Psychometric properties of the General Oral Health Assessment Index (GOHAI) and dental status of an elderly Mexican population

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Keywords

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Abstract

Objectives: To evaluate the psychometric properties of the Geriatric/General Oral Health Assessment Index, Spanish version (GOHAI-Sp) and their relationship with the dentition status of an elderly Mexican population as a discriminatory validation. **Methods:** A cross-sectional study was conducted among persons over 60 years of age. A Spanish version the GOHAI-Sp validated in Spain in institutionalized geriatric patients was used. Clinical evaluation was done in order to determine experience with coronal and root caries.

Results: Measurement of internal consistency of the GOHAI gave a Cronbach alpha coefficient of 0.77 for the 12 items. In factorial analysis, one factor alone was capable of explaining 30.6 percent of the total variance. The factor that was most apparent in the factorial analysis of the GOHAI had coefficients >0.30 for the 12 items. The Kaiser-Meyer-Olkin measure of simple adequacy was 0.81 and the Bartlett's sphericity test was 1,748.55 with 66 degrees of freedom (P < 0.001). There was a statistically significant difference in the GOHAI scores between the responses to self-perception of oral and general health (P < 0.001). Also, there was a statistically significant low correlation coefficient between the missing and filled components of the DMFT index and the number of healthy and functional teeth (P < 0.05).

Conclusions: The GOHAI has acceptable psychometric properties, discriminates between self-perception of oral health and self-perception of general health, and correlates with past caries experience measured by the DMFT index.

Introduction

One of the responsibilities of oral health workers is to improve or maintain the quality of life of people, because the majority of oral diseases and their consequences have an impact on the activities of daily life (1,2). Contemporary concepts of health suggest that oral health is not just the absence of disease, but is physical, psychological, and social well–being that depends on the condition of the dentition and the hard and soft tissues of the oral cavity (2-4).

Traditionally, the methods used to estimate oral health have been limited to registration of clinical and oral indexes, as well as the presence or absence of diseases. This perspective does not include subjective measurements, such as people's perception of their oral health.

Oral health has been related to quality of life (Oral Health-Related Quality of Life, OHRQOL) as a multidimensional concept that specifically self-reports as regards oral health, capturing the functional, social, and psychological impacts of oral disease on the individual. For example, a specific disorder or disease (caries) leads to a deficiency (loss of dental organs), which, in turn, evolves into a disability (masticatory deficiency), which becomes a handicap for the person, affecting daily activities. Intervention requires an understanding of the origins and natural history of oral diseases, of which social and environmental factors are the main causes. In most cases, oral diseases are avoidable, often with appropriate interventions (5,6). The concept of OHRQOL can be used for various purposes, including evaluation of people's needs and their levels of satisfaction, evaluation of the results of intervention and human services programs, the planning and provision of these services, and the formulation of appropriate policies for the general population and specific sub-populations.

In the last three decades, numerous instruments have been developed to measure OHRQOL. One of these instruments is the Geriatric/General Oral Health Assessment Index (GOHAI) described by Atchison and Dolan in 1990 (7). It is based on three suppositions: a) that oral health can be measured using self-evaluation; b) that the levels of oral health vary among people and that this variation can be demonstrated using measurement based on a person's selfperception; and c) that self-perception has been identified as predictive of oral health.

The GOHAI measures respondents' oral functional problems in a compact questionnaire of 12 items that, in a simply administered manner, evaluates problems related to oral health in the past 3 months. It is also designed to estimate the severity of psychosocial impacts associated with oral diseases, and is being tested as an outcome measure to evaluate the effectiveness of dental treatment.

The measure, based on a patient-centered definition of oral health for older adults, includes items regarding freedom from pain and infection, and the respondent's ability to continue in his or her desired social roles. This person-centered definition of health diverges from the disease-centered epidemiological measures of health (presence or absence of disease) traditionally used in dentistry (8).

Adapted and validated versions of the GOHAI are available for Spain, China, France, Sweden, Malaysia, Japan, Germany, Turkey, and recently for Jordan (9-17). Factors that have allowed the measurement of the psychometric parameters using this kind of instrument depend on the linguistic and cultural context of the population from which participants come (18), which makes it necessary to evaluate these properties in the context in which they are used.

Therefore, the objective of this present study was to evaluate the psychometric properties of the GOHAI and their relationship with the dental status of an elderly Mexican population as a discriminant validation.

Methods

A cross-sectional study was performed in persons over 60 years of age, all of whom had at least one natural tooth. They were beneficiaries of insurance operated by the Mexican Institute of Social Security (IMSS) and lived in the south-western part of Mexico City. The participants belonged to a population cohort that was participating in a study to evaluate risk factors for root caries. The research protocol was reviewed and approved by the Health Research and Ethics Committee of the IMSS of Delegation no. 3 Southwest Federal District (Mexico City) (Registration no. 2002-721-0013).

The study was carried out between January and March 2004. The study included 695 elderly adults, mean age (SD) 71.6 (7.1) years. Women comprised 68.3 percent (n = 475) and men 31.7 percent (n = 220) of the group, with mean age 71.3 (7.0) and 72.2 (7.3), respectively.

After providing written informed consent, participants were interviewed and clinically examined in their homes. In the interview, information was collected regarding socio– demographic variables, cognitive deterioration, depression, number and type of chronic diseases diagnosed by a physician (diabetes, hypertension, depression, cancer, Parkinson's disease, cardiac disease, osteoporosis, and arthritis), polypharmacy (use of more four medications by a patient), utilization of oral health services in the past year, self-perception of oral and general health, as well as the GOHAI.

The Spanish version GOHAI (GOHAI-Sp) used was the one translated and validated in an institutionalized geriatric population in Granada, Spain (9). It consisted of 12 items (2 positive items and 10 negative ones) with Likert-style answers, and values that ran from one to five: Always (1); Often (2); Sometimes (3); Seldom (4); Never (5). Items 3 and 7 have inverse values to the rest of the items, conversion being done at the time of analysis (Table 1).

Table 1 Version of GOHAI as translated and validated for an institutionalized elderly population of Granada, Spain (8)

Question: in the past three months					
Pregunta: ¿En los tres últimos meses	S	F	AV	RV	Ν
How often did you limit the kinds or amounts of food you eat because of the problems with your teeth or dentures?	1	2	3	4	5
Cuántas veces ha tenido que comer menos o cambiar de comida por culpa de sus dientes o de su dentadura?					
How often did you have trouble biting or chewing any kinds or food such as firm meat or apples?	1	2	3	4	5
Cuántas veces ha tenido problemas al masticar comidas como la carne o las manzanas					
How often were you able to swallow comfortably?	5	4	3	2	1
Cuántas veces ha tragado usted bien?					
How often have your teeth or dentures prevented you from speaking the way you wanted?	1	2	3	4	5
Cuántas veces no ha podido usted hablar bien por culpa de sus dientes o dentadura?					
How often were you able to eat anything feeling discomfort?	1	2	3	4	5
Cuántas veces no ha podido comer las cosas que usted quería sin tener ninguna molestia?					
How often did you limit contacts with people because of the condition of your teeth or denture?	1	2	3	4	5
Cuántas veces no ha querido salir a la calle o hablar con la gente por culpa de sus dientes o dentadura?					
How often were you pleased or happy with the looks of your teeth and gums or dentures?	5	4	3	2	1
Cuando usted se mira al espejo, cuántas veces ha estado contento de cómo se ven sus dientes o su dentadura?					
How often did you use medication to relive pain or discomfort from around your mouth?	1	2	3	4	5
Cuántas veces ha tenido que utilizar algún medicamento para aliviar el dolor de sus dientes o las molestias en su boca?					
How often were you worried or concerned about the problems with your teeth, gums or dentures?	1	2	3	4	5
Cuántas veces ha estado preocupado o se ha dado cuenta de que sus dientes o su dentadura no están bien?					
How often did you feel nervous or self-conscious because of problems with your teeth, gums or dentures?	1	2	3	4	5
Cuántas veces se ha puesto nervioso por los problemas de sus dientes o de su dentadura?					
How often did you feel uncomfortable eating in front of people because problems with your teeth or dentures?	1	2	3	4	5
Cuántas veces no ha comido a gusto delante de otras personas por culpa de sus dientes o dentadura?					
How often were your teeth or gums sensitive to hot, cold or sweets?	1	2	3	4	5
Cuántas veces ha tenido molestias o dolor en sus dientes por el frío, el calor o las cosas dulces?					
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S = Siempre/Always (1); F = Frecuentemente/Frequently (2); AV = Algunas veces/Sometimes (3); RV = Rara vez/Seldom (4); N = Nunca/Never (5). Items 3 and 7 have an inverse value to the rest of the items (Siempre/Always [5]; Frecuentemente/Frequently [4]; Algunas veces/Sometimes [3]; Rara vez/Seldom [2]; Nunca/Never [1]).

Items 1, 2, 3, and 4 evaluate physical function, which included eating, speaking, and the corresponding swallowing. Items 6, 7, 9, 10, and 11 evaluated psychosocial function, including worries about oral health, dissatisfaction with appearance, self–consciousness about oral health, and difficulty in social contact due to oral conditions. Items 5, 8, and 12 evaluated pain and discomfort including the use of medication to alleviate pain in the oral cavity. The GOHAI outcome measure consists of the simple totaling of the responses for each subject, giving a range between 12 and 60, higher values indicating better self-perception of oral health.

To determine the presence of cognitive impairment, the Mini–Mental State instrument was used, in the version translated into Spanish and validated for the Mexican population (19). A score equal to or less than 23 points was positive for cognitive impairment. The Geriatric Depression Scale with 10 items instrument was used in the abbreviated version. It had been translated into Spanish and adapted for the Mexican population by Yesavage (20), and served to determine the presence of depressive symptomatology, indicated by a score equal to or greater than four points.

In order to evaluate self-perception of oral and general health, specific questions with a scale of three possible answers (good, regular, and bad) were also included. Clinical evaluation was done in order to measure coronal cries experience (DMFT index = number of Decayed/ Missing/Filled Teeth) and root caries (DFT index = number of Decayed/Filled Roots). Healthy tooth crowns and roots were counted, as well as the number of functional teeth present. A tooth was classified as functional when it fulfilled normal chewing, phonetic, aesthetic, and facial expression functions, even if the tooth was restored or crowned. A tooth was classified as healthy when no signs of caries experience were evident (2).

Clinical oral assessments were done by three dental surgeons who previously had participated in a training and standardization course (Kappa > 0.85 inter- and intraexaminer) in accordance with World Health Organization (WHO) criteria to assess dental status (21). The assessment was done with the subject seated on a chair (in some cases in a wheelchair) under natural light, using a no. 5 mirror and a WHO-type periodontal probe (PCP 11.5B, Hu–Friedy).

Data analysis

The Cronbach alpha coefficient was used to determine the internal consistency of GOHAI, which establishes the degree of correlation among the items and the total scale. Underlying

			GOHAI	Mann-Whitney
Variables	n	%	Mean (SD)	test
GOHAI score (range 20-60)	695	100.0	45.8 (7.0)	
Sex				
Female	475	68.3	45.5 (7.4)	P = 0.162
Male	220	31.7	46.5 (6.1)	
Age				
60-74 years	459	66.0	45.6 (7.1)	P = 0.443
75 years or more	236	34.0	46.1 (6.9)	
Marital status				
Married	341	49.1	46.1 (6.6)	P = 0.510
Single/Widowed/Divorced	354	50.9	45.5 (7.4)	
Schooling				
>6 years	391	56.3	47.1 (6.1)	<i>P</i> < 0.001
≤6 years	304	43.7	44.1 (7.8)	
Paid work				
Yes	414	59.6	46.4 (6.3)	P = 0.074
No	281	40.4	44.9 (7.9)	
Cognitive decline				
Yes	166	23.9	47.0 (6.8)	<i>P</i> = 0.007
No	529	76.1	45.4 (7.1)	
Depression				
Yes	258	37.1	43.1 (8.0)	<i>P</i> < 0.001
No	437	62.9	47.4 (5.8)	
Chronic disease				
≤3	188	27.1	45.2 (7.3)	<i>P</i> = 0.282
>3	507	72.9	46.0 (6.9)	
Polypharmacy				
≤4	131	18.8	45.9 (7.0)	P = 0.768
>4	564	81.2	45.8 (7.0)	
Utilization of oral health services in the last year				
Yes	372	53.5	45.8 (7.0)	<i>P</i> = 0.975
No	323	46.5	45.7 (7.1)	

 Table 2
 Mean (SD) GOHAI values by characteristics of the sample of elderly Mexicans

and fundamental dimensions were explored through factorial analysis. Extraction of factors used the principal components method and a posterior rotation with the varimax orthogonal method. Adequacy of the factorial analysis was evaluated using the Kaiser-Meyer-Olkin test and Bartlett's sphericity test.

A descriptive analysis was performed and the mean (SD) GOHAI score was obtained from the socio–demographic data, cognitive deterioration, depression, chronic diseases, polypharmacy, utilization of oral health services in the last year, and self-perception of oral and general health. For comparison between two groups, the Mann-Whitney and the Kruskal-Wallis tests were used for comparison of GOHAI scores in more than two groups. The Pearson correlation coefficient was calculated between the components of the coronal DMFT index and root DFT index, healthy crowns and roots, and the number of functional teeth with GOHAI scoring (bivariate analysis), and controlling for sex, age, schooling, paid work, cognitive decline, depression, and chronic disease (multivariate analyses). The dependent vari-

able (GOHAI scoring) was analyzed as a continuous variable. The confidence interval chosen was 95 percent. The analysis was done using SPSS version 12 for Windows.

Results

The mean (SD) score on the GOHAI was 45.8 (7.0). The frequency and distribution of socio-demographic characteristics, cognitive deterioration, depression, chronic diseases, polypharmacy, utilization of oral health services in the last year, and the mean GOHAI score, are presented in Table 2. It can be seen that the elderly with more than 6 years of schooling, presence of cognitive decline, and without clinically significant symptoms of depression, show a higher mean GOHAI score in comparison with those not meeting these characteristics. A statistically significant difference was observed between GOHAI scores (P < 0.05).

The frequencies and distributions of answers to the 12 items of the GOHAI are presented in Table 3. The 10 negative items more frequently attracted the response of "Never" and

Dimension	ltem	Always	Frequently	Sometimes	Seldom	Neve
Physical function	1	14.7	7.1	9.1	3.3	65.9
	2	24.5	6.2	12.2	1.7	55.4
	3	77.6	2.9.	2.6	7.1	9.9
	4	11.8	2.9	11.9	2.7	70.6
Psychosocial function	6	6.5	1.9	7.1	2.0	82.6
	7	57.6	2.7	3.5	10.6	25.6
	9	9.1	1.3	8.5	3.0	78.1
	10	28.2	5.0	13.4	3.9	49.5
	11	8.5	1.7	6.3	1.7	81.7
Pain and discomfort	5	12.5	6.2	4.2	3.0	74.1
	8	1.4	1.20	7.1	4.20	86.2
	12	8.3	3.0	14.1	4.9	69.8

the two positive items were more frequently answered "Always."

The internal consistency of the GOHAI showed a Cronbach alpha coefficient of 0.61 for the 12 items. The scores for each

 Table 4
 Component matrix of the factorial analysis of the GOHAI in the sample of elderly Mexicans

	Component				
	1	2	3	4	
ltem					
1	0.673	-0.410	0.249	0.249	
2	0.678	-0.445	0.255	0.083	
3	-0.395	-0.051	-0.480	0.454	
4	0.624	-0.233	-0.226	0.018	
5	0.443	-0.071	0.316	-0.504	
6	0.665	0.033	-0.320	0.123	
7	-0.480	0.138	0.430	0.110	
8	0.304	0.312	0.453	0.471	
9	0.637	0.385	-0.090	-0.185	
10	0.503	0.540	-0.142	-0.243	
11	0.679	-0.005	-0.272	0.146	
12	0.372	0.458	0.178	0.366	

item appear in Table 1. After eliminating the positive items 3 and 7, the Cronbach alpha coefficient increased to 0.77.

In factorial analysis, one factor explained 30.6 percent of the total variance. The Kaiser-Meyer-Olkin measure of simple adequacy was 0.81 and the Bartlett's sphericity test was 1,748.55 with 66 degrees of freedom (P < 0.001). The factors that became apparent through the factorial analysis of the GOHAI differed slightly from the interpretation of Locker (6) on "intermediate impacts" (Table 4). In fact, it is possible to say that just one factor embraced all items, because all the coefficients were over 0.30. Items 3 and 7 had negative coefficients in factor one because of its inverse score. It possible means that the participants do not differentiate among psychological, functional, or behavioral impacts and that the perception of the oral health is a global concept. Some coefficients are higher in other factors, i.e., items 7 and 8 in factor 3, but conceptual interpretation is much more solid if we assume only one factor.

Table 5 presents the frequency and distribution of the responses to self-perception of oral and general health, and the mean (SD) GOHAI score. There is a statistically significant difference in GOHAI scores between the responses to

 Table 5
 Mean (SD) scores of the GOHAI according to self-perception of oral and general health in the sample of elderly Mexicans

Variable	n	%	GOHAI Mean (SD)	Kruskal-Wallis test
Self-perception of oral health				
Good	211	30.4	48.4 (5.0)	<i>P</i> < 0.001
Regular	222	31.9	46.3 (6.3)	
Bad	262	37.7	43.3 (8.1)	
Self-perception of general health				
Good	282	40.6	47.3 (6.0)	<i>P</i> < 0.001
Regular	251	36.1	45.0 (7.3)	
Bad	162	23.3	44.3 (7.8)	

		Pearson coefficient of correlation with GOHAI scores					
State of dentition	Mean (SD)	Bivariate	Bivariate analyses		Multivariate analyses		
Coronal		r	р	r	р		
Decayed	2.4 (3.1)	-0.006	0.882	0.016	0.617		
Missing	12.1 (7.7)	-0.160	<0.001	-0.167	< 0.001		
Filled	2.6 (3.0)	0.138	<0.001	0.125	0.001		
DMFT index	17.2 (6.0)	-0.136	<0.001	-0.139	< 0.001		
Healthy	8.6 (5.7)	0.124	0.001	0.145	< 0.001		
Functional teeth	13.1 (7.2)	0.175	<0.001	0.172	< 0.001		
Root							
Decayed	1.2 (2.1)	-0.025	0.517	-0.021	0.587		
Filled	0.1 (0.5)	0.008	0.834	0.012	0.741		
DFT index	1.3 (2.3)	-0.021	0.572	-0.016	0.666		
Healthy	8.3 (11.5)	-0.064	0.089	-0.058	0.126		

Table 6 Correlation of GOHAI with dental status in the sample of elderly Mexicans

Controlling for: sex, age, schooling, paid work, cognitive decline, depression, and chronic disease.

self-perception of oral and general health (P < 0.001); that is, the highest GOHAI means were reported by participants with good self-perception of oral and general health.

The results of the clinical evaluations are presented in Table 6, as well as the mean (SD) of the components and the coronal DMFT index and root DFT index, healthy coronal and roots, number of functional teeth, as well as the coefficient of correlation of these factors with the GOHAI. Multivariate analysis, controlling for sex, age, schooling, paid work, cognitive decline, depression, and chronic disease confirmed the findings of bivariate analysis. There was a statistically significant coefficient of correlation between missing teeth, fillings components, and the coronal DMFT index, as well as functional and healthy teeth (P < 0.05). A statistically significant coefficient of correlation was found between neither the GOHAI components and the root DFT index nor with healthy dental roots and GOAHI score.

Discussion

This study explored, for the first time, the psychometric abilities of the GOHAI as a measure of OHRQOL in an elderly Mexican population, and our results suggest that the psychometric properties are acceptable.

Transcultural validation of an OHRQOL instrument is especially important when there are differences between cultures (15). It is important that the GOHAI be tested in diverse populations with different cultural, language, and geographical backgrounds. In this study, we used the GOHAI version translated and validated for an institutionalized elderly population of Granada, Spain (9). This Spanish version was used in the survey on Health, Well-Being, and Aging (22), undertaken in the principal urban areas of seven countries of Latin America and the Caribbean (Argentina, Barbados, Brazil, Cuba, Chile, Mexico, and Uruguay). Nevertheless, there are no studies of the reliability and validity of the GOHAI in any or all of the seven countries.

The GOHAI was originally developed and tested in a simple of elderly Americans (8) and there have been few studies that have evaluated its properties in a Spanish-speaking population (23).

The internal consistency of GOHAI in the original version in English was reported with a Cronbach alpha coefficient of 0.79 (7). In the versions adapted and validated in Spain was of 0.86 (9), China of 0.81 (10), France of 0.86 (11), Sweden of 0.86 (12), Malaysia of 0.79 (13), Japan of 0.89 (14), Germany of 0.92 (15), Turkey of 0.75 (16), and Jordan of 0.88 (17). Our results show a comparable and adequate internal consistency in an elderly Mexican sample (Cronbach alpha coefficient = 0.77); internal consistency measured by Cronbach's alpha should be above 0.70 (24). Possibly, these differences from the validation done in Spain (9) are explained by sociocultural differences. In Latin America, elderly people suffer poor oral health, have a lower level of utilization of oral health services, and lose their teeth, not as a consequence of aging but due to uncontrolled chronic diseases and neglected oral health (25). Mexican senior populations use oral health services less than medical services (26). This figure could mean that, even when the elderly have a correct perception of their own oral health, public institutions in developing countries do not meet their oral health needs because oral health services provision is focused on preventive and restorative strategies. However, we have to admit that there is no information about the oral health status of the elderly at a national level and further research must be done to get a national picture of the oral health of this section of the population.

The factor that became obvious in the factorial analysis of the GOHAI is in accordance with the interpretation of Locker (6), who adapted the International Classification of Deficiencies, Disabilities and Handicaps (27) of the WHO for dental conditions. This factor includes "early intermediate impacts" like pain, discomfort, dysfunction, and dissatisfaction with appearance. The main difference between our results and those of Locker (6) is that impacts in different areas are seen as a whole by the Mexican participants.

Variables that influence the GOHAI score in an important way are sex, level of schooling and paid work of the elderly. Being male, with more than six years of education and being in paid work mean a higher score on the GOHAI, as has been reported previously (10,16,23). Likewise, we note that the elderly with cognitive deterioration and in the absence of clinically significant symptoms of depression, show a higher average score of the GOHAI in comparison with those not having these characteristics. It is possible that the presence of cognitive deterioration does not allow the participants to recognize their oral health problems, compared with the presence of depression, which seems to exaggerate a negative oral health perception.

Self-perception both of oral and general health is also associated with the scoring of the GOHAI; that is, the elderly who perceive themselves as having good oral and general health have a higher average score on the GOHAI and the opposite is true with a poor perception (11,13,15,17). Our results reinforce this observation and they also indicate that the GOHAI can discriminate.

Dental caries is a serious oral health problem for the elderly. The final consequence of dental caries is loss of teeth, which, in turn, has serious consequences for general health and the quality of life of the elderly (28). Our results show that the missing and filled components of the DMFT index demonstrate a significant correlation with the GOHAI score, but this correlation is low. The same occurs when teeth are healthy and functional. The lack of significant correlation with clinical measures confirms findings by other researches (2,8,29,30) and suggests that patients may not identify early dental disease as a problem, but base their oral health perceptions on other, more functional concerns (8).

The existing subjective measurements of oral health, such as the OHRQOL, are not sufficiently useful in providing data about oral health status and they cannot help in the decision–making process concerning resource allocation for improving oral health in the elderly population. They do give an idea of the extent to which oral health affects individuals and the population, so they should carry weight when decisions about improving or maintaining the quality of life of the elderly are made (2).

We hypothesized that the psychometric properties of GOHAI in our elderly Mexican population would be similar to those reported in the literature, and that a distinction between oral health and general health would be apparent. Further, we anticipated an acceptable correlation between dental status and the GOHAI. All these assumptions were confirmed in our study. In conclusion, our results indicate that the Spanish version of the GOHAI offers acceptable psychometric capabilities, discriminates between the self perception of oral health and general health, and correlates with caries experience (missing teeth and restorations).

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Competing interests

The authors declare that they have no competing interests.

References

- 1. Cohen K, Jago JD. Toward the formulation of socio-dental indicators. *Int J Health Serv.* 1976;6:681-87.
- Sánchez-García S, Juárez-Cedillo T, Reyes-Morales H, De la Fuente-Hernández J, Solórzano-Santos F, García-Peña C. State of dentition and its impact on the capacity of elders to perform daily activities. *Salud Publica Mex.* 2007;49:173-81.
- WHO. Definition of health. [WWW document]. URL http:// www.who.int/about/definition/en/print.html/ [accessed on 8 July 2009]
- 4. Engel GL. The clinical application of biopsychosocial model. *Am J Psychiatry*. 1980;**137**:535-44.
- 5. Cushing AM, Sheiham A, Maizels J. Developing socio-dental indicators the social impact of dental disease. *Community Dent Health.* 1986;**3**:3-17.
- Locker D. Measuring oral health: a conceptual framework. Community Dent Health. 1988;5:3-18.
- Atchison KA, Dolan TA. Development of the Geriatric Oral Health Assessment Index. *J Dent Educ.* 1990;54: 680-87.
- Atchison KA. The General Oral Health Assessment Index (GOHAI). In: Slade GD, editor. *Measuring oral health and quality of life*. Chapel Hill, NC: University of North Carolina; Dental Ecology; 1997. p. 71-9.
- Pinzón-Pulido SA, Gil-Montoya JA. Validación del índice de Valoración de Salud Oral en Geriatría en una población geriátrica institucionalizada de Granada. *Rev Esp Geriatr Gerontol.* 1999;34:273-82.
- Wong MC, Liu JK, Lo EC. Translation and validation of the Chinese version of GOHAI. *J Public Health Dent*. 2002;62: 78-83.
- Tubert-Jeannin S, Riordan PJ, Morel-Papernot A, Porcheray S, Saby-Collet S. Validation of an oral health quality of life index (GOHAI) in France. *Community Dent Oral Epidemiol*. 2003;**31**:275-84.
- Hägglin C, Berggren U, Lundgren JA. Swedish version of the GOHAI index. Psychometric properties and validation. *Swed Dent J.* 2005;29:113-24.

- Othman WN, Muttalib KA, Bakri R, Doss JG, Jaafar N, Salleh NC, Chen S. Validation of the Geriatric Oral Health Assessment Index (GOHAI) in the Malay language. *J Public Health Dent.* 2006;66:199-204.
- Naito M, Suzukamo Y, Nakayama T, Hamajima N, Fukuhara S. Linguistic adaptation and validation of the General Oral Health Assessment Index (GOHAI) in an elderly Japanese population. *J Public Health Dent*. 2006;**66**:273-75.
- Hassel AJ, Rolko C, Koke U, Leisen J, Rammelsberg PA. German version of the GOHAI. *Community Dent Oral Epidemiol.* 2008;36:34-42.
- Ergül S, Akar GC. Reliability and validity of the Geriatric Oral Health Assessment Index in Turkey. *J Gerontol Nurs.* 2008;34: 33-9.
- 17. Daradkeh S, Khader YS. Translation and validation of the Arabic version of the Geriatric Oral Health Assessment Index (GOHAI). *J Oral Sci.* 2008;**50**:453-59.
- Bowling A. Research methods in health: investigating health and health services. 2nd ed. Houston, TX: Open University Press; 2002.
- Reyes-Beaman S, Beaman PE, García-Peña C, Villa MA, Heres J, Cordova A, Jagger C. Validation of a modified versión of the Minimental State Examination (MMSE) in Spanish. *Aging Neuropsychol Cogn.* 2004;11:1-11.
- Reyes S. Population ageing in the mexican institute of social security: health policy and economic implications. México: IMSS-Fundación Mexicana para la Salud; 2001.
- World Health Organization. Oral health surveys: basic methods. 4th ed. Geneva, Switzerland: World Health Organization; 1997.
- 22. Albala C, Lebrão ML, León Díaz EM, Ham-Chande R, Hennis AJ, Palloni A, Peláez M, Pratts O. The Health, Well-Being, and

Aging ("SABE") survey: methodology applied and profile of the study population. *Rev Panam Salud Publica*. 2005;**17**: 307-22.

- Atchison KA, Der-Martirosian C, Gift HC. Components of self-reported oral health and general health in racial and ethnic groups. *J Public Health Dent*. 1998;58: 301-08.
- 24. Bland JM, Altman DG. Cronbach's alpha. BMJ. 1997;314:572.
- 25. Mariño R. Oral health of the elderly: reality, myth, and perspective. *Bull Pan Am Health Organ*. 1994;**28**:202-10.
- 26. Sánchez-García S, de la Fuente-Hernández J, Juárez-Cedillo T, Ortega Mendoza JM, Reyes-Morales H, Solórzano-Santos F, García-Peña C. Oral health service utilization by elderly beneficiaries of the Mexican Institute of Social Security in Mexico city. *BMC Health Serv Res.* 2007;7:211.
- World Health Organization (WHO). International classification of impairments, disabilities, and handicaps. A manual of classification relating to the consequences of disease. Geneva: WHO; 1980.
- 28. Mack F, Schwahn C, Feine JS, Mundt T, Bernhardt O, John U, Kocher PT, Biffar R. The impact of tooth loss on general health related to quality of life among elderly Pomeranians: results from the study of health in Pomerania (SHIP-O). *Int Journal Prosthodont.* 2005;18:414-19.
- 29. Gooch BF, Dolan TA, Bourque LB. Correlates of self-reported dental health status upon enrollment in the Rand Health Insurance Experiment. *J Dent Educ.* 1989;**53**:629-37.
- Rosenberg D, Kaplan S, Senie R, Badner V. Relationships among dental functional status, clinical dental measures, and generic health measures. *J Dent Educ.* 1988;52: 653-7.

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