

The prevalence of and risk factors for dysphagia among elderly residents in nursing homes: a systematic review and meta-analysis

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Abstract

Background

Elderly residents in nursing homes are at high risk for dysphagia. However, the prevalence estimates of this condition and its risk factors among this population were inconsistent.

Objective

To estimate the prevalence of dysphagia and examine its risk factors among the elderly in nursing homes.

Methods

Electronic database of PubMed, Web of science, Embase for English language, Wangfang, VIP and CNKI for Chinese language were systematically searched to identify relevant observational studies published not later than July 4, 2021. Studies conducted in nursing homes and reported dysphagia assessment methods were included.

Results

In total, 43 studies involving 56,746 participants were included in this systematic review and meta-Analysis. The overall pooled crude prevalence of dysphagia was 35.9% (95%CI: 29.0%, 43.4%), with high heterogeneity ($I^2 = 99.5\%$). There was a statistically significant difference in prevalence estimates with respect to study locations, methods of assessment of dysphagia, dysphagia assessment staff, representativeness of samples, and validity of assessment tools. Pooled estimates indicated that male (OR = 1.13, 95%CI: 1.00, 1.27), cognitive impairment (OR = 2.47, 95%CI: 1.59, 3.84), functional limitation (OR = 2.59, 95% CI: 1.75, 3.84), cerebrovascular disease (OR = 2.90, 95%CI: 1.73,4.87), dementia (OR = 1.50, 95%CI: 1.15, 1.96) and Parkinson's disease (OR = 1.81, 95%CI: 1.06, 3.08) were significant risk factors for dysphagia.

Conclusions

The prevalence of dysphagia in nursing homes is relatively high, and with high heterogeneity. Also, many factors were associated with the risk of dysphagia. Further research is needed to identify strategies for management and interventions targeted at these disorders in this population.

Background

Dysphagia was listed as one of the geriatric syndromes in the European Union Geriatric Medicine Society white paper in 2016¹. It may lead to adverse physical consequence and fatal complications, such as aspiration pneumonia, malnutrition and dehydration²⁻⁴. Although diet is a pleasant social activity, people with swallowing problems were more likely to report depression symptoms and lower quality of life^{5 6}. Studies suggest that residents in nursing homes experience high rates of dysphagia. However, estimates of the prevalence of dysphagia in nursing homes varied across studies from 15% to 70%⁷. This variation may be explained by various assessment methods of dysphagia. In this regard, there is lack of reliable estimate of dysphagia prevalence among the elderly in nursing homes in the current literature. Furthermore, several risk factors associated with dysphagia have been reported, some of which are having advanced age, functional limitations, history of dementia, cognition impairment, and neuromuscular impairments⁸⁻¹⁰. These also varied across studies, and most of which were done in clinical or community settings.

Reliable estimates of the prevalence of dysphagia, and identification of risk factors for dysphagia, are important for informing efforts to prevent and treat swallowing problems and its complications, especially in nursing homes where this condition has frequently been reported. Therefore, we conducted this systematic review and meta-analysis to estimate the prevalence of dysphagia among the elderly in nursing homes and explore its risk factors.

Methods

Data sources and search strategy

This systematic review and meta-analysis of scientific peer-reviewed literature were performed using the recommendations from the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guideline (See Table S1 in supplement).

A systematic literature search for English studies published not later than July 4, 2021 was conducted in the Embase, PubMed, and Web of Science databases. A systematic literature search for Chinese studies was also conducted in the WanFang, CNKI and VIP databases. All these searches focused on studies that assessed the prevalence and risk factors of dysphagia in nursing homes. The following search terms were used: (swallowing OR swallowing disorder OR swallowing impairment OR dysphagia OR deglutition disorder OR swallowing difficulty OR swallowing dysfunction OR swallowing problem OR oropharyngeal dysphagia OR esophageal dysphagia) AND (assisted living facility OR care facility OR nursing home OR homes for the aged OR long-term care OR care home OR institutionalized elderly OR residential aged care facility OR skilled nursing facility OR institution OR residential care). References in the

retrieved papers and citations of relevant reviews were checked and hand searched for further references and to minimize the chance of missing substantial studies. Gray literature was not included in this study.

Inclusion criteria

Studies that met the following criteria were included for data extraction: (1) reported data on individual dysphagia with 60 years or older, (2) observational study design, (3) published in peer-reviewed journals, (4) reported dysphagia assessment method, and (5) conducted in nursing homes. Reviews, case reports, and conference abstracts were excluded.

Data extraction and quality assessment

Two independent authors (Zhao Hu and Baohua Zheng) retrieved relevant literature. The first-round screening was performed based on the title and abstract to exclude irrelevant studies. Next, the remaining articles were screened based on full text, and articles that did not meet the inclusion criteria were excluded. Any discrepancies on the selected studies were resolved by consensus with another author (Huilan Xu). Data extraction was performed using a standardized data collection form including first author and published year, study location, study design, sample size, age of participants, swallowing assessment method and prevalence of dysphagia. When there were studies involving the same population, only the most comprehensive or recent publications were included.

The same two authors independently assessed the risk of bias of these studies using a modified version of the Newcastle-Ottawa scale, which assesses sample representativeness and size, comparability between respondents and non-respondents, Assessment method of dysphagia and quality of descriptive statistics reporting (details are described in the supplement materials method S1). Studies were judged to be at low risk of bias (≥ 3 points) or high risk of bias (< 3 points). Any discrepancies were resolved by discussion and adjudication with another author (Huilan Xu).

Statistical analysis

Prevalence estimates of dysphagia in nursing homes were calculated by pooling the study-specific estimates using the random-effects meta-analyses that accounted for between-study heterogeneity. If data were extracted from a longitudinal study, only the rate from baseline measurements was included in the analyses. As the distribution of prevalence estimates in the original datasets was positively skewed, all estimates were transformed using a logit in order to meet the parametric assumption of normality. Standard χ^2 test and I^2 statistic were used to assess between-study heterogeneity. I^2 values of 25% and 75% were used as the criteria for classifying the degree of intertrial heterogeneity, namely low heterogeneity ($I^2 < 25\%$), moderate heterogeneity ($25\% \leq I^2 < 75\%$), and high heterogeneity ($I^2 \geq 75\%$).

Sensitivity analyses were conducted by omitting 1 study in each turn to determine the influence of individual studies on the overall prevalence estimates. Subgroup analyses were conducted to explore the potential sources of heterogeneity according to prespecified study-level characteristics as follows: location (Asia, Europe, North America, South America, and global), study design (cross-sectional or prospective), assessment method of dysphagia (subjective, objective, and subjective and objective), self-report of dysphagia (yes and no), country (China and all other countries), publication year (before 2010 or 2010 and after), assessment staff of dysphagia (SLP attend or not), and Newcastle-Ottawa Scale components risk of bias (low and high). Publication bias was visually assessed using funnel plots, and quantified by the Egger's test, when more than 7 studies were used to pool data.

The meta-analysis of association between risk factors and dysphagia was performed using a random effects model to ensure stability and reliability of the results, regardless of the degree of heterogeneity. All analyses were performed using R software version 4.0.2 (R Foundation for Statistical Computing). Statistical tests were 2-sided and used a significance threshold of $P < 0.05$.

Results

3.1 Literature search

A total of 2301 records were identified through electronic database searching (Pub Med : 651; Wos: 735; Embase: 664; Wangfang: 211; Vip: 25; CNKI: 15). After removing duplicate records (n=857), 1446 records remained to be screened for title and abstract. Therefore, 1,365 records were excluded after reading the title and abstract, which left 81 articles to be assessed for eligibility. Then, 38 studies were excluded for not reporting assessment method for dysphagia (n=20), for having study subject as facility rather than participants (n=3), for not conducted in nursing homes (n=7), for having study participants from the same sample (n=2) and for being intervention or pilot studies (n=6). In the end, 43 studies met the inclusion criteria and were included in the systematic review and meta-analysis. The flowchart of the study selection process is presented in Figure 1.

Figure 1. The flowchart of the study selection process

3.2 Characteristics of the included studies

The characteristics of the included studies are shown in Table 1. Forty-two studies involving a total of 56,746 individuals from the four continents (Europe, North America, South America, and Asia) were included in the analysis. Among these, 35 were cross-sectional studies and 8 were longitudinal studies. The sample size ranged from 30 to 23,549 participants. Various dysphagia assessment methods were used including mealtime screening tool, eating assessment tool-10 items (EAT-10), water swallow test (WST), 3-Ounce Water Swallow Test (3 oz WST), modified water swallow test (MWST), Yale Swallow Protocol (YSP), Gugging swallowing screentest (GUSS), flexible endoscopic evaluation of swallowing (FEES), videofluoroscopic swallowing study (VFSS), clinical swallow evaluation (CSE). Two studies used a polar question, whereas one study used two questions to assess dysphagia. Mean age of participants in most

of the studies was more than 80 years. The assessment staff included speech pathologist or therapist (SLP), dentist, clinician staff, nurse and self-reported. Four studies were at high risk of bias and others were at low risk of bias. The total Newcastle-Ottawa score for the studies appear in Table S2 in the supplement material.

Table 1 Characteristics of included studies

First author, year	Study design	Study location	Sample size	Age(years)	gender	Dysphagia assessment method	Dysphagia assessment staff	Prevalence(%)
Steele,1997 ¹¹	Cross-sectional	Canada	349	Mean:87	Male:69 Female:280	mealtime screening tool	SLP	68
Langmore,1998 ¹²	longitudinal	USA	41	60 or older	NA	FEES	Clinician	60.98
Kayser-Jones,1999 ¹³	Cross-sectional	USA	82	Mean:83.4	NA	CSE	SLP	55
Lin,2002 ¹⁴	Cross-sectional	Taiwan	1221	Mean:77.07	Male:634 Female:587	self-report; neurological examination; timed WST	Nurses	51.0
Kumlien, 2002 ¹⁵	Cross-sectional	Sweden	40	Median:80	NA	RAI	Nurses	22.5
Boczko,2006 ¹⁶	Cross-sectional	USA	199	Mean:79.9	Male:74 Female:125	dysphagia screening tool; CSE	Self-report; Clinician	15
Han, 2012 ¹⁷	Cross-sectional	China	931	Mean:83.9	Male:504 Female:427	Neill dysphagia screening test	NA	32.5
Takahashi,2012 ¹⁸	longitudinal	Japan	647	Mean:85.1	NA	Screening checklist	Caregiver report	26.43
Bomfim,2013 ¹⁹	Cross-sectional	Brazil	30	Mean:83.75	NA	CSE	SLP	63.3
Nogueira,2013 ²⁰	Cross-sectional	Portugal	266	Mean:82	Female:75%	DST, 3 oz WST	Self-report; SLP	DST:40.1 3 oz WST:38.2
Park,2013 ²¹	Cross-sectional	South Korea	395	Mean:80.7	Male:93 Female:302	GUSS	Nurses	52.70
Chen, 2014 ²²	Cross-sectional	China	400	60 or older	NA	CNSAT	NA	52.5
Maarel-Wierink, 2014 ²³	Cross-sectional	Netherlands	8119	Mean:84.0	Female:74%	Polar question	Self-report	9
Lindroos,2014 ²⁴	Cross-sectional	Finland	1466	Mean:83	Female:78%	Polar question	Caregiver report	11.8
Chen,2015 ²⁵	Cross-sectional	China	276	65 or older	NA	dysphagia screening tool	NA	41.3
Murakami, 2015 ²⁶	Cross-sectional	Japan	255	Mean:85.2	Male:58 Female:197	MWST	Dentists	15.69
Sarabia-Cobo, 2016 ²⁷	longitudinal	Spain	2384	Mean:88.7	Female:73.4%	EAT-10;3 oz WST	Clinician	69.6
Santos, 2016 ²⁸	Cross-sectional	England	166	elderly	NA	Medical record	HCPs	22.9
Wakabayashi, 2016 ²⁹	Cross-sectional	Japan	89	Mean:84	Male:20 Female:69	EAT-10	Self-report	29
Hollaar, 2017 ³⁰	Cross-sectional	Netherlands	373	Mean:83.3	Male:113 Female:260	Medical record	SLP	16
MacDonald,2017 ³¹	Cross-sectional	Canada	639	Mean:87	Male:199 Female:440	STAND;90 ml WST; mealtime observation	NA	59.2
Okabe, 2017 ³²	Cross-sectional	Japan	238	60 years or older	Male:52 Female:186	MWST	Dentists	18.5
Pu,2017 ³³	Cross-sectional	Hong Kong	865	Mean:84.5	Male:259 Female:606	WST	SLP	57.10

Rech,2017 ³⁴	Cross-sectional	Brazil	123	60 years or older	Male:42 Female:81	CSE	SLP	60.98
Streicher,2017 ³⁵	Cross-sectional	19 countries	23549	65 years or older	Male:5734 Female:17815	Polar question	Caregiver report	13.4
Brochier, 2018 ³⁶	Cross-sectional	Brazil	115	60 years or older	Female:67.0%	CSE	SLP	60.9
Huppertz,2018 ³⁷	Cross-sectional	Netherlands	6349	Mean:84.5	Female:70.2%	Two questions	Self-report	12.1
Wakabayashi, 2018 ³⁸	Cross-sectional	Japan	176	Mean:85	Male:39 Female:137	DSS	multidisciplinary coworkers	92.05
Yatabe, 2018 ³⁹	Cross-sectional	Japan	236	Mean:87.7	Male:52 Female:184	MWST	Dentists	16.9
Gao, 2019 ⁴⁰	Cross-sectional	China	997	Mean:70.4	Male:480 Female:517	WST	SLP	25.98
Jukic-Peladic,2019 ⁴¹	longitudinal	Italy	1490	Mean:83.5	Female:71.5%	CSE	HCPs	12.8
Hägglund,2019 ⁴²	longitudinal	Sweden	391	Mean:84.0	Male:182 Female:209	WST	Dentists and SLP	55.3
Hoshino, 2019 ⁴³	longitudinal	Japan	312	Mean:84.6	Male:69 Female:267	MWST	Dentists	16.3
MacDonald,2019 ⁴⁴	Cross-sectional	Canada	397	Mean:86.8	Female:66%	STAND	NA	10
Wu,2019	Cross-sectional	China	600	65 years or older	NA	WST	NA	66.2
Chen,2020	Cross-sectional	China	775	Mean:81.3	Male:305 Female:470	EAT-10	Self-report	31.1
Horgan,2020 ⁴⁵	Cross-sectional	Germany	100	Mean:71	Male:42 Female:58	Medical record	SLP	35
Imaizumi,2020 ⁴⁶	Cross-sectional	Japan	413	Mean:84.4	Male:111 Female:302	Dysphagia screening questionnaire;EAT-10	Self-report	55.4
Ward, 2020 ⁴⁷	longitudinal	USA	240	Mean:77	Male:51.7% Female:49.3%	YSP	Clinician	67
Simoes,2020 ⁴⁸	Cross-sectional	Brazil	280	70 or older	Male:174 Female:106	MWST	NA	45.71
Kulvanich2021 ⁴⁹	Cross-sectional	Japan	37	Mean:88	Male:5 Female:32	MWST	Clinician	35
Zhang, 2021 ⁵⁰	Cross-sectional	China	645	65 and older	Male:258 Female:397	Ohkuma questionnaire	Self-report	24.96
Izumi, 2021 ⁵¹	longitudinal	Japan	52	65 and older	Male:11 Female:41	MWST	NA	25

SLP: Speech pathologist or therapist; CSE: clinical swallow evaluation; FEES: fiberoptic endoscopic evaluation of swallowing; WST, Water Swallow Test; STAND: Screening Tool for Acute Neuro Dysphagia; CNSAT: Clinical Nursing Swallowing Assessment Tool; MWST: modified Water Swallow Test; DSS: dysphagia severity scale; DST: dysphagia self-test; GUSS: Gugging swallowing screentest; HCPs: healthcare professions; EAT-10:10-items Eating Assessment Tool. YSP: Yale Swallow Protocol.

3.3 Prevalence of dysphagia in nursing homes

The prevalence estimates of dysphagia reported by the individual studies ranged from 9% to 92%. Meta-analytic pooling of the prevalence estimates of dysphagia reported by the 43 studies showed a crude summary prevalence of 35.9% (95%CI: 29.0%, 43.4%), with significant evidence of high between-study heterogeneity ($Q=8421.3, \tau^2=1.07, I^2=99.5\%, P<0.001$). The results are shown in Figure 2. Sensitivity analysis, for which the meta-analysis was serially repeated after omission of each study, demonstrated that no individual study affected the overall prevalence estimate by more than 1% (Table S3 in the supplement material).

Figure 2 The prevalence estimates of dysphagia in nursing homes

To further characterize the range of dysphagia prevalence estimates identified by these methodologically diverse studies, subgroup meta-analyses with subgroups defined by assessment method, study design, assessment staff, study location, risk of bias and Newcastle-Ottawa scale components were conducted. The subgroup analysis results are shown in Table 2. No statistically significant differences in prevalence estimates ($Q=0.17, P=0.679$) were noted between cross-sectional studies (35.2%, 95%CI: 27.7%, 43.4%) and longitudinal studies (39.1%, 95%CI: 23.8%, 57.0%). However, there was a high significant difference in the prevalence estimates from studies conducted in different study locations ($P<0.001$). Further, significantly lower prevalence estimates ($Q=8.22, P=0.004$) were found among studies only using self-report method to assess dysphagia (20.6%, 95%CI: 13.0%, 31.1%) compared with those using mixed methods (40.1%, 95%CI: 32.3%, 48.4%). Dysphagia prevalence estimates from studies that used SLP to assess dysphagia (50.2%, 95%CI: 36.8%, 63.6%) were significantly higher ($Q= 8.70, P=0.013$) than those from studies that did not use SLP to assess dysphagia (27.1%, 95% CI: 20.0%, 35.7%).

As regards the Newcastle-Ottawa criteria components, lower prevalence estimates of dysphagia ($Q= 8.18, P=0.004$) were found among studies with more representative samples (54.2%, 95% CI: 42.5%, 65.6%) than among studies with less representative samples (33.7%, 95%CI: 36.6%, 41.6%). Further, higher prevalence estimates ($Q= 28.54, P<0.001$) were found among studies using validated assessment tools (41.0%, 95%CI: 33.5%, 49.0%) than among those not using valid assessment tools (15.4%, 95%CI: 11.2%, 20.9%). There were no statistically significant differences in prevalence estimates when studies were stratified by sample size, respondent and nonrespondent comparability, thoroughness of descriptive statistics reporting and risk of bias ($P>0.05$ for all comparisons).

Visual inspection of the funnel plot of the eligible studies revealed significant asymmetry (Figure S1 in supplement material). Thus, there was evidence of publication bias as shown by the Egger's test ($P=0.003$).

Table 2 Subgroup analysis of prevalence estimates of dysphagia

Characteristics	Studies	Prevalence(95%CI)	β statistics	Q statistics	P -value
Study design					
Cross-sectional	35	35.2%(27.7%,43.4%)	99.4%	0.17	0.679
Longitudinal	8	39.1%(23.8%,57.0%)	99.4%		
Publication year					
Before 2010	6	43.8%(27.1%,62.0%)	96.2%	0.84	0.360
2010 and after	37	34.7%(27.4%,42.8%)	99.5%		
Study location					
Asia	20	37.5%(28.3%,47.7%)	98.0%	214.07	<0.001
Europe	11	24.4%(15.3%,36.4%)	99.7%		
North America	7	44.8%(25.8%,65.4%)	98.2%		
South America	4	56.3%(48.0%,64.2%)	77.2%		
Global	1	13.4%(12.9%,13.8%)	-		
Country					
All other countries	34	34.3%(26.3%,43.4%)	99.5%	1.34	0.248
China	9	41.9%(32.8%,51.6%)	98.4%		
Dysphagia assessment method					
Subjective	6	24.1%(14.1%,38.2%)	99.4%	3.17	0.205
Objective	33	37.6%(29.5%,46.5%)	99.3%		
Subjective and objective	4	41.8%(22.2%,64.3%)	99.0%		
Self-report of dysphagia					
Yes	8	20.6%(13.0%,31.1%)	99.2%	8.22	0.004
No	35	40.1%(32.3%,48.4%)	98.6%		
Dysphagia assessment staff					
SLP attend	13	50.2%(36.8%,63.6%)	97.8%	8.70	0.013
SLP not attend	22	27.1%(20.0%,35.7%)	99.6%		
Not clear	8	39.9%(26.9%,54.5%)	98.1%		
Sample size					
\geq 100 participants	36	35.1%(27.4%,43.6%)	99.6%	0.52	0.469
<100 participants	7	40.5%(28.9%,53.3%)	82.7%		
Representativeness of sample					
Good	38	33.7%(26.6%,41.6%)	99.5%	8.18	0.004
Poor	5	54.2%(42.5%,65.6%)	91.9%		
Comparability of respondents					
Good	15	33.4%(24.0%,44.4%)	99.4%	0.29	0.593
Poor	28	37.3%(28.3%,47.3%)	99.5%		
Valid assessment tool					
Yes	36	41.0%(33.5%,49.0%)	98.6%	28.54	<0.001
No	7	15.4%(11.2%,20.9%)	96.1%		
Quality of descriptive statistics					
High	38	35.4%(28.1%,43.4%)	99.5%	0.15	0.703
Low	5	39.6%(21.7%,60.8%)	98.6%		
Risk of bias					

Low	37	34.9%(27.6%,43.1%)	99.6%	0.49	0.484
High	6	41.9%(25.3%,60.6%)	97.2%		

3.4 Risk factors of dysphagia in nursing homes

A total of twenty-two studies reported potential risk factors of dysphagia in nursing homes. The potential risk factors were older age, male, less education, cognition impairment, depression symptoms, feeding dependence, less teeth, CVD, cerebrovascular disease, COPD, functional limitation, long feed time, solid food, malnutrition, underweight, comorbidity, Parkinson's disease, dementia, pneumonia and absence occlusal support.

The pooled data from 16 studies showed that males were more likely to report dysphagia than females (OR=1.13, 95%CI: 1.00, 1.27), with a moderate heterogeneity ($I^2=53%$; Supplement Figure S2). No significant publication bias was observed for this association ($P=0.168$; Supplement Figure S3). Also, the pooled data from 6 studies indicated that cognitive impairment was significantly associated with an increased risk of dysphagia (OR=2.47, 95%CI: 1.59, 3.84), with high heterogeneity ($I^2=87%$; Supplement Figure S4).

The pooled data from 9 studies showed that functional limitation was significantly associated with an increased risk of dysphagia (OR=2.59, 95%CI: 1.75, 3.84), with high heterogeneity ($I^2=96%$; Supplement Figure S5). No significant publication bias was observed for this association ($P=0.363$; Supplement Figure S6). The pooled data from 13 studies indicated that cerebrovascular disease was significantly associated with an increased risk of dysphagia (OR=2.53, 95%CI: 1.58, 4.05), with high heterogeneity ($I^2=94%$; Supplement Figure S7). No significant publication bias was observed in this association ($P=0.423$; Supplement Figure S8). Furthermore, the pooled data from 6 studies indicated that Parkinson's disease was significantly associated with an increased risk of dysphagia (OR=1.81, 95%CI: 1.06, 3.08), with moderate heterogeneity ($I^2=65%$; Supplement Figure S9). The pooled data from 11 studies indicated that dementia was significantly associated with an increased risk of dysphagia (OR=1.50, 95%CI: 1.15, 1.96), with high heterogeneity ($I^2=81%$; Supplement Figure S10). No significant publication bias was observed in this association ($P=0.195$; Supplement Figure S11). Meta-analysis was not conducted for other factors due to insufficient data. The results are shown in Table 3.

Table 3 Risk factors for dysphagia in nursing homes

Risk factor	Included studies(n)	Pool OR(95%CI)	Heterogeneity (I^2)	P value for publication bias
Male	16	1.13(1.00,1.27)	53%	0.168
Cognitive impairment	6	2.47(1.59,3.84)	87%	-
Functional limitation	9	2.59(1.75,3.84)	96%	0.363
Cerebrovascular disease	13	2.53(1.58,4.05)	94%	0.423
Parkinson's disease	6	1.81(1.06,3.08)	65%	-
Dementia	11	1.50(1.15,1.96)	81%	0.195

Discussion

This is the first systematic review and meta-analysis to explore the prevalence of and potential risk factors for dysphagia in nursing homes. This systematic review and meta-analysis included 43 original studies involving 56,146 residents in nursing homes, and demonstrated that 35.9% (95%CI: 29.0%, 43.4%) was the estimated pooled prevalence of dysphagia. Among these included studies, 22 reported potential risk factors for dysphagia. The pooled estimates indicated that being male; and having cognitive impairment, functional limitation, cerebrovascular disease, dementia and Parkinson's disease were significant factors associated with an increased risk of dysphagia.

Therefore, the pooled prevalence of dysphagia among the nursing home residents was higher than that reported in the community dwelling elderly. For example, a cross-sectional study, using a questionnaire for dysphagia screening, conducted in a Japan community among 1,313 elderly people, reported that the prevalence rate of dysphagia was 13.8%⁵². A meta-analysis of 6 high quality studies in the community dwelling elderly showed that the average prevalence of dysphagia was 15%⁹. On the other hand, residents in nursing homes were more likely to report frailty status and suffer from many kinds of chronic disease, such as dementia, cerebrovascular disease and Parkinson's disease^{53 54}, which further led to swallowing disorders. Additionally, the high prevalence rate may be caused by various medical problems that trigger swallowing disorders, such as oral medication, mechanical ventilation and head and neck surgery^{55 56}.

This study also observed lower prevalence estimates among studies using self-report method to assess dysphagia than among those using mixed method. Although the difference is not statistically significant, the pooled prevalence of dysphagia from studies that used objective assessment method seemed higher than that from studies which used subjective assessment method. This finding, therefore, needs further investigation. Nevertheless, an observational cohort study conducted in Maryland found that about 72% of elderly women demonstrated swallowing dysfunction following a 3-ounce water swallowing test, but the participants reported few symptoms of dysphagia on a swallowing function questionnaire⁵⁷. Another study found that 80% of the residents in the long-term care homes, who failed the swallowing screening test, did not previously report that swallowing was an issue. Nevertheless, that study indicated

that cognition level was not a related factor of the accuracy in reporting swallowing status⁴⁴. Therefore, further studies are warranted to explore the related factors for such a gap.

This study has also shown the significance of assessment tools for dysphagia, and the staffs attending to dysphagia in nursing homes. For example, our study found that higher prevalence of dysphagia was reported when dysphagia was assessed by SLP, and when a validated assessment method was used. Even though numerous methods or tools were exploited for dysphagia assessment, many of them had not been validated for use in this population. Therefore, different assessment procedures, assessment tools and assessment staff might have contributed to the high between-study heterogeneity. This may suggest the need for the development of formal and systematic programs for dysphagia screening and assessment in nursing homes. Noteworthy, even though the high prevalence estimate of dysphagia in nursing homes was found in this study, the management situation in nursing homes is poor. For instance, a national survey in Norway found that the residents in nursing homes were not routinely screened or assessed for swallowing problems among approximately 75% of the nursing homes, lacked oral hygiene strategies in over 80% of the nursing homes, and did not have access to external experts, including speech therapists in almost 50% of the nursing homes⁵⁸. Thus, this is significant evidence to support the idea of training and up-skilling staff in nursing homes, and raising awareness of the serious consequences of dysphagia.

Similar with the systematic review on the community dwelling elderly⁹, our study found that functional limitation, cerebrovascular disease, dementia and Parkinson's disease were significant factors associated with the increased risk of dysphagia in nursing homes. Besides, being male and cognitive impairment were significant factors associated with the increased risk of dysphagia. A combination of factors has been reported to place residents in nursing homes at an increased risk for dysphagia, which is related to negative health sequelae. Considering demographic factors, three studies²⁰⁻²² used multivariable models to show an independent association of dysphagia with advanced age. Similarly, three studies^{21 33 41} used multivariable logistic regression models to show that men were more likely to suffer from swallowing problems than women. Even though gender difference in the prevalence of dysphagia was also observed in this meta-analysis, the underlying mechanisms are still unclear. Cognitive impairment and dementia may be associated with the damage or weakening of brain nerves related to the swallowing activity and function, and hence leading to dysphagia⁵⁹. Moreover, functional limitation, usually measured by Barthel and Katz index, was associated with degeneration of muscle and strength, also leading to swallowing difficulties⁶⁰. However, most of the preceding risk factors of dysphagia were reported in cross-sectional studies, which cannot establish causal relationships.

Several limitations need to be acknowledged. First, the data were derived from studies that had different designs, instruments for assessing dysphagia, and location. The high heterogeneity among the studies remained largely unexplained by the variables inspected. Second, subgroup analyses were not conducted to uncover the prevalence estimates of dysphagia among specific assessment tools because numerous studies may be using multiple tools simultaneously. Finally, most of risk factors were measured by self-report, hence measurement bias was unavoidable. Further studies can calculate the strength of the association between other factors which not examined due to inadequate data and risk of dysphagia in nursing homes setting.

Conclusion

In this systematic review and meta-analysis, the summary estimate of the prevalence of dysphagia among the residents in nursing homes was 35.9%. Being male; and having cognitive impairment, functional limitation, cerebrovascular disease, dementia and Parkinson's disease were significant factors associated with an increased risk of dysphagia. Further research is needed to identify strategies for management and interventions targeted at these disorders in this population.

Declarations

Availability of data and materials

All data generated or analysed during this study are included in this published article [and its supplementary information files].

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Conceptualization, ZH; Methodology, ZH; Software, ZH.; Validation, ZH and BHZ; Formal Analysis, ZH; Data Curation, ZH and BHZ; Writing – Original Draft Preparation, ZH; Writing – Review & Editing, ACK and HLX.

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Abbreviations

CSE: clinical swallow evaluation; FEES: fiberoptic endoscopic evaluation of swallowing; WST, Water Swallow Test; STAND: Screening Tool for Acute Neuro Dysphagia; CNSAT: Clinical Nursing Swallowing Assessment Tool; MWST: modified Water Swallow Test; DSS: dysphagia severity scale.

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Figures

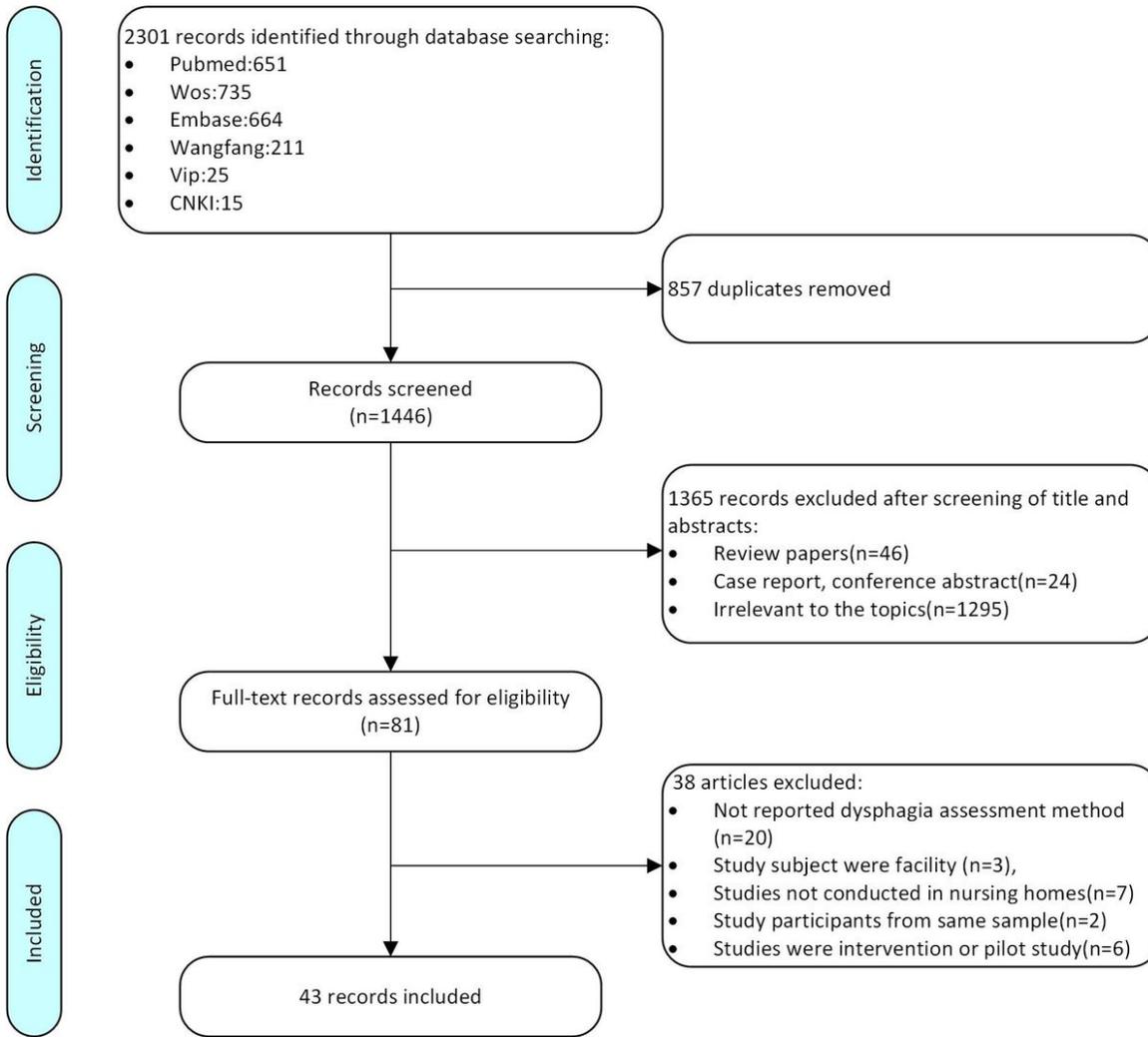


Figure 1

The flowchart of the study selection process

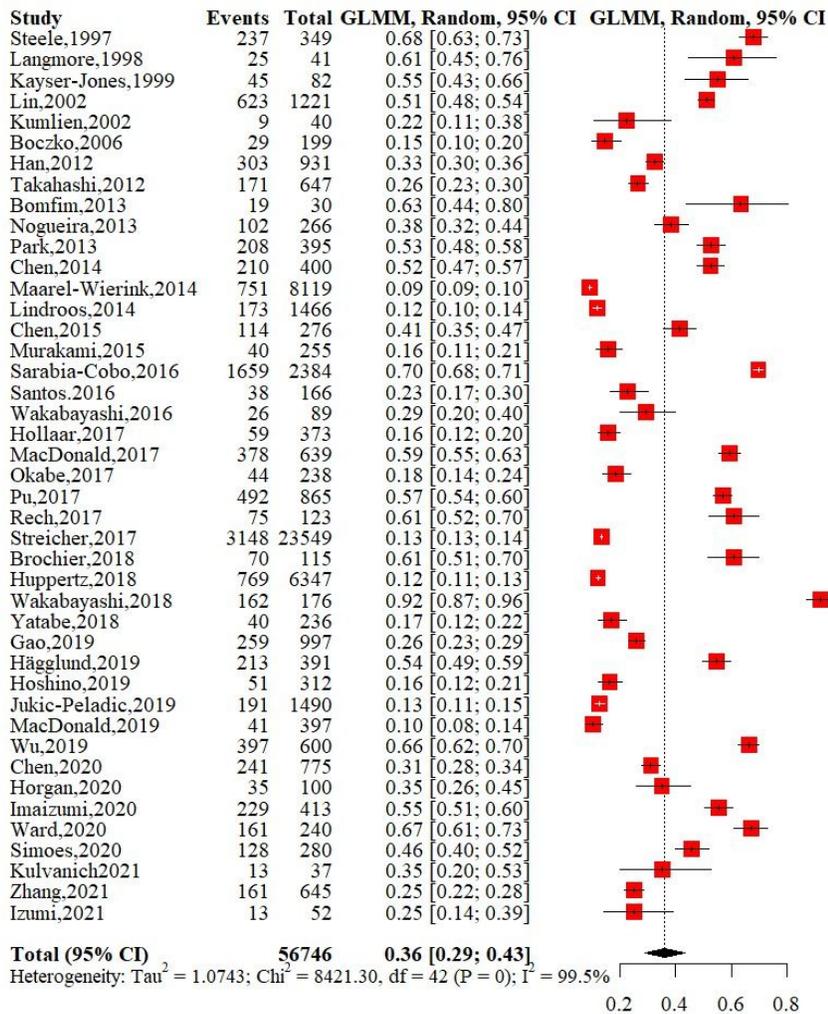


Figure 2

The prevalence estimates of dysphagia in nursing homes

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