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The Oral Health Assessment Tool – Validity and reliability

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Abstract

Background: The Oral Health Assessment Tool (OHAT) was a component of the *Best Practice Oral Health Model for Australian Residential Care* study. The OHAT provided institutional carers with a simple, eight category screening tool to assess residents' oral health, including those with dementia. This analysis presents OHAT reliability and validity results.

Methods: A convenience sample of 21 residential care facilities (RCFs) in urban and rural Victoria, NSW and South Australia used the OHAT at baseline, three-months and six-months to assess intra- and inter-carer reliability and concurrent validity.

Results: Four hundred and fifty five residents completed all study phases. Intra-carer reliability for OHAT categories: percent agreement ranged from 74.4 per cent for oral cleanliness, to 93.9 per cent for dental pain; Kappa statistics were in moderate range (0.51-0.60) for lips, saliva, oral cleanliness, and for all other categories in range of 0.61-0.80 (substantial agreement) ($p<0.05$). Inter-carer reliability for OHAT categories: percent agreement ranged from 72.6 per cent for oral cleanliness to 92.6 per cent for dental pain; Kappa statistics were in moderate range (0.48-0.60) for lips, tongue, gums, saliva, oral cleanliness, and for all other categories in range of 0.61-0.80 (substantial agreement) ($p<0.05$). Intraclass correlation coefficients for OHAT total scores were 0.78 for intra-carer and 0.74 for inter-carer reliability. Validity analyses of the OHAT categories and examination findings showed complete agreement for the lips category, with the natural teeth, dentures, and tongue categories having high significant correlations and percent agreements. The gums category had significant moderate correlation and percent agreement. Non-significant and low correlations and percent agreements were evident for the saliva, oral cleanliness and dental pain categories.

Conclusion: The Oral Health Assessment Tool was evaluated as being a reliable and valid screening assessment tool for use in residential care facilities, including those with cognitively impaired residents.

Key words: Nursing facilities, geriatric dentistry, assessment tool, older adults.

Abbreviations and acronyms: BOHSE = Brief Oral Health Status Examination; OHAT = Oral Health Assessment Tool; OHCP = Oral Hygiene Care Plan; RCF = residential care facility.

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INTRODUCTION

Within the increasing older population, there is a significant group at very high risk of developing complex oral diseases and dental problems – institutionalized older adults in residential care facilities.[1-6] The abundant medical, medication, functional, cognitive, social and financial problems of this group of high risk older adults are associated not only with the development of oral diseases, such as dental caries, but with the many barriers they encounter in accessing adequate dental care. Researchers have endeavoured to quantify the barriers that frequently impede residents' access to dental treatment, and an abundance of literature has trialed, recommended, and reviewed a great variety of oral hygiene care strategies, programmes, and staff educational/training initiatives.[7-21] However, very little of this research has evidenced long-term maintenance or improvement of residents' oral health status. Many dental professionals continue to struggle to provide dental treatment, institute preventive oral care recommendations, and reduce the progression of caries and other oral diseases and conditions for institutionalized patients, especially those with dementia. A multiple case-study analysis by MacEntee *et al*.[22] for managing strategies for the provision of oral health care to residents has identified three common components: oral hygiene care, dental treatment, and regular oral assessment, and concluded that 'the solution to high-quality oral health services in long-term care facilities may be considerably more complex

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than simply providing on-site services, routines, and resources', and that 'crisis management was an inefficient and ineffective way in which to organize a service'.[22,23] Central to the development of a successful residential care dental service was a 'regular system of oral assessments for all residents' using 'an explicit, systematic, and routinized assessment plan'.[23]

A recent systematic review of oral hygiene care for adults with dementia in residential aged care facilities by Pearson and Chalmers discussed a variety of issues concerning the assessment of residents' oral health.[24] Oral health assessment relies on a person's ability to self-report any dental symptoms which is problematic for many residents, especially those with cognitive impairment. Delineation is required between a comprehensive dental examination conducted by a qualified dentist (using visual and tactile evaluation of all oral structures and hard and soft tissues using specific extraoral and intraoral light sources and dental equipment), and a dental assessment screening by a carer, nurse, allied health professional or medical practitioner (using an extraoral light source but not the use of any intraoral light sources or specific dental equipment such as a mouth mirror).[24] Oral health indices for use by dentists and dental hygienists with older adults have been developed, but these are not suitable for non-dental professionals to use.[24] Indeed, oral assessment screening tools have been developed for use by non-dental professionals with established validity and reliability.[24] However, these are mainly focused on hospitalized and rehabilitation patients in settings such as intensive care and cancer units, and have not been trialed in residential care settings with cognitively impaired residents.[24]

In an ideal situation, all residents would have a dental examination by a dentist upon admission to a facility (or shortly thereafter), and at regular intervals afterwards. Best-practice has indicated that these examinations should be supplemented with oral health assessments and screenings by trained nurses and carers. Further, there may be situations in which there are no dentists located in the area (especially some rural areas), there is no dentist that can provide dental examinations at the facility on a regular basis, or residents cannot afford to pay for a dental examination by a dentist. Social, political and health care policies and practices differ across states and countries, and will dictate who can provide residents' dental examinations and assessments at various intervals.

Research has been conducted on providing educational programmes for carers working in residential care facilities, but little has specifically addressed the actual assessment of residents' oral health status by the carers.[25-26] Oral assessment tools for use in residential care facilities have been published, but few were validated or had reliability assessed.[27] The only published, comprehensive, oral health assessment tool developed specifically for use by carers for residents in residential care facilities, especially for residents with moderate-severe dementia, was the Kayser-Jones Brief Oral Health Status Examination (BOHSE).[28] Other oral mucosal or oral hygiene tools have been developed, but these do not provide a comprehensive screening for oral health.[24] Further trialing using a modified BOHSE (termed the Oral Health Assessment Tool (OHAT)) was conducted nationally during 2003 in an Australian institutional setting with the Department of Health and Ageing.[29] The BOHSE was modified to simplify the categories and their content. Therefore, assessment was considered a screening, and could be conducted by a range of residential care staff from Registered Nurses to Personal Care Attendants.

To further investigate the use of this oral screening assessment tool for residents of residential care facilities, the *Best-Practice Oral Health Model for Residential Care* study was conducted to investigate the: (1) development of dental policies and procedures; (2) use and assessment of the reliability and validity of a modified version of the BOHSE,[28] termed the OHAT; and (3) use of an Oral Hygiene Care Plan (OHCP) developed as part of an evidence-based oral health protocol for carers of dependent older adults.[14] This analysis focused on the study aim of testing the reliability and validity of the use by carers of the OHAT over a six-month period in Australian residential care facilities.

MATERIALS AND METHODS

This research was implemented in three Australian States: NSW, Victoria, and South Australia, with a key geriatric dental researcher coordinating the data collection in each State. From the available list of accreditation assessments for Commonwealth-funded residential aged care facilities in each of these States (Commonwealth Department of Health and Aged Care), a convenience sample of the 50 highest-ranked facilities was selected and 23 individual facilities were approached to participate (South Australia – three urban and three rural; NSW – three urban and four rural; Victoria – six urban and four rural). No facilities refused to participate at the commencement of the project. However, two urban facilities in NSW did not continue participation after baseline data collection, and their data has not been included in analyses for this study. In total, 21 residential care facilities in the three States completed the project. Approval was obtained from the appropriate administrators/Directors of Nursing at each residential care facility, and where required by the Human Research Ethics Committee for any affiliated Regional Health Organizations, as well as by The University of Adelaide Human Research Ethics Committee (National Health and Medical Research Council guidelines applied). All residents living at each facility at baseline were offered participation in the project. All appropriate persons/guardians were contacted by telephone and mail to obtain written consent to participate. Follow-up procedures to obtain

consent were those as used in previous oral epidemiological nursing home research, and included a mailing followed where required by an in-person or telephone conversation.[3]

A liaison person from each residential care facility was designated to assist with the project. The liaison person obtained the following details from participating residents' care plans and medical records including their date of birth, gender, date of admission to the facility, general medical conditions, and any diagnosed dementia (as per the questionnaire used in The Adelaide Dental Study of Nursing Homes).[3] Each liaison person was given a study protocol and a log sheet to monitor the collection of data during the study. The great majority of staff participating in the study were Personal Care Attendants, with some Registered Nurses, Enrolled Nurses, and Nurse Assistants also participating – these were all termed 'carers' in this study.

Feedback from residential care staff in the piloting stage of this study indicated that the BOHSE was too complicated and took too long to complete. Thus, during OHAT development, the BOHSE was simplified for practical use by a more diverse range of carers in residential care facilities, and to facilitate assessment of residents with dementia.[14,28]

The original BOHSE tool with 10 categories was modified in three ways. Firstly, by eliminating the categories for lymph nodes and pairs of teeth in chewing position. Secondly, by combining the tissue and gum categories, and thirdly, by adding a category for the assessment of behavioural problems and pain related to oral and dental problems. Also, a trigger for referral to a dentist was added. Thus, the final OHAT used in this study had eight categories. A score of 0=healthy, 1=oral changes, or 2=unhealthy was given in each of the assessment categories, and a score over the eight categories was summed to give a total score. This tool was used by carers for all residents in each facility at baseline and at the following regular intervals at baseline, three-months, and six-months. Residents were usually screened on a chair or bed in their rooms.

The numbers of carers selected varied according to the number of residents participating at each facility, and the enthusiasm of the facility, with some facilities requesting all staff to participate and conduct OHATs. At baseline a focus group and a three-hour training programme was completed with carers at each facility; this was in accordance with the BOHSE instrument.[28] This included a calibration session for the OHAT. At the completion of the project comprehensive practical oral hygiene care training was offered to all staff of all facilities.

To evaluate the appropriateness and effectiveness of the OHAT, qualitative focus groups were held with carers at each residential care facility at baseline, three-months and six-months using key questions to facilitate discussion. At three-months and at six-months a questionnaire was also given to carers at the focus groups concerning their use of the OHAT. The questionnaire contained 12 questions for the OHAT with a four-point Likert response scale from strongly disagree to strongly agree.[14] Another question estimated the average time taken to complete the OHAT. An open-ended question also asked for comments concerning any problems encountered with the OHAT.

Reliability assessments of the tool were made using duplicate administration of the OHAT by the carers on randomly selected residents at each of the facilities at three-months. Reliability was assessed as per the BOHSE procedures.[28] Pads of 50 coloured duplicate OHCP-reliability forms (white/yellow) were distributed to liaison persons. The top white form was returned upon completion to the researchers, while the yellow duplicate form was retained by the nursing facility to be placed in the resident's record. Intra-carer reliability was assessed by the carer re-examining a group of the same residents again. Inter-carer reliability was assessed by ensuring that each resident was examined by a second carer. Duplicate administration of the tool was made within 48 hours of the original assessment.

Content and face validity of the original BOHSE items and its subsequent usefulness in another institutionalized population of older adults with dementia did reflect a high level of content validity.[28,30] The content validity of the OHAT was developed using the systematic review of the literature concerning oral assessment tools and by consultation during the piloting stage with numerous peers in geriatric dentistry, dementia care, and residential aged care including dentists, registered nurses, directors of nursing, dental hygienists, and personal care attendants in both Australia and the USA.[14,24] Suggestions and comments by these peers were reviewed and incorporated into the final OHAT. Concurrent validity assessment of the OHAT was conducted by one calibrated qualified dentist (JC) who completed comprehensive oral epidemiological dental examinations on 21 participants to assess dental pain and behavioural problems, oral mucosal lesions, denture status, tooth status and plaque accumulation using standardized assessments and indices (as further detailed in data analysis section).

Data management and analysis was conducted using SPSS Version 12.0. Descriptive statistics were used to quantify: carers' questionnaire results from the focus groups and the scores (both total and for individual components) from the administration of the OHATs over the three study phases. Qualitative review was undertaken of written comments on carers' questionnaires and of transcripts of focus groups discussions, in which recurrent themes were identified.

Reliability assessments for the stability of the OHAT were assessed in a test-retest of residents using percent agreement and Cohen's Kappa Statistic for the individual categories and Intraclass correlation for the total score.[31,32] The Kappa statistic indicated the degree of departure between the actual observed percent

Table 1. OHAT score distribution at baseline (B), three-months (3), and six-months (6) (n=455) (%)

Category	Score 0			Score 1			Score 2		
	B	3	6	B	3	6	B	3	6
Lips	71.6	70.8	72.5	28.1	28.6	27.5	0.2	0.7	0.0
Tongue	74.7	74.1	76.3	23.3	24.6	22.2	2.0	1.3	1.5
Gums and tissues	76.0	79.8	83.3	19.1	16.0	13.6	4.8	4.2	3.1
Saliva	86.8	86.8	87.5	11.9	13.0	11.6	0.2	0.2	0.9
Natural teeth (n=305 (B); 311 (3); 327 (6))	50.5	53.4	56.3	27.2	25.4	25.7	22.3	21.2	18.0
Dentures (n=373 (B); 365 (3); 389 (6))	58.7	63.0	65.3	25.7	21.2	18.8	15.5	15.9	15.9
Oral cleanliness	48.8	53.0	53.6	36.9	38.2	35.4	14.3	8.8	11.0
Dental pain	90.8	91.4	90.5	4.8	6.4	7.0	4.4	2.2	2.4

agreement and chance agreement, and was not weighted. In the interpretation of the Kappa statistic, values under 0.00 were considered poor, 0.20 slight, 0.21-0.40 fair, 0.41-0.60 moderate, 0.61-0.80 substantial and 0.81-1.0 almost perfect agreement.[33]

Concurrent OHAT validation was undertaken by comparing results from a visual and tactile dental examination of 21 residents using standard criteria by a qualified dentist (JC) to OHAT category responses: oral cleanliness category with Plaque Index (Silness and Loe – this was also extended to dentures)[34]; saliva category with a clinical evaluation of dry mouth; lips, tongue, gums and tissues categories with the presence of oral lesions (WHO)[35]; dentures category with denture assessment (Rise)[36]; natural teeth category with tooth status (NIDR)[37]; and dental pain/behaviour category with self-reported pain and a list of problems with oral hygiene care from The Adelaide Dental Study of Nursing Homes.[3] Percent agreement and Pearson correlation were analyzed for each comparison, using a significance level of $p<0.05$.

RESULTS

In the 21 facilities who completed the study, 534 residents participated at baseline, with 455 residents completing all three study phases. The data collected from the two facilities who commenced at baseline but then withdrew from the study were not included. There were no significant differences between deceased participants and those who completed the study for having a diagnosed dementia, Resident Classification Scale score, or for type of consent needed. However, the deceased participants did have a significantly higher mean baseline OHAT score ($p<0.05$). Mean age of the 455 residents who completed all three phases was 82.1 years, 56.5 per cent had a diagnosed dementia, and 88.9 per cent were Resident Classification Scale categories 1-4 (most dependent).

Table 2. Percentage distribution of OHAT total scores over study period for all residents (n=455)

Time period	Total score (%) 0-3	4-8	9+
Baseline	72.3	26.4	1.3
Three-month	70.5	26.4	3.1
Six-month	74.3	23.5	2.2

No sig diff $p>0.05$ chi-square test.

Table 1 presents the OHAT score distribution for individual categories over the six-month study period. Across the study period, score distribution remained stable. The first four categories of lips, tongue, gums and tissues and saliva had similar distributions throughout the study period, with approximately three-quarters or more of residents scoring '0', and only a small percentage of residents scored '2'.

Scores were distributed differently for the categories of natural teeth, dentures and oral cleanliness, with approximately half of the residents scoring '0' and over 14 per cent scoring '2'. Ninety per cent or more of residents over the study period scored '0' for the dental pain category over the study period.

Table 2 presents the percentage distribution of OHAT total scores over the study period for all residents. There were no significant differences in this percentage distribution at the three data collection times during the study period. Table 3 presents mean OHAT scores over study period for all residents for category and total scores. There were no significant differences in category scores. However, the mean total OHAT scores decreased significantly from the baseline score over the study period. Mean OHAT scores were 2.71 at baseline, 2.5 at three-months, and 2.4 at six-months.

Table 4 presents the intra-carer and inter-carer reliability for individual OHAT categories and total score. There were no significant differences for having a diagnosed dementia, Resident Classification score,

Table 3. Mean OHAT scores over study period for all residents (n=455)

Category	Mean Baseline score	Mean three-month score	Mean six-month score
Lips	0.29	0.30	0.27
Tongue	0.27	0.27	0.25
Gums and tissues	0.29	0.24	0.20
Saliva	0.16	0.13	0.13
Natural teeth	0.72 (n=305)	0.68 (n=311)	0.62 (n=327)
Dentures	0.57 (n=373)	0.53 (n=365)	0.51 (n=389)
Oral cleanliness	0.65	0.56	0.57
Dental pain	0.14	0.11	0.12
Total score	2.71	2.50*	2.4**

*sig $p<0.01$ between baseline and three-month total scores.
**sig $p<0.01$ between baseline and six-month total scores.
(nb., no sig. differences between three- and six-month scores).

Table 4. Intra-carer and inter-carer reliability for individual OHAT categories and total score[a]

Category	Intra-carer (n=485)		Inter-carer (n=485)	
	Percent agreement	Kappa statistic	Percent agreement	Kappa statistic
Lips	79.8	0.52*	78.1	0.48*
Tongue	84.6	0.61*	80.4	0.53*
Gums and tissues	90.5	0.71*	86.1	0.57*
Saliva	88.8	0.51*	86.9	0.48*
Natural teeth	80.6	0.70*	77.9	0.66*
Dentures	83.7	0.70*	80.9	0.65*
Oral cleanliness	74.4	0.56*	72.6	0.54*
Dental pain	93.9	0.66*	92.6	0.62*
Referral to dentist	96.6	0.51*	96.8	0.47*
	Intra-carer IntraClass correlation coefficient		Inter-carer IntraClass correlation coefficient	
Total score	0.78*		0.74*	

[a]Please note that 30 residents who completed three-months data collection but who deceased before six-month data collection have been included in these reliability analyses (n=455+30=485).
*p<0.001.

consent type between participants who completed all three phases and those who deceased after three-months (and did not complete the six-month study phase). Thus, Table 4 includes reliability data for 485 residents: the 455 residents who completed all three study phases plus an additional 20 residents who completed the first two study phases but had deceased by the third study phase at six-months. Intra-carer percent agreement for individual categories ranged from a low of 74.4 per cent for oral cleanliness, to a high of 93.9 per cent for dental pain and 96.6 per cent for referral to dentist. Intra-carer Kappa statistics were in the moderate range (0.51-0.60) for lips, saliva, oral cleanliness and referral to dentist. All other categories had an intra-carer Kappa statistic in the range of 0.61-0.80 indicating substantial agreement. The correlation coefficient for intra-carer total OHAT score was 0.78. All intra-carer analyses were statistically significant. Inter-carer percent agreement for individual categories ranged from a low of 72.6 per cent for oral cleanliness to a high of 92.6 per cent for dental pain and 96.8 per cent for referral to dentist.

Inter-carer Kappa statistics were in the moderate range (0.48-0.60) for lips, tongue, gums, saliva, oral cleanliness, and referral to dentist. All other categories had an inter-carer Kappa statistic in the range of 0.61-0.80 indicating substantial agreement. The correlation coefficient for inter-carer total OHAT score was 0.74. All inter-carer analyses were statistically significant.

Table 5 presents the percent agreement and correlation coefficients for OHAT categories and associated dental examination findings for 21 residents. There was complete agreement on scoring for the lips. Natural teeth, dentures, and tongue had the highest significant correlations and high percent agreements, and the gums also had a significant but lower correlation. Non-significant and low correlations and percent agreements were evident for saliva, oral cleanliness and dental pain. In particular the dentist ratings of plaque accumulation were much higher than those reported on the OHAT.

Table 6 presents responses to the focus group questionnaire from participating RCF care staff. The great majority of carers agreed or strongly agreed with the statements concerning the use and completion of the OHAT. A distinct subgroup of these participants responded that they did not have adequate time to learn about the OHAT, and some were not able to complete the dental pain category. Three-quarters of the focus group questionnaires were completed at the three-month focus groups and one-quarter at the six-month focus groups. There were no statistically significant

Table 5. Percent agreements (%) and Pearson correlations (C) between OHAT categories and associated dental examination findings (Assessments and Indices) (n=21)

OHAT Category	WHO oral mucosal lesions		Clinical dry mouth evaluation		Decayed tooth status		Rise denture assessment		Plaque Index		Problems with oral hygiene care	
	%	C	%	C	%	C	%	C	%	C	%	C
Lips	100	1.0*										
Tongue	95.2	0.80*										
Gums and tissues	85.7	0.60*										
Saliva			57.1	0.07								
Natural teeth					86.7	0.88*						
Dentures							92.3	0.94*				
Oral cleanliness									42.9	0.15		
Dental pain											85.7	-0.1

*p<0.01.

Table 6. Responses to focus group questionnaire (%) (n=60)

	Oral Assessment Tool	Strongly disagree	Disagree	Agree	Strongly agree
1.	I feel knowledgeable and prepared to use the Oral Assessment Tool	0.0	3.3	68.3	28.3
2.	Using the Oral Assessment Tool improves my ability to detect dental pain and problems in residents' mouths	1.7	0.0	65.0	33.3
3.	I had enough time to learn about the Oral Assessment Tool before it was implemented	1.7	18.3	61.7	18.3
4.	I feel supported in my efforts to implement the Oral Hygiene Care Plan for residents	0.0	0.0	75.0	25.0
5.	I am able to complete the 'lips' category of the Oral Assessment Tool	0.0	0.0	63.3	36.7
6.	I am able to complete the 'tongue' category of the Oral Assessment Tool	0.0	0.0	71.7	28.3
7.	I am able to complete the 'gums and tissues' category of the Oral Assessment Tool	0.0	1.7	73.3	25.0
8.	I am able to complete the 'saliva' category of the Oral Assessment Tool	0.0	0.0	75.0	25.0
9.	I am able to complete the 'natural teeth' category of the Oral Assessment Tool	0.0	6.7	65.0	28.3
10	I am able to complete the 'dentures' category of the Oral Assessment Tool	0.0	0.0	68.3	31.7
11.	I am able to complete the 'oral cleanliness' category of the Oral Assessment Tool	0.0	0.0	73.3	26.7
12.	I am able to complete the 'dental pain' category of the Oral Assessment Tool	5.1	6.8	69.5	18.6

differences among responses from the three- and six-month participants. Mean reported time taken to complete the Oral Health Assessment Tool was 7.8 minutes (minimum time taken = 1 minute; maximum time taken = 30 minutes) (SD=5.6).

Thirty-seven respondents made comments concerning 'problems you have been having when using the Oral Health Assessment Tool', seven of these stated they had 'no problems'. The main themes identified from these focus group questionnaire comments and from transcripts of focus groups discussions were: (1) the ease of integration of the OHAT varied from difficulty 'timing it to fit in between residents' meals and outings' to 'it is now a part of our regular care'; (2) some carers would have liked more OHAT training to increase their confidence, especially 'with behaviourally difficult residents and some type of video or written material to keep for reference'; (3) inadequate understanding of three OHAT categories was expressed for 'assessing dental pain in residents with dementia' and 'saliva and gum sections'; (4) an evaluation section was requested 'at the end of the OHAT'; (5) several areas on the OHAT were 'missing information – no halitosis section and need somewhere to write if resident has natural teeth, dentures or both'; and (6) resident issues were a focus of many comments, especially the 'more demented residents who can't give information, who may not open their mouth, who don't understand what is happening and who take longer to do', as well as 'residents with dentures are easier and it was harder with natural teeth'.

DISCUSSION

The quantitative and qualitative data from both this study and previous BOSHE studies supported that the OHAT was a reliable and valid tool for use in residential care facilities, including those with cognitively impaired residents. Kayser-Jones who developed the BOHSE recommended that 'replication of the study in multiple sites is recommended'.[28] Thus, rather than directly recommending the BOHSE for use in Australian Aged Care, considerable peer, professional and industry input was considered in a pilot study which resulted in the development of a modified version of the BOHSE, termed the OHAT in this study. Such methodology enabled the simplification of the assessment tool, whilst maintaining the integrity, validity and indeed improving the reliability of the original BOHSE. It was important to ensure that the OHAT was able to be used by all staff ranging from Personal Care Attendants to Registered Nurses. As has been stated internationally 'oral assessment is recommended on admission to residential care using criteria which are client centred and which can be used by all grades of staff'.[38] All BOHSE studies to date also used a convenience sample, but this was the largest sample used to date. The self-reported mean time taken to complete the OHAT in this study was slightly shorter (mean = 7.8 minutes) than that reported by observation in other BOHSE studies (mean = 8.7 minutes). However, this was expected as the OHAT has fewer categories than the original BOHSE. Mean OHAT scores (range mean scores 2.4-2.7 over the study period) were also lower than reported mean BOHSE scores (mean = 3.75), as would be expected as the OHAT possible total score was 16 and the BOHSE possible total score was 20 due to the varying numbers of categories.

Intra-carer reliability percent agreement and Kappa statistics for individual categories and correlations for total scores were very similar to those reported in the previous studies or even higher in this study.[28,30] Inter-carer reliability for categories and total score were generally higher in this study than in previous studies. The previous studies were conducted at one point in time, whereas this study was conducted over a longer time period. Thus, participants had more time to

Resident:_____ Completed by:_____				Date:___/___/___
	Scores – *You can circle individual words as well as giving a score in each category (* if 1 or 2 scored for any category please organize for a dentist to examine the resident)*			
Category	0 = healthy	1 = changes*	2 = unhealthy*	Category scores
Lips	smooth, pink, moist	dry, chapped, or red at corners	swelling or lump, white/red/ulcerated patch; bleeding/ulcerated at corners	
Tongue	normal, moist roughness, pink	patchy, fissured, red, coated	patch that is red and/or white, ulcerated, swollen	
Gums and tissues	pink, moist, smooth, no bleeding	dry, shiny, rough, red, swollen, one ulcer/sore spot under dentures	swollen, bleeding, ulcers, white/red patches, generalized redness under dentures	
Saliva	moist tissues, watery and free flowing saliva	dry, sticky tissues, little saliva present, resident thinks they have a dry mouth	tissues parched and red, very little/no saliva present, saliva is thick, resident thinks they have a dry mouth	
Natural teeth Yes/No	no decayed or broken teeth/roots	1-3 decayed or broken teeth/ roots or very worn down teeth	4 + decayed or broken teeth/roots, or very worn down teeth, or less than 4 teeth	
Dentures Yes/No	no broken areas or teeth, dentures regularly worn, and named	1 broken area/tooth or dentures only worn for 1-2 hrs daily, or dentures not named, or loose	more than 1 broken area/tooth, denture missing or not worn, loose and needs denture adhesive, or not named	
Oral cleanliness	clean and no food particles or tartar in mouth or dentures	food particles/tartar/plaque in 1-2 areas of the mouth or on small area of dentures or halitosis (bad breath)	food particles/tartar/plaque in most areas of the mouth or on most of dentures or severe halitosis (bad breath)	
Dental pain	no behavioural, verbal, or physical signs of dental pain	are verbal &/or behavioural signs of pain such as pulling at face, chewing lips, not eating, aggression	are physical pain signs (swelling of cheek or gum, broken teeth, ulcers), as well as verbal &/or behavioural signs (pulling at face, not eating, aggression)	
□ Organize for resident to have a dental examination by a dentist □ Resident and/or family/guardian refuses dental treatment □ Complete Oral Hygiene Care Plan and start oral hygiene care interventions for resident □ Review this resident's oral health again on Date:___/___/___				TOTAL SCORE: ___ **16**

Fig 1. Oral Health Assessment Tool (OHAT) for Dental Screening (modified from Kayser-Jones et al (1995) by Chalmers (2004)).

become familiar with the OHAT before reliability was evaluated. Although in this and previous studies the content and face validity of the BOHSE and OHAT were established, adequate concurrent validity was not established for several categories. These were the same categories that participants reported difficulties with in qualitative questionnaires and focus groups in this study, and were also problematic in other oral assessment tool studies which reported comprehensive, long-term training requirements for their valid and reliable use and the weighting of the Kappa statistic to achieve a high level of reliability.[24] Future research and training initiatives with these tools will need to focus on improvement in the categories of saliva, oral cleanliness, and dental pain. As similar issues have arisen in the use of oral assessment screening tools in other acute and rehabilitative care settings, future research could reflect on the challenges encountered in these other geriatric settings.[24]

In the initial BOHSE study nurses found the tongue examination with gauze and light 'challenging', as was the use of the tongue blade – thus their use was not continued in the OHAT study. Indeed, the OHAT was clearly indicated for use only as a screening assessment tool which used no 'special dental equipment', with the exception of clean gloves and the best available extraoral natural or artificial light source. Use of an oral assessment tool for screening of residents' oral health can increase staff's interest in dental issues, and also can be used to monitor residents' oral health, to evaluate oral hygiene care interventions, to act as a trigger to call in a dentist when required, to assist with residents' individualized oral hygiene care planning and to assist with triaging and prioritization of residents' dental needs (these are especially important initiatives when attendance of dental professionals to the facility is limited or financially costly).[24] Although OHAT training was provided to these carers participating in this study, comments indicated that they wanted a 're-usable', tangible and visual training resource that they could refer to and easily access; such suggestions included a CD 'training program', visual prompts for the OHAT and OHCP that could be placed in residents' records, oral hygiene care interventions that could be placed inside residents' cupboards, and 'dental handover sheets' for changes of shifts. These resources are continuing to be developed by the authors.

There were several improvements made to the OHAT from the data and comments obtained in this study, including the 'missing information' such as

halitosis and dentate status (Fig 1). Additional actions were listed at the bottom of the OHAT, with any further actions or outcomes to be individualized by each facility for their specific documentation policies and procedures. Such outcomes could include: diminishing of residents' dental problems; documentation of improvement or decline of residents' oral health status; numbers of referrals to dentists; and dental examinations conducted by dentists. Interventions could include: use of an oral hygiene care plan (such as the OHCP which was also trialed in this study)[14]; use of a short oral hygiene intervention list that could be used on handover sheets daily; or a visual diagram of the teeth and mouth for staff to make comments and drawings on. Several interesting comments highlighted the need for better integration of care plans concerning dental, nutritional, mealtime, and swallowing issues. The replication and dissemination of care plan information in facilities is a challenge in residential care, but it is important that dental issues be incorporated into future changes in aged care documentation.[29]

The qualitative and quantitative data substantiated that carers' involvement in maintenance of residents' oral health was improved by the use of the Oral Health Assessment Tool, even with the more than half of participants who were cognitively impaired. Carers found the OHAT user-friendly and as was stated by many of the study participants 'it was very interesting and we (RCF staff) looked better than we would normally look'. Increased advocacy for and interest in dental issues in the residential care facilities was evident both during and at the end of the study period with 'this (is) now infiltrating among staff so that it is second nature' and 'we are now doing a dental audit for all new residents'. These positive responses from staff exemplified that many residential care facilities embraced the focus on oral health, and that 'everyone knows it is an issue that needs to be looked at'. Interestingly, similar comments from residential care facilities concerning dental issues were also made in two other recent reports.[29,39]

However, it was also very important to note that not all facilities embraced this study – there were two facilities from the original sample of 23 that did not complete this study, and two others who did complete the study who were undergoing extensive re-building and renovation. Even financial incentives could not induce the two facilities who did not complete the study to continue, as they felt they were too burdened with physical and organizational issues at that time. In the initial Kayser-Jones study, the workload of the participating staff was reduced by 30 per cent when doing study, whereas in this study staff's time and employment of extra staff was paid for.[28] However, it is important to note that even with these initiatives there were problems with workload and time commitments in both studies. Such considerations need to be incorporated into any future clinical, research and oral health promotional initiatives in the aged care industry.

CONCLUSION

The OHAT was evaluated as being a reliable and valid screening assessment tool for use in residential care facilities, including those with cognitively impaired residents. Further research with geriatric oral assessment screening tools is needed in all settings to investigate and trial the more challenging oral health categories of saliva, oral cleanliness, and dental pain.

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REFERENCES

1. Berkey DB, Ettinger RL, Meskin LH. Oral health care variables affecting the institutionalized and homebound individual: a review and analysis of the literature 1970–1989. Monograph Series, No. 3. Iowa Geriatric Education Center, 1990.
2. Dolan TA, Atchison KA. Implications of access, utilization and need for oral health care by the non-institutionalized and institutionalized elderly on the dental delivery system. J Dent Educ 1993;57:876-887.
3. Chalmers JM, Carter KD, Fuss JM, Spencer AJ, Hodge CP. Caries experience in existing and new nursing home residents in Adelaide, Australia. Gerodontology 2002;19:30-40.
4. Wyatt CC. Elderly Canadians residing in long-term care hospitals: Part II. Dental caries status. J Can Dent Assoc. 2002;68:359-363.
5. Stubbs C, Riordan PJ. Dental screening of older adults living in residential aged care facilities in Perth. Aust Dent J 2002;47:321-326.
6. Locker D. Dental status, xerostomia and the oral health-related quality of life of an elderly institutionalized population. Spec Care Dent 2003;23:86-93.
7. Berkey DB, Call RL, Gordon SR, Berkey KG. Barriers influencing dental care in long-term care facilities. Gerodontics 1988;4:315-319.
8. Chalmers JM, Hodge C, Fuss J, Spencer AJ, Carter KD, Mathew R. Opinions of dentists and directors of nursing concerning dental care provision for Adelaide nursing homes. Aust Dent J 2001;46:277-283.
9. MacEntee MI, Weiss RT, Waxler-Morrison NE, Morrison BJ. Opinions of dentists on the treatment of elderly patients in long-term care facilities. J Public Health Dent 1992;52:239-244.
10. Weiss RT, Morrison BJ, MacEntee MI, Waxler-Morrison NE. The influence of social, economic, and professional considerations on services offered by dentists to long-term care residents. J Public Health Dent 1993;53:70-75.
11. Gift HC, Cherry-Peppers G, Oldakowski RJ. Oral health care in US nursing homes, 1995. Spec Care Dent 1998;18:226-233.
12. Weeks JC, Fiske J. Oral care of people with disability: a qualitative exploration of the views of nursing staff. Gerodontology 1994;11:13-17.
13. Johnson TE, Lange BM. Preferences for and influences on oral health prevention: perceptions of directors of nursing. Spec Care Dentist 1999;19:173-180.

14. Blanco VL, Chalmers JM. Oral Hygiene Care for Dependent Older Adults – Evidence-Based Protocol. Gerontological Nursing Interventions Center. Research Dissemination Core. Iowa City, IA: The University of Iowa, 2001.
15. Simons D, Baker P, Jones B, Kidd EA, Beighton D. An evaluation of an oral health training programme for carers of the elderly in residential homes. Br Dent J 2000;188:206-210.
16. Connell BR, McConnell ES, Francis TC. Tailoring the environment of oral health care to the needs and abilities of nursing home residents with dementia. Alzheimer's Care Q 2002;3:19-25.
17. Frenkel HF. Behind the screens: care staff observations on delivery of oral health care in nursing homes. Gerodontology 1999;16:75-80.
18. Matear DW. Demonstrating the need for oral health education in geriatric institutions. Probe 1999;33:66-71.
19. Wardh I, Hallberg LR, Berggren U, Andersson L, Sorensen S. Oral health care – a low priority in nursing. In-depth interviews with nursing staff. Scand J Caring Sci 2000;14:137-142.
20. Kambhu PP, Levy SM. An evaluation of the effectiveness of four mechanical plaque-removal devices when used by a trained care-provider. Spec Care Dentist 1993;13:9-14.
21. Reese D. A mouthful of care. A primer on making your residents' smiles brighter. Contemp Longterm Care 2002;25:14-15.
22. MacEntee MI, Thorne S, Kazanjian A. Conflicting priorities: oral health in long-term care. Spec Care Dentist 1999;19:164-172.
23. Thorne SE, Kazanjian A, MacEntee MI. Oral health in long-term care: the implications of organisational culture. J Aging Stud 2001;15:271-283.
24. Pearson A, Chalmers JM. Systematic review. Oral hygiene care for adults with dementia in residential aged care facilities. JBI Reports 2004;2:65-113.
25. King PL. A dental health education program for caregivers of elderly people in nursing homes. Sydney: The University of Sydney, 1992. MDS Thesis.
26. Paulsson G, Fridlund B, Holmen A, Nedefors T. Evaluation of an oral health education program for nursing personnel in special housing facilities for the elderly. Spec Care Dentist 1998;18:234-242.
27. Shaw M. Oral hygiene in the elderly: a nursing practice challenge. Perspectives 1998;22:8-15.
28. Kayser-Jones J, Bird WF, Paul SM, Long L, Schell ES. An instrument to assess the oral health status of nursing home residents. Gerontologist 1995;35:814-824.
29. Australian Department of Health and Ageing. Urbis JHD. Trial of the Draft National Framework for Documenting Care in Residential Aged Care Services Draft Report, 2004.
30. Lin CY, Jones DB, Godwin K, et al. Oral health assessment by nursing staff of Alzheimer's patients in a long-term-care facility. Spec Care Dentist 1999;19:64-71.
31. Fleiss JL, Chilton NW, Park MH. Inter- and intra-examiner variability in scoring supragingival plaque: II. Statistical analysis. Pharmacol Ther Dent 1980;5:5-9.
32. Kahn HA, Sempos CT. Chapter the primacy of data collection. Statistical Methods in Epidemiology. New York: Oxford University Press, 1989.
33. Landis, Koch. Measurement for observer agreement for categorical data. Biometrics 1977;33:159-174.
34. Silness H, Loe W. Periodontal disease in pregnancy (II). Correlation between oral hygiene and periodontal condition. Acta Odont Scand 1964;22:121-135.
35. WHO. Oral health surveys. Basic methods. 3rd edn. Geneva: World Health Organization, 1987.
36. Rise JS. An approach to the epidemiologic assessment of complete dentures. Acta Odont Scand 1979;37:57-63.
37. NIDR 1987. Oral health of United States adults: National findings. US Department of Health and Human Services. NIH Publication No. 87-2868.
38. Fiske J, Griffiths J, Jamieson R, Manger D. Guidelines for oral health care for long-stay patients and residents. Report of BSDH Working Group. Revised, January, 2000. British Society for Disability and Oral Health.
39. Chalmers JM, Robinson J, Nankivell A. The Practical Oral Care Video – evaluation of a Dental Awareness Month initiative. Aust Dent J 2005;50:75-80.

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