



Australian
National
University



THE UNIVERSITY
of ADELAIDE

Medical GP assessment of need for dental care

The oral health for older people study

Keuskamp D, Brennan DS, Roberts-Thomson K

ACKNOWLEDGEMENTS

This research is a project of the Australian Primary Health Care Research Institute, which is supported by a grant from the Australian Government Department of Health. The information and opinions contained in it do not necessarily reflect the views or policy of the Australian Primary Health Care Research Institute or the Australian Government Department of Health.

The authors also acknowledge participating organisations (Central and Adelaide Hills Medicare Local, Southern Adelaide, Fleurieu and Kangaroo Island Medicare Local, Northern Adelaide Medicare Local, South Australian Dental Service and staff), and the research participants.

CITATION

Keuskamp D, Brennan DS, Roberts-Thomson KF. Medical GP assessment of need for dental care: The oral health for older people study. APHCRI Centre of Research Excellence in Primary Oral Health Care, University of Adelaide, 2016.

APHCRI Centre of Research Excellence in Primary Oral Health Care

Australian Research Centre for Population Oral Health

School of Dentistry

The University of Adelaide

SA 5005 Australia

T 61 8 8313 3291

F 61 8 8313 3070

E arcpoh@adelaide.edu.au

CONTENTS

Commonly used acronyms.....	4
Background.....	5
RESEARCH AIMS.....	5
Methods.....	7
STUDY DESIGN AND PARTICIPANTS.....	7
PROCEDURE.....	7
Recruitment of participants.....	7
Survey and logbook completion.....	7
OUTCOME MEASURES AND DATA ANALYSIS.....	8
ETHICS CONSIDERATIONS.....	8
Results.....	9
RESPONSE AND BIAS ANALYSIS.....	9
PARTICIPANT PROFILE.....	9
Demographic and socioeconomic profile.....	9
General health and wellbeing.....	10
Oral health and oral health-related quality of life.....	11
Representativeness.....	11
ANALYSES OF BASELINE DATA.....	11
Bivariate analyses.....	11
Multivariable analyses.....	13
FINDINGS FROM THE INTERVENTION.....	15
Equivalence of groups at baseline.....	15
Intervention outcomes.....	16
Discussion.....	19
ORAL AND GENERAL HEALTH RELATIONSHIPS.....	19
Common risk factors for oral and general health.....	19
Representativeness.....	19
Recruitment to study and access of public dental care.....	19
INTERVENTION AND OUTCOMES.....	20
Variation in oral health outcomes.....	20
General health and quality of life outcomes.....	20
Lack of differential impact.....	20
Conclusions.....	22
IMPLICATIONS FOR POLICY.....	22
STRENGTHS AND LIMITATIONS OF THE STUDY.....	22
References.....	23
Appendices.....	25
APPENDIX A: TABLES 3A, B AND C.....	25

Commonly used acronyms

ARCPOH	Australian Research Centre for Population Oral Health
BMI	Body Mass Index
NDTIS	National Dental Telephone Interview Survey
OHIP	Oral Health Impact Profile
OHRQoL	Oral health-related quality of life

Background

With the ageing of the Australian population there is a growing challenge to maintain health into older age and to meet the health needs of this expanding sector of the population.¹ In Australia, the proportion of adults aged 65 years and over is projected to increase from 13% in 2004 to 26-28% in 2051.² The health system increasingly faces issues in managing multiple chronic diseases into older age. Oral health is considered fundamental to overall general health and wellbeing.³

Oral conditions affect 3.9 billion people world-wide, with untreated caries in permanent teeth being the most prevalent condition in the Global Burden of Disease 2010 Study.⁴ Oral diseases such as dental caries are a major public health problem; the experience of pain, problems with eating, chewing, smiling, communication, discoloured or damaged teeth can have a major impact on people's daily lives.⁵ Consistent with widespread dental problems, health expenditure on dental services in Australia is large, accounting for over \$8.9 billion in 2013-14.⁶

For adults in Australia there has been a marked decline in complete tooth loss or edentulism⁷, with a reduction in the level of tooth loss linked with increased dental treatment needs, especially in older people.⁸ A study of older adults found that those who retained higher numbers of teeth had more periodontal disease and dental caries experience, and reported a past pattern of visiting the dentist more frequently.⁹

Oral diseases are common in Australia and impact on peoples' lives. Over 90% of Australians born before 1970 have some experience of tooth decay; a quarter of adults have untreated coronal decay, and one in five adults have moderate or severe gum disease.¹⁰ An international study of 26 countries found that higher levels of caries existed in adults than in children, suggesting that caries will remain as a problem in adults even with low caries levels among children.¹¹ General health tends to be worse not only when there are more health problems present, but also where there are higher numbers of impacts related to oral health problems.¹²

According to the National Advisory Council on Dental Health¹³, oral health is integral to general health. There is a direct association of tooth loss with compromised nutrition, which can impair general health and exacerbate existing health conditions. The mouth is also considered as an entry point for infections, which may spread to other parts of the body. International research has documented associations between chronic oral infections and heart and lung diseases, stroke, low birth-weight and premature births, as well as between periodontal disease and diabetes. Dental disease also negatively impacts general quality of life, affecting psychological and social wellbeing in addition to physical wellbeing.

Our ageing population is tending to keep their teeth into older age. This leads to problems such as tooth wear, tooth fracture, root caries and pulpal infections (National Oral Health Plan 2004-13). Older people also face access issues relating to receiving adequate dental care, resulting in worse overall oral health with many impacts on their quality of life. Good oral health and adequate dental care are important to facilitate healthy ageing, and can contribute to better general health which can alleviate strain on the health system.

The local public dental care provider in South Australia is the South Australian (SA) Dental Service. Patients' eligibility for public dental care is determined by concession card status. Patients requesting non-emergency care are waitlisted before being seen at a community clinic, for a period of months to years.

RESEARCH AIMS

This research project conducted and evaluated a community-based randomised trial of priority (no waitlist) and waitlisted public dental care for people aged 75 years or older, living

at home, who held concession status. The overall aim was to address whether priority dental care *via* referral by Health Assessments can contribute to successful ageing and help prevent declining health in older age. The research aimed to provide new knowledge to benefit patients, policymakers, service providers, other researchers, and the broader community.

The objectives of the study were to,

1. Evaluate oral health, general health and their relationship in this sample of 75 years or older persons
2. Assess whether persons accessing priority dental care have better oral health outcomes than those waitlisted
3. Assess whether persons accessing priority dental care have better general health outcomes than those waitlisted.

Methods

STUDY DESIGN AND PARTICIPANTS

This study involved a community-based, randomised trial comparing prioritised and waitlisted dental care from the SA Dental Service. The participant group comprised people who received Health Assessments from general medical practitioners located in three Medicare Local (now Primary Health Networks) areas in South Australia. All people aged 75 years or older and living at home are eligible for Assessments. Recruitment occurred from December 2013 to December 2015, with data collection from December 2013 onward.

PROCEDURE

Recruitment of participants

A steering committee staffed by members of Australian Research Centre for Population Oral Health (ARCPOH), SA Dental Service, Central Adelaide and Hills Medicare Local (CAHML) and Southern Adelaide Fleurieu Kangaroo Island Medicare Local (SAFKIML) began meeting regularly from March 2013 to discuss implementation of the trial. Three information sessions were held jointly in November and December 2013 and nurses and GPs from general practices in those Medicare Locals were invited to attend. General practices who agreed to participate were sent referral forms, patient information forms and forms outlining contacts for information and complaints.

Referral forms comprised patient contact information, concession eligibility, medical information, six oral health screening questions and a consent section. The consent section asked for consent to be involved in the research and separately, to access care with the SA Dental Service and have their information forwarded on to the SA Dental Service. At the time of each participant's assessment, a nurse or GP (a) informed participants of the study and provided them with patient information and contact forms; (b) confirmed that they were cognitively capable of consent; (c) asked screening questions, and (d) solicited consent. Referral forms from those participants who consented to either the research or public dental care were then faxed to the ARCPOH. Referral forms from those participants who consented to public dental care were forwarded to the SA Dental Service.

Further meetings were held beginning June 2014 with Northern Adelaide Medicare Local in response to a lower than expected recruitment rate. One final information session in that region was held in August 2014, and practices who wished to participate were involved in the project as above.

Survey and logbook completion

A self-report baseline survey of 12 pages was developed. It was purpose-designed using large font and spacing to make it easy to read and complete by older people who may have visual difficulties. The survey was mailed to participants following receipt of a referral wherein they had consented to participate in the research study. Two follow-up reminders were mailed three weeks apart. A logbook was mailed to participants on receipt of a completed survey.

Follow-up surveys of similar length were mailed to participants one year, and two years afterward, at which time a mail out also recalled and replaced logbooks. Two follow-up reminders for survey and logbook recall were mailed three weeks apart.

OUTCOME MEASURES AND DATA ANALYSIS

The referral of participants and their random allocation to either priority or waitlisted public dental care served as the main explanatory variable in the study.

Outcomes measured in the survey included,

- > Self-rated global general health, self-rated global oral health
- > At follow-up: self-rated change in general health, self-rated change in oral health
- > General quality of life (EuroQol: EQ-5D)¹⁵
- > Oral health-related quality of life (OHRQoL) as measured by OHIP-14 (Oral Health Impact Profile)¹⁶
- > Number of dental visits, number and type of dental services received.

Other survey variables and scales used in analysis were,

- > Sex, age, educational level, language spoken at home, living arrangement, housing status
- > Self-rating of financial situation and material standards of life (proxies for socioeconomic status), concession card status, health and dental insurance status
- > Height, weight, smoking frequency, self-reported chronic medical conditions
- > Instrumental Activities of Daily Living (IADL)¹⁷
- > Nutrition Screening Initiative (NSI)¹⁸
- > Multidimensional Scale of Perceived Social Support (MSPSS)¹⁹
- > Satisfaction with Life Scale (SWLS)²⁰
- > Self-reported major life events
- > Dental behaviours: tooth brushing frequency and timing, reason and sector of service for last dental visit.

Logbook records provided additional detail on the timing and nature of dental treatment.

Survey responses were entered into SPSS Statistics (version 20, 2011), and data were validated, cleaned and recoded where necessary. Descriptive and inferential statistics were calculated according to the outcome measure of interest for baseline and/or follow-up.

ETHICS CONSIDERATIONS

Ethics approval was granted by the Human Research Ethics Committee of the University of Adelaide (H-2013-057).

Results

RESPONSE AND BIAS ANALYSIS

General practices were not able to notify researchers of all those persons presenting for Health Assessments who chose to neither participate in the study nor access public dental care. However anecdotal reports indicated that this figure was likely to be far larger than the final number of 590 referrals wherein participants consented to the research study.

Of the 590 consenting persons, there were 459 responses to the baseline survey that was subsequently mailed to them (a 78% response rate). When measuring the differences between respondents and non-respondents with the only data available at time of referral (age, sex and edentulism), age was the only significant systematic difference between groups (Table 1). The younger age group was more likely to respond.

Table 1. Participant characteristics at point of referral comparing response and non-response

		Row n	Nonresponse n (%)	P-value ^a
Age group	75-84	423	82 (19%)	0.012
	85+	154	45 (29%)	
Sex	Male	261	54 (21%)	0.333
	Female	320	77 (24%)	
Edentulism	Yes	449	98 (22%)	0.636
	No	126	30 (24%)	

^achi-square test

A one-year follow-up survey was mailed to 370 respondents by the end of March 2016. From this follow-up survey, there were 236 respondents (a 64% response rate). However, the attrition included 29 deceased persons (a 8% death rate), thus the adjusted response rate was 69%. There was no significant systematic bias in demographic or socioeconomic variables or in edentulism between those responding to the second survey and those lost to follow-up (Table 2).

PARTICIPANT PROFILE

Demographic and socioeconomic profile

The mean age of participants was 81 years. Just over three-quarters of participants were aged between 75 and 84 years old, the remainder over 85 years. 54% were female. Only 31% of participants recorded education above secondary level. By far the majority (87%) spoke English as their main language at home. The most common other primary language was Italian (8% of all responses). A majority (60%) of participants lived with others, and most often this was with their spouse. Consequently, 40% lived alone. Nonetheless, values for the social support measure (MSPSS) were relatively high: out of a possible range from 12 (low) - 60 (high), the mean value was 49.

The majority of participants (80%) owned or mortgaged their own home, or lived in a retirement village. The remainder rented, and 4% overall rented from the public Housing Trust. Some form of concession card (most often a Pensioner Concession Card) was held

Table 2. Participant characteristics at baseline comparing response and loss to first year follow-up

		Row n	Loss to follow-up n (%)	P-value ^a
Age group	75-84	282	98 (35%)	0.294
	85+	88	36 (41%)	
Sex	Male	176	64 (36%)	0.955
	Female	194	70 (36%)	
Educational level	Secondary or less	241	93 (39%)	0.180
	Tertiary	121	38 (31%)	
Living arrangement	With others	221	80 (36%)	0.872
	Alone	147	52 (35%)	
Satisfaction with material standards	Low - moderate	214	75 (35%)	0.859
	High	139	50 (36%)	
Edentulism	Yes	81	34 (42%)	0.588
	No	289	100 (35%)	

^achi-square test

by 99% of participants. Health insurance was held by 38%, and 26% held dental insurance. Where participants were asked to rate their satisfaction with their financial situation and material standards respectively, mean values recorded were 6.6 and 7.3, relatively high from a scale of 0-10.

General health and wellbeing

Participants self-rated their general health, and 44% did so as either fair or poor (collated to 'poor'). Mean Body Mass Index (BMI) derived from self-reported height and weight was 26.8, and 65% and 23% of participants fell into the overweight (BMI 25+) and obese (30+) categories respectively. Only 2% qualified as underweight (<18.5). Only 6% of participants currently smoked cigarettes and of those that were not, 44% were former smokers. Almost all participants had at least one chronic condition, and 55% had four or more. The most common were arthritis (reported by 57%), hypertension or high blood pressure (53%) high cholesterol (35%) and a heart condition or heart attack history (33%). With regard to the Instrumental Activities of Daily Living scale, from a potential range of seven (less able) - 21 (more able) the mean was 19, with most participants needing little assistance from others. Values from the nutritional risk measure showed 23% in good nutritional health, 40% at moderate risk and 37% at high risk. The most common risk factors were taking three or more medications per day (74%) followed by eating few fruits, vegetables or milk products (50%) and eating alone most of the time (41%), and having tooth or mouth problems impacting on eating (40%).

Quality of life as measured by the EuroQol health utility score (where 1 can be conceptualised as full health) had a mean 0.71. Pain or discomfort was the most commonly reported impact from the scale (69% moderate and 9% extreme). With regard to wellbeing,

as measured by the SWLS, out of a potential range 5 (low) - 25 (high), the mean was a relatively high 18.

Oral health and oral health-related quality of life

The percent of the sample that was edentulous (reporting no natural teeth) was 23%. Of the majority dentate group, only 41% had 20 or more teeth, a threshold indicator of functional dentition. The mean number of teeth for dentate participants was 17. However, 40% and 25% of the entire sample had full or partial upper dentures, respectively, and 23% and 22% had full or partial lower dentures. Mean values for satisfaction with upper and lower dentures respectively were 2.8 and 3.5 on a scale of 1 (low) to 5 (high).

Self-rated oral health was reported as poor by 65% of participants overall, and was higher for edentulous participants. Oral health-related quality of life was measured by the frequency of 14 impacts from oral problems listed as items in the OHIP-14 scale. The 'prevalence' of impact, i.e. one or more items reported fairly or very often amounted to 45%, the 'extent' of impact, i.e. the mean number of aforementioned items, was 1.8, and the summed item score, or 'severity', was 13.6 out of a potential range 0 (all impacts never) -56 (all very often). The most common impacts from oral problems that were reported often were 'finding it uncomfortable to eat' (34%), 'being self-conscious' (26%) and 'feeling tense' (17%).

At least one year had elapsed since the last dental visit for 62% of the sample. For most of the participants (58%) that visit had been for treatment of relief of pain, rather than a checkup. Almost 40% had last visited a public, rather than a private, dental service. Tooth brushing frequency, a dental behaviour significant for oral health, was twice per day or more (the recommended frequency) for 63% of the sample.

Representativeness

Values for the baseline sample were compared where possible to data from the Census or other national surveys (Tables 3a-c, Appendix A). The sample was relatively younger than the Census and thus also had more males. Although comparable in terms of educational level and living arrangement, the sample had a higher number of people with English as a second language, reflecting the Mediterranean background of many older people in Adelaide. A higher proportion were concession holders and lower proportion held insurance compared with data from the 2010 National Dental Telephone Interview Survey (NDTIS).

The sample was less healthy overall in terms of self-rated general health, but had a similar proportion smoking. Quality of life as measured by the EQ-5D was poorer than the national estimate. There was a lower proportion of edentulism and oral health was generally worse in the sample compared with the national population. For example, OHIP severity was double the national mean for 65 years or older.²² The dental visiting patterns of the sample reflected this also. More people had last visited a dentist over a year ago, had last visited for treatment or relief of pain, and had last accessed the public dental service.

ANALYSES OF BASELINE DATA

The baseline sample of 459 participants was used to explore the predictors of four health outcomes: self-rated oral health, self-rated general health, general quality of life, and oral health-related quality of life (OHIP-14). Of the baseline sample, 65% rated their oral health as poor and 44% rated their general health as poor (Table 3b). The mean value for general quality of life as measured by EQ-5D Health Utility was 0.71 and for oral health-related quality of life as measured by OHIP-14 'severity' was 13.6.

Bivariate analyses

The four outcome variables were cross-tabulated with seven variables to determine unadjusted associations: age, sex, educational level, living arrangement, extent of chronic conditions, nutritional risk, and a proxy for socioeconomic status. (Tables 4 and 5). Poor oral

health was significantly associated with only socioeconomic status and nutritional risk (those with lower status and at greater risk were in worse health) but neither age group, sex, educational level, living arrangement nor extent of chronic conditions (Table 4). Poor general health was associated with the same two variables as oral health, and also living arrangement and extent of chronic conditions (those living with others and with more conditions were in worse health).

Table 4. Poor oral and general health by selected characteristics

		n (max)	Poor oral health n (row %)	P- value ^a	Poor general health n (row %)	P- value ^a
Age group	75 – 84	349	224 (65%)	0.862	152 (44%)	0.645
	85+	110	70 (66%)		45 (42%)	
Sex	Male	210	139 (67%)	0.455	92 (44%)	0.863
	Female	249	155 (64%)		105 (43%)	
Educational level	Secondary	308	200 (66%)	0.395	136 (45%)	0.245
	Above	140	85 (62%)		55 (39%)	
Satisfaction with material standards	Low – moderate	198	71 (73.2%)	0.001	110 (56%)	<0.001
	High	230	117 (57.1%)		79 (34%)	
Living arrangement	With others	275	183 (68%)	0.131	126 (47%)	0.040
	Alone	180	107 (61%)		67 (37%)	
Chronic conditions	<4 conditions	209	126 (62%)	0.187	63 (31%)	<0.001
	4+ conditions	250	168 (68%)		134 (55%)	
Nutritional risk	Good health	95	62 (51%)	<0.001	33 (27%)	<0.001
	Moderate to high risk	316	221 (72%)		159 (52%)	

^achi-square test

For the two quality of life measures, differences between means were tested (Table 5). As for poor oral health, oral health-related quality of life varied significantly only for groups defined by socioeconomic status and nutritional risk. General quality of life means differed significantly for groups defined by all variables except living arrangement. Lower quality of life was found in those persons who were older, female, with less formal education and of lower socioeconomic status as well as those at higher nutritional risk and with more chronic conditions.

Table 5. Oral health-related quality of life and general quality of life by selected characteristics

		n (max)	OHIP severity row mean (SD)	P- value ^a	Health utility row mean (SD)	P- value ^a
Age group	75 – 84	349	13.6 (12.5)	0.874	0.73 (0.25)	0.006
	85+	110	13.8 (12.4)		0.65 (0.30)	
Sex	Male	210	14.0 (12.3)	0.534	0.74 (0.26)	0.031
	Female	249	13.3 (12.6)		0.69 (0.26)	
Educational level	Secondary	308	13.0 (12.4)	0.228	0.69 (0.27)	0.013
	Above	140	14.5 (12.2)		0.76 (0.23)	
Satisfaction with material standards	Low – moderate	198	17.5 (13.6)	<0.001	0.65 (0.29)	<0.001
	High	230	10.3 (10.6)		0.77 (0.23)	
Living arrangement	With others	275	13.6 (11.6)	0.867	0.72 (0.27)	0.843
	Alone	180	13.4 (13.6)		0.71 (0.24)	
Chronic conditions	<4 conditions	209	12.4 (11.9)	0.070	0.80 (0.21)	<0.001
	4+ conditions	250	14.6 (12.8)		0.64 (0.27)	
Nutritional risk	Good health	95	10.4 (11.0)	0.001	0.83 (0.17)	<0.001
	Moderate to high risk	316	15.1 (12.9)		0.67 (0.27)	

^at-test

Multivariable analyses

Models were built using multivariable logit regression (Table 6), to estimate poor general health and poor oral health using the aforementioned seven independent variables. Having lower socioeconomic status, living with others and being at higher nutritional risk were common factors predictive of poor oral health and general health ($P < 0.05$). In addition, persons with more chronic conditions had approximately double higher odds of poor general health (no association was found with oral health).

Table 6. Results of logit regression analyses for poor oral and general health (odds ratio with 95% CI of significant predictors only).

Variable		Oral health (n=401)	General health (n=404)
Satisfaction with material standards	High (ref: low to moderate)	0.52 (0.33-0.81)	0.41 (0.27-0.64)
Living arrangement	Alone (ref: with others)	0.59 (0.37-0.94)	0.50 (0.31-0.80)
Chronic conditions	4+ conditions (ref: <4)	NS	2.18 (1.41-3.37)
Nutritional risk	Moderate to high risk (ref: good health)	2.57 (1.61-4.10)	2.76 (1.69-4.53)

Multivariable linear regressions were used to estimate general and health-related quality of life (Table 7). More severe oral health impact was predicted by lower socioeconomic status and higher nutritional risk ($P < 0.05$). A lower health utility score was also predicted by those variables, as well as greater age, being female, living with others and having more chronic conditions. The importance of living with others in predicting general health and quality of life probably reflects a selection effect, i.e. those in worse health are more likely to live with others, rather than vice versa.

Table 7. Results of linear regression analyses for OHRQoL and general quality of life (beta with 95% CI of significant predictors only)

Variable		OHIP severity (n=392)	Health utility (n=379)
Age	85+ years (ref: 75-84)	NS	-0.092 (-0.15 - -0.036)
Sex	Female (ref: male)	NS	- 0.073 (-0.12 - -0.021)
Satisfaction with material standards	High (ref: low to moderate)	-6.49 (-8.92 - -4.05)	0.11 (0.064 – 0.16)
Living arrangement	Alone (ref: with others)	NS	0.063 (0.012 – 0.11)
Chronic conditions	4+ conditions (ref: <4)	NS	-0.13 (-0.18 - -0.079)
Nutritional risk	Moderate to high risk (ref: good health)	3.75 (1.04 - 6.45)	-0.14 (-0.19 - -0.88)

FINDINGS FROM THE INTERVENTION

At April 2016, of the 337 respondents who had been mailed a follow-up survey, 233 had responded (70.0%). Of this sample, 109 were offered prioritised care with SA Dental Service, and 109 had been waitlisted for care. The remaining 18 had not sought care.

Equivalence of groups at baseline

Baseline measures were compared between priority and waitlist groups to estimate equivalence prior to the intervention (Table 8). The priority group had a significantly higher proportion of edentulism and those living with others and holding dental insurance. All other measures, including self-rated oral and general health, OHRQoL and general quality of life did not differ statistically between groups.

Table 8. Selected participant characteristics at baseline comparing priority and waitlist groups (n=109 each).

		Waitlist	Priority	P-value ^a
Age	85+	26%	16%	0.066
Sex	Female	58%	47%	0.104
Educational level	Secondary or less	65%	64%	0.959
Living arrangement	Alone	49%	32%	0.013
Social support	Mean (SD)	48.4	49.1	0.575
Insurance holder	Dental	22%	36%	0.025
Satisfaction with material standards	Mean (SD)	7.5	7.4	0.821
Self-rated general health	Fair or poor	42%	34%	0.195
BMI	Mean (SD)	26.7	27.2	0.396
Current smoker		6%	9%	0.290
Chronic conditions	4 or more	55%	55%	>0.999
Nutritional risk	Moderate to high risk	77%	74%	0.523
EQ-5D Health Utility	Mean (SD)	0.74	0.74	0.903
Satisfaction with life scale	Mean (SD)	17.9	18.2	0.594
Edentulism		15%	26%	0.043
Number of teeth (dentate)	Less than 20	58%	62%	0.628
Brushing frequency	Less than twice per day	36%	32%	0.567
Last dental visit	More than 1 year	57%	63%	0.373
Self-rated oral health	Fair or poor	65%	63%	0.669
OHIP prevalence		41%	42%	0.889

OHIP extent	Mean (SD)	1.49	1.67	0.643
OHIP severity	Mean (SD)	12.1	13.5	0.388

^achi-square or t-test

Of those persons referred for public dental care, wait times until first appointment were estimated. Although both groups experienced a wide range of wait times, prioritised patients were seen earlier with a mean of 43 days wait (range 11 – 90) compared with 133 days (55 – 300). Nonetheless the mean difference in wait times between groups (approximately 3 months) was not as large as anticipated.

Intervention outcomes

Several outcomes were compared between priority and waitlist groups (Table 9a-b). These included measures of oral and general health at baseline and follow-up, and self-rated change in oral health and general health measured at follow-up. The number of visits, and number and types of dental services utilised by participants were also analysed.

Several oral health measures changed significantly from baseline to follow-up. These were self-rated oral health and two measures of OHRQoL, OHIP extent and severity. Change in OHIP prevalence did not attain statistical significance. Change for all oral health measures occurred in both waitlist and priority groups. The magnitude of change was larger in the priority group for each measure, however the difference was small. For example, the proportion of participants reporting poor oral health decreased by 21% in the waitlist group and 24% in the priority group, and mean OHIP severity decreased by 2.7 and 3.0 respectively. When analysis was stratified by dentate status instead of intervention group (not shown), it was seen that most of the change in OHRQoL occurred in the edentulous group. Edentulous participants (n = 34) reported a change of 7.6 and dentate participants only 1.8.

None of the general measures (self-rated general health, health utility, and BMI) changed significantly between baseline and follow-up, for either waitlist or priority group.

Table 9a. Intervention outcomes: health and quality of life compared between baseline and follow-up (n = 109 each)

		Poor health n (%)		P-value ^a
		Baseline	Follow-up	
OHIP prevalence	Waitlist	43 (41%)	30 (30%)	0.052
	Priority	44 (42%)	34 (32%)	0.064
Self-rated oral health	Waitlist	70 (65%)	48 (44%)	0.001
	Priority	67 (63%)	42 (39%)	<0.001
Self-rated general health	Waitlist	46 (42%)	41 (39%)	0.690
	Priority	36 (34%)	36 (34%)	>0.999

Table 9b. Intervention outcomes: health and quality of life compared between baseline and follow-up (n = 109 each)

		Mean		P-value ^b
		Baseline	Follow-up	
OHIP severity	Waitlist	11.4	8.7	0.005
	Priority	13.6	10.6	<0.001
OHIP extent	Waitlist	1.34	0.84	0.042
	Priority	1.66	1.18	0.010
Health utility	Waitlist	0.73	0.71	0.222
	Priority	0.75	0.72	0.183
BMI	Waitlist	26.9	26.7	0.261
	Priority	27.3	27.3	0.985

^aMcNemar test of change

^bpaired t-test of change

Slightly more than 10% of participants overall self-rated their health as improved at follow-up (Table 10). However, neither measure differed between waitlist and priority groups. The majority (70% of waitlist and 66% of priority) reported that their oral health stayed the same. However, 43% and 38% respectively reported worsened general health.

Table 10. Intervention outcomes: self-rated change in health in past year at follow-up (n = 109 each)

	Improved health n (%)		P-value (t-test)
	Waitlist	Priority	
Self-rated oral health	11 (11%)	14 (13%)	0.592
Self-rated general health	8 (8%)	13 (12%)	0.280

Data from dental visits were reported at follow-up, and for this purpose the range of dental services provided were categorised into five principal types: diagnostic/preventive, surgical, endodontic, restorative and prosthodontic (Table 11). While the mean number of visits and services did not differ significantly between waitlist and priority groups, participants in the waitlist group received a significantly higher number of service types than the priority group, although the difference was small (0.3).

Table 11. Intervention outcomes: visits and services in past year reported at follow-up (n = 109 each)

	Mean		P-value (t-test)
	Waitlist	Priority	
Number of visits	3.7	3.2	0.390
Number of services	6.1	5.7	0.652
Number of service types	2.1	1.8	0.029

Anecdotally, many of the participants reported benefits from their dental care. Some undertook extensive courses of care but others only sought single appointments, e.g. checkups, small restorations or repairs. Some in this latter group took advantage of the referral pathway to public care but retained their private dentist for ongoing regular treatment.

Discussion

ORAL AND GENERAL HEALTH RELATIONSHIPS

This study presented data profiling the oral and general health of a sample of persons 75 years or older accessing Health Assessments. The oral and general health profile of the sample was worse than the national average for that age group, despite being younger and all living at home (12% of those 75 years or older live in aged care according to the 2011 Census). For example, almost twice as many people (65%) rated their oral health as poor than the national figure estimated from the 2010 NDTIS.

Common risk factors for oral and general health

Associations with oral and general health and quality of life outcomes were addressed using baseline sample data. These analyses highlighted several common risk factors for the oral and general health of older people, namely socioeconomic status, the extent of comorbidity of chronic conditions and nutritional risk factors. The risk of undernutrition was highlighted, and this most heavily reflected the extent of medication use and dietary limitations. Medication use and dietary limitations in turn are influenced by oral and other chronic disease, exemplifying the interactions among factors. These findings corroborate growing evidence on the links between oral and general health, and lifetime social and economic determinants of health.²³ They also highlight opportunities for prevention of oral disease in primary care settings. Living alone *per se* was anticipated as being a risk factor for oral and general health and wellbeing. However, it was found that those living with others were actually in worse health, with the support of spouse probably enabling them to remain living independently.

Representativeness

It should be noted that it was not possible to estimate with accuracy the representativeness of the study sample given the estimated high rate of non-participation at time of the assessment. Nonetheless, Health Assessments are only available to those living at home. This is a group expected to be healthier than average for that age, given 12% of those over 75 years live in care (2011 Census).²⁴ Thus the potential pool of persons undertaking assessments are likely to be healthier and also younger than the general population. There was further bias toward a younger sample in the response to the baseline survey (Table 1). Given the nature of the study and care being offered, it is not surprising that the sample were more likely to be concession holders and in worse health (especially oral health) than the respective population. This was reflected in the comparison between the baseline sample and national population data where available, where the former had a poorer health profile (Tables 3b-c). Nonetheless, there was no evidence of non-random loss to follow-up (Table 2), and the extent of attrition due to refusal, nonresponse and death was as expected.

Recruitment to study and access of public dental care

General practice nurses who conducted Health Assessments noted anecdotally that patients who did not participate in the study (despite eligibility for public care) did so for several reasons. Principally these were,

- > Seeing a private dentist and did not want to change
- > Not requiring treatment and saw no need for preventive care (especially edentulous persons)
- > Burdened by multiple visits to health professionals
- > Effects of age, frailty and/or cognitive ability.

INTERVENTION AND OUTCOMES

Referral to public dental care from Health Assessments benefitted participants in this study. Almost all oral health and OHRQoL measures improved from baseline to follow-up. Although most improvements attained statistical significance, overall the extent of the improvement was low in real terms. Moreover, self-reported improvement for both groups was little more than 10%. In comparison with other studies the differences were not large. For example, the decrease in OHIP severity of 2.7-3 was lower than the minimally important difference of five points noted by others.²⁵ Prior to treatment, participants reported an average of 1.5 impacts that occurred fairly or very often (OHIP extent). This was reduced to 1 at follow-up, yet this was still considerably higher than the population value of 6.5 for those aged 65 years and older.²² The changes in OHIP extent and severity were lower than those reported by an uncontrolled study which served as a pilot for the current one, and which measured change over six months.²⁶ This could be due to an attenuation of the effect over time, a difference in the profile of participants between studies, or a real difference in the impact of the interventions in the two studies. Another possible cause of greater self-reported change in the uncontrolled study is the Hawthorne effect, i.e. that participants, aware of being studied, modified their responses to conform to expectations of improvement. Study participants in the uncontrolled study were all given priority care, and were interviewed in person by research staff at follow-up within months after their treatment.

Variation in oral health outcomes

The variation in oral health outcomes reflected the different groups of participants seeking dental treatment.²⁶ Some had relatively intractable oral health problems, while others had moderate treatment needs and received care sufficient to maintain their oral health. Likewise, a Canadian study that reported oral health outcomes for older adults provided with dental treatment identified that some participants' health even deteriorated in spite of the dental care they received.²⁷ Costs were identified as a barrier for the group of older people in this study. Anecdotal evidence suggested that the cost of private specialist dental care (which was recommended following assessment at an SA Dental Service clinic) prohibited some participants from seeking the treatment they needed.

General health and quality of life outcomes

The analysis of baseline data highlighted relationships between oral and general health and quality of life. However, no change in general health and quality of life outcomes was observed in this study despite measurable improvement for oral outcomes. The magnitude of change in oral outcomes was not large and may have limited our capacity to determine whether there was a subsequent measurable impact on general outcomes. Notably, over the one year to follow-up, 40% of participants reported worsened general health, so there was probably limited capacity for dental care to attenuate that decline.

Lack of differential impact

No observable difference between waitlist and priority groups was observed in outcomes. Unfortunately the difference in wait time between the groups was far lower than anticipated. Based on data from previous years published by the SA Dental Service, the difference was expected to be at least 9-12 months. However, funding from the National Partnership Agreement on Treating More Public Dental Patients was implemented from January 2013 by the SA Dental Service. In South Australia the major strategy of the Plan was to reduce waitlist times and this was effective in reducing wait time to three months in many metropolitan public dental clinics. As a consequence, the measured difference between groups was on average only three months for most of the period of the intervention. By 2015, metropolitan waitlist times for SA Dental Service had increased again to 12 months.

Analysis of baseline data demonstrated relative equivalence in oral and general health measures between priority and waitlist groups. Some upgrading of waitlist patients did occur

and this may have influenced the distribution of the sample between groups. Nonetheless, the extent of attrition from the study due to refusal, non-response and death was similar to that expected and relatively free of bias.

Conclusions

IMPLICATIONS FOR POLICY

General practice assessment of the need for dental care and referral to public dental care improved the self-rated oral health and oral health-related quality of life of patients over one year.

We recommend:

- > The integration of oral health assessment routinely in Health Assessments for those 75 years and older. Encouragement and incentive should be provided to general practices to do so.
- > The implementation of a standardised route for referral to public dental care from Health Assessments for eligible older people.
- > The expansion of opportunities within public dental care for older people to gain timely dental treatment.
- > Further research to identify barriers and enablers that facilitate older people's access to regular public dental treatment.

STRENGTHS AND LIMITATIONS OF THE STUDY

The strengths of this study include its context as a real-world community-based intervention which delivered tangible benefits to the participant group. A sufficient sample size was achieved to be able to detect meaningful differences in the measured outcomes between the intervention groups. The building of collaborative research interactions involving GP clinics, public dental services and university researchers enabled the study to be undertaken.

The primary limitation of the study was the time taken to achieve the sample, dictated by a low rate of recruitment of participants. The speed of intake was considerably poorer than anticipated based on the previous discussions with the steering group prior to commencing the project, and previous experience from an uncontrolled pilot study.²⁶ It is possible that the contraction of public dental clinics in the decade since that study had forced older people eligible for public dental care to engage with private dental services. Understandably, they were unwilling to change back.

The capacity of Medicare Locals to facilitate general practices in the conduct of research and liaison between practice staff and the research team was hampered by their review and then disbandment beginning 2014. Regardless, some general practices did not engage with the study from the outset, citing cost as a barrier to adding tasks and time to the Health Assessment.

Further research could adopt a similar collaborative approach between GPs, public dental services and researchers to undertake primary care research into linkages between oral health and general health.

References

1. AIHW: Britt H, Miller G, Charles J, Pan Y, Valenti L, Henderson J et al. *General practice activity in Australia 2005–06*. Canberra: AIHW; 2007.
2. Australian Bureau of Statistics Population projections. *Australia. 3222.0. 2004 to 2101*. Pg 44. Chapter 4: In: *Australia to 2050: future challenges*. Commonwealth of Australia; 2010.
3. Gift HC, Atchison KA. Oral health, health and health-related quality of life. *Med Care* 1995;33:NS57-77.
4. Marcenes W, Kasselbaum NJ, Bernabe E, Flaxman A, Naghavi M, Lopez A et al. Global burden of oral conditions in 1990-2010: a systematic analysis. *J Dent Res* 2013;92:592-7.
5. Petersen PE, Bourgeois D, Ogawa H, Estupinan-Day S, Ndiaye C. The global burden of oral diseases and risks to oral health. *Bull World Health Organ* 2005;83:661-9.
6. AIHW: Australian Institute of Health and Welfare. *Health Expenditure Australia 2013-14*. Canberra: AIHW;2015.
7. Chrisopoulos S, Harford JE. *Oral health and dental care in Australia: key facts and figures 2012*. Canberra: AIHW;2013.
8. Douglass CW. Implications of demographic and dental disease changes for the financing of geriatric dental services. *Health Matrix* 1988;6:113-8.
9. Joshi A, Douglass CW, Feldman H, Mitchell P, Jette A. Consequences of success: do more teeth translate into more disease and utilization? *J Pub Hlth Dent* 1996;56:190-7.
10. Slade GD, Spencer AJ, Roberts-Thomson KF. *Australia's dental generations. The National Survey of Adult Oral Health 2004-06*. Canberra: AIHW;2013.
11. Bernabe E, Sheiham A. Extent of differences in dental caries in permanent teeth between childhood and adulthood in 26 countries. *Int Dent J* 2014;64:241-5.
12. Brennan DS, Singh KA. General and oral health self-ratings, and impact of oral problems. *Eur J Oral Sci* 2011;119:46973.
13. Australian Health Ministers' Advisory Council. *Healthy Mouths, Healthy Lives: Australia's National Oral Health Plan 2015-24*. Prepared by the Oral Health Monitoring Group. Canberra: COAG Health Council; 2015.
14. AIHW: Australian Institute of Health and Welfare. *Older Australia at a glance: 4th edition*. Cat. no. AGE 52. Canberra: AIHW;2007.
15. Brooks R. EuroQol: the current state of play. *Health Policy* 1996;37:53-72.
16. Slade GD. Derivation and validation of a short-form oral health impact profile. *Community Dent Oral Epidemiol* 1997;25:284-90.
17. Lawton MP, Brody EM. Assessment of older people: Self-maintaining and instrumental activities of daily living. *Gerontologist* 1969;9:179-86.
18. Posner BM, Jette AM, Smith KW, Miller DR. Nutrition and health risks in the elderly: the Nutrition Screening Initiative. *Am J Pub Health* 1993;83: 972-8.
19. Dahlem NW, Zimit GD, Walker RR. The Multidimensional Scale of Perceived Social Support: a confirmation study. *J Clin Psychol* 1991;47:756-61.
20. Diener E, Emmons RA, Larsen RJ, Griffin S. The Satisfaction With Life Scale. *J Personality Assessment* 1985;49:71-5.

21. Clemens S, Begum N, Harper C, Whitty JA, Scuffham PA. A comparison of EQ-5D-3L population norms in Queensland, Australia, estimated using utility value sets from Australia, the UK and USA. *Qual Life Res* 2014;23:2375-81.
22. Slade GD, Nuttall N, Sanders A, Sanders AE, Steele JG, Allen PF, Lahti S. Impacts of oral disorders in Australia and the United Kingdom. *Br Dent J* 2005;198:489-93.
23. Benyamini Y, Leventhal H, Leventhal EA. Self-rated oral health as an independent predictor of self-rated general health, self-esteem and life satisfaction. *Soc Sci Med* 2004;59:1109-16.
24. Australian Bureau of Statistics. *Reflecting a Nation: Stories from the 2011 Census, 2012–2013*. Cat No. 2071.0. Canberra: ABS;2013.
26. Gagliardi DI, Slade GD, Sanders AE. Impact of dental care on oral health-related quality of life and treatment goals among elderly adults. *Aust Dent J* 2008;53:26-33.
27. Locker D. Does dental care improve the oral health of older adults? *Community Dent Hlth* 2001;18:7-15.

Appendices

APPENDIX A: TABLES 3A, B AND C.

Table 3a. Participant characteristics at baseline compared with national Australian data: Demographic and socioeconomic

		This study	National^a	National^b
Age	75 – 84	76%	61%	77%
	85+	24%	39%	23%
Sex	Female	54%	58%	58%
Educational level	Secondary or less	69%	71%	50%
	Some tertiary	31%	29%	50%
Main language at home	English	87%		95%
	Other	13%		5%
Living arrangement	Alone	40%	36%	46%
	With others	60%	62%	54%
Social support	Mean (SD)	48.9 (8.8)		
Housing status	Own/mortgage	61%		
	Retirement village	19%		
	Rent private	9%		
	Rent public	8%		
Concession holder		99%		91%
Insurance holder	Health	62%		50%
	Dental	26%		37%
Satisfaction with financial situation	Mean (SD)	6.6 (2.3)		
Satisfaction with material standards	Mean (SD)	7.3 (2.2)		

^a 2011 Census or 2011/2 Health Survey

^b 2010 NDTIS or other as noted

Table 3b. Participant characteristics at baseline compared with national Australian data: General health and wellbeing

		This study	National^a
Self-rated general health	Fair or poor	44%	33%
IADL	Mean (SD)	19 (2.5)	
BMI	Mean (SD)	27 (4.6)	
Obesity	Underweight	2%	2%
	Healthy range	33%	30%
	Overweight	42%	43%
	Obese	23%	25%
Current smoker		6%	
Chronic conditions	Any	97%	
	4 or more	55%	
Nutritional risk	Healthy range	23%	
	Moderate risk	40%	
	High risk	37%	
EQ-5D Health Utility	Mean (SD)	0.71 (0.26)	0.78 – 0.81 ^b
Satisfaction with life scale	Mean (SD)	17.8 (3.9)	

^a 2011 Census, 2011/2 Health Survey or as noted

^b 95% confidence intervals of national estimate²¹

Table 3c. Participant characteristics at baseline compared with national Australian data: Oral health and OHRQoL

		This study	National^a
Edentulism		23%	27.9%
Number of teeth (dentate)	Mean (SD)	17 (7.4)	
Number of teeth (dentate)	Less than 20	59%	
Upper denture	Partial/full	64%	69%
	Satisfaction mean (SD)	2.8 (1.5)	
Lower denture		45%	42%
	Satisfaction mean (SD)	3.5 (1.5)	
Tooth brushing frequency	Less than twice per day	37%	
Last dental visit	More than 1 year	62%	54%
	For treatment or relief of pain	58%	43%
	Public sector	38%	77%
Self-rated oral health	Poor (dentate n=354)	63%	34% ^b
	Poor (edentulous n=101)	74%	
OHIP prevalence		45%	
OHIP extent	mean (SD)	1.8 (2.9)	
OHIP severity	mean (SD)	13.6 (12.5)	6.5 ^c

^a 2010 NDTIS or other as noted

^b 'dental health' for dentate only

^c for 65 years or older (2005)²²