3.1)	0.1	(0.4)
6+	1.3	(1.8)	19.9	(7.4)	3.0	(4.7)	24.2	(5.4)	0.8	(1.0)	0.1	(0.6)
Number of medications												
1-4	0.8	(1.3)	18.3†	(9.3)	2.9*	(3.7)	21.9	(6.6)	0.8	(0.9)	0.4	(0.6)
5-7	0.9	(1.6)	20.9	(6.3)	2.7	(3.6)	24.5	(4.3)	0.8	(1.2)	0.3	(1.9)
8+	1.4	(1.8)	16.3	(7.0)	5.7	(5.5)	23.4	(4.9)	1.6	(3.4)	0.4	(1.7)
Time since admitted												
<3 years	1.1	(1.8)	20.5	(6.7)	4.1	(5.4)	25.7*	(3.4)	0.4*	(0.7)	0.6	(2.5)
3+ years	1.0	(1.5)	17.6	(7.5)	3.6	(3.9)	22.1	(5.4)	1.6	(2.8)	0.2	(0.4)
Time since last visit												
≤12 months	1.0	(1.7)	20.0	(7.4)	4.7	(5.7)	25.7*	(3.4)	0.5	(0.8)	0.2	(0.7)
Not ≤12 months	1.1	(1.6)	18.3	(7.3)	3.3	(3.8)	22.6	(5.3)	1.4	(2.7)	0.4	(2.0)
Government card												
Yes	1.0	(1.6)	19.7*	(7.0)	3.2*	(4.0)	23.9	(4.8)	1.0	(2.4)	0.4	(1.8)
Don't know/No	1.3	(1.9)	14.5	(7.6)	6.8	(6.0)	22.6	(5.9)	1.6	(1.5)	0.1	(0.4)
ADL score (no. of dependent activities)												
0-4	1.0	(1.8)	19.5	(8.1)	3.8	(5.2)	24.4	(5.6)	1.6	(3.9)	0.1	(0.4)
5	1.1	(1.8)	20.0	(7.8)	4.1	(5.3)	25.3	(4.3)	1.0	(1.8)	0.1	(0.4)
6	1.0	(1.5)	18.0	(6.8)	3.6	(3.9)	22.7	(4.9)	0.8	(1.2)	0.5	(2.3)
MMSE score												
≤10	1.2	(1.6)	19.3	(8.0)	3.3	(3.7)	23.8	(5.3)	0.8	(1.5)	0.7	(2.4)
11-30	1.0	(1.8)	18.0	(7.1)	4.8	(5.6)	23.8	(5.2)	1.5	(3.0)	0.1	(0.3)
Diagnosed dementia												
Yes	1.1	(1.6)	19.0	(8.0)	4.2	(4.9)	24.4	(4.8)	0.8	(1.4)	0.2	(0.5)
No	0.9	(1.7)	18.6	(6.0)	3.0	(3.9)	22.5	(5.1)	1.4	(3.2)	0.6	(2.7)
Body weight change per month												
Negative	0.9	(1.5)	18.7	(6.9)	3.8	(4.1)	23.5	(4.5)	0.9	(1.5)	0.3	(1.5)
Positive	1.1	(1.7)	19.5	(7.4)	3.4	(4.5)	24.1	(5.3)	1.3	(3.0)	0.4	(2.1)
Number of foods can eat												
0-1	1.2	(1.9)	17.9	(5.7)	2.6**	(3.1)	21.7	(4.7)	1.3	(1.7)	1.6*	(4.3)
2-3	1.0	(1.5)	19.8	(7.7)	2.7	(3.4)	23.5	(5.6)	1.2	(2.7)	0.1	(0.5)
4-5	1.0	(1.8)	17.1	(7.0)	7.1	(6.1)	25.3	(2.8)	0.5	(0.9)	0.1	(0.4)
Total	1.1	(1.6)	18.9	(7.3)	3.8	(4.5)	23.7	(5.0)	1.1	(2.2)	0.3	(1.7)

Teeth were present but could not be scored because they were covered in plaque, calculus or other debris.

* sig. p<0.05 weighted least squares regression; (first category different from remaining categories – Tukey HSD test)

** sig. p<0.05 weighted least squares regression; (last category different from remaining categories – Tukey HSD test)

† sig. p<0.05 weighted least squares regression; (middle category different from remaining categories – Tukey HSD test)

Coronal caries (weighted)

Table 42 presents coronal caries prevalence by residents' characteristics. Residents taking 8+ medications had over twice as many filled surfaces, and higher DFS and coronal caries attack rates ($p < 0.05$). Residents with a government pension had nearly 50% less filled surfaces, coronal DFS and coronal caries attack rate ($p < 0.05$). Residents who could not eat many foods had less than half as many filled surfaces, and lower coronal DFS, and coronal caries attack rates, and many more surfaces covered with plaque ($p < 0.05$). More severely cognitively impaired residents had more decayed surfaces, fewer filled surfaces, and higher coronal DFS and coronal caries attack rates (not significant).

Table 42: Coronal caries by residents' characteristics (n=76)

	Decayed surfaces		Filled surfaces		Coronal DFS		Plaque surfaces#		Attack rate (%)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Number of medical conditions										
1-3	1.0	(2.1)	10.2	(9.9)	11.2	(9.7)	4.0	(13.6)	17.5	(10.5)
4-5	2.0	(2.9)	8.5	(13.1)	10.5	(14.1)	0.3	(1.1)	16.1	(14.4)
6+	2.0	(2.9)	7.6	(12.7)	9.6	(13.1)	0.4	(2.3)	18.6	(16.2)
Number of medications										
1-4	1.3	(2.4)	5.4**	(7.7)	6.7**	(7.8)	1.6	(2.2)	10.7**	(11.5)
5-7	1.6	(3.0)	5.8	(8.5)	7.4	(9.3)	1.2	(8.1)	14.9	(11.7)
8+	2.1	(2.6)	14.4	(15.8)	16.5	(16.2)	1.3	(7.6)	22.8	(15.7)
Time since admitted										
<3 years	1.6	(2.6)	9.9	(14.9)	11.5	(15.3)	2.2	(10.8)	18.4	(16.7)
3+ years	1.8	(2.8)	7.8	(9.4)	9.6	(10.2)	0.6	(1.5)	16.1	(11.2)
Time since last visit										
<12 months	1.7	(2.7)	11.6	(16.6)	13.2	(17.6)	0.6	(2.3)	19.9	(17.8)
Not <12 months	1.7	(2.8)	7.3	(8.7)	9.0	(9.0)	1.7	(8.8)	15.6	(11.0)
Government card										
Yes	1.6	(2.7)	7.1*	(11.0)	8.8*	(11.5)	1.5	(7.9)	15.1*	(13.3)
Don't know/No	2.1	(2.9)	17.2	(14.3)	19.3	(15.2)	0.1	(0.6)	27.0	(12.4)
ADL score (no. of dependent activities)										
0-4	1.2	(2.3)	9.2	(13.5)	10.5	(13.3)	0.3	(0.7)	17.6	(15.3)
5	1.6	(2.6)	10.6	(16.2)	12.3	(17.6)	0.2	(0.7)	17.9	(15.5)
6	2.0	(3.0)	7.6	(9.0)	9.6	(9.5)	2.3	(10.0)	16.6	(12.7)
MMSE score										
≤10	2.1	(3.1)	7.5	(10.8)	9.5	(11.7)	2.5	(10.5)	16.6	(12.2)
11-30	1.4	(2.4)	11.6	(14.2)	13.0	(14.5)	0.2	(0.6)	20.6	(15.7)
Diagnosed dementia										
Yes	1.9	(2.9)	10.0	(13.6)	11.9	(14.4)	0.6	(1.5)	18.6	(14.9)
No	1.3	(2.4)	6.6	(8.7)	7.9	(8.6)	2.5	(11.8)	14.6	(11.5)
Body weight change per month										
Negative	1.8	(3.2)	8.0	(10.5)	9.8	(11.6)	1.3	(6.5)	16.1	(12.5)
Positive	1.6	(2.2)	8.2	(12.0)	9.8	(12.3)	1.5	(8.7)	17.2	(14.3)
Number of foods can eat										
0-1	2.6	(4.5)	5.0**	(6.6)	7.7**	(7.5)	7.0*	(18.8)	15.6†	(12.0)
2-3	1.6	(2.3)	6.1	(9.7)	7.7	(10.5)	0.4	(1.2)	14.0	(13.2)
4-5	1.5	(2.5)	17.3	(15.8)	18.8	(16.2)	0.3	(0.8)	25.4	(13.4)
Total	1.7	(2.7)	8.7	(12.1)	10.4	(12.6)	1.3	(7.3)	17.1	(13.8)

Teeth were present but could not be scored because they were covered in plaque, calculus or other debris.
 * sig. p<0.05 weighted least squares regression; (first category different from remaining categories – Tukey HSD test)
 ** sig. p<0.05 weighted least squares regression; (last category different from remaining categories – Tukey HSD test)
 † sig. p<0.05 weighted least squares regression; (middle category different from remaining categories – Tukey HSD test)

Root caries (weighted)

Table 43 presents root caries by residents' characteristics. Root DFS were higher for residents taking 8+ medications and those who had lived at the nursing home for less than 3 years ($p < 0.05$). Number of plaque-covered root surfaces were much higher for those who had visited a dentist in the previous 12 months, those who had lost weight, those who could not eat many foods and residents with severe cognitive impairment ($p < 0.05$). Severely cognitively impaired residents also had fewer filled root surfaces (not significant). Residents taking 8+ medications had two times more decayed root surfaces, as did those resident for < 3 years, and those who gained weight (not significant).

Table 43: Root caries by residents' characteristics (n=76)

	Decayed surfaces		Filled surfaces		Root DFS		Plaque surfaces#		RCI (%)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Number of medical conditions										
1-3	1.1	(2.1)	1.3	(1.7)	2.4	(2.8)	9.9	(15.0)	21.3	(20.3)
4-5	1.8	(2.5)	1.3	(2.1)	3.1	(3.4)	5.2	(10.0)	19.5	(18.3)
6+	1.4	(2.8)	0.6	(1.9)	2.0	(3.6)	12.7	(18.8)	18.1	(26.6)
Number of medications										
1-4	1.1	(2.2)	0.5	(1.1)	1.6**	(2.3)	7.4	(11.6)	15.7	(21.2)
5-7	1.1	(2.2)	0.8	(1.5)	1.9	(3.0)	10.7	(17.2)	16.4	(21.3)
8+	2.2	(2.9)	1.8	(2.6)	4.0	(3.8)	6.1	(10.9)	25.4	(20.2)
Time since admitted										
<3 years	2.0	(3.2)	1.6	(2.5)	3.6*	(4.4)	7.9	(13.7)	24.2	(24.9)
3+ years	1.1	(1.7)	0.7	(1.2)	1.8	(1.9)	9.1	(15.2)	16.3	(17.4)
Time since last visit										
<12 months	1.1	(2.3)	1.1	(2.1)	2.2	(3.1)	13.8*	(18.0)	15.7	(22.2)
Not <12 months	1.7	(2.6)	1.1	(1.9)	2.8	(3.5)	5.8	(11.5)	21.6	(20.4)
Government card										
Yes	1.4	(2.4)	1.1	(2.0)	2.5	(3.5)	8.6	(15.2)	19.0	(21.8)
Don't know/No	1.9	(3.0)	1.3	(1.5)	3.2	(2.6)	8.4	(10.1)	22.5	(17.1)
ADL score (no. of dependent activities)										
0-4	2.0	(3.2)	1.5	(2.3)	3.5	(4.0)	3.9	(5.6)	20.9	(24.6)
5	2.0	(2.8)	1.2	(1.6)	3.2	(3.4)	5.5	(9.0)	24.0	(15.6)
6	1.0	(1.9)	0.9	(1.9)	1.9	(2.9)	12.2	(18.1)	16.7	(21.9)
MMSE score										
≤10	1.2	(2.1)	0.9	(1.7)	2.1	(3.1)	12.6*	(17.8)	20.9	(22.6)
11-30	1.8	(3.0)	1.5	(2.3)	3.4	(3.8)	5.3	(8.7)	20.7	(21.3)
Diagnosed dementia										
Yes	1.5	(2.4)	1.2	(2.0)	2.7	(3.5)	9.5	(14.9)	22.6	(22.8)
No	1.5	(2.6)	1.0	(1.9)	2.5	(3.2)	7.1	(13.7)	14.7	(17.0)
Body weight change per month										
Negative	1.1	(1.8)	1.2	(1.9)	2.2	(2.9)	12.1*	(17.2)	18.9	(19.9)
Positive	1.9	(3.2)	1.2	(2.1)	3.1	(3.9)	5.0	(10.5)	18.7	(22.0)
Number of foods can eat										
0-1	0.6	(1.8)	0.7	(1.3)	1.3	(2.6)	20.9*	(19.8)	26.3	(35.8)
2-3	1.9	(2.5)	1.0	(2.0)	2.9	(3.5)	7.3	(13.8)	20.5	(19.2)
4-5	1.2	(2.7)	1.5	(2.2)	2.7	(3.4)	4.6	(8.2)	15.1	(18.7)
Total	1.5	(2.5)	1.1	(1.9)	2.6	(3.3)	8.6	(14.5)	19.6	(21.1)

Teeth were present but could not be scored because they were covered in plaque, calculus or other debris.

* sig. p<0.05 weighted least squares regression; (first category different from remaining categories – Tukey HSD test)

** sig. p<0.05 weighted least squares regression; (last category different from remaining categories – Tukey HSD test)

Normative, rational and perceived needs for dental care

Table 44: Denture treatment needed and wanted – upper denture

	Denture treatment wanted (%)	
	Agreed	Disagreed
Denture treatment needed*		
Adjustment (n=1)	100	0
Reline (n=15)	46.7	53.3
Repair (n=19)	42.1	57.9
Full denture (n=32)	31.3	68.8
Partial denture (n=5)	40.0	60.0

* rational treatment need determined by dentist considered all of a participant's modifying factors, such as functional status, cognitive status, medical history, medications, social history, financial history, dental history, ethical issues, etc.

Table 45: Denture treatment needed and wanted – lower denture

	Denture treatment wanted (%)	
	Agreed	Disagreed
Denture treatment needed*		
Adjustment (n=3)	66.7	33.3
Reline (n=11)	54.5	45.5
Repair (n=7)	42.9	57.1
Full denture (n=31)	32.3	67.7
Partial denture (n=4)	25.0	75.0

* rational treatment need determined by dentist considered all of a participant's modifying factors, such as functional status, cognitive status, medical history, medications, social history, financial history, dental history, ethical issues, etc.

Tables 44 and 45 present denture treatment needed and wanted for the upper and lower dentures. The rational treatment need assessed by dentists in this section of the dental inspection considered all of a participant's modifying factors, such as functional status, cognitive status, medical history, medications, social history, financial history, dental history, ethical issues and the like. In many cases, a normative dental need (assessed purely on dental criteria) was evident (Table 30), but after the complete rational treatment evaluation, treatment was not advocated. Thus, the rational treatment need often under-reported normative dental needs. Rational dental treatment needs were low for both upper and lower dentures in this study; 31% of participants required a new full upper denture and 32% a new full lower denture. Participants' perceived denture treatment needs were even lower again than the rational treatment need. For example, 68% of residents who were assessed to require a new full denture in either the upper or lower arch did not want the new denture. Approximately 50% of residents assessed to require a reline for their upper or lower denture did not want the reline.

Table 46: Participants' perceived dental need by dentate status from interview (n=224)

	Participants' perceived need for dental treatment		
	Yes	No	Don't know
Dentate status			
Dentate	26.3	63.2	10.5
Edentulous	17.6	73.6	8.8

Table 46 presents participants' perceived dental need by dentate status from interview. Perceived need for dental treatment was low. Edentulous residents had a lower perceived need than did dentate residents. The low perceived needs of dentate residents are in contrast to the high normative treatment needs presented in Table 47.

Table 47 presents dentate residents' normative treatment needs for restorations, extractions and preventive care. Dentate residents required restorations for a mean of 2.86 surfaces. When categorised by type of restoration (for 1–4 surfaces), residents required a 1-surface restoration for a mean of 0.97 teeth; a 2-surface restoration for 0.41 teeth, a 3-surface restoration for 0.30 teeth and a 4-surface restoration for 0.04 teeth. Normative need for extractions was high – nearly 1 tooth per resident (0.87 teeth). Preventive care was determined at tooth level, and was 0.33 teeth per resident.

Table 47: Dentate residents – normative treatment needs (n=76)

Type of treatment	Mean number of teeth requiring treatment
Restorations	
For 1 surface	0.97
For 2 surfaces	0.41
For 3 surfaces	0.30
For 4 surfaces	0.04
Extractions	0.87
Preventive	0.33

3.4 Specialised epidemiological dental inspection procedures for nursing home residents

In many Australian and overseas dental studies investigating the oral health of nursing home residents, there have been exclusion criteria in place restricting participation for specific 'categories' of residents. For example, in one study information was 'discarded' from 'patients with the gross disabilities of age which rendered them unsuitable for dental treatment, for example, advanced dementia, facial paralysis, severe parkinsonism' (Walker, 1984). In another Melbourne study, '23.5% of nursing home patients were not assessed because of advanced senility' (Crack et al., 1980). The consequence of these restrictions was highlighted in a review of US geriatric dental research by Dolan & Atchison (1993). When discussing information available concerning institutionalised older adults, the authors commented that:

'the majority of [US] studies are of single nursing facilities, involve atypical or convenience samples and exclude residents who are uncooperative or unable to give informed consent. Therefore, the cognitively impaired and those with behavioural problems or communication disorders are under-represented in the research findings.'

A goal of the dental examiners in the Adelaide Dental Study of Nursing Homes was to examine a representative sample of Adelaide nursing home residents. This involved the completion of a dental inspection for all participating residents, including those with physical, behavioural, and cognitive difficulties. In this study, examiners did not need to administer sedative/anaesthetic medications to residents, change their current behaviour-modifying medications or use restraint to facilitate the completion of the dental inspections. The experience of the dentists involved in the study led them to believe that the great majority of nursing home residents, including those with dementia, could have a dental inspection completed for them. The dentists used a specialised protocol for the dental inspections which included strategies they had developed from their clinical and educational experiences and from publications by Chalmers et al. (1997) and Kayser-Jones (1996). These strategies included:

- examiners familiarising themselves with the resident's medical and dental histories, functional status, dentate status, any current dental problems as perceived by carers, and their individual behavioural and communication problems *before* meeting the resident and commencing the dental inspection;
- developing rapport with residents and carers before conducting the dental inspection;
- explaining to residents and carers why we were there to visit with them;
- providing a quiet and familiar environment (resident's room or more private section of communal areas);
- reducing the number of people in the room;
- enlisting the help of a familiar carer;
- using task breakdown methods (pacing, demonstrating, repeating instructions and breaking them down into short steps);
- encouraging the active participation of residents and carers in the dental inspection to ensure that the interaction was resident-focused and not dentist-focused;

- using multiple communication forms and non-verbal cues (visual, written and touch initiated);
- using communication strategies such as distraction, chaining, hand-over-hand, bridging and rescuing. These involved approaching residents from the front and conducting most of the dental inspection from that position, always staying in the resident's visual field, relating to the resident at their physical level (e.g., sitting, standing), speaking slowly and clearly, speaking in a low voice, focusing all attention on the resident and not other people in the room, always addressing conversation to the resident and not other people in the room, never assuming that the resident did not understand what was happening, using appropriate terms (titles, first names as suited the resident) when addressing and speaking with the resident, and maintaining continual sensory (visual/verbal/touch) contact with the resident from the initial greeting to farewell;
- following speech patterns and conversation topics of the residents to facilitate cooperation with directions and intra-oral inspection procedures (this was sometimes to the point of 'play-acting' the dental inspection as a totally different event – see examples below);
- allowing several rest periods during the dental inspection;
- completing the dental inspection over several sessions and at a time of the day (generally mornings and early afternoons) that would suit the resident and carers;
- using distracting tactile aids to 'occupy' resident's hands (e.g., some residents used specially developed boards that had tactile, familiar objects such as zips, buttons, frills, switches and latches attached to them);
- completing the dental inspection in a more flexible manner than is generally the case in epidemiological dental inspections of other groups of adults (discussed later in this section);
- using specialised 'tools' developed by Chalmers et al. (1997) (e.g., backward-bent toothbrushes, and multiple toothbrushes and mouth mirrors) to gently break oral muscle spasms and improve physical and visual access to the oral cavity;
- completing the dental inspection in association with resident's general daily toothbrushing and denture oral hygiene care procedures;
- always attempting the dental inspection and never 'giving-up' because of comments made by other dentists, carers or family members; and
- providing a positive environment with lots and lots of care, love, humour and smiles!

Two scenarios illustrate the importance of some of the more interesting of these strategies. (1) *Using a bridging technique. Following speech patterns and conversation topics of the residents to facilitate cooperation with directions and intra-oral inspection procedures. Always attempting the dental inspection and never 'giving-up' because of comments made by other dentists, carers or family members:* Mrs B was a dentate resident with late stage Alzheimer's disease. The research team arrived at the nursing home to examine Mrs B and went to the nurses' station in Mrs B's unit to greet the staff and locate Mrs B. The registered nurse in charge of the unit had a general chat and 'chuckled' to the research staff that she did not think they would be able to examine Mrs B, but to 'have a go anyway'. Recently, the domiciliary dentist and staff of the Dental Hospital had tried to examine Mrs B, as her family felt that she may have had a broken tooth. The nurse

informed the research team that Mrs B was a 'very behaviourally difficult resident' and she had 'such bad tantrums' that no-one had been able to complete a dental examination for her. The examining dentist was pregnant at the time, and after greeting Mrs B, the disjointed and sporadic conversation initiated by Mrs B focused on pregnancy and babies. After a few minutes of following Mrs B's speech patterns and conversation topic, the dentist realised that Mrs B had 'bonded' with her; Mrs B thought that she also was pregnant and was hospitalised for the delivery of her baby. Mrs B's way of coping with her institutional surroundings was to revisit an earlier time in her life when she was in similar surroundings. By maintaining the conversation on the topic of pregnancy and babies, and the importance of maintaining dental health during pregnancy, the dentist completed a full dental inspection for Mrs B and advised the nursing home staff and dental staff of her findings.

(2) Using specialised 'tools' to break oral muscle spasms and improve physical and visual access to the oral cavity, using task breakdown methods, providing a quiet and familiar environment, and following speech patterns and conversation topics of the residents to facilitate cooperation with directions and intra-oral inspection procedures: Mrs S was an edentulous resident with moderate/severe dementia. She liked to wander around the nursing home unit and had a happy, fit and healthy appearance. Mrs S was located wandering in the unit corridor, and after using task breakdown to simplify instructions, the research team accompanied her to her room. Mrs S initially would not open her mouth, but sat happily in her chair smiling at the dentist. The dentist attempted to initiate conversation with her, but Mrs S would not talk or open her mouth. After explaining that he wanted to check her dentures and clean them for her, the dentist used a toothbrush and mouth mirror to gently break the muscle spasm and gain access to Mrs S's oral cavity. This caused no distress to Mrs S, and she maintained her happy demeanour throughout the dental inspection. The dentist removed Mrs S's lower and then upper denture, and then inspected the oral soft tissues. To his amazement, stuck to the roof of Mrs S's mouth was a gold wedding ring band; it appeared that this was a 'regular hiding place' for Mrs S's wedding ring, as an imprint of the ring was evident in the oral mucosa. The dentist was then able to initiate a dialogue with Mrs S concerning marriage and wedding rings to confirm that the ring did belong to Mrs S. The nursing home staff also confirmed that it was Mrs S's wedding ring. The dentist and nursing home staff were then able to recommend to Mrs S and her family that her wedding ring be cared for by her daughter.

All but three of the residents that consented to participate in the study had a dental inspection completed by a dentist. As previously discussed in Section 3.2 'response rates', these three individuals all had moderate levels of cognitive impairment in addition to complex behavioural and depressive problems. It appeared that the depressive component of their disorders was governing their general behaviour and staff commented that all three residents were generally behaving with an extremely negative attitude toward all aspects of their lives. Other residents whose guardians had declined their participation in the study indicated that the residents had severe combative, aggressive and resistive behaviours. Many of the residents that did participate resided in the same dementia-specific units and also had complex aggressive and resistive behaviours similar to those of the non-participants. Thus, the dentists were confident that they examined a full and diverse range of cognitively impaired and behaviourally difficult residents.

A manual epidemiological charting system was ultimately used in this study. Initially, it was planned that a portable direct data entry system would be used. However, the

physical difficulties involved with accessing power sources for the laptop computer and portable light source made the use of the computer impractical. Another difficulty was with the different sections of the dental inspection. It was not possible with the majority of the cognitively impaired residents to use a standard approach to dental epidemiological charting. In the standard procedure, charting commences systematically in the upper right quadrant, and proceeds through the upper left and then lower left and lower right quadrants. With the nursing home residents in this study, dentists needed a much more flexible approach to dental charting, which was more time-consuming than the standard approach. For example, the upper and lower anterior teeth were often charted first and then access was gained to the posterior teeth. In a few cases, the dental charting was completed over 1–3 sessions for some of the more physically/behaviourally difficult residents. However, the great majority (over 95%) of the dental inspections were completed in one session.

Complete tooth status epidemiological data was obtained for all participants. Complete surface level epidemiological coronal and root caries data was obtained for nearly all participants. Surface level charting was incomplete for one resident only. In this resident, muscle contractures had resulted in her head being buried into her chest, making physical access almost impossible. The collection of periodontal data was more difficult because of the need to place the periodontal probe in a specific orientation and position on the tooth surfaces; this became a difficulty with more physically disabled and behaviourally difficult residents. Access was also difficult with the portable light source used; an improved light source would have greatly assisted completion of the periodontal inspections. Also, a large number of dentate residents were precluded from the periodontal inspection because of medical conditions (Tables 38 and 39).

The successful completion of a high percentage of the dental inspections was attributable to several factors:

- the development of a specialised dental inspection protocol, as described above and in the methods section of this report;
- development of rapport and trust among and between the research team members and the nursing home staff;
- communication and feedback from residents' guardians/family members and nursing home carers;
- the assistance of nursing home carers during the dental inspections;
- the communication, behavioural management skills and clinical experience of the dentists conducting the dental inspections;
- the preparation, experience and motivation of the study team members in caring for special care patients, especially those with dementia;
- the nursing home dentistry experience of the dentists; and
- completion of the cognitive testing procedure only when rapport and trust had been developed with residents after the completion of the dental inspection.

3.5 Discussion

Clinical dental inspections

Residents' characteristics in this Adelaide sample were similar to those reported by the AIHW (1998) for all South Australian nursing home residents. Residents' age, sex, government card status, time since admitted, and dependency levels were all comparable.

The unit chosen for sampling in this study was the nursing home; sampling at the resident level was not possible as the information required to do so was not available. Information such as residents' dentate status would be needed to ensure that representative samples of dentate and edentulous residents were obtained. Currently, national/State level nursing home resident data collections do not record any dental characteristics. Incorporation of simple dental characteristics such as dentate status and presence of dentures would greatly improve the investigation of nursing home residents' oral health status and would enable better comparison of participants and non-participants.

Precise quantification of the prevalence of oral diseases and conditions in Adelaide nursing home residents therefore cannot be provided by this study. However, nursing homes were randomly chosen for participation, all approached enthusiastically agreed to participate and the clinical dental inspection data was weighted to provide prevalence estimates of oral diseases and conditions for all Adelaide nursing homes.

With the sampling, methodological and ethical constraints operating in this study, it was very difficult to profile the non-participants in the study. Researchers could not access any information about the non-participants except their sex and consent status (self-consent or guardian consent) which yielded similar percentages for participants and non-participants. Given that the characteristics of residents in this study seem to be comparable with those investigated for State-level data, the main possible differences between the participants and non-participants are likely to be their dentate status and the severity of their cognitive impairment. Guardians may have been less likely to agree to the participation of edentulous and more severely cognitively impaired residents; thus the percentages of edentulous and severely cognitively impaired residents may have been under-reported in these study results.

Response rates for the clinical dental inspections were comparable, and in some instances much higher, than in similar Australian and overseas studies. More precise response rates were calculated in this study than have been presented in many of the previous studies; often numbers of residents participating have been presented but not actual response rates.

It is important that precise response rates are presented in these types of studies to assist other researchers investigating nursing home populations. Estimates of the time required to complete the various sections of the study were also presented. They will assist with the planning of other similar investigations, as research in this population is time-consuming and costly. The most difficult areas, methodologically, in this study, were the obtaining of written consent from guardians and the follow-up of non-respondents (this took 4–6 weeks for each nursing home), and the collection of questionnaire information from nursing home records (up to 30 minutes per resident). Completion of the dental inspections (which included administration of cognitive

tests) required approximately 15 minutes for each edentulous resident and 30–45 minutes for each dentate resident (depending upon number of teeth present).

With the good response rate for consent to participate of over 50%, and the almost universal completion rate for the dental inspections (only 3/227 residents refused the dental inspection), the data obtained in this study was comprehensive and as representative as possible.

From recent national data it is estimated that 57% of older Australians aged 85+ years are edentulous (Carter, personal communication, 1999). This percentage is 9% lower than the 66% of residents who were edentulous in the Adelaide Dental Study of Nursing Homes. The percentage of edentulous participants in this study (66%) was lower than that reported in previous Australian studies of nursing home residents:

- 83% edentulous in South Australia (Vowles et al., 1977);
- 90% edentulous in South Australia (Walker, 1984);
- 74% edentulous in Western Australia (Stockwell, 1987); and
- 71% edentulous in Queensland (Homan, et al. 1988).

These decreasing rates of edentulism in clinical studies parallel the current and projected estimates from national data (Carter, personal communication, 1998).

Some of the consequences of these declining rates of edentulism and of the changing composition and increasing dependence of nursing home residents were evident in a comparison of the results from the clinical dental inspections in this and the above-mentioned studies. Although numbers of residents wearing full dentures had decreased, numbers wearing partial dentures had increased from the previous studies. Edentulous residents wearing full upper and lower dentures still had significant denture problems and treatment needs.

As was previously reported, edentulous residents again had more difficulty eating foods, were less likely to think they needed treatment and more likely to have visited only for a dental problem. A large increase in the prevalence of denture-related oral mucosal lesions (denture stomatitis increased from 8% to 16%; angular cheilitis increased from 8% to 18.5%) and debris/plaque covered dentures was evident.

The prevalence of oral diseases and conditions among dentate residents was much higher and the pattern more complex in the Adelaide Dental Study of Nursing Homes compared with the previous studies. Dentate Adelaide nursing home residents in this study had an increased mean number of teeth (11.9 teeth) compared with dentate participants in the South Australian Walker (1984) study (8.0 teeth). They also required twice the number of coronal and root restorations reported by Stockwell (1987) and Walker (1984). Accumulation of plaque also appeared to be a greater problem in the Adelaide Dental Study of Nursing Homes. Number of extractions required by dentate residents was similar across all studies.

The very high levels of oral diseases and conditions in the dentate residents was highlighted when compared with recent data from community-living older adults participating in The South Australian Dental Longitudinal Study (SADLS). (Slade & Spencer, 1997). Although the two studies were not designed to directly compare participants' oral health status, both used randomly chosen participants, the protocols used to collect the data were the same and data were weighted to provide population

estimates. Coding systems for tooth status and restorations can vary between oral epidemiological protocols. In both of these studies, however, retained roots were coded separately as decayed root restorations or sound root restorations. Also, a '50-50' rule was applied to restorations and decayed surfaces – the coronal or root surface was scored depending on where the majority of the restoration/decay was present. Thus, comparisons between the two studies can provide an indication of the types and magnitude of differences in the prevalence of oral diseases and conditions.

DMFT scores were similar:

- 23.2 for Adelaide and 24.3 for 80+ participants in SADLS; and
- 23.7 for Adelaide nursing home residents.

However, the components of the DMFT index varied greatly, with 3.5 times more decayed teeth, 1/3 more missing teeth and less than half as many filled teeth in nursing home residents. Nursing home residents also had 5.5 times more retained roots than SADLS participants. When surface level coronal and root caries data was compared, numbers of decayed and filled surfaces (DFS) were higher in SADLS participants (coronal DFS = 22.3; root DFS = 3.1) than in nursing home residents (coronal DFS = 10.4; root DFS = 2.6) only because of the increased number of filled surfaces. The coronal caries attack rate for SADLS participants was higher (26.7%) than for nursing home residents (17.1%). However, the root caries attack rate (Root Caries Index) was much higher in nursing home residents (19.6%) than in SADLS participants (11.9%). In addition, it is likely that these caries estimates are under-reporting the disease prevalence in nursing home residents, as an additional mean of 1.3 coronal + 8.6 root surfaces were so covered with plaque/calculus/debris that they could not be scored accurately.

Although severe periodontal disease was not prevalent, the large amount of accumulation of plaque, calculus and debris was of concern. Nearly two-thirds of teeth assessed for periodontal loss of attachment had calculus present on probing. Together with the moderately-high mean Plaque Index Score of 1.75, this data indicated that adequate oral hygiene was not being maintained in these dentate residents. Factors complicating oral hygiene care for residents are discussed in the following text.

The Adelaide nursing home residents participating in this study were very functionally dependent, medically compromised, cognitively impaired and behaviourally difficult older adults. They presented many complex challenges to carers who provided their oral hygiene care and to dental professionals who provided their dental treatment.

Perhaps the most significant finding in the study was that three-quarters of the residents had MMSE scores indicative of dementia, 55% of severe dementia. These functionally dependent, severely cognitively impaired residents were the most difficult for carers. All required carers' assistance with oral hygiene care of their dentures and natural teeth. With these residents, carers reported many more:

- difficulties accessing the mouth and keeping residents' heads still enough to complete oral hygiene procedures;
- problems with their non-comprehension of oral hygiene procedures;
- verbal, physical, combative and resistive behaviours with oral hygiene procedures;
- difficulties removing and replacing dentures; and

- problems because of their inabilities to rinse, spit and swallow effectively.

These behavioural and communication problems would also make dental treatment a challenging event for most dental professionals. Other issues complicating dental treatment for these severely demented residents would include:

- the difficulty obtaining accurate dental histories and assessing any current dental pain/problems;
- residents' high levels of coronal and root caries and treatment needs;
- residents' high levels of plaque accumulation on natural teeth and dentures; and
- the physical limitations related to transporting these residents off-site from the nursing home to dental practices or hospitals (for general anaesthetic/sedation procedures).

However, even with all of these challenges, in the familiar environment of their nursing home, comprehensive dental inspections were completed in the Adelaide Dental Study of Nursing Homes for all of these severely cognitively impaired residents. This success was attributable to many of the strategies that were incorporated into the specialised study protocol, in addition to the skills of the dentists. These can be used by all dental professionals and included:

- dentists' comprehensive and practical clinical experience in caring for older adults with dementia;
- dentists' development of their communication, behaviour management and task-breakdown skills with demented older adults;
- the use of good portable light sources and examination equipment;
- the collection of residents' information from doctors and nursing home records onto standardised recording forms before attempting the dental inspection;
- the communication with and assistance from carers;
- the development of good rapport and trust with residents and their carers;
- the provision of a quiet, familiar, safe, reassuring and positive environment within the nursing home for the dental inspections; and
- dentists always attempting the dental inspection, on several occasions if needed, and never pre-judging possible outcomes.

There are several of the study's findings related to the severely cognitively impaired residents that are of great concern:

- they had multiple dental treatment needs – the prevalence of coronal and root caries, retained roots, denture problems and plaque accumulation on natural teeth and dentures were very high;
- fewer of the demented residents were treated off-site at dental practices where more complex dental treatment could be provided;
- demented residents had more check-ups at their last dental visit, but few had received any dental treatment;
- the frequency of oral hygiene care provision was low and difficult to accurately ascertain;

- their dependence upon carers for assistance with oral hygiene care was very high;
- the use of preventive oral care agents such as chlorhexidine or fluorides (with the exception of toothpaste) was almost non-existent in the nursing homes;
- education of nursing home staff by dental professionals in oral hygiene care provision for these difficult residents was almost non-existent; and
- the perceived need for dental treatment by these residents and their carers was very low.

Discussions with carers highlighted a major complicating issue with oral care provision for severely cognitively impaired residents – the issue of restraint. What should carers do when a resident verbally and/or physically refuses oral hygiene care? When a cognitively impaired resident is excessively resistive, aggressive, abusive or threatening to carers, oral hygiene care cannot be consistently provided at an adequate level. Realistically, it may not be possible to provide oral hygiene care on a regular, daily basis. It may only be possible to provide oral care infrequently and in an unpredictable manner. Even if carers have the knowledge and skills to provide adequate oral hygiene care for nursing home residents, there are some residents for whom, on some occasions, a form of physical or sedative restraint would be required to provide oral care. Dental professionals, nursing home administrators and government officials must become more aware and understanding of these immense behavioural challenges that carers encounter with severely demented residents. Improved preventive dental therapeutic products containing fluorides and chlorhexidine need to be developed to assist carers with reducing plaque accumulation and oral diseases. It is with these severely cognitively impaired residents that carers require continual advice and support from dentists and dental hygienists.

The findings and concerns arising from the clinical dental inspections, together with the findings from the questionnaires to dentists and Directors of Nursing, highlight the urgent need for dental professionals and nursing home staff to communicate, support and work with each other to improve the dental health of residents. Neither group alone can overcome the complex difficulties and challenges that these residents present with their dental problems. Each group has many specialised skills that need to be shared with the other – dental professionals can assist nursing home staff with practically oriented training about dental diseases and their prevention and management. In turn, nursing home staff can assist dental professionals to improve their knowledge, communication and behaviour management skills in relation to issues such as dementia, swallowing in impaired residents, and palliative care. Nursing home staff can also help dental professionals to better understand and integrate into the nursing home environment.

The information provided by this study indicated that Adelaide nursing home residents do have many complex dental diseases, dental problems, treatment needs and preventive oral hygiene care needs. With the changing dental profile of the increasing older adult population, there will be many more residents retaining their natural teeth. The challenges that these dentate residents will provide for dental professionals and nursing home staff will only become more difficult in future years. Further longitudinal investigation is needed concerning the initiation and development of dental diseases and problems in nursing home residents, including evaluation of oral health status of older adults before or immediately after they are admitted to nursing homes. Currently, dental professionals and nursing home staff are not educated, practically trained, nor supported to meet these challenges.

There is inadequate professional, administrative, political and government support available at present to provide the necessary funding to address the problems highlighted by this study. Representatives from the dental profession, nursing homes and government bodies need to work together to improve this situation. Achievable and practically oriented standards for residents' dental health need to be developed with input from dental professionals and nursing home carers. These standards need to have an improved focus on the evolving population of dentate nursing home residents and be well supported, with improved training for carers and dental professionals. Initiatives such as the ADA (SA) Nursing Home Scheme and the changes to the South Australian dental hygiene regulations need to be encouraged, supported and further developed.

Many special thanks must be given to all the nursing homes who participated in this study. All were extremely enthusiastic toward the study and nursing home staff gave the research team a very supportive environment in which to work. It is sincerely hoped that the findings and recommendations from this study will assist these and all other Adelaide nursing homes with the difficult challenge of providing preventively oriented oral care for their residents.

4 Conclusions

4.1 Questionnaires to all practising Adelaide dentists and all Adelaide Directors of Nursing

Dental care provision

Dental care provision for residents of Adelaide nursing homes was reported, by both dentists and Directors of Nursing, to be very low. There was a distinct pattern of service provision reported in which dentists preferred to treat residents at their dental practices and not on-site at nursing homes. The reported use of dental hygienists in nursing homes was minimal.

Attitudes toward nursing home dentistry

The majority of Adelaide dentists indicated that they had inadequate training in nursing home dentistry and low levels of interest in nursing home dentistry. There was very little assistance given to nursing homes by dental professionals in relation to the education of staff in oral care for residents. Both dentists and Directors of Nursing were generally unaware of the ADA Nursing Home Scheme and the regulation permitting hygienists to work unsupervised to a dentist's prescribed treatment plan in a nursing home. The majority of dentists and Directors of Nursing indicated that dental exams conducted by a dentist were required for residents upon admission to the nursing home and at regular intervals. Many dentists commented that a centrally coordinated and financed approach was need for nursing home dentistry, involving government support.

Problems encountered with the organisation and provision of dental care for nursing home residents

Between dentists and DONs there were several perceptions in common and many differing perceptions of the problems they encountered with the organisation and provision of dental care for nursing home residents. Four problems identified by both dentists and Directors of Nursing illustrate the main difficulty involved in nursing home dentistry – the inability of Adelaide dentists to provide dental care at nursing home premises. A lack of portable dental equipment and of suitable areas for dental treatment in nursing homes resulted in the preference of dentists to provide treatment at their practices/clinics and the need to transport residents to these dental practices/clinics for dental care. Dentists further identified nursing home/dental practice-related problems such as increased time needed for nursing home dentistry, low financial reimbursement, nursing home staff's dislike of providing regular oral hygiene care for residents, and low priority of dentistry in nursing homes. Directors of Nursing further identified resident-related problems such as residents' cognitive status, behavioural problems, financial status and difficulty in obtaining consent for dental care.

4.2 Clinical dental inspections of residents from randomly selected Adelaide nursing homes

Most Adelaide nursing home residents participating in this study were very functionally dependent, medically compromised, cognitively impaired and behaviourally difficult older adults who presented many complex challenges to carers and to dental professionals.

Dentate status and denture-related problems

Two-thirds (66%) of residents in this study were edentulous. Edentulous residents had significant dental problems and treatment needs. They had lost more percentage body weight, could eat fewer foods, were more likely to have visited for a dental problem, and were less likely to think they needed treatment. Up to 20% of residents owned dentures that were not worn. Denture-related oral mucosal conditions such as denture stomatitis and angular cheilitis were prevalent. Dentate residents had a mean number of 11.9 teeth present. Approximately one-quarter of residents wore partial dentures. Carers had more difficulties with oral hygiene care for dentate residents.

Oral health status of more cognitively impaired and functionally dependent residents

Severely cognitively impaired residents, dependent for nearly all Activities of Daily Living:

- had less information available concerning their dental history, current dental problems, and need for dental treatment;
- required the most assistance with oral hygiene care;
- gave carers more difficulties with oral hygiene care;
- had a higher prevalence of coronal and root caries; and
- had greater accumulation of plaque on natural teeth and dentures.

Prevalence of oral diseases and conditions (dentate residents) and associated characteristics

The prevalence of coronal and root caries and plaque accumulation was very high in the dentate residents in this study, especially in males, those who had been admitted more than three years previously, those who could not eat many food types and those who were severely cognitively impaired. Root caries attack rates (root caries index) were high. When compared with community-dwelling older adults residing in Adelaide, these Adelaide nursing home residents had many more retained roots, decayed teeth and missing teeth, and fewer filled teeth. Severe periodontal disease was not prevalent in these residents, however, rates of presence of plaque and calculus were high. Nearly two-thirds of teeth assessed for periodontal loss of attachment had calculus present on probing and the mean Plaque Index Score was 1.75 (out of 3).

Residents' normative versus perceived dental treatment needs

Residents had high levels of normatively assessed prosthodontic, preventive, extraction and restorative treatment needs. However, residents' perceived dental needs were low, especially for edentulous residents.

Specialised epidemiological dental inspection procedures for nursing home residents

The development and use of a specialised epidemiological dental inspection protocol in this study greatly facilitated the successful completion of the clinical dental inspections, especially for the high percentages of severely cognitively impaired residents. This protocol would be of assistance to other researchers and to dental professionals providing dental care for nursing home residents.

4.3 Recommendations

- Adelaide dental professionals need to improve dentistry's profile in nursing homes and their provision of dental care for nursing home residents.
- Adelaide dental hygienists need to be supported and encouraged to provide dental care and educational training in nursing homes.
- Improved undergraduate and postgraduate educational initiatives are needed for dental professionals. These initiatives need to include practically oriented training in nursing home dentistry, as well as impart greater knowledge concerning cognitive impairment communication and behaviour management strategies, and nursing home residents' medical and medication issues.
- Increased availability of portable dental equipment is urgently required for both private and public dental professionals. A centrally coordinated private sector scheme, supported by the ADA, could be an effective way to achieve improved access to portable equipment for private practitioners. An annual fee could be paid to the ADA by participating dental professionals and the ADA would be responsible for regular maintenance of the equipment. Various funding sources for the equipment need to be identified.
- The ADA (SA) Nursing Home Scheme plays an important role in facilitating private dental care for Adelaide nursing home residents. However, the scheme requires some updating, increased publicity and additional administrative support. A centrally placed administrative coordinator is needed to facilitate communication. Advertising of the scheme to nursing home staff in the form of mailouts or brochures, in conjunction with presentations to the three Adelaide Directors of Nursing groups would increase awareness of the scheme. A smaller more interested group of dentists who are responsible for a greater number of nursing homes may be more effective than the current organisational structure.
- Increased funding is needed to improve the Public Dental Domiciliary Service to Adelaide nursing homes. Purchasing of portable dental equipment would increase the range of services available to residents, and improve utilisation of the service by increasing the range of dental treatment that can be provided at nursing home premises. Increasing of FTE staffing levels of dentists and hygienists would

decrease waiting times for dental care and improve preventive dental educational initiatives for nursing home staff.

- A centrally coordinated and financed approach to nursing home dentistry is needed, with government assistance, to support public and private dental sectors. A united initiative is needed from all sectors of dentistry to ensure that adequate oral care is provided for all nursing home residents.
- Private and public sector dental professionals need to work together with nursing home staff and public sector administrative staff and government representatives to improve the Commonwealth Dental Standard for nursing homes. This has begun under the auspices of a Federal Australian Dental Association specialist working group, and further review of the standard is needed, especially concerning the need for regular dental examinations by a dentist and the institution of practically oriented training programs in preventive oral hygiene procedures for carers.
- Regular distribution of written material to dental professionals and nursing homes, concerning nursing home dental issues, is needed. For example, distribution of information about the changes to dental hygiene legislation is necessary.
- Improved preventive oral care provision by carers and dental professionals is needed for Adelaide nursing home residents to address their high oral disease levels.
- Improved educational assistance needs to be provided to nursing homes by dental professionals, incorporating practical 'hands-on' training in preventive oral care provision for residents.

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Appendix 1

Commonwealth Department of Health and Family Services Standards for Aged Care Facilities – Standard 2: Health and Personal Care – *Standard 2.15: Oral and Dental Care*

<i>Expected Outcome</i>	Residents' oral and dental health is maintained
<i>Criteria</i>	Policies and practices provide: <ol style="list-style-type: none">1. that residents' oral hygiene is assessed, documented, regularly reviewed and acted upon;2. that residents have timely access to treatment for oral and dental conditions; and3. appropriate procedures for oral and dental care in accordance with each resident's needs and preferences.
<i>Guidelines</i>	2.15: <i>Oral and Dental Care</i>

Expected Outcome

Residents' oral and dental health is maintained.

Preamble

This Expected Outcome provides for maintaining residents' oral and dental health and access to professional services to achieve optimum oral and dental care. A dental problem may be the cause of distress or challenging behaviour especially in residents unable to articulate their symptoms.

Staff should understand that oral health has a major influence on residents' quality of life and that continuing dental management assists them as far as possible to eat and talk comfortably, feel happy about their appearance and to stay free of pain from dental causes.

The management of oral conditions and dental diseases is essential to minimise oral sources of pathogens and to alleviate oral side effects of medications, such as dry mouth syndrome.

Considerations

- Procedures for assessing, documenting, treating and regularly reviewing each resident's oral and dental health needs
- Consultation with each resident or their representative in relation to their oral and dental care
- Resident care plan identifies the treatment required to maintain the resident's oral and dental hygiene, including daily oral hygiene and any necessary assistance

- Identification of oral and dental services available to residents
- Resident information on the services available and associated costs
- Documentation of referrals to oral and dental services
- Procedures to encourage and assist residents to maintain their oral and dental health
- Assistance for residents in the care and storage of their dentures
- Residents' dentures discreetly marked
- A system to ensure prompt repair or replacement of dentures
- Staff education addresses oral and dental care, including strategies for residents with dementia and challenging behaviours.

Appendix 2

AMENDED REGULATION 12 UNDER S.A. DENTISTS ACT – Gazetted 1/97 *Restrictions and conditions on the provision of dental treatment by dental hygienists*

- 12.(1) The provision of dental treatment by a dental hygienist is subject to the following restrictions and conditions –
- (a) the dental treatment must fall within the following categories:
 - (i) chairside assisting duties;
 - (ii) dental health education (including dietary counselling for dental purposes);
 - (iii) the recording of periodontal disease or instruction in, and the supervision and recording of, plaque control routines;
 - (iv) prophylaxis (including polishing of restorations if required);
 - (v) fluoride therapy and associated procedures or the application of remineralising solutions or desensitising agents;
 - (vi) debridement to remove deposits from teeth (other than debridement involving definitive subgingival scaling, or root planing or both);
 - (vii) the application and removal of rubber dam;
 - (viii) the application of fissure sealants;
 - (ix) the removal of supragingival deposits of calculus from teeth;
 - (x) root planing;
 - (xi) the application and removal of periodontal packs and the removal of sutures and irrigation of the mouth (including pre-operative and post-operative instructions);
 - (xii) the taking of alginate impressions;
 - (xiii) dental radiography (but only if the dental hygienist has qualifications in dental radiography recognised by the Board);
 - (xiv) orthodontic bands and attachment, selection and removal of arch wires, bands and attachments; and
 - (b) the dental treatment must be supervised by a dentist who is on the premises at the time of treatment unless –
 - (i) the treatment falls within one of the categories referred to in paragraph (a)(i) to (viii); and
 - (ii) the treatment is provided on the premises of the Julia Farr Centre or at a supported residential facility as defined in section 3 of the *Supported Residential Facilities Act 1992*; and
 - (iii) a medical practitioner or a registered nurse is at close call during the time of treatment; and
 - (c) the dental treatment must be provided in accordance with a treatment plan prepared by a dentist who has personally examined the patient; and
 - (d) a dentist must examine a patient as soon as practicable on completion by a dental hygienist of the treatment plan referred to in paragraph (c).