



# Contributing Factors of Dysphagia in Indonesian Elderly

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## Abstract

**Objective** Dysphagia is one of the signs that can describe oral hypofunction in the elderly. This condition is usually not noticed nor realized by the elderly and their families, resulting in disability and death. Studies on the relationship between age, gender, education, the number of systemic diseases, and the number of remaining teeth toward dysphagia in the elderly are still limited, so further research is needed. The aim of this study was to analyze the relationship between age, sex, education level, the number of systemic diseases, and the number of remaining teeth with dysphagia and find out which factors contribute the most to dysphagia. The contributing factors need to be known to minimize the risk of dysphagia.

**Materials and Methods** This is a cross-sectional study with 121 elderly aged 60 years living in community dwellings as subjects of this study. General health data were obtained from anamnesis; demographic data were also collected and an examination of the number of remaining teeth was carried out and recorded on the odontogram by one researcher. After that, a dysphagia screening tool was given for self-assessment or assisted by the two researchers according to the conditions felt. Two researchers were calibrated before collecting data.

**Results** In the bivariate analysis, age, the number of remaining teeth, and several systemic diseases were associated with dysphagia ( $p = 0.027$ ,  $0.023$ , and  $0.047$ , respectively). No association was found between gender, education, and dysphagia status ( $p > 0.05$ ). Age ( $p = 0.027$ ), gender ( $p = 0.165$ ), number of remaining teeth ( $p = 0.023$ ), and the number of systemic diseases ( $p = 0.047$ ) are the risk factors that were included in the multivariate model. From the final multivariate model, the number of remaining teeth ( $p = 0.017$ ; odds ratio [OR] = 4.318), several systemic diseases ( $p = 0.036$ ; OR = 2.427), and age ( $p = 0.072$ ; OR = 1.962) contributed most to the dysphagia status, after controlling for confounding variables.

**Conclusion** It is concluded that the number of remaining teeth, several systemic diseases, and age are the factors that contribute the most to the occurrence of dysphagia.

## Keywords

- ▶ elderly
- ▶ dysphagia
- ▶ age
- ▶ number of remaining teeth
- ▶ systemic diseases

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## Introduction

Dysphagia is a subjective sensation of difficulty or inability to swallow fluids and/or food from the oral cavity to the abdominal cavity.<sup>1-4</sup> According to the Japanese Society of Gerodontology, dysphagia is one of the signs that can describe oral function hypofunction. This condition can be prevented and treated so that it does not progress to the stage of irreversible oral dysfunction.<sup>5</sup> Dysphagia could occur in all age groups (infants to the elderly), but it is more prone to occur in the elderly. As much as 15 to 40% elderly people aged over 60 years experience dysphagia.<sup>2</sup> Igarashi et al also stated that up to 53.8% dependent elderly and 25.1% independent elderly are at risk of experiencing dysphagia.<sup>6</sup> The causes of dysphagia are various, depending on the cause and the accompanying systemic conditions.<sup>1,2,7,8</sup> Treatment is multidisciplinary and requires collaboration between otolaryngologists, dentists, neurologists, pulmonologists, nutritionists, nurses, and cardiologists.<sup>3</sup>

Dysphagia tends to affect the elderly population, as many of the causes of dysphagia are associated with increasing age. Kawashima et al stated that as many as 13.8% of independent elderly people experience dysphagia.<sup>9</sup> According to Holland et al, one in nine elderly healthy people exhibit signs and symptoms of dysphagia, with a prevalence of 11.4% in the healthy elderly population in United Kingdom.<sup>10</sup> In Korea, 33.7% of elderly people show symptoms consistent with dysphagia in the community.<sup>11</sup> Based on these data, we carried out our study in the community. In Indonesia, every community population has an Elderly Integrated Healthcare Services Center that holds activities for the elderly. This is a government program, and the activities are held every month and followed regularly by the elderly in their community. To be able to reach elderly people in the community, researchers considered conducting research involving these activities. The population in the community describes the elderly population in Indonesia.

The etiology and risk factors need to be known to minimize the risk of dysphagia. One factor that plays a role is age. As they get older, individuals experience the aging process that can cause characteristic changes in the swallowing mechanism. This is because the orofacial structures and functions experience loss of mucosal elasticity, decreased performance, and motor function in the oral cavity and its surroundings. Haresaku et al stated that age has a significant relationship with the occurrence of dysphagia.<sup>12</sup> Several studies support this theory.<sup>13,14</sup> However, other studies, like Inui et al, found contradictory results.<sup>15</sup> This is due to the differences in the inclusion criteria, the research methods, and the measurement tools used.<sup>15</sup> Therefore, further research in the subject is required.

Humans in their life will experience a gradual decrease in the physiological function, caused by the aging process. As a result, the elderly are susceptible to one or several systemic diseases. Therefore, it is extremely difficult to remove the link between aging and dysphagia from the other confounding variables because these occur simultaneously.<sup>16</sup> Baijens et al observed that dysphagia itself is a geriatric syndrome. Dysphagia is a clinical condition in the elderly that does not

fit into the disease category but ordinarily in old age, is associated with multiple comorbidities, and gives poor outcomes. It can only be treated with a multidisciplinary approach.<sup>4</sup> Geriatric patients are elderly patients with multiple diseases and/or disorders due to decreased organ function and psychological, social, economical, and environmental issues, and they require health services in an integrated manner with a multidisciplinary approach.<sup>17</sup> In China, Zhang et al conducted a study regarding the effect of comorbidities (stroke, cancer neurodegenerative disease in the head and neck) on dysphagia. They found that elderly people with comorbidities have a 2.9 times higher risk of showing symptoms of dysphagia.<sup>18</sup> However, there are no data about the relationship and influence of a person who has several diseases (more than one disease) on the occurrence of dysphagia, so further research is needed.

Research on the impact of sociodemographic factors such as gender and education on the occurrence of dysphagia in the elderly is still limited. Park et al stated that gender has a significant relationship with the risk of dysphagia (males are 1.83 times more likely to experience dysphagia) and education has no relationship with the occurrence of dysphagia.<sup>19</sup> van Der Maarel-Wierink et al conducted a cross-sectional study regarding the prevalence of dysphagia in the elderly community in the Netherlands. They found that gender had no relationship with the occurrence of dysphagia.<sup>14</sup> Zhang et al observed that gender did not affect the occurrence of dysphagia in patients who had stroke, neck and head cancer, and neurodegenerative diseases in China.<sup>18</sup> Lim et al found that women (odds ratio [OR] = 1.82) and low education (OR = 2.29) are risk factors for dysphagia in South Korea.<sup>20</sup> These studies show different results. It is necessary to study whether gender and education play a role in the occurrence of dysphagia.

Several studies have shown that dysphagia has a significant relationship with dental and oral health problems that are often faced by the elderly, who experience tooth loss. The teeth play an essential role in mastication and directly play a role in the swallowing process. The World Dental Federation recommends that individuals aged 65 and above should have 20 or more teeth. The World Health Organization (WHO) also suggests that the elderly have at least 20 natural teeth to measure oral health.<sup>21</sup> However, the recommendation is still not seen in terms of the function of swallowing. Research by Okamoto et al found that those with 13 to 22 teeth have a higher risk of dysphagia compared to those with 27 to 32 remaining teeth.<sup>13</sup> Inui et al also observed that the elderly with an average number of 19 remaining teeth may experience dysphagia, while those with 24 teeth do not experience dysphagia.<sup>15</sup> In addition, according to Okabe et al, many elderly people do not experience dysphagia if they have a small number of teeth remaining.<sup>22</sup> There is a difference in the number of teeth and the risk of dysphagia, so further research is needed.

The main objective of this study was to analyze the relationship between age, sex, education, the number of remaining teeth, and the number of systemic diseases with dysphagia and the factors that contribute the most to dysphagia.

## Materials and Methods

This research was a cross-sectional study conducted from August to October 2022. Data were collected using consecutive sampling method from 121 elderly aged 60 years and above, who attended at the Elderly Integrated Healthcare Services Center activities in East Jakarta. This research was approved by the Ethical Committee of the Faculty of Dentistry, Universitas Indonesia (No. 39/Ethical Approval/FKGUI/VI/2022).

Individuals aged 60 years and above who can read, speak, and communicate in Indonesian both orally and in writing were included in this study. If they were not willing to participate in this study, they were excluded. The researcher was assisted by two researchers (students of dentistry) in distributing the 10-item Eating Assessment Tool in Indonesian EAT-10 (EAT-10-ID) questionnaire. Before data collection was carried out, two researchers were trained to be able to use the EAT measuring instrument. Then the two researchers filled in EAT 10-ID on the same 10 participants each. The results were analyzed using the kappa test to investigate the similarity of the measurement. The result showed a kappa of 0.80 indicated good similarity of measurement between the two researchers.

Dental examinations were carried out by one researcher. The number of teeth in each participant was recorded. The remaining teeth were defined as healthy, caries enamel or dentin, amalgam or composite filling, restoration (including crowns, inlays, bridge abutment teeth), removable dentures that replace lost teeth, and fully erupted third molars. After we collected the data, we counted the number of remaining teeth in each participant. The denture and fixed prosthesis were counted as remaining teeth. Meanwhile, systemic disease data were obtained via anamnesis, and the total number of systemic disorders everyone had were tallied.

The EAT-10-ID is valid and reliable and is used to identify the risk of experiencing dysphagia in an individual. EAT-10-ID demonstrated good internal and external consistency (Cronbach's alpha of 0.896 and interclass correlation of 0.935). EAT-10-ID also showed a correlation with the 3-oz water swallow test as a clinical symptom measurement tool for dysphagia, meaning the EAT-10-ID distinguishes individual with and without the risk of dysphagia. The EAT-10-ID consists of 10 items and each statement is scored from 0 (no problem) to 4 (severe problem). If the total score is  $\geq 3$ , then the individual has a risk of experiencing dysphagia.<sup>23</sup>

After obtaining the data according to the sample, statistical analysis tests were carried out using the chi-squared test and continuity correction to analyze the relationship between age, sex, education, number of remaining teeth, and the number of systemic diseases on the dysphagia status. A multivariate analysis used a logistic regression test using the backward elimination selection method. The independent variables that are not significant are removed one by one from the model, and the final result is the final model consisting of significant variables ( $p < 0.05$ ) and meaningful variables.

## Result

This research was conducted in the community involving 121 elderly, comprising 34 males and 87 females. The age of the participants ranged from 60 to more than 80 years. Seventy-two people were aged 60 to 69 years (59.5%), 38 people were 70 to 79 years (31.4%), and 11 people were  $\geq 80$  years (9.1%).

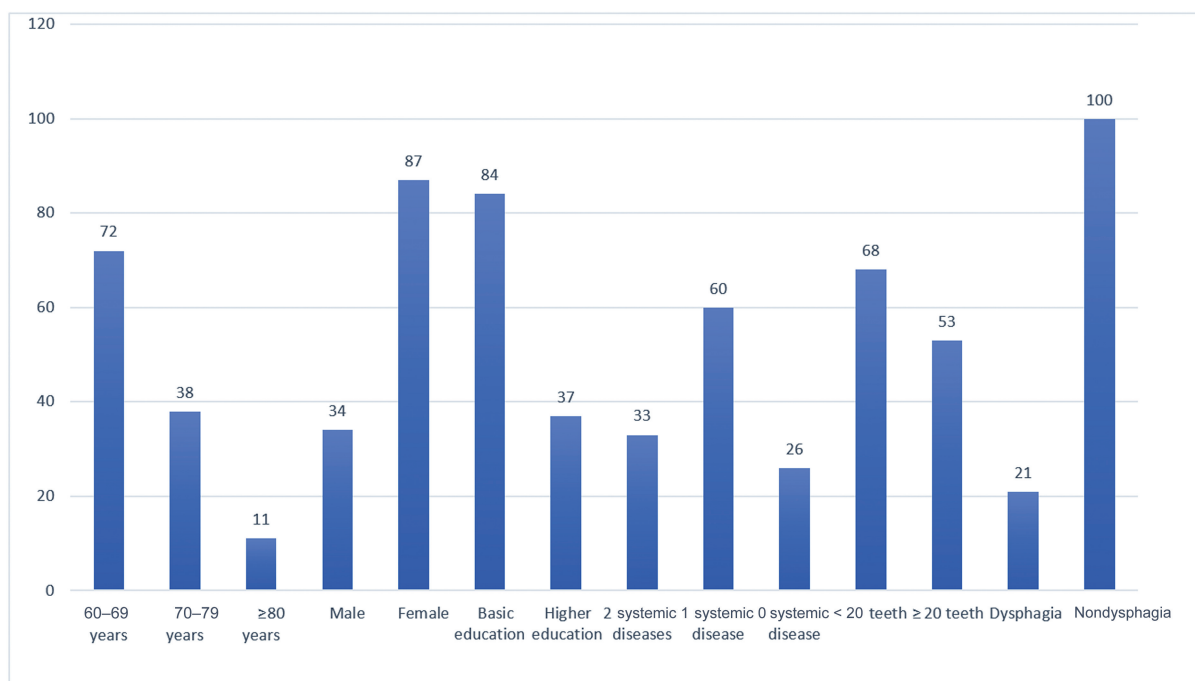
► **Table 1** shows that only 37 people (30.6%) had a higher education, which is senior high school and university level education. In this study, 60 individuals had 1 systemic disease

**Table 1** Frequency and relationship of age, gender, education, number of remaining teeth, and number of diseases to the risk of dysphagia (EAT-10-ID)

Independent variable		Dysphagia risk n(%)	No risk of dysphagia n(%)	Total (n = 121)	p-value
Age (y)	60–69	7 (9.7%)	65 (90.3%)	72 (59.5%)	0.027 <sup>a</sup>
	70–79	11 (28.9%)	27 (71.1%)	38 (31.4%)	
	$\geq 80$	3 (27.3%)	8 (72.7%)	11 (9.1%)	
Gender	Male	9 (26.5%)	25 (73.5%)	34 (28.1%)	0.165 <sup>b</sup>
	Female	12 (13.8%)	75 (86.2%)	87 (71.9%)	
Education	Basic education (elementary school, junior high school)	15 (16.7%)	70 (83.3%)	84 (69.4%)	1.000 <sup>b</sup>
	Further education (senior high school, college)	6 (19%)	30 (81%)	37 (30.6%)	
Number of systemic diseases	0 systemic diseases	2 (7%)	26 (93%)	28 (23%)	0.047 <sup>a</sup>
	1 systemic disease	9 (15%)	51 (85%)	60 (50%)	
	2 systemic diseases	10 (30%)	23 (70%)	33 (27%)	
Number of remaining teeth	<20 teeth	17 (25%)	51 (75%)	68 (56.2%)	0.023 <sup>b</sup>
	$\geq 20$ teeth	4 (7.5%)	49 (92.5%)	53 (43.8%)	

<sup>a</sup>Chi-squared test.

<sup>b</sup>Continuity correction.



**Fig. 1** Characteristics of the participants in the study and the contributing factors of dysphagia in the Indonesian elderly.

(50%), 33 individuals had 2 systemic diseases (27%), and 28 participants (23%) did not have a systemic disease. Sixty-eight elderly (56.2%) had less than 20 remaining teeth and 53 (43.8%) had ≥20 remaining teeth. In addition, 21 elderly (17.4%) were at risk of experiencing dysphagia (►Fig. 1).

In ►Table 1, frequency data and the relationship between age, gender, education, number of systemic diseases, and the number of remaining teeth with dysphagia are presented. The results of statistical analysis showed that age, number of systemic diseases, and number of remaining teeth had a significant relationship with the risk of dysphagia ( $p \leq 0.05$ ), while gender and education did not have a significant relationship with the risk of dysphagia ( $p > 0.05$ ). Age, gender, number of systemic diseases, and number of remaining teeth had a  $p$ -value of less than 0.25, so that these variables can be included in the multivariate analysis.

►Table 2 shows the results of the multivariate logistic regression with the best results obtained if the gender variable is excluded. The most significant were the number of systemic diseases ( $p = 0.036$ ) with an odds ratio of 2.427, the number of remaining teeth ( $p = 0.017$ ) with an odds ratio of 4.318, and age ( $p = 0.072$ ) with an odds ratio of 1.962 for

dysphagia. From these results, it was clear that the number of remaining teeth, the number of systemic diseases, and age were the factors contributing the most to dysphagia (EAT-10-ID). This final model had an  $R^2$  of 21.4%.

### Discussion

Swallowing ability is a part of oral function in each individual. People often do not pay attention to swallowing ability due to lack of knowledge and do not carry out regular medical health checks.<sup>1</sup> With increasing age, the muscular and nervous systems weaken, and poor dental and oral health conditions can lead to dysphagia. The consequences of dysphagia are not only aspiration pneumonia but also dehydration, malnutrition, weight loss, susceptibility to other diseases, and death. To avoid this, the role of medical personnel, especially doctors and dentists, is needed to detect elderly people who are at risk of dysphagia early.

The aging process can cause a person to experience changes in the characteristics of the swallowing mechanism. Haresaku et al observed a significant relationship between dysphagia (EAT-10) and age in elderly psychiatric patients.<sup>12</sup>

**Table 2** The final model multivariate analysis showed the most contributing factor for dysphagia

Variables	Coefficient	OR	$p$ -value	95% CI
Age	0.674	1.962	0.072	0.941–4.088
Number of systemic diseases	0.887	2.427	0.036 <sup>a</sup>	1.062–5.547
Number of remaining teeth	1.463	4.318	0.017 <sup>a</sup>	1.299–14.356
Constant	-3.594		0.131	

Abbreviations: CI, confidence interval; OR, odds ratio.

<sup>a</sup> $p$ -value < 0.05.

In contrast, Inui et al found no significant relationship between age and dysphagia (repetitive saliva swallowing test) in the elderly patients.<sup>15</sup> This difference in the study results is due to the differing sample population in the studies, that is, healthy individuals were involved in the study by Inui et al and the measuring instruments used for assessing dysphagia were different. Although there are differences in the results obtained, theoretically changes in swallowing characteristics due to the aging process are caused by changes in the orofacial structure and function due to loss of elasticity of the oral mucosa, decreased performance, and motor function in the oral cavity and its surroundings. As a result, the elderly are at high risk of experiencing dysphagia.<sup>16</sup>

In the final result, age is one of the most influential variables in the swallowing function. Okamoto et al observed that swallowing problems experienced due to aging are more likely to occur in individuals with a small number of teeth (0–12), with an OR = 2.49 for risk of experiencing dysphagia.<sup>13</sup> According to van der Maarel-Wierink et al, elderly people had a 0.978 chance of experiencing dysphagia.<sup>14</sup> This is because a person would lose more and more teeth as they grow older. In the same study, it was found that the number of teeth in the mouth had a direct impact on the ability to swallow, which is an indicator of dysphagia. Thus, it can be concluded that the status of missing teeth in the mouth can be an intermediary for an elderly person experiencing dysphagia.<sup>24</sup>

This study showed that gender and education did not have a significant relationship with the dysphagia status. This is similar to the research by Zhang et al who conducted a study on the prevalence of dysphagia in China. They did not find any significant relationship between gender and dysphagia.<sup>18</sup> For education, it is similar to research by Park et al who found no relationship between education and the occurrence of dysphagia. However, they observed that gender had a significant relationship with the risk of dysphagia (males are 1.83 times more likely to experience dysphagia than females).<sup>19</sup> Lim et al found the female gender (OR = 1.82) and low education (OR = 2.29) to be risk factors for dysphagia in South Korea.<sup>20</sup> This difference is due to other accompanying risk factors such as systemic diseases (nervous and musculoskeletal disorders) and low dental and oral health, which have a high probability of occurring in certain sex groups and different location sampling.<sup>7,15,24</sup> However, research is needed in different locations to increase knowledge regarding this matter.

The number of systemic diseases suffered by the elderly has a significant relationship with the occurrence of dysphagia. The findings of this study are similar to that of Zhang et al who found comorbidities to be related to the occurrence of dysphagia.<sup>18</sup> Individuals with  $\geq 2$  systemic diseases have a high risk of experiencing dysphagia. This is because elderly people with systemic diseases are susceptible to dysphagia. This is because dysphagia itself is a of geriatric syndrome that needs consideration and a multidisciplinary approach.<sup>4</sup>

In this study, the number of systemic diseases is the factor contributing the most to dysphagia. Elderly people who have

one or  $\geq 2$  systemic diseases are 2.47 times more at risk of experiencing dysphagia than the elderly group with no systemic diseases. Similar to Zhang et al, we found that the elderly with comorbid conditions have 2.9 times higher risk of showing symptoms of dysphagia. The comorbid conditions studied by Zhang et al were stroke, neurodegenerative disease, and cancer of the head and neck. They were systemic diseases that were predisposing factors to dysphagia.<sup>18</sup> In this study, individuals with comorbid conditions such as stroke, hypertension, diabetes mellitus, laryngeal cancer, cardiovascular disease, tuberculosis, upper respiratory tract infection, Parkinson's disease, essential tremor, osteoporosis, prostate cancer, and appendicitis were at risk of experiencing dysphagia. Systemic diseases such as stroke, laryngeal cancer, and Parkinson's disease are the risk factors for dysphagia.<sup>2</sup> Other diseases are also associated with dysphagia. Several systemic conditions that were not found in this study are also risk factors for dysphagia. These include gastroesophageal reflux disease (GERD), progressive neurological diseases such as dementia, Alzheimer's, multiple sclerosis, cerebral palsy, amyotrophic lateral sclerosis, and others. Some drugs such as sedatives, neuroleptics, anticholinergics, tricyclic antidepressants, steroids, antipsychotics, and bisphosphonates also trigger dysphagia.<sup>4,7</sup> Thus, geriatric patients are at risk of developing dysphagia due to a combination of several systemic diseases they suffer from.<sup>4</sup>

In this study, the number of remaining teeth has a relationship with and influences the occurrence of dysphagia. A prospective study by Okamoto et al showed that individuals with 0 to 12 remaining teeth (OR = 2.49) or 13 to 22 teeth (OR = 2.42) were at higher risk of dysphagia compared with those with 27 to 32 teeth (OR = 1.00).<sup>13</sup> In a study by Furuta et al, the risk of developing dysphagia was higher if the elderly had fewer than nine teeth (OR = 2.82).<sup>25</sup> Inui et al also found that the elderly with an average of 19 remaining teeth can experience dysphagia, while those with 24 remaining teeth had no history of complaints of dysphagia.<sup>15</sup> In this study, the individuals with fewer than 20 teeth were at higher risk of dysphagia than those who had more than 20 teeth because occlusal forces were maintained (200 N) in mastication and swallowing functions.<sup>21</sup> People who have fewer teeth are less capable of mastication. They could struggle to create a bolus with the viscosity and particle size necessary for swallowing without delaying the process. Reduced bolus viscosity may make elderly people with fewer teeth more susceptible to developing swallowing issues.<sup>13</sup>

Treatment for dysphagia mostly relies on the etiology. Nonetheless, compensatory and rehabilitative techniques are the two main forms of treatment to reduce dysphagia symptoms for safely swallowing boluses. Compensation techniques focus on applying techniques to facilitate food and fluid intake through safe oral administration on an ongoing basis as an alternative for nutritional intake such as changes in body posture, swallowing maneuvers, and dietary modifications. Strategies for rehabilitation are aimed at enhancing the physiology of swallowing disorder.<sup>3,26</sup> Numerous methods have been implemented by fusing



several types of physical activity. Swallowing therapies by exercise have been demonstrated to enhance swallowing function, limit or prevent dysphagia and morbidity, and improve swallowing physiology. However, the specifics and volume of exercise vary widely throughout the rehabilitation approaches. Several exercises are used in swallowing rehabilitation, such as chewing gum, expiratory muscle strength training (EMST), the McNeill dysphagia therapy program (MDPT), using the Peko-panda tongue training device, rotational movement exercises, tongue right positioner (TRP), and exercises to push the tongue against the hard palate while closing the mouth.<sup>26-31</sup>

The result of this study shows the importance of prevention of missing teeth by regular maintenance of oral hygiene and replacing missing teeth with dentures. By replacing missing teeth, individuals can maintain jaw stabilization and not disrupt the swallowing phase (oral phase). Dentists take an important part in dysphagia prevention and further collaboration with medical doctors and other health workers is needed.

Our study has limitations. First, the systemic disease data from this study were obtained from anamnesis, and this study analyzed the number of systemic diseases suffered by individuals for dysphagia. Future studies should be done by taking into consideration the type of systemic disease of the individuals. Second, we examined the number of remaining teeth. A detailed examination of the condition of the dentures of individuals who wore dentures and the occlusion of the remaining teeth was not made. Therefore, further research focused on these details is required.

## Conclusion

This study shows that there is a relationship between the number of systemic diseases, age, and dysphagia, but there is no relationship between gender, education and dysphagia. The remaining teeth, the number of systemic diseases, and age are the variables that have the biggest influence on dysphagia.

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### Conflict of Interest

All other authors do not report any conflict of interest.

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