International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

Prevalence of Swallowing Disorders and Its Association with Geriatric Syndromes in Elderly Patients Attending to a First Level Care Center

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Abstract: ***Background: Worldwide ageing population is increasing and this is followed by an increase in some negative outcomes called Geriatric Syndromes (GS). A key element of overall health in elderly is adequate swallowing. The swallowing disorders (SD) have been associated with some GS, like malnutritionand depression in elders. Objectives: To determine the prevalence of Swallowing disorders (SD) and its associations between socio-demographic characteristics, health status and some GS in adults aged 60 or older, attending at first level care in Mexico. Methods: Cross-sectional study in participants aged ≥60, recruited in 2016. Participants underwent a comprehensive geriatric assessment (CGA), with which the diagnosis of Swallowing disorders (SD) and GS was obtained. Regression analyses adjusted for confounding variables were determined to establish the association between the socio-demographic characteristics, Swallowing disorders (SD) and some GS. Results: We included 264 subjects; mean age was 73 years (SD = ±6), women accounted for 60%. Overall, 13% had cough when eating foodand 12% had a choking feeling during swallowing. After adjusted by age, sex and literacy, multiple logistic regression analyses showed a significant association between cough,chokingand some GS (falls, depression, pain, immobility and malnutrition risk). Conclusions: This study showed that the prevalence of swallowing disorders is higher in Mexican elders. These results suggest the importance of monitoring swallowing capabilities, as they seem to confer a negative impact on health status of the elderly, and that the swallowing evaluation should be included in the geriatric assessment to prevent GS.***

Keyword: Geriatric Syndrome; swallowing; dysphagia

1. Introduction

The worldwide ageing population is increasing, and it is predicted that by 2050 one in five people will be aged 60 years or more in developing countries[1,2]. This demographicevolutionmay be associated with an increase in the prevalence of Geriatric Syndromes (GS) [3-5]. This term has commonly been used to indicate the ‘‘accumulated effect of impairments in multiple domains’’ that result in a particular adverse outcome in older people[6].Falls, depression, disability, cognitive impairment, immobility, malnutrition and chronic pain are some of the more prevalent GS.Oropharyngeal dysphagia (OD) matches the definition of a geriatric syndrome as it is highly prevalent among older people, is caused by multiple factors, is associated with several comorbidities and poor prognosis, and needs a multidimensional approach to be treated[7].

It is generally accepted that a key element of overall health is swallowing function[8,9]. Any disruption in the swallowing process may be defined as dysphagia [10].The risk for dysphagia or difficultyswallowing increases with age[11]. In the US, dysphagia affects 300,000–600,000 people’s yearly[12]. OD is pandemic among older people, affecting between 27% and 91% of the population 70 years or older[13]. The term presbyphagia refers to all changes of swallowing physiology that are manifested with increasing age [14].So, healthy aging takes its toll on head and neck anatomy and physiologic and neural mechanisms underpinning swallowing function. This progression of change contributes to alterations in the swallowing in healthy older adults, diminishing functional reserve [8,9]. Loss of swallowing function can have negativeoutcomes including dehydration, pneumonia, as well as some GS (malnutrition, reduced quality of life in elders for example) [15]. Age-related changes place older adults at risk for dysphagia, and dysphagia is a co-morbidity of many age-related diseases and/or their treatments[11]. Some of the more common symptoms, such cough and choking, are often related to oral and pharyngeal disease[16-21].World Health Organization defined OD as the difficulty or inability to move a bolus safety and effectively from the oral cavity to the esophagus, and can include aspirations, choking, and residue[13].Despite its prevalence and severity, OD is still under diagnosed and untreated in many medical centers[7].

This study aims to determine the prevalence of swallowing disorders and its associations between geriatric syndromes in adults aged 60 or older, attending at medical consultation of a first level unit of care in Mexico.

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2. Material and Methods

Study population

Cross-sectional study including participants aged 60 or older, which were consecutively recruited from a primary careclinic (a family medicine unit N° 54 belonging to the Mexican Institute of Social Securityof Mexico which grants 1700 consultations per year to adults ≥60 years) between September 2015 and April 2016. Subjects were invited to voluntary participate in the study the day of their scheduled medical visit. Once participants agreed, they underwent a comprehensive geriatric assessment by trained staff using standardized methods. Detailed sociodemographic, swallowing disorders and GS information was also obtained. Subject who did not complete the questionnaire responses or did not authorize the consent were excluded to avoid the inclusion of incomplete covariates. The hospitalEthic Committee reviewed and approved the study protocol.

Assessments

Dependent variables

Depression, immobility risk, malnutrition and chronic pain were investigated as geriatric´s syndromes outcome:

Depression

Depressive symptoms were assessed using the validated version of the 15-item Geriatric Depression Scale (GDS). A cut-off point of >5 indicated the presence of depression[22].

Immobility risk

The Rosow-Breslau Functional Health Scale assessed mobility trough 3 items (walking half a mile, climbing stairs, and doing heavy work around the house) in order to make high risk of immobility diagnosis[23].

Malnutrition

The nutritional risk was evaluated through the Questionnaire for the detection of malnutrition in older adults (DNA). The cut-off point of >6 indicated the presence of high nutritional risk, and <2 points was considered for low nutritional risk[24].

Chronic Pain

The presence of pain was assessed through the question: do you have pain? CGA and physical examination corroborated the presence and impact of pain.

Swallowing Disorders

Two swallowing disorders were investigated as independent variables: sensation of choking on eating foods and the presence of cough after eating.Participants who responded positively to the question “Do you sometimes choke on drinks/food such as tea and soup?” or those who presented with cough or abnormal repetitive saliva swallowing test findings were diagnosed with OD.

Covariates

Socio-demographic variables included age, sex, schooling, marital status, andmorbidity variables. Education was recorded in years. Body mass index was calculated as measured weight in kilograms divided by measured height in meters squared (kg/m^2). Individuals were considered as normal from 22 to 24; as overweighed 25 to 29;obese with >30, and malnutrition <22[25].

Smoking status was categorized as current or not. A trained physician determined diseases according to standardized, well-known, pre-established criteria and algorithms combining information from self-reported diagnoses, medical records, current pharmacological treatment and clinical examinations. All participants were asked whether they had a diagnosis of any chronic diseases per the World Health Organization’s International Classification of Diseases (ICD-10). Acutoff point of >2 were considered for polypharmacy[26-27].

The falls was evaluated through a simple question: have you fallen on one occasion during the last year? [28]. Impairment in basic (ADL) and instrumental activities of daily living (IADL) was used to identify disability[29,30]. For each domain, if the participants indicated that they were unable to carry out at least one of the activities without assistance, they were considered as having disability. Cognitive function was assessed by the Mexican population validated version of the Mini-Mental State Examination (MMSE). The lower score was determined with a cut-off score of <23, adjusted by age and education[31].

Statistical Analyses

Baseline descriptive data for the final sample are shown as means and standard deviations for continuous variables and frequencies for categorical variables. X^2 test or Fisher’s exact test were used as appropriate. Logistic regression and Odds Ratioswere used to determine the association strength between dependents (cough and choking) and independents (depression, immobility, malnutrition, and chronic pain) variables.

Univariate analyses were first performed to screen for predictor variables for GS. The choice of independent variables used in the univariate analyses was based on the review of literature and clinical judgment. In the next step, variables that were statistically significant at P<0.05levels in the univariate analyses were included in multivariate regression models with additional adjustment for age,sex, schooling and comorbidity.All analyses were evaluated using 95% confidence intervals and aP-value of <0.05 was considered statistically significant. Statistical analyses were performed in SPSS software for Windows® (SPSS Inc., Chicago, IL, version 19).

3. Results

The final sample was made up of 264 individuals aged 60 years or older; women accounted for 60%, and the mean of age was 73(SD = ±6). The main baseline characteristics are presented in Table 1 between those and the presence of choking, and cough.

Of the total, 64% of the sample wasmarried, and28% were widowed. Regarding the education level, only 5% were illiterate. Almost 78% and 55% reported economic and health situation as good, respectively. The prevalence of

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smoking was 36%. Hypertension and diabetes were the most prevalent morbidities (44% and 33%). The prevalence of polypharmacy was 84%, and the mean of prescribed drugs was 4.5 (SD ±2).The 47% of womenand 11% of men presented one or more disabilities in the ADL scale respectively, and disability for IADL was 3%. A total of 47% had mild cognitive impairment, MMSE mean was 24 (SD±4), and 25% had clinically depressive symptoms, with GDS score mean of 4 (SD±3).

As for the nutritional status, 2% was on high nutritional risk and 83% in low nutritional risk. The mean in the DNA was 1 (SD ± 1.5). According to the BMI, 22% were classified as overweight and up to 29.5% in obesity. The prevalence of weight loss in the last year was 15%. The mean weight in kg was 69 (SD ±12), and the BMI mean was 27 (SD ± 5). 52% reported dental prosthesis use, and 33% reported the presence of dry mouth (xerostomia).

Seven per cent classified at high risk of immobility according to the Rosow-Breslau Functional Health Scale. The prevalence of at least one falls in the last year was 39%, and 15% used a gait auxiliary. The prevalence of old fractures was 26%. Up to 48% of the sample reported chronic pain.

Swallowing disorders variables were as follows:13% had cough when eating foodand 12% had had a choking feeling in swallowing.

Univariate and multivariate analysis

The results from the univariate regression analyses of the associations between baseline swallowing disorders variables and some GS are presented in Table 2. The unadjusted logistic regression analysis showed a significant association between cough and depression, cognitive impairment, immobility risk, weight loss, malnutrition risk, and chronic pain. Also a significant association was observed between choking and depression, immobility risk, weight loss, malnutrition risk. Factors with higher P-values were disability, obesity and overweight, andfalls. However, the presence of cough on food intake showed significance for MCI (OR = 2.1, CI 95% 1-4.4, P = 0.04). It was observed statistically relevant associationsin the presence of cough and the groups with depression (OR = 2.4,95% CI 1.15-5.16), MCI(OR = 2, 95% CI 1-4), risk of immobility (OR = 2.8, 95% CI 0.0- 8.5), weight loss(OR = 2.3, 95% CI 1-5.5),risk of malnutrition (OR = 15, 95% CI 2.6-85), and chronic pain (OR = 2.2, 95% CI 1.05-4.7).

The presence of choking increased 2 times the probability of depression (95% CI 1-5). The OR for risk of mobility was significant (OR = 3, 95% CI 1-9.7), as was the OR for weight loss and risk of malnutrition (2.6; 16, respectively).

Table 3 displays the results of the multivariate regression analysis for geriatrics syndromes ([b]Model 2). The probability of depression was significantly, twice as high in the presence of cough (OR = 2.3, 95% CI 1.05-4.5;). The risk of immobility was 3 times more in the presence of choking (P= 0.04). Also for choking OR for weight loss was significantafter adjustment (2.7, 95% IC 1.10-6.92). The dependent variable that showed the highest OR in the multivariate analysis was the risk of malnutrition in the presence of coughing and choking (OR= 14. 6, 95% IC 2.4 to 89.66, and OR= 42 95% IC 3.7 to 486.2, respectively).

4. Discussion

The results showed an association between swallowing disorders (cough and choking)and depression and malnutrition risk prevalence in Mexican elders. By other hand, to the best of our knowledge, this is the first study to associate SD and GS in Mexican elders. These results showed that swallowing impairmentit is higher in Mexican elders and that their presence could increase the probability of had some GS, even after adjustment for age, sex, literacy, and comorbidities. This result is consistent with previous work, in which the presence of SD can increase the chances of development of negative outcomes in elders[7,9,15,32].

In many studies,itwas found that the presence of cough or choking increased the risk of depression[33-35]. In a systematic review, the majority of the studies concluded that symptoms of depression and anxiety were associated with impaired swallowing function[36].

Also we showed that coughing and choking could increase the risk of malnutrition. For example, in an analysis made by Budtz-Jørgensen it was found it that alterations in chewing caused by oral pathologies were compensated by prolonged mastication and swallowing of a larger volume bolus, which may generate choking sensation during swallowing. This eventually leads to malnutrition due to the unpleasant experience of the feeding process[37]. As is known malnutrition is associated with a worsening of the state of health in elders, so it is not surprising that deteriorated swallowing functionis also linked to negative outcomes, particularly with the presence of GS, as our study showed[38]. In other studies, the co-occurrence of dysphagia and malnutrition in all health care settings, including community-dwelling older persons were seen in 29% to 45%[32,39,40]. For example in a study on independently living older persons with OD showed that the percentage of patients with or at risk of MN was 21.7%. Moreover, prevalence of MN at 1-year follow-up rose to 26% in patients with OD[41]. In our study, this prevalence reached 68%.

Regarding the association of OD and the risk of immobility found in our study, it seems to be the first report that associates decreased physical performances and swallowing difficulties in elders. In an analysis of an elderly Japanese community, the absence of physical activity (aerobic exercise routine once a week) increased the risk of dysphagia in a cross-sectional study. This risk did not reach statistical significance[42]. Our results, on the other hand, showed statistical significance in both the univariate and multivariate model, and in this last one the cough and choking in swallowing increased to 3 times the risk of immobility (P <0.005).

Although our study did not studied frailty, we must say that we evaluated components that are recognized as clinical or etiological characteristics of physical frailty, such as

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decreased mobility, unintentional weight loss and some depressive symptoms. In our study, OD increased the risk of malnutrition dramatically even after adjustments.

We believe that the biological pathway plausible behind the association between OD and the presence of GS is an altered inflammatory state. It has been shown that higher concentrations of pro-inflammatory cytokines could favor the altered inflammation state observed in GS.In presence of oral pathology, there are an increase in soft tissue injuries or exposure to bacterial endotoxins, pro-inflammatory cytokines, mitogens and viral proteins triggers the immune-inflammatory reactions, such as the arachidonic acid (AA) pathway. Furthermore, there is activation of nuclear factor kappa-B (NF-κB), which regulates the chronic inflammatory reactions and proinflammaory cytokine production [43,44].

Our study has several limitations. First, information on OD was self-reported, and the findings must be interpreted with caution.Further longitudinal studies including objective measures of OD (e.g., barium esophagram, esophageal manometry) should be developedto confirm or refute these findings. Another limitation was the loss of follow-up; this could limit generalizationof the findings. The possibility of reversecausality in the direction of the association between OD and physical performance should not be ignored. Finally,validated questionnaires for dysphagia (EAT-10 for example) were not used because the personnel were not trained for their correct performance, and must be taken into account wheninterpreting these findings. However, the main strengths of this study include GS screening, which was done with standardized tests. Our analysis did consider many other confounding variables; all these factors are well known for their influence on the development of GS.

5. Conclusion

This study showed that the prevalence of OD is higher in Mexican elders.The results suggest the importance of monitoring swallowing function, as they seem to have an impact on health status of the elderly. Adequately recognizing these problems can prevent malnutrition by sending nutritional advice, comprehensive dental evaluation and rehabilitation to avoid complication (malnutrition and risk of aspiration pneumonia, e.g.). So it is important that everyone with dysphagia receive nutritional assessment to identify individuals who have or are at risk for protein-energy malnutrition or specific nutrient deficiencies.We think that CGA, which includes a swallowing evaluation,could be a tool to promote positive changes at the individual level and have the potential to establish therapeutic strategies in multiple levels to prevent deterioration in oral health in the Mexican elderly community, and to avoid the development of some GS. However, these results must be replicated in a more extensive cohort with a longitudinal approach.

Funding sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

[1] Yuka Minagawa , Yasuhiko Saito. An Analysis of the Impact of Cell phone Use on Depressive Symptoms among Japanese Elders. Gerontology. 2014; 60(539-547).
[2] Shan Hung M, Min-Shan Li M, Yen-Lin Chen M, Jung-Hsien Chiang P, Ying-Yeh Chen MS, Galen Chin-Lun Hung MS. Smartphones-based ecological momentary assessment for Chinese patients with depression: An exploratory Study in Taiwan. Asian Journal of Psychiatry. 2016 August 6; 23(131-136).
[3] Nancy M. Gell PM, Dori E. Rosenberg PM, Geotge Demiris P, Andrea Z. LaCroix P, Kushang V.Patel PM. Patterns of Technology Use Among Older Adults With and Without Disabilities. The Gerontologist. 2015; 55(3):412-421.
[4] Ari J. Elliot , Christopher J. Mooney , Kathryn Z. Douthit , Martin F. Lynch. Predictors of Older Adults' Technology Use and Its Relationship to Depressive Symptoms and Well-being. Journals of Gerontology. 2013; 69(5): 667-677.
[5] Colin A Depp PD, Alexandrea L Harmell MS, Ipsit V Vahia MD, Brent T Mausbach PD. Neurocognitive and Functional Correlates of Mobile Phone Use in Middle-Aged and Older Patients with Schizophrenia. Aging Ment Health. 2016 September 13;(1-7).
[6] Selwyn, N , Gorard, S , Furlong, J , Madden, L. Older adults' use of information and communications technolgy in everyday life. Ageing and Society. ; 23: 561-582(doi:10.1017/S0144686X03001302).
[7] Zickuhr, K , Madden, M. Older Adults and Internet use. [Online].; 2012. Available from: http://www.pewinternet.org/Reports/2012/Olderadults-and-internet-use/Summary-of-findings.aspx.
[8] Fox, S. Older Americans and the Internet. [Online].; 2004. Available from: http://http://www.pewinternet.org/Reports/2004/Older-Americans-and-theInternet/1-Summary-of-Findings.aspx.
[9] Duggan, M , Smith, A. Cell phone and Internet Use. Pew Research Center. 2013.
[10] Fox, S , Duggan, M. Mobile Health. Pew Research Center. [Online]. [cited 2012 December 12. Available from: http://www.pewinternet.org/Reports/2012/Mobile-Health/Main-Findings/MobileHealth.aspx
[11] Thomee S , Harenstam A , Hagberg M. Mobile phone use and stress, sleep disturbances, and symptoms of depression among young adults - a prospective cohort study. BMC Public Health. ; 11:66.
[12] Cody MJ , Dunn D , Hoppin S , Wendt P. Silver surfers: Training and evaluating internet use among older adult learners. Commun Educ. 1999; 48:269-286.
[13] Vanderwerker LC , Prigerson HG. Social support and technological connectedness as protective factors in bereavement. J Loss Trauma. 2004; 9:45-57.
[14] Gerber, T , Olazabal, V , Brown, K , Pablos-Mendez, A. An agenda for action on global e-health. Health Affairs. ; 29:233-236(doi:10.1377/hlthaff.2009.0934).
[15] Czaja SJ , Charness N , Fisk AD , Hertzog C , Niar Sankaran N , Rogers WA , et al. Factors predicting the use of technology: findings from the Center for

Licensed Under Creative Commons Attribution CC BY

Research and Education on aging and Technology Enhancement (CREATE). Psychology and aging. 2006; 21(2):333([PubMed: 16768579]).
[16] World Health Organization,. mHealth: New horizons for health through mobile technologies. [Online]. [cited 2013 March 27. Available from: http://www.who.int/goe/publications/goe_mhealth_web.
[17] Patrick K , Griswold WG , Raab F , Intille SS. Health and the mobile phone. Am J Prev Med. 2008; 35:177-181.
[18] Leong KC , Chen WS , Mastura I , Mimi O , Sheikh Ma , Zailinawati AH , et al. The use of text messaging to improve attendance in primary care: a randomized controlled trial. Fam Pract. 2006; 23: 699-705.
[19] Logan AG , Mclsaac WJ , Tisler A , Irvine MJ , Saunders A , Dunai A , et al. Mobile phone-based remote patient monitoring system for management of hypertension in diabetic patients. Am J Hypertens. 2007; 20: 942-948.
[20] Ito M. Personal, Portable, Pedestrian: Mobile Phone in Japanise Life. Cambridge, MIT Press.
[21] Ling RS. New Tech, New Ties: How mobile Communications Is Reshaping Social Cohesion. Cambridge, MIT Press. 2008.
[22] Commercce USDo. [Online]; 2011 [cited 201 September 18. Available from: http://www.ntia.doc.gov/files/ntia/publications/.
[23] Slegers,K , van Boxtell , M. P. J , Jolles, J. Effects of computer training and Internet usage on the well-being and quality of life of older adults: A randomized, controlled study. Journals of Gerontology, Series B: Psychological Sciences and Social Sciences. 2008; 63: 176-184(doi:10.1093/geronb/63.3.P176).
[24] Barg, F. K , Huss-Ashmore, R , Wittink, M. N , Murray, G.F , Bogner, H. R , Gallo, J. J. A mixed-methods approach to understanding loneliness and depression in older adults. Journals of Gerontology, Series B: Psychological Sciences and Social Sciences. 2006; 61:329-339(doi:10.1093/geronb/61.6.S329).
[25] Borson S, Scanian J, Brush M, Vitaliano P, Dokmark A. The mini-cog: a cognitive "vital signs" measure for dementia screening in multilingual elderly. Int J Geriatr Psychiatry. 2000; 15(11):1021.
[26] Ferner RE, Aronson JK. Communicating information about drug safety. BMJ. 2006; 333(7559):143.
[27] Choi N. Relationship Between Health Service Use and Health Information Tchnology Use Among Older Adults: Analysis of Us National Health Interview Survey. J Med Internet Res. 2011; 13(2):e3.
[28] Beer JM, Takayama L. Mobile remote presence systems for older adults: acceptance, benefits and concerns. In Proceedings of the 6th international conference on Human-robot interaction; 2011; Lausanne.Switzerland.
[29] Nasir MHNM , Hassan H , Jomhari N. The use of mobile phones by elderly: a study in Malasia perspectives. J Soc Sci. 2008; 4:123-127.
[30] Velazquez O, Rosas M, Lara A, Pastelin G, Gutierrez G, Henry M. Prevalencia e interralacion de enfermedades crónicas no transmisibles y factores de riesgo cardiovascular en México: Resultados finales de la encuensta nacional de Salud (ENSA) 2000. Arch Cardiol Mex. 2003; 73(1):62-77.
[31] Chen X, Mao G, Leng S. Frailty Syndrome: an overview. Clin Interv Aging. 2014; 9:433-441.
[32] Collard R, Boter H, Schoevers R, Oude R. Prevalence of Frailty in Community-Dwelling Older Persons: A Systematic Review. J Am Geriatr Soc. 2012; 60(8):1487-92.
[33] Aguilar S, Amieva H, Gutierrez L, Avila J. Frailty among community-dwelling elderly: a story told 11 years later. The Mexican Health and Aging Study. Salud Publica Mex. 2015; 57(3):62-9.
[34] Sanchez S, Sanchez R, Garcia P, Rosas O, Avila J. Frailty among community-dwelling elderly Mexican people: Prevalence and association with sociodemographic characteristics, health state and the use of health services. Geriatr Gerontol Int. 2014; 14(2):395-402.
[35] Ottenbacher KJ, Ostir GV, Peek MK. Frailty in older Mexican Americans. J Am Geriatr Soc. 2005;(53):1524-1531.
[36] Katz S, Ford AB, Moskowitz RW. Studies of illness in the aged. The index of ADL: a standardized measure of biological and psychosocial function. JAMA. 1963;(185):914-919.
[37] Zheng Z, Guan S, Wang Z, Zhang J, Zhao J, Ma J, et al. Prevalence and Incidence of Fraity in Community-Dwelling Older People: Beijing Longitudinal Study of Aging II. Journal of the American Geriatrics Society. 2016 june; 64(6):1281-1286.
[38] Peltzer K,HS,YA,MP,PRW,G,AP,SJ,CS,EM,&KP. Prevalence of Loss of All Teeth (Edentulism) and Associated Factors in Older Adults in China, Ghana, India, Mexico, Russia and South Africa. International Journal of Environmental Research and Public Health. 2014 october.
[39] O'Neil A, Berk M, Venugopal K, Kim S, Williams L, Jacka F. The association between poor dental health and depression: findings from a large-scale, population-based study (the NHANES study). General Hospital Psychiatry. 2014; 36(3):266-270.
[40] Islas Granillo H, Borges Yañez A, Fernandez Barrera M, Avila Burgos L, Patiño Marin N, Marquez Corona M, et al. Relationship of hyposalivation and xerostomia in Mexican elderly with socioeconomic, sociodemographic and dental factors. SCIENTIFIC REPORT. 2017 January; 7:1-8.
[41] Islas Granillo H, Borges Yañez A, Fernandez Barrera M, Avila Burgos L, Patiño Marin N, Marquez Corona M, et al. Relationship of hyposalivation and xerostomia in Mexican elderly with socioeconomic, sociodemographic and dental factors. SCIENTIFIC REPORT. 2017 January; 7.
[42] Castrejon Perez R. Salud bucal en los adultos mayores y su impacto en la calidad de vida. In Gutierrez R, Gutierrez A, editors. Envejecimiento humano. Una visión transdisciplinaria.: Secretaría de Salud México; 2010.258-270.
[43] Medina Solís C, Pontigo Loyola A, Pérez Campos E, Hernández Cruz P, Avila Burgos L, Mendoza Rodríguez M, et al. Edentulism and other variables associated with self-reported health status in Mexican adults. Medical Science Monitor. 2014 april.

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[44] Castrejón Pérez R, Borges Yáñez A, Gutiérrez Robledo L, Ávila Fuentes J. Oral health conditions and frailty in Mexican community-dwelling elderly: a cross sectional analysis. BMC PUBLIC HEALTH. 2012; 12.

Table 1: Prevalence of swallowing disorder according to the sociodemographic and clinical characteristics

	Swallowing disorder	
***Variable* (total)**	*Cough* **n, (%)**	*Choking* **n, (%)**
Sex		
Female (154)	24 (16)	26 (17)*
Male (106)	10 (9.4)	6 (6)*
Age, years		
60-74 (176)	24 (14)	22 (13)
75-84(84)	8 (10)	9 (11)
85+ (4)	2 (50)	1 (25)
Marital status		
Married (165)	21 (13)	21 (13)
Widowhood (75)	11 (15)	10 (13)
Smoking		
Yes (94)	12 (13)	12 (13)
No (167)	22 (13)	20 (12)
Depression (GDS >5)		
Yes (65)	14 (22)*	13 (20)*
No (194)	20 (10)*	19 (10)*
MCI (MMSE <23)		
Yes (96)	18 (19)*	16 (17)
No (164)	16 (10)*	16 (10)
Pain		
Yes (125)	22 (18)*	19 (15)
No (136)	12 (9)*	13 (10)
Immobility High Risk		
Yes (18)	5 (28)	5 (28)*
No (242)	29 (12)	26 (11)*
Disability (Barthel)		
Yes (7)	2 (29)	1 (14)
No (254)	32 (13)	31 (12)
Lawton (Male Disability)		
Yes (189)	23 (12)	22 (12)
No (72)	11 (15)	10 (14)
Lawton (Female Disability)		
Yes (123)	18 (15)	16 (13)
No (138)	16 (12)	16 (12)
Obesity		
Yes (77)	6 (8)	8 (10)
No (183)	28 (15)	23 (12)
Overweight		
Yes (58)	10 (17)	10 (17)
No (202)	22 (11)	21 (10)
Weight Loss (Last Year)		
Yes (39)	9 (23)*	9 (23)*
No (222)	25 (11)*	23 (10)*
Nutritional Risk (DNA>6)		
Yes (6)	4 (68)*	4 (68)*
No (255)	30 (12)*	28 (11)*

GDS: Geriatric Depression Scale, *MCI*: Mild Cognitive Impairment *MMSE*: Mini Mental State Evaluation, *DNA*: Questionnaire for the detection of malnutrition in older adults. * P < 0.05

Table 2: Univariate Regression Logistic Analyses of geriatrics syndromes by Swallowing disordervariables

Variable	Swallowing disorder	
Geriatric Syndrome scores, per SD	*Cough* *OR* *(95%IC)* P	*Choking* *OR* *(95%IC)* P
Falls	1.3 (0.6-2.6), *0.5*	1 (0.5-2.29), *0.85*
Depression (GDS>6)	2.4 (1.15-5.16), *0.02**	2.30 (1-5), *0.03**
Disability		
ADL (Lawton)		
Female	1.3 (0.6-2.6), *0.48*	1.14 (0.54-2.4), 0.*72*
Male	0.77 (0.35-1.7), *0.5*	0.81 (0.37-1.82), *0.62*
IADL (Barthel)	2.7 (0.5-15), *0.23*	1.2 (0.14-10), 0.87
MCI (MMSE<23)	2.12 (1-4.4), *0.043**	1.85 (0.88-3.9), *0.10*
Mobility (Rosow-Breslow)	2.8 (0.9-8.5), *0.05**	3.20 (1-9.7), *0.04**
Malnutrition		
Obesity	0.5 (0.2-1.2), *0.11*	0.80 (0.34-1.89), *0.6*
Overweight	1.5 (0.7-3.4), *0.3*	1.79 (0.8-4.06), *0.16*
Weight loss	2.35 (1-5.5), *0.04**	2.6 (1.09-6.1), *0.03**
Malnutrition risk (DNA)	15 (2.6-85), *0.002**	16 (2.8-92.6), *0.002**
Pain	2.2 (1.05-4.7), *0.03**	1.7 (0.8-3.6), *0.17*

[a]Model 1: Univariate by Swallowing disorder variables

GDS: Geriatric Depression Scale, *ADL*: Activities Daily Living,*IADL*: Activities Daily Living, *MCI*: Mild Cognitive Impairment*MMSE*: Mini Mental State Evaluation, *DNA*: Questionnaire for the detection of malnutrition in older adults. * P < 0.05

Table 3: Multivariate Regression Logistic Analyses of geriatrics syndromes by Swallowing disorder variables

Variable	**Swallowing disorder**	
Geriatric Syndrome scores, per SD	*Cough* *OR* *(95%IC)* P	*Choking* *OR* *(95%IC)* P
Depression (GDS)	2.28 (1.056-4.5), 0.030*	2.31 (0.98-5.4), 0.04*
MCI	2.02 (0.93-4.40), 0.07	-
Mobility (Rosow-Breslow)	2.56 (0.79-8.32), 0.11	3.5 (1.024-12.3), 0.04*

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Malnutrition Weight loss Malnutrition risk (DNA)	 2.12 (0.88-5.1), 0.09 14.6 (2.4-89.66), 0.004*	 2.76 (1.101-6.92), 0.03* 42 (3.7-486.2), 0.002*
Pain	2.03 (0.93-4.4), 0.072	-

[b]Model 2: Model Univariateplus adjusted by age, sex and literacy.

GDS: Geriatric Depression Scale, *MCI*: Mild Cognitive Impairment, *DNA*: Questionnaire for the detection of malnutrition in older adults. * P < 0.05

Acknowledgment: none.

Conflict of interest: none.

Financial Disclosure: All authors state no financial interest, stock, or derived direct financial benefit.

Previous presentations: none.

Elements of Financial/Personal Conflicts	JADR		MIMC		YCJA		CFA		VMRA		EAC		DLM	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Employment or Affiliation		X		X		X		X		X		X		X
Grants/Funds		X		X		X		X		X		X		X
Honoraria		X		X		X		X		X		X		X
Speaker Forum		X		X		X		X		X		X		X
Consultant		X		X		X		X		X		X		X
Stocks		X		X		X		X		X		X		X
Royalties		X		X		X		X		X		X		X
Expert Testimony		X		X		X		X		X		X		X
Board Member		X		X		X		X		X		X		X
Patents		X		X		X		X		X		X		X
Personal Relationship		X		X		X		X		X		X		X

Drs Díaz-Ramos, Mondragon-Cervantes, Jiménez-Acosta, and de la Fraga-Ávila developed conceptualization and design of the study, searched the information and interpreted the data. Drs, Mondragon-Cervantes, Jiménez-Acosta and Díaz-Ramos wrote the manuscript under the supervision of Drs Ramírez-Anguiano, Coss-Adame, and Leal-Mora. The co-authors certify that they have participated substantially in the conceptualization and design of this work and the analysis of the data as well as the writing of the manuscript. They have reviewed the final version of the manuscript, and have approved it for publication.

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