

Review articles

Variability in quantitative parameters of instrumental swallowing assessments: a scoping review protocol

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ABSTRACT

Purpose: to present a scoping review protocol mapping scientific evidence on the level of variability in quantitative parameters or outcomes extracted with instrumental swallowing examinations.

Methods: a protocol following the methodological approach designed by the Joanna Briggs Institute and the scoping review recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols – extension for scoping reviews (PRISMA-ScR). The search will be made in PubMed/MEDLINE, LILACS, Cochrane Library, EMBASE, Web of Science, Scopus, and CINAHL and the grey literature (Google Scholar and ProQuest) with a search strategy developed for PubMed/MEDLINE, adapted for each database. Two independent reviewers will initially select articles by title and abstract, and the full text of the selected ones will be read and analyzed according to the eligibility criteria. Data will be extracted from the selected articles in a standardized form, and the results will be presented in a flowchart and narrative summary, following PRISMA-ScR guidelines.

Final considerations: the scoping review resulting from this protocol is expected to present the overall state of the scientific evidence and identify gaps in the topic that need to be addressed in studies.

Keywords: Deglutition; Diagnosis; Dysphagia; Deglutition Disorders

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INTRODUCTION

The advancement of research and development of new assessment methods have ushered various swallowing assessment instruments to aid the investigation process. Such advancements help visualize structures in biomechanics and provide measures and quantitative parameters, which furnish more precise diagnoses and guide therapeutic procedures^{1,2}.

Although not that effective to observe the oral phase, the fiberoptic endoscopic evaluation of swallowing (FEES) is an important method to diagnose the functional and structural dynamics of the laryngopharynx, making it possible to visualize and assess the anatomy, physiology, and sensitivity of the visible structures involved in swallowing². In its turn, the videofluoroscopic swallowing study (VFSS) analyzes the function with different volumes and consistencies, testing postural maneuvers and visualizing all phases of swallowing. On the other hand, it has some limiting factors such as the use of contrast agents and exposure to radiation¹. Ultrasound (US), like FEES and VFSS, enables descriptive and quantitative assessments of swallowing parameters and has been increasingly used as a complementary method³. Since it is a noninvasive procedure, the patient is not exposed to risks, real food can be ingested, and the examination can be repeated with no time limits⁴.

Such examinations require raters to be previously trained because they use computer programs; moreover, their subjective analysis depends on the rater's experience^{1,4}. The literature shows concern with the reliability of these instruments, aiming to ensure precise and feasible function assessment. Hence, the level of variability in examination results must be also investigated – which is usually done with the variation coefficient (VC), a measure of dispersion that divides the standard deviation by the mean of the set of data. Thus, it verifies the dispersion of data and is expressed in percentages, making it possible to analyze data in different units⁵⁻⁷. Since it is free from units of measurement, CV is widely used to compare variability in and between individuals in sets of data with different units of measurement or quite different mean values⁸.

Given the above, this manuscript aimed to present a scoping review protocol to map scientific evidence on the level of variability of quantitative parameters or outcomes extracted with instrumental swallowing examinations. To reach its objective, the review will:

1. Identify the most used instrumental examinations to help diagnose oropharyngeal dysphagia.
2. Assess the level of variability by investigating the VC of quantitative parameters or outcomes extracted with instrumental examinations and synthesize available evidence.
3. Relate the measure of variability to the assessment method used in each instrument (phases/stages, utensils, consistencies, volumes, number of swallows, investigated measures, and VC).
4. Point out existing gaps in both practice and the literature regarding the study topic, as well as questions that may be answered in future research.

METHODS

This scoping review protocol will follow the methodological approach designed by the Joanna Briggs Institute for this study type⁹ and the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols – Extension for Scoping Reviews (PRISMA-ScR)¹⁰. It will be registered in the Open Science Framework. If methodological changes are made in the protocol as it is carried out, they will be reported in the final product of the scoping review.

The PCC acronym (**P**opulation, **C**oncept, and **C**ontext) was used to develop the research question: a) regarding the population: adults and/or older adults who have been submitted to instrumental swallowing assessments, extracting quantitative parameters or outcomes; b) regarding the concept: levels of variability in quantitative parameters or outcomes obtained with instrumental swallowing assessments; c) regarding the context: studies using instrumental assessments with quantitative VC results to analyze swallowing parameters. Thus, the following research question was defined for this scoping review: “What is the level of variability in quantitative parameters of instrumental swallowing assessment in adults and/or older adults?”.

Eligibility criteria

The eligibility criteria will be defined based on the PCC acronym (Chart 1).

The review will exclude studies that do not analyze the level of variability with VC or do not inform the mean and standard deviation with which VC can be

calculated, that use instruments and present only descriptive swallowing assessment results, that assess only esophageal dysphagia, and that are conducted in children. All articles available in the full text will be considered, with no restriction on language or year of publication.

Chart 1. Study eligibility

	Inclusion criteria
Population	Adults and/or older adults who have been submitted to swallowing assessment.
Concept	Level of variability of swallowing assessment quantitative data.
Context	Studies using instrumental examinations with quantitative results of the variation coefficient to analyze swallowing parameters.
Types of sources of evidence	Peer-reviewed journals, textbooks, editorials, conference proceedings, and dissertations/ theses in the predefined databases, with no restriction on language or year of publication.

Sources of information and search strategy

The search will be conducted in PubMed/MEDLINE, LILACS, Cochrane Library, EMBASE, Web of Science, Scopus, and CINAHL, as well as sources in the grey literature, such as Google Scholar and ProQuest.

The search strategy will aim to retrieve published

and unpublished studies by combining descriptors and words present in the titles, abstracts, and keywords of articles related to the topic, forming a search strategy for PubMed/MEDLINE (Chart 2), which will be later adapted for each database. References in the articles will also be considered.

Chart 2. Search strategy - MEDLINE via PubMed (search made on August 12, 2022)

Search	Keywords	Records Found
#1	("deglutition disorders" OR "dysphagia" OR "swallowing disorders" OR "deglutition" OR "swallowing" OR "dysphagia" OR "deglutit*" OR "swallow*")	71,032
#2	("coefficient of variation")	25,978
#1 AND #2	("deglutition disorders" OR "dysphagia" OR "swallowing disorders" OR "deglutition" OR "swallowing" OR "dysphagia" OR "deglutit*" OR "swallow*") AND ("coefficient of variation")	46

Study selection and data extraction

Articles will be selected with EndNote software (Clarivate Analytics, PA, USA), to which references will be imported for management and removal of duplicates. After this phase, articles will be imported to the free Rayyan software (Qatar Computing Research Institute, Doha, Qatar) for reviewers to blindly screen them by title and abstract and classify them as either

included or excluded. All these stages will be independently conducted by two reviewers; if any divergence in article eligibility is not solved between them, a third reviewer will help to decide.

After screening, all included articles will be analyzed by full-text reading to decide whether they are eligible for this review. In the case of access difficulties or questions, the authors of the articles may be consulted

during the selection process. Data will be analyzed according to the study content, and research results will be presented in a PRISMA-ScR¹⁰ flowchart and published in the scoping review.

Two independent reviewers will synthesize extracted data after reading the full text of included articles. Information will be detailed with an auxiliary tool developed by the reviewers (Chart 3).

Chart 3. Data extraction instrument

Article identification:	
Author(s):	
Year:	
Country of origin:	
Institution(s) where the study was conducted:	
Source:	
POPULATION	
Population/sample size:	
Age range:	
CONCEPT	
Swallowing parameters assessed:	
Assessment protocol used:	
Utensil(s) used and volume(s) and consistency(ies) offered:	
Diagnosis(es) of the populational group(s) assessed:	
Quantitative measures investigated:	
Variation coefficient result:	
CONTEXT	
Diagnostic examination used in the study:	
Main results:	

Outcomes

The following variables will be collected: description of quantitative parameters, methods to acquire these parameters, investigated VC (in and/or between individuals), level of variability in parameters or outcomes, year of publication, and target population. The tool developed for this review may be changed as needed during article reading and data synthesis; these changes will be mentioned in the final product.

Data synthesis

Data will be analyzed according to the research objectives, characterizing study variables and methods. Both quantitative and qualitative analyses will be made. Collected data will be presented in a flowchart, and the main results will be pointed out in the discussion to answer the research question and reach its objectives.

DISCUSSION

Dysphagia affects the good functioning of swallowing, possibly causing nutritional deficits, dehydration, pulmonary problems due to aspiration, and the risk of death¹¹. Instruments with more objective quantitative parameters are increasingly used to assess this function and investigate the performance and movement of structures during swallows to obtain data that will help in these patients' diagnosis and prognosis¹².

To analyze these quantitative data – e.g., morphometric, temporal, spatial, or velocity data –, it is essential to verify their significance and homogeneity. When investigating measure variability, it is possible to verify to what extent values diverge from the mean and identify which ones have the lowest VC⁷ – i.e., the parameters more likely to characterize the subject's actual function performance.

In a study, 38 patients with head and neck cancer were submitted to VFSS to verify whether penetration and aspiration scale (PAS) scores differed between

the first and second swallows with the same content offered. Six types of servings were used: 3, 5, 10, and 20 mL of thin liquids, 5 mL of mildly thick liquids, and 3 mL of extremely thick liquids. Results show a variation in many individuals, especially when swallowing 20 mL of thin liquid, 5 mL of mildly thick liquid, and 3 mL of extremely thick liquid¹³. Thus, there may be great intra-subject performance variability in repeated swallows, which can make it more difficult not only to understand the subject's swallowing pattern but also to decide on assessment parameters consistent with normal standards¹⁴.

A study¹⁵ characterized the variability in pharyngeal peristaltic pressure during volitional swallowing in 32 healthy individuals. It used manometry to study the subjects' dry swallows of 5 and 10 mL of water, repeated three times, with 20-second intervals in between them. There was a wide range of mean pressures between subjects for each site, from under 50 mmHg to over 300 mmHg. Both site-specific pressure VC and pharyngeal contractile integral ranged from 2 to 25% of the mean between subjects ($p = 0.001$). Moreover, factors such as position, age, and volume of ingested liquids did not influence the magnitude of variability.

Thus, studies that address variability both in and between individuals aim to investigate the consistency of extracted values and measures to verify the extent to which they disperse one from the other and understand what factors can explain data homogeneity or heterogeneity within samples.

This scoping review will furnish important data, presenting information on the degree of variability in parameters extracted with instrumental swallowing assessments. This study aims to map all the literature and identify the evidence investigating, through VC analysis, the extent to which examinations and their results characterize the patients' swallowing profiles during assessments. Previously publishing this protocol will help organize and plan research development and disseminate it to academic and scientific circles.

FINAL CONSIDERATIONS

This scoping review protocol has been developed based on recommended guidelines to develop this type of study and is within standards to be immediately carried out. The study to be developed from the protocol will present the overall state of the literature on the research topic, identifying gaps and pointing out existing evidence.

REFERENCES

1. Anéas GCG, Dantas RO. A videofluoroscopia da deglutição na investigação da disfagia oral e faríngea. *GE Jornal Português de Gastrenterologia*. 2014;21(1):21-5. doi:10.1016/j.jpg.2013.11.004
2. Freitas L, Moscoso E, Machado M, Rita A, Simão M, Dias O et al. Avaliação videoendoscópica da deglutição na abordagem da disfagia orofaríngea. *Revista Portuguesa de Otorrinolaringologia e Cirurgia Cérvico-Facial*. 2012;50(4):285-9.
3. Leite KKA, Mangilli LD, Sassi FC, Limongi SCO, Andrade CRF. Ultrasonography and swallowing: a critical review of the literature. *Audiol Commun Res*. 2014;19(4):412-20. doi:10.1590/s2317-64312014000300001378
4. Rocha SG, Silva RG, Berti LC. Qualitative and quantitative ultrasound analysis of oropharyngeal swallowing. *CoDAS*. 2015;27(5):437-45. doi:10.1590/2317-1782/20152015015
5. Reed GF, Lynn F, Meade BD. Use of coefficient of variation in assessing variability of quantitative assays. *Clin Diag Lab Immunol*. 2002;9(6):1235-9. doi: 10.1128/CDLI.9.6.1235-1239.2002
6. Molfenter SM, Steele CM. Temporal variability in the deglutition literature. *Dysphagia*. 2012;27(2):162-77. doi:10.1007/s00455-012-9397-x
7. Vieira S. Estatística básica - 2ª edição revista e ampliada. Cengage Learning Brasil, 2018. E-book. Available at: <https://integrada.minhabiblioteca.com.br/#/books/9788522128082/>. Accessed 2022 ago 4
8. Teoh WL, Khoo MB, Castagliola P, Yeong WC, Teh SY. Run-sum control charts for monitoring the coefficient of variation. *European Journal of Operational Research*. 2017;257(1):144-58.
9. Peters MDJ, Godfrey CM, Khalil H, McInerney P, Parker D, Soares CB. Guidance for conducting systematic scoping reviews. *Int J Evid Based Healthc*. 2015;13(3):141-6.
10. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Ann Intern Med*. 2018;169(7):467-73.
11. Padovani AR, Moraes DP, Mangili LD, Andrade CRF. Protocolo Fonoaudiológico de Avaliação do Risco para Disfagia (PARD). *Rev Soc Bras Fonoaudiol*. 2007;12(3):199-205.

12. Barberena LS, Brasil BC, Melo RM, Mezzomo CL, Mota HB, Keske-Soares M. Ultrasound applicability in speech language pathology and audiology. *CoDAS*. 2014;26(6):520-30. doi:10.1590/2317-1782/20142013086
13. Hedström J, Tuomi L, Andersson M, Dotevall H, Osbeck H, Finizia C. Within-bolus variability of the penetration-aspiration scale across two subsequent swallows in patients with head and neck cancer. *Dysphagia*. 2017;32(5):683-90. doi:10.1007/s00455-017-9814-2
14. Söder N, Miller N. Using ultrasound to investigate intrapersonal variability in durational aspects of tongue movement during swallowing. *Disfagia*. 2002;17(4):288-97. doi: 10.1007/s00455-002-0071-6.
15. Balasubramanian G, Sharma T, Kern M, Mei L, Sanvanson P, Shaker R. Characterization of pharyngeal peristaltic pressure variability during volitional swallowing in healthy individuals. *Neurogastroenterol Motil*. 2017;29(11):e13119. doi:10.1111/nmo.13119