

Prevalence of Diseases and Conditions Which Impact on Oral Health and Oral Health Self-Care Among Older Chilean

Journal of Aging and Health

2015, Vol. 27(1) 3–16

© The Author(s) 2014

Reprints and permissions:

sagepub.com/journalsPermissions.nav

DOI: 10.1177/0898264314533723

jah.sagepub.com



Rodrigo Mariño, PhD¹, Cecilia Albala, MD²,
Hugo Sanchez, MPH², Ximena Cea, MD²,
and Alejandra Fuentes, MPH²

Abstract

Objective: The aim is to describe the prevalence of chronic diseases and conditions that may affect the oral health and oral health self-care of independent living Chilean older adults. **Method:** In all, 4,766 residents aged 60 years and older took part in the study. Participants were interviewed using an 11-module instrument, including demographic data, quality of life, nutritional status, systemic diseases, and lists of medications. **Results:** Participants with cognitive impediments ($n = 553$) were eliminated from further analysis. Of the remaining 4,213, 61.2% were female. The mean age was 71.1 ($SD = 7.8$) years. A total of 19.6% reported no medical conditions, 53.1% reported one or two conditions, and 27.3% reported between three and nine conditions. The most commonly reported conditions were high blood pressure (78.0%), diabetes (26.5%), depression (23.4%), and cardiovascular disease (18.7%). Seventy-six percent reported taking medication, with an average of 3.4 drugs per person. Among those

¹University of Melbourne, Parkville, Victoria, Australia

²University of Chile, Santiago, Chile

Corresponding Author:

Rodrigo Mariño, Oral Health Cooperative Research Centre, Melbourne Dental School, University of Melbourne, Victoria 3010, Australia.

Email: rmarino@unimelb.edu.au

taking medication, 70.2% were taking at least one that may cause salivary hypofunction. **Discussion:** With the aging of Chile and the reciprocal links between oral disease and chronic diseases, policies and innovative initiatives need to be implemented so that programs become affordable and accessible for this population.

Keywords

oral health, xerostomia, Chile, systemic conditions

The Chilean population, as well as the world population, is aging (Kandelman, Petersen, & Ueda, 2008). By 2035, it is expected that those aged more than 60 years will represent almost 18% of the Chilean population (Instituto Nacional de Estadísticas, 2010). In addition, there has been an increased retention of natural teeth (Mariño, Cueto, Badenier, Acevedo, & Moya, 2011; Mariño, Chiang-Fu, & Giacaman, 2013), which translates into more older adults at risk of dental caries and periodontal disease, with medical considerations involved when treating older adults. This rapidly changing situation will bring about important challenges for health care providers. Increased efforts should be directed to identifying opportunities for older persons to improve and maintain their oral health. Although oral diseases are rarely life-and-death situations, they are among the most common chronic diseases worldwide. Furthermore, decreased oral health status can also affect personal appearance and self-image and, therefore, reduces life satisfaction and quality of life (Ghezzi & Ship, 2000). Poor oral status, or the deterioration of the oral function, reduces masticatory efficacy impacting on the selection of the food and, more importantly, the social enjoyment of the foods (Ritchie, Joshipura, Hung, & Douglass, 2002). A healthy mouth enables people to eat, speak, and socialize without pain, discomfort, or embarrassment.

There is also sound evidence of associations between oral disease, in particular periodontal health, and some medical conditions (Ghezzi & Ship, 2000). These associations first became evident in the 1990s and are now firmly established, with stronger interconnections than previously supposed (Cohen, 2002; Genco & Williams, 2010; Hein, 2010; Kandelman et al., 2008; Loesche et al., 1998). Although the evidence for their influence is very strong in some diseases, but still somewhat weak in others, there is now increased awareness that the consequences of neglected oral hygiene are not only confined to the mouth. Various biological mechanisms have been suggested, including the entry of mediators of oral inflammatory conditions into the circulatory system, contributing to systemic inflammation (Ioannidou,

Swede, & Dongari-Bagtzoglou, 2011; Thomopoulos, Tsioufis, Soldatos, Kasiakogias, Stefanadis, 2011; Willershausen et al., 2009), and aspirative pneumonia (Sjögren, Nilsson, Forsell, Johansson, & Hoogstraate, 2008). In fact, roughly 1 in 10 cases of death from pneumonia in nursing homes could be prevented by improving oral hygiene (Sjögren et al., 2008).

Several conditions interfere with the care of the mouth, chewing, and use of dental prosthesis, and therefore contribute to oral disease. Often chronic diseases, their consequences and treatment, produce important manifestations in the mouth, which are independent from the aging process. In many cases, the pharmacological treatment of these conditions has direct consequences for oral health, and negatively affects oral function and quality of life (Mariño, Schofield, Wright, Calache, & Minichiello, 2008; World Health Organization [WHO], 2008). For example, more than 400 medications, including medications to control hypertension, antidepressants, antihistamines, decongestants, painkillers, and diuretics, can cause dry mouth, a condition known as xerostomia. Saliva is a fluid with multiple functions and is essential for oral health and oral function. Thus, xerostomia has a severe impact on oral health: It increases the risk of dental caries, particularly root caries, periodontal disease, and oral infections (such as glossitis and candidiasis), and makes it difficult to chew, speak, and swallow (Orellana, Lagravère, Boychuk, Major, & Flores-Mir, 2006; Petersen & Yamamoto, 2005). Furthermore, many diseases occur simultaneously and have common causes with oral diseases and conditions.

The awareness of oral health as an essential part of general health is a major aim for the WHO (2008), the World Dental Federation (World Dental Federation, 2012), Healthy People 2020 Objectives (U.S. Department of Health and Human Services, 2013), and the Chilean National Health Strategy (Ministerio de Salud, 2013). Oral diseases are commonly thought to have little effect on systemic health, and are perceived as inevitable and natural, even though effective, efficient, economic, and highly responsive methods of prevention have been available for years. Oral diseases have a direct impact on the national health expenditure, as well as on household expenditure on health (Kandelman et al., 2008). The integration of interventions for oral health in older adults into programs of general health is being encouraged by the WHO. Education about the oral–systemic relationship is important to ensure that treatment decisions are well informed (Hein, 2010). Despite this, oral health is traditionally evaluated independently of other diseases and chronic conditions. Some of this lack of interaction can be explained by the lack of communication with general health, or more fundamentally, because oral health is seen as irrelevant for older people, or even as a distraction to older adults' health conditions.

To increase awareness of the association between systemic conditions and oral health, this article describes the prevalence of chronic diseases and conditions that may affect the oral health and oral health self-care of independent living Chilean older adults. It also provides information on their distribution by selected socio-demographic characteristics and their associations with oral diseases and chronic conditions. It is hoped that this knowledge will help to position oral health within the wider concept of health and social and personal well-being, and the preservation and maintenance of oral health-related quality of life in older adults. This information is also important to familiarize health and welfare providers and carers with the oral health implications of common systemic diseases and their treatment, and the role that treating such diseases can have in improving health and social outcomes in the community that they serve, as well as the identification and assignment of priorities to oral health diseases and conditions.

Method

Study Design

The study conducted a secondary analysis of data collected as part of a larger study of dependency (Servicio Nacional del Adulto Mayor, 2010). The study was a cross-sectional, random sample of independent living older adults, 60 years of age and older, residents of all Chilean regions. Information from the national census 2002 was used as the sampling frame. A stratified, multi-stage sampling design, with selection proportional to population size, was the method chosen to ensure that participants in rural as well as urban areas were included. Households were identified from census area maps. From each municipality, sectors were selected randomly, and from each sector households were selected randomly. Once a household was selected, one person aged 60 years or older was selected at random and invited to participate in the study.

Data Collection

The questionnaire included 11 modules examining a variety of topics, including participants' socio-demographic characteristics, cognitive and sensorial evaluations, quality of life, social support, functional status, discrimination, and health and nutritional status. In addition, thigh circumference and hand dynamometry were included. Data collection extended from November 2009 to January 2010.

Information for this analysis included the following:

- a. Socio-demographic: Gender; age; marital status, coded as “Single/Separated/divorced,” “Widow/widower,” and “Married”; and place of residence (Rural/Urban). Socio-economic status was determined by asking participants their health insurance status. In Chile, health insurance enrollment is tied to income. Health insurance status was classified into six categories: “Private Health Insurance Plans (ISAPRES)” and one of four National Health Fund (FONASA) levels—A (most in need) to D (relatively higher income)—(Superintendencia de Salud, 2012). An “Other” category was added for those who were in the public system but did not know which category.
- b. Medical history was measured by the presence (1) or absence (0) of nine types of diagnosed chronic conditions related to oral health namely diabetes, Parkinson’s disease, ischemic disease, high blood pressure, cardiovascular disease, respiratory disease, cancer, arthritis and depression. In addition, cognitive impairment was defined according to the Mini-Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) and Pfeffer activities questionnaire (Pfeffer, Kurosaki, Harrah, Chance, & Filos, 1982) with thresholds validated for the Chilean older population (Quiroga, Albala, & Klaasen, 2004). The assessment also included conditions that may affect oral hygiene; blindness and visual difficulties even when using glasses; auditory impairments, and manual dexterity, measured as the ability to grasp a coin about the size of a US\$0.05 coin. The need for help to climb stairs and the likelihood of obtaining such help were included. It was considered that this would be indicative of difficulties accessing health care services. A medical history score was computed by summing up these nine conditions.
- c. In addition, medical history asked about the number of medications currently being taken. Participants were further asked to include the names of up to seven medications that they were taking. From this list, medications were classified based on whether they cause xerostomia.
- d. Oral health question included self-assessed number of natural teeth coded into four groups: “No teeth,” “Most missing,” “A few missing,” “None missing.”

Analysis

The analysis provides descriptive information on the sample’s health and medical conditions and various socio-demographic variables. Chi-square analysis was

used to test for associations between health and medical conditions and independent variables on the nominal or ordinal scales, while for variables on an interval scale, results were analyzed using one-way ANOVA. A significant ANOVA was followed by post hoc comparisons using Tukey's Honestly Significant Differences tests. When a probability value was smaller than 0.05, the difference was considered to be statistically significant. Data were also analyzed using multiple regression analysis with a forward stepwise selection procedure to determine the relative importance of a set of independent variables in determining the participant's medical history score. Data were screened for violation of the assumptions underlying multivariate methods (Tabachnick & Fidell, 2001). Data manipulation and analysis were done using SPSS PC (Version 20.0).

Results

A total of 4,766 older adults were interviewed. Participants ($n = 553$; 11.6%) identified as having cognitive impediments were eliminated from further analysis due to their inability to provide reliable self-assessment information. Of the remaining 4,213, the majority (61.1%) were female. The mean age was 71.1 years ($SD = 7.8$) with 24.7% aged 60 to 64 years, 42.7% 65 to 74 years, and 32.6% 75 years old and older. By marital status, almost half (49.2%) lived with their spouses or partners; 30.9% were widowed; 9.2% were divorced or separated; and 10.7% never married. The great majority was under the National Health Fund (87.8%) and lived in urban locations (69.2%). Overall 19.9% reported having no natural dentition (Table 1). Nonetheless, the largest proportion (43.2%) indicated having the majority of their natural teeth missing. Another 31.9% reported having "A few" teeth missing, and the remaining 5.0% reported having no missing teeth.

Regarding general health, about one fifth of participants (19.6%) reported having none of the selected medical conditions, 27.1% reported one condition, another 26.0% reported two medical conditions, 15.6% reported three medical conditions, and the remainder (11.7%) reported between four and nine conditions. The most commonly reported conditions were high blood pressure (78.0%), diabetes (26.5%), depression (23.4%), cardiovascular disease (18.7%), and respiratory disease (15.0%). Ischemic disease was reported by 139 participants (4.1%) and Parkinson's disease by 72 participants (2.1%). Cancer was reported in 156 participants (4.7%). Among those who reported suffering from cancer, the most commonly reported cancers were cervical cancer ($n = 33$; 21.0%), prostate cancer ($n = 28$; 17.8%), and breast cancer ($n = 22$; 14.0%). Oral cancer (cancer of the oral cavity; lips, tongue, salivary glands, gingivae, floor of the mouth, and pharynx) was reported by 11 participants (7.0% of all cancers).

Table 1. Distribution of Selected Health Conditions Among Chilean Older Adults by Self-Reported Number of Teeth.

	Natural teeth ^a			p
	All missing (%)	The majority missing (%)	A few missing and all present (%)	
	19.9	43.2	36.9	
Medical conditions				
None	15.1	18.9	22.6	<.001
One	24.9	26.7	28.9	
Two	27.5	25.2	26.0	
Three	17.1	16.6	13.8	
Four or more	15.4	12.6	8.7	
Medical conditions				
High blood pressure	68.6	63.3	59.9	<.001
Diabetes	24.2	22.0	19.2	<.02
Depression	21.8	18.6	17.8	
Cardiovascular disease	17.9	15.3	15.3	<.02
Respiratory disease	14.5	13.2	9.5	<.001
Cancer	4.4	3.7	3.5	
Audition				
Bad/very bad	11.1	8.9	5.9	<.001
Vision				
Blind	0.6	1.1	0.7	
Bad/very bad (even with glasses)	46.5	41.9	36.9	<.001
Manual dexterity				
Not able to grasp a coin	14.3	13.1	9.1	<.001
Climbing stairs				
No difficulties	59.2	60.2	71.7	<.001
With difficulties	25.2	26.6	19.9	
With serious difficulties	15.6	13.2	8.4	

^an = 4,213.

Four hundred eighty-five participants (8.1%) reported having “Bad” or “Very bad” hearing. Seventy-two participants (0.9%) indicated being blind, and 6.2% indicated having “Bad” or “Very bad” eyesight, even when using glasses. Regarding manual dexterity, 11.3% had difficulties or were not able to grasp a coin. The majority self-reported no difficulty in climbing stairs (64.2%). Another 23.9% indicated that they were able to climb stairs, but with difficulties. The remaining 11.9% reported serious difficulties climbing stairs.

Age was significantly associated with all health conditions. The exemptions were cancers and Parkinson disease. Generally, older participants reported more conditions than younger participants. Gender was also associated with

Table 2. Final Multivariate Model Predicting Medical History Score in Older Chileans, 2010.

Independent variable	Multiple regression coefficient B (SE)	p
Gender (female = 1/male = 0)	0.474 (0.045)	.0001
Age	0.020 (0.003)	.0001
National Health Found A and B (yes = 1/no = 0) ^a	0.192 (0.043)	.0001
Marital status (married = 1)	0.144 (0.045)	.001
Locality (urban residency = 1)	0.145 (0.046)	.002
A few missing or all natural teeth present (yes = 1/no = 0)	-0.194 (0.045)	.0001
Constant	-0.657 (0.230)	.0001
Adjusted R ² = .055		

^aNational Health Found (FONASA) has four levels: A (most in need) to D (relatively higher income).

health status, with females reporting significantly more frequent hypertension, diabetes, respiratory disease, and particularly depression, than males ($p < .001$). Participants living in urban centers reported significantly higher proportions of diabetes ($p < .01$), depression and cancer ($p < .05$). By health insurance, those with public health insurance reported significantly higher prevalence of high blood pressure, cancer, and depression ($p < .05$).

Self-reported number of natural teeth was significantly associated with all health conditions, with those with no natural teeth reporting those conditions more frequently than dentate participants (see Table 2). The only exception was cancers. Furthermore, those with no natural dentition reported an average of two ($SD = 1.4$) conditions compared with 1.7 ($SD = 1.4$) of those who reported having no missing teeth ($p < .001$). To explain the variance in medical history score, the five socio-demographic variables and self-reported number of teeth were entered into a multiple linear regression model. These six variables remained significant, $F(6, 4084) = 39.52$; $p < .0001$, accounting for 5.5% of the variance in medical history score (adjusted $R^2 = .055$; see Table 2). From this analysis, the profile of those with more medical conditions would be a female, married, with low income, living in urban areas, and edentulous or with the majority of natural teeth missing. Age was also a predictor of medical conditions, indicating that the younger the person, the less medical conditions they had.

Seventy-six percent of participants ($n = 3,195$) reported taking medications ranging from 1 to 12 different medications. Among those who took medication, there was an average of 3.4 drugs per person. More women than

men took medications ($p < .001$). No significant associations were found with reference to age groups. Notably, among those taking medications, 70.2% were taking at least one that may cause salivary hypofunction. The majority of them (57.6%) took only one medication that may cause salivary hypofunction; nonetheless, some were consuming up to seven different medications that may cause salivary hypofunction.

Discussion

This study describes the prevalence of common systemic diseases associated with oral health and function by selected socio-demographic variables in the Chilean older adult population. Findings indicate that the majority (80.4%) of participants have at least one chronic disease that could impact on oral health, with more than a quarter (27.3%) reporting three or more of these conditions. In this study, 78.0% of the sample reported a positive history for high blood pressure. This is important for oral health as it raises a number of concerns for the oral health care treatment of these patients. Also, antihypertensive medications are associated with salivary hypofunction (Ghezzi & Ship, 2000). Depression was the most common mental health condition in the present sample. Antidepressants also reduce salivary flow. Furthermore, independent of medications, people who are depressed and/or overly anxious have lower rates of salivary flow. It is also not uncommon that depression may lead to neglected oral hygiene, which would lead to gum disease.

Because of the self-reported nature of the data used in this analysis, individuals with cognitive impairment were not fully analyzed. However, this group represented a significant proportion (11.6%) of the total sample. Patients with cognitive impairment are more susceptible to the deterioration of their oral health function due to their decreased ability to self-care and keep his or her mouth in good condition.

More than a quarter of the participants (26.5%) reported having diabetes. The two-way link between diabetes and periodontal disease (a significant preventable oral health problem, which affects the structures that attach the teeth to the surrounding bone) has been established (Chapple & Genco, 2013; Mealey, 2006), but not well promoted. Diabetics are more susceptible to periodontal infections. Diabetes also diminishes the ability of the body to defend itself against infection. In these circumstances, bacteria that causes gum disease are not easily controlled by the body's defenses. Thus, periodontal therapy may improve control of diabetes (Chapple & Genco, 2013).

Limited manual dexterity was also somewhat prevalent in this sample of older adults. This condition may limit mobility and the dexterity required for

daily oral hygiene (i.e., to hold and use toothbrushes or dental floss). When the active hand is affected, oral hygiene practices may need to be relearned. In addition to manual dexterity, decreased visual dexterity, auditory capacity, and difficulties of movement (i.e., climbing-up stairs) were found to be prevalent in this study. Difficulty in stair climbing has a strong association with activity limitations (Verghese, Wang, Xue, & Holtzer, 2008); therefore, it impacts on obtaining the necessary clinical care, as well as, for participating in health promotion activities.

The great majority of the participants (76%) were taking one or more medication. The medication for some chronic conditions, which were found to be high in this study (e.g., depression, hypertension, anti-seizure, etc.), may lead to salivary hypofunction. In addition, a number of over-the-counter (OTC) medications (expectorants and decongestants) can also reduce saliva flow (Walsh, 2001). Thus, oral health professionals and general medical practitioners treating older adults must be aware of the xerogenic effect of medicines. Some of those medicines may be replaced by others with less xerogenic properties. Also, there is a series of measures that a person with salivary hypofunction can take. In addition, some common medication used in the treatment of chronic diseases may produce disturbances in taste (Ghezzi & Ship, 2000). However, any change in medications or in personal measures will only happen if health professionals are aware of this relationship and have the information to provide the correct advice to patients. Clinicians must be proactive in questioning patients about prescription and non-prescription drugs that their patients are using (Donaldson & Touger-Decker, 2013). Nonetheless, despite medical practitioners being aware that some medications caused hyposalivation, it has been reported that medical practitioners identify this problem only when patients complained of xerostomia (Stacey, Temple-Smith, Appleby, Pirota, & Bailey, 2013). Furthermore, even when practitioners were aware, they often gave advice that was potentially deleterious to oral health and were uncertain as to whether dry mouth would influence their prescribing (Stacey et al., 2013).

Malignant neoplasms are the second most common cause of death in Chile (Pan-American Health Organization, 2013). Many chemotherapy agents used in cancer therapy have as a side effect, salivary gland dysfunction (Wind, 1996). Oral cancer made up 1.6% of total cancer cases in Chile (Riera & Martinez, 2005). This figure is lower than the self-reported prevalence from this study. Oral cancers are significant in that they can lead to death and their treatment is associated with disfigurement and dysfunction. Cancer treatment may damage the salivary glands tissue, thus contributing to dry mouth. Reports indicate that up to 92% of those who had radiotherapy of the head and neck reported chronic, severe xerostomia (Wind, 1996).

We also explored the association between general health conditions and self-reported oral health status (i.e., number of natural teeth) in a sample of older Chileans. This study found cross-sectional associations between medical conditions and oral health status. For most of the conditions, oral health status remained significant after controlling for socioeconomic status (SES) variables. Nonetheless, association may not imply causality. Thus, this study warrants further longitudinal studies to confirm the association and the establishment of causality.

In view of this profile, primary and secondary prevention is even more important. However, the organization of the health system is not designed for engagement in preventive activities. More information is necessary on the engagement of preventive services by older adults. Reports indicate that the use of dental health services tends to decrease after retirement (Australian Institute of Health and Welfare, 2001). A parallel decline in oral health status in the older adult populations has also been identified (Gift & Newman, 1993). Thus, to reach an increased number of older adults there is a need for increased collaboration among the team of health professionals working with older patients. For this purpose, the whole team should be aware of the potential impact systemic disease may have on oral health (and vice versa), and its extent in the community that they serve. Furthermore, as many OTC medications may also affect dry mouth, pharmacists should also be aware of this association. This will contribute to optimizing the oral health outcome and therefore the overall health and quality of life of older adults. Ignoring opportunities for collaboration may increase inequalities in health and may lead to even greater demands for curative and rehabilitative services.

Summary and Conclusion

Given that the proportion of dentate older adults will increase in the future, improving health professional's awareness of the prevalence of conditions and their pharmacology that may affect health and oral health becomes even more relevant. However, oral health professionals need to continue communicating the oral health preventive message and educating the public about the risks of tobacco and alcohol use, or unhealthy diet, diabetes control, and blood pressure, as well as to promote healthy environments. Oral health professionals also need to be aware of, and be able to identify, risk factors for chronic diseases, and verify whether patients are obtaining appropriate medication.

Although the results of this study need to be considered in the light of the limitations imposed by its cross-sectional design and the self-reported nature of the data, we believe that due to the size of the population whose data were collected, the use of validated instruments for assessments, and the breadth of

data collection, our study is unique and represents a substantial study of older Chileans. With the aging of Chile, as well as other developing nations, the robust evidence on the reciprocal links between oral disease and conditions and chronic diseases, policies, and innovative initiatives need to be implemented so that oral health care services and preventive services and programs become affordable and accessible for this expanding aging population. In addition, there is a need for effective oral health education programs to improve awareness of systemic diseases' impact on patients' oral health, therefore improving health practitioners' clinical decisions. Many countries are facing similar issues; thus, it was considered appropriate to present the Chilean results as they provide information that should inform the design of future studies aimed at determining predictors of oral health and the planning of health services for older adults.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study was funded by the National Service of the Older Adult (SENAMA), The Chilean International Cooperation Agency (AGCI), and The Spanish Agency for International Development Cooperation (AECID).

References

- Australian Institute of Health and Welfare. (2001). *Oral health and access to dental care*. Canberra, Australia: AIHW Dental Statistics and Research Unit.
- Chapple, I. L., & Genco, R. (2013). Diabetes and periodontal diseases: Consensus report of the Joint EFP/AAP Workshop on Periodontitis and Systemic Diseases. *Journal of Periodontology*, 84(4 Suppl.), S106-S112. doi:10.1111/jcpe.12077
- Cohen, M. (2002). Major long-term factors influencing dental education in the twenty-first century. *Journal of Dental Education*, 66, 360-373.
- Donaldson, M., & Touger-Decker, R. (2013). Dietary supplement interactions with medications used commonly in dentistry. *Journal of the American Dental Association*, 144, 787-794.
- Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state." A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, 12, 189-198.
- Genco, R., & Williams, R. (2010). Overview. In R. Genco & R. Williams (Eds.), *Periodontal disease and overall health: A clinicians' guide* (pp. 1-4). Yardley, PA: Professional Audience Communications.

- Ghezzi, E., & Ship, J. (2000). Systemic disease and their treatment in the elderly: Impact on oral health. *Journal of Public Health Dentistry, 60*, 289-296.
- Gift, H. C., & Newman, J. F. (1993). How older adults use oral health care services: Results of a National Health Interview Survey. *Journal of the American Dental Association, 124*, 89-93.
- Hein, C. (2010). The role of the professional in education the public about the importance of oral health. In R. Genco & R. Williams (Eds.), *Periodontal disease and overall health: A clinicians' guide* (pp. 288-304). Yardley, PA: Professional Audience Communications.
- Instituto Nacional de Estadísticas. (2010). *Estadísticas Vitales: Informe anual 2010*. Santiago, Chile: INE. Retrieved from http://www.ine.cl/canales/chile_estadistico/demografia_y_vitales/estadisticas_vitales/estadisticas_vitales.php
- Ioannidou, E., Swede, H., & Dongari-Bagtzoglou, A. (2011). Periodontitis predicts elevated C-reactive protein levels in chronic kidney disease. *Journal of Dental Research, 90*, 1411-1415.
- Kandelman, D., Petersen, P. E., & Ueda, H. (2008). Oral health, general health, and quality of life in older people. *Special Care Dentistry, 28*, 224-236.
- Loesche, W. J., Schork, A., Terpenning, M. S., Chen, Y. M., Dominguez, B. L., & Grossman, N. (1998). Assessing the relationship between dental disease and coronary heart disease in elderly U.S. veterans. *Journal of the American Dental Association, 129*, 301-311.
- Mariño, R., Chiang-Fu, M., & Giacaman, R. (2013). Root caries prevalence among older adults living in central Chile. *Gerodontology*. Advance online publication. doi:10.1111/ger.12060
- Mariño, R., Cueto, A., Badenier, O., Acevedo, R., & Moya, R. (2011). Oral health status and inequalities among ambulant older adults living in the central of Chile. *Community Dental Health, 28*, 143-148.
- Mariño, R., Schofield, M., Wright, F. A. C., Calache, H., & Minichiello, V. (2008). Self-reported and clinically determined oral health status predictors for quality of life in dentate older migrant adults. *Community Dentistry and Oral Epidemiology, 36*, 85-94.
- Mealey, B. L. (2006). Periodontal disease and diabetes: A two-way street. *Journal of the American Dental Association, 137*(Suppl.), 26S-31S.
- Ministerio de Salud. (2013). *Estrategia nacional de salud 2011 – 2020*. Santiago, Chile: Gobierno de Chile.
- Orellana, M. F., Lagravère, M. O., Boychuk, D. G., Major, P. W., & Flores-Mir, C. (2006). Prevalence of xerostomia in population-based samples: A systematic review. *Journal of Public Health Dentistry, 66*, 152-158.
- Pan-American Health Organization. (2013). *Basic health indicator data base—Chile*. Retrieved from http://www1.paho.org/English/DD/AIS/cp_152.htm
- Petersen, P. E., & Yamamoto, T. (2005). Improving the oral health of older people: The approach of the WHO Global Oral Health Programme. *Community Dentistry and Oral Epidemiology, 33*, 81-92.
- Pfeffer, R. I., Kurosaki, T. T., Harrah, C. H. Jr., Chance, J. M., & Filos, S. (1982). Measurement of functional activities in older adults in the community. *Journal of Gerontology, 37*, 323-329.

- Quiroga, P., Albala, C., & Klaasen, G. (2004). [Validation of a screening test for age associated cognitive impairment, in Chile]. *Revista Medica de Chile*, 132, 467-478.
- Riera, P., & Martinez, B. (2005). Morbidity and mortality for oral and pharyngeal cancer in Chile. *Revista Medica de Chile*, 133, 555-563.
- Ritchie, C. S., Joshupura, K., Hung, H. C., & Douglass, C. W. (2002). Nutrition as a mediator in the relation between oral and systemic disease: Associations between specific measures of adult oral health and nutrition outcomes. *Critical Reviews in Oral Biology and Medicine*, 13, 291-300.
- Servicio Nacional del Adulto Mayor. (2010). *Estudio Nacional de la Dependencia en las Personas Mayores*. Author. Retrieved from <http://www.senama.cl/filesapp/Estudio%20Nacional%20de%20Dependencia%20en%20las%20Personas%20Mayores.pdf>
- Sjögren, P., Nilsson, E., Forsell, M., Johansson, O., & Hoogstraate, J. (2008). A systematic review of the preventive effect of oral hygiene on pneumonia and respiratory tract infection in elderly people in hospitals and nursing homes: Effect estimates and methodological quality of randomized controlled trials. *Journal of the American Geriatric Society*, 56, 2124-2130.
- Stacey, M., Temple-Smith, M., Appleby, N., Pirota, M., & Bailey, D. (2013). *Developing a dry mouth education program for GMPs*. Retrieved from www.worlddentalposters.com/poster/download/97
- Superintendencia de Salud. (2012). *Preguntas frecuentes*. Retrieved from <http://www.supersalud.gob.cl/consultas/570/w3-article-6304.html>
- Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (4th ed.). Needham Heights, MA: Allyn & Bacon.
- Thomopoulos, C., Tsioufis, C., Soldatos, N., Kasiakogias, A., & Stefanadis, C. (2011). Periodontitis and coronary artery disease: A questioned association between periodontal and vascular plaques. *American Journal of Cardiovascular Disease*, 1, 76-83.
- U.S. Department of Health and Human Services. (2013). *Healthy people 2020: Objectives*. Retrieved from <http://www.healthypeople.gov/2020/topicsobjectives-2020/overview.aspx?topicid=32>
- Verghese, J., Wang, C., Xue, X., & Holtzer, R. (2008). Self-reported difficulty in climbing up or down stairs in nondisabled elderly. *Archives of Physical Medicine and Rehabilitation*, 89, 100-104.
- Walsh, L. (2001). Salivary dysfunction: Management approaches for the dry mouth patient. *Hygiene Today*, 11, 4-7.
- Willershausen, B., Kasaj, A., Willershausen, I., Zahorka, D., Briseño, B., Blettner, M., . . . Münzel, T. (2009). Association between chronic dental infection and acute myocardial infarction. *Journal of Endodontics*, 35, 626-630.
- Wind, D. (1996). Management of xerostomia: An overview. *Journal of Practical Hygiene*, 5, 23-27.
- World Dental Federation. (2012). *FDI policy statement*. Retrieved from <http://www.fdiworldental.org/media/11403/World-oral-health-day-2012.pdf>
- World Health Organization. (2008). *Oral health in ageing societies: Integration of oral health and general health*. Geneva, Switzerland: Author.