



Sensitivity and Specificity of the Geriatric Bedside Swallowing Screen (GEBS): A Diagnostic Accuracy Pilot Study

Sensitivität und Spezifität des Geriatric Bedside Swallowing Screen (GEBS): Eine Diagnostische Pilotstudie

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Abstract

Purpose: The projected increase in older adults in the EU to 28.5% by 2050 highlights the need for improved geriatric care. Oropharyngeal dysphagia is common in older adults; it is linked to frailty and neurodegenerative diseases, and can cause malnutrition, dehydration, and aspiration pneumonia. Though screening reduces pneumonia cases in stroke patients, it also risks overdiagnosis in geriatric patients due to age-related swallowing changes that are often misinterpreted by existing tools.

Objectives: To address this gap, the Geriatric Bedside Swallowing Screen (GEBS) was developed. The goal was to validate the GEBS against an objective instrumental assessment, the Flexible Endoscopic Evaluation of Swallowing (FEES).

Methods: Between November 2022 and June 2024, a total of 30 participants aged 75 years or more (mean age 79.13 SD $\pm$ 5.7) from an acute geriatric ward in Salzburg, Austria, were recruited for this prospective observational cohort study. Participants completed both GEBS and FEES within seven consecutive days, with the FEES investigators being blinded for the results of the GEBS.

Results: The GEBS demonstrated a sensitivity of 67% and a specificity of 83%, as well as positive and negative predictive values of 73% and 80%, respectively. There were no adverse effects.

Conclusions: The results indicate the GEBS's potential as a promising dysphagia screening tool specifically for geriatric patients. Swallowing function should be assessed as part of geriatric assessments, as recommended by the guidelines of several societies.

Abstract

Hintergrund: Der prognostizierte Anstieg älterer Erwachsener in der EU auf 28,5 % bis 2050 verdeutlicht den Bedarf an besserer geriatrischer Versorgung und frühzeitiger Erkennung altersassoziierter Erkrankungen wie oropharyngealer Dysphagie, die 2016 als geriatrisches Syndrom anerkannt wurde. Dysphagie, verbunden mit Frailty und neurodegenerativen Erkrankungen, kann Mangelernährung, Dehydratation und Aspirationspneumonie verursachen. Die Diagnostik beginnt mit einem Screening zur frühzeitigen Identifikation betroffener Patient*innen. Obwohl Screenings Aspirationspneumonien nachweislich reduzieren, erfassen etablierte Tools altersbedingte Schluckveränderungen oft unzureichend, was Überdiagnosen begünstigen kann.

Ziel der Arbeit: Um diese Lücke zu schließen, wurde der Geriatric Bedside Swallowing Screen (GEBS) entwickelt. Ziel war es, die Anwendbarkeit im klinischen Alltag zu erfassen und den GEBS im Vergleich zu einer objektiven instrumentellen Untersuchung, der flexiblen endoskopischen Schluckuntersuchung (FEES), zu validieren.

Methoden: Zwischen November 2022 und Juni 2024 wurden insgesamt 30 Teilnehmende über 74 Jahre (Durchschnittsalter 79,13 Jahre, SD $\pm$ 5,7) aus einer Akutgeriatrie in Salzburg, Österreich, für diese prospektive, beobachtende Kohortenstudie rekrutiert. Die Teilnehmenden absolvierten sowohl den GEBS als auch die FEES innerhalb von 7 aufeinanderfolgenden Tagen, wobei die FEES-Untersuchenden verblindet für die Ergebnisse des GEBS waren.

Ergebnisse: Der GEBS zeigte eine Sensitivität von 67 % und eine Spezifität von 83 % sowie positive und negative prädiktive Werte von 73 % bzw. 80 %. Es traten keine unerwünschten Nebenwirkungen auf.

Schlussfolgerungen: Die Ergebnisse weisen auf das Potenzial des GEBS als vielversprechendes Screening-Tool für Dysphagie bei geriatrischen Patienten hin. Die Schluckfunktion sollte als Bestandteil der geriatrischen Beurteilung berücksichtigt werden, wie von verschiedenen Fachgesellschaften und Leitlinien empfohlen.

Keywords

Presbyphagia – Dysphagia – Geriatrics – Screening – Validation

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BACKGROUND

Dysphagia affects nearly 50% of geriatric patients across different healthcare settings, with considerable variations depending on living conditions. In highly dependent, multimorbid long-term care patients, a prevalence of dysphagia of up to 90% has been reported, while the rate is around 40% in hospitalized older adults and 18% in community-dwelling older adults (Tian et al., 2024). Oropharyngeal dysphagia was declared as a geriatric syndrome in 2016 by the European Society of Swallowing Disorders (ESSD) in conjunction with the European Geriatric Medicine Society (EuGMS) (Baijens et al., 2016).

Dysphagia is defined as an impaired ability to safely prepare and move a bolus from the mouth into the digestive tract, as described in the World Health Organization in the International Statistical Classification of Diseases and Related Health Problems (ICD-11: MD39) as well as the International Classification of Functioning, Disability and Health (ICF: b5101) (WHO, 2022, 2024). It is closely linked to frailty and neurodegenerative diseases such as Parkinson's, dementia, multiple sclerosis and amyotrophic lateral sclerosis, as well as stroke, head and neck cancers, osteophytes, and traumatic spinal injury. This leads to a higher prevalence of the disorder in care facilities for older adults with advanced conditions (Mateos-Nozal et al., 2024).

Dysphagia significantly impacts quality of life through food intake restrictions and can cause severe outcomes like malnutrition, dehydration, and aspiration pneumonia, especially in frail individuals (Yang et al., 2022). Patients on modified-texture diets (e.g., thickened liquids, pureed meals) experience a marked decline in quality of life (Flynn et al., 2018; Hansen et al., 2022).

Diagnosis begins with screening to find high-risk patients — a process shown to reduce pneumonia in stroke patients and identify patients needing further evaluation (Palli et al., 2017; Wirth et al., 2016). There are a wide variety of dysphagia screening tools, but most of them were developed for acute neurological or emergency patients and validated in these populations. These include the GUSS (Gugging Swallowing Screen), the TOR-BSST (Toronto Bedside Swallowing Screening Test), and the Daniels Test (Daniels et al., 2013; Daniels et al., 1997; Martino et al., 2009; Trapl et al., 2007).

International geriatric guidelines recommend screening for dysphagia, although some highlight the lack of dysphagia screening tools specifically for geriatric populations (British Geriatrics Society, 2019; Deutsche Gesellschaft für Geriatrie, 2024; Ward & Reuben, 2024). This can lead to potential overdiagnosis, as physiological aging results in functional changes in the swallowing process known as “presbyphagia” (Labeit et al., 2022). Some screening tools that include a wide variety of

healthy ageing populations, including the MASA (Mann Assessment of Swallowing Ability), the EAT-10 (Eating Assessment Tool) and the V-VST (Volume-Viscosity Swallow Test) (Belafsky et al., 2008; Clavé et al., 2008; Ohira et al., 2017), have been validated for older people, but not against an objective instrumental reference test, or describe “older people” as aged 60 and above.

At the time of planning this study in 2021, an extensive literature search was conducted to look for dysphagia screening tools that has been validated against an instrumental reference test in a population of 75 and older. This yielded no results (Javorszky, 2022). An exception is the Dysphagia Screening Tool for Geriatric Patients (DSTG), published in 2023 (Thiem et al., 2023). A possible limitation in implementing dysphagia screening is the need to train staff to correctly administer and chart screenings, especially if these consist of more than one step. Some screening tools require little more than a teaspoon and a cup of water and are quick to be administered, but these single-step procedures usually have been developed in institutions where referral for further dysphagia assessment is readily available, such as stroke units (Javorszky, 2022). When putting them to practice in geriatric institutions with limited speech language pathologist (SLP) availability, and sometimes no possibility of instrumental dysphagia diagnostics, a lot of these easy screening tools pose a problem: if applied correctly, a significant number of patients might have to be put on a nil-by-mouth regime for an extended period until an SLP is available. Multi-consistency screening tools try to avoid this problem by trialling not only liquids, but also purees and possibly solids, and some can even be used to achieve a diet recommendation while awaiting an SLP assessment such as the GUSS or the V-VST (Clavé et al., 2008; Trapl et al., 2007).

The Geriatric Bedside Swallowing Screen (GEBS) is a new, practical tool to screen dysphagia in older adults and assess oral nutrition feasibility without an SLP. This multi-step approach involves evaluating risk factors, a water swallowing test, and, if necessary, a pureed bolus test using the International Dysphagia Diet Standardisation Initiative (IDDSI) framework (Cichero et al., 2017) for safety until further examination.

The objective of this pilot study was to test the feasibility, specificity and sensitivity of the GEBS and its possible use in geriatric patients, as well as to compare the full protocol, including the pureed bolus test, to using only the first steps (involving risk factors and water swallows). Flexible Endoscopic Evaluation of Swallowing (FEES), the gold standard for dysphagia assessment, was used for validation (Wirth et al., 2016). This study hypothesized that GEBS is easy to use, feasible in clinical practice, and demonstrates sufficiently high sensitivity and specificity in detecting dysphagia in geriatric patients. A clear goal for sensitivity and specificity was not determined for this pilot study.



METHODS

A prospective diagnostic accuracy pilot study was conducted from November 2022 to June 2024, registered at International Standard Randomised Controlled Trial Number Registry (ISRCTN11581931) with the protocol published prior to recruitment (Javorszky et al., 2023). Though the study was initially planned as multicentric, only one of three Austrian centres recruited participants due to staffing and recruitment challenges. Ethics approvals were obtained for Vienna (EK 21-212-1021), Salzburg (EK 1040/2022), and Lower Austria (GS1-EK-4/848-2023). The study received no external funding.

Participants

Participants were consecutively recruited from the Department of Geriatric Medicine, Christian Doppler University Hospital (CDK), Salzburg, Austria. To be eligible, individuals needed to be aged 75 or older and able to give informed consent. Exclusion criteria included a history of severe stroke as measured by the National Institutes of Health Stroke Scale (NIHSS). The NIHSS defines the severity of stroke by points from 0-42, where higher scores indicate more severe strokes. Scores of under 5 points indicate a minor stroke, 5-15 points a moderate, 16-20 moderate to severe, and above 20 a severe stroke. Thus, we decided on an NIHSS > 20 as cut-off for our inclusion criteria (Brott et al., 1989).

We also excluded patients with moderate to advanced cognitive impairment as calculated by the Mini Mental State Examination (MMSE), a 30-point scale with lower points indicating more advanced impairments. 0-10 points indicate severe dementia, 10-19 moderate dementia, 20-26 mild dementia or mild cognitive impairment, and points above 26 indicate no cognitive impairment. To ensure participants would be able to give informed consent and partake in the testing procedures, we decided on a cut-off value of MMSE ≤ 20 as an exclusion criterion (Folstein et al., 1975).

Lastly, we excluded patients with a tracheostoma with or without ventilatory dependence (Heidler, 2019). Newly admitted patients were screened for eligibility, and those meeting criteria provided informed consent for their participation.

Index test

The index test, GEBS, was based on the screening protocol already in use at CDK. This protocol had been reported as convenient and easy to use by hospital staff, making it a feasible starting point. It was updated to include predictors of dysphagia that were considered risk factors (table 1) and structured into a three-step protocol.

Table 1: Risk Factors for Dysphagia

Neurological or neuropsychiatric disease	Unintentional weight loss
Pneumonia within the last 12 months	Symptoms of dysphagia (drooling, wet voice, coughing)
Sarcopenia	Impaired oral health

The risk factors could be assessed by patient reports, chart review and observation.

After assessing risk factors and patient vigilance, a water swallow test was performed. The patient swallowed 10 sips of water from a teaspoon, with pauses for voice checks, and one sip from a cup. Clinical signs of aspiration, such as coughing, wet voice, or breathing difficulties, resulted in stopping the test, failing the screening, and referral to a speech-language pathologist (SLP). If only one risk factor was present and no clinical signs of aspiration occurred, the patient had passed the screening. If more than one risk factor was present or the water swallow test showed signs of aspiration even in the absence of any risk factors, the screening was considered to have been failed.

If the water test indicated dysphagia with multiple risk factors and no SLP was available (e.g., due to staffing limits or admission timing), a third step would be applied. This involved the patient swallowing a pureed bolus (IDDSI-4) after ensuring they were awake, upright, and had saliva control. Teaspoons of puree were administered with pauses for voice checks, and the test was stopped if there were aspiration signs or severe drooling. Dysphagia indicators include coughing, wet voice, and oral residues. To obtain full results during the study, the full protocol was administered to each participant and not stopped after the water swallow test. The three-step protocol was intended for later clinical use to make the tool more feasible and quicker to administer.

A score of 5 points allowed for oral nutrition with IDDSI Level 4 puree and Level 2 thickened liquids while awaiting SLP assessment. Scores below 5 indicated high dysphagia risk and resulted in nil-by-mouth instructions.

Reference test

Following Studies of Diagnostic Accuracy (STARD) guidelines, a gold-standard reference test is essential for validating a new test (Bossuyt et al., 2015). Dysphagia can be assessed using FEES or VFSS (videofluoroscopic swallowing study) (Wirth et al., 2016). FEES, being portable, repeatable, and not time-limited, is preferred over VFSS, which requires high-resolution X-rays, transportable patients, and their compliance. FEES is considered the gold standard for dysphagia assessment in geriatric patients due to its high diagnostic accuracy (Warnecke et al., 2009), especially with standardized



protocols like the Penetration-Aspiration Scale (PAS) (Rosenbek et al., 1996).

In this study, FEES was conducted within six days of the index test by two blinded, experienced physicians. This rather long time span of six days was set to enable the participation of long-term care institutions, where FEES is not available daily but rather only once a week, and the inhabitants usually living there full-time without acute events that would require hospitalization, and thus a change in overall status was less likely to occur. In fact, the average time span was 1.2 days, with FEES being administered the following day in the majority of cases (21 times), within two days (five times) or on the same day (three times) and only once with six days in between.

Colored boluses of puree, liquids and solids were administered in this order with increasing volumes, and results were recorded on the PAS. A structured examination of oral, pharyngeal, and laryngeal sensitivity and motor function was also performed. During the endoscopic assessment, both the PAS and the Bolus Observation and Dysphagia Severity (BODS) score were documented, routinely used to evaluate swallowing function, saliva management, and oral intake potential (Starrost et al., 2012). Leaking and residues were recorded in the structured assessment, but without a standardized rating score. All participants underwent testing using purees and liquids. Testing was stopped after purees and liquids in one case because of the patient's refusal to continue. Testing was not discontinued upon the first sign of aspiration so that researchers could determine the possibility of oral intake with different strategies — e.g., changing the bolus size or integrating swallow maneuvers.

Analysis

To analyze the diagnostic accuracy of the GEBS in comparison to the results of the instrumental swallowing assessment, a 2×2 table was used. To count true positives, the results of the PAS and BODS, along with clinical observations, were merged into two categories: those under the presence of or absence of dysphagia. PAS scores of 1-3 were considered physiological, as penetration without actual airway compromise has been reported to occur more frequently in older adults, while PAS scores of 4 or higher in any of the tested consistencies were considered to indicate dysphagia (Butler et al., 2011; Daggett et al., 2006; Jardine et al., 2021). BODS-1 scores of higher than 1, and BODS-2 scores of higher than 2, were considered pathological, with two exceptions where BODS-2 was scored 3 but no clinically relevant dysphagia was reported during the FEES.

In cases of doubt, the clinical observation results were considered in order to correctly classify results as indicating presence or absence of dysphagia. The

GEBS results did not need to be pooled, as the results indicated a clear pass or fail. To evaluate whether the full protocol (including the pureed bolus test) should always be administered, two separate analyses were conducted. Firstly, the results of the GEBS according to the first two steps (risk-factor assessment and water-swallow test) were analyzed. In a second step, the results of the full protocol were analyzed again with the same calculations. Sensitivity and specificity, as well as positive and negative likelihood, were first calculated in Microsoft Excel with the use of field functions and classic formulas (e.g. $\text{Sensitivity} = \frac{\text{True Positives}}{\text{True Positives} + \text{False Negatives}}$) to get a quick impression of the results. As all participants successfully completed both tests; there was no missing data to consider. Statistical analysis of individual risk factors and their impact on dysphagia prediction, as well as confidence intervals, was performed using IBM SPSS Statistics.

To estimate a sample size, other dysphagia validation studies were taken into account. The aforementioned established tools reported recruitment rates between 50 (GUSS) and 311 (TOR-BSST) (Martino et al., 2009; Trapl et al., 2007). Since this study was planned as a pilot study, feasibility was a major factor when planning the sample size. To account for potential drop-outs due to withdrawal of consent, rapid changes in health status, or unexpected transfers, a total sample size of 100 patients was established as the recruitment goal. To form a broader picture of different geriatric patients, recruitment was planned in multiple settings: acute geriatric wards and a long-term care institution (LTC).

RESULTS

Participants

A total of 225 patients were admitted to the CDK, of which 30 participants (mean age 79.13 years, $SD \pm 5.7$) fulfilled inclusion requirements and gave informed consent to participate. They were subsequently recruited between November 2022 and June 2024 at CDK. The most common reasons for non-eligibility were an age of under 75 and a history of severe stroke. The initially planned center, Haus der Barmherzigkeit in Vienna, could not recruit due to staff shortages for FEES and lockdown regulations limiting non-essential medical contact. The University Hospital Sankt Pölten also withdrew from the study due to health issues among key staff. No participants experienced adverse side effects from the tests, and there were no dropouts. Participant flow is shown in figure 1. All participants completed both tests. Out of the 30, 12 were diagnosed with dysphagia. The highest PAS scores were for liquids, with six patients scoring 6 or higher, indicating severe dysphagia for liquids. No severe dysphagia was observed with puree ($PAS \leq 2$), while two

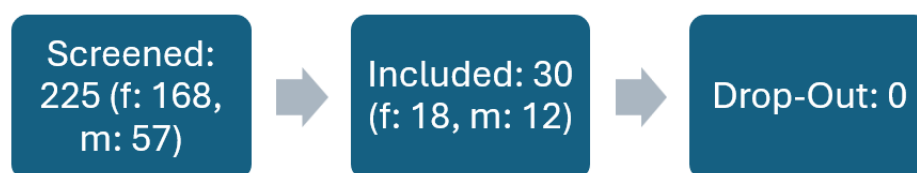


Figure 1: Flow diagram of participants, f: female; m: male

patients had moderate dysphagia with solids (PAS = 3). The geriatric participants — all over 74 — had multiple comorbidities, with a median Charlson Comorbidity Index (CCI) of 2.5 (SD ± 1.7) (Quan et al., 2011). This index evaluates the one-year mortality rate by cross-calculating the accumulated burden of the diseases. For geriatric patients, a score of < 5 indicates a 1-year mortality rate of 85%; a 3–4 point score indicates 52%; a 1–2 point score indicates 26%; and 0 points indicate 12%. Most lived at home with light dependency for activities of daily living (ADL) before admission, primarily due to neurological events (e.g., stroke) or exacerbated health conditions. Four had been admitted for acute internal events, and two for fall complications. Demographics are in Table 2 and test results of PAS and BODS are in Table 3.

Both tests were conducted within seven days, with investigators blinded to the other test's results.

Test results

The GEBS demonstrated promising validity, with 58% sensitivity (95% CI: 0.28–0.85) and 83% specificity (95% CI: 0.59–0.96) using only the first two steps: risk factor assessment and the water swallow test. Tables 3 and 4 illustrate the distribution of cases in a 2x2 table for the combination of the risk factor assessment and water swallow test (GEBS WST) (Table 3) as well as the full GEBS protocol (Table 4).

The positive predictive value (PPV) and negative predictive value (NPV) were 70% (95% CI: 0.43–0.88) and 75% (95% CI: 0.60–0.86) respectively, while positive likelihood ratio (LR+) was 3.5 and negative likelihood ratio (LR-) was 0.5.

When the third step of pureed bolus testing was included and the full GEBS administered, the results showed a higher sensitivity of 67% (95% CI: 0.35–0.90) while maintaining a specificity of 83% (95% CI: 0.59–0.96), with a PPV of 73% (95% CI: 0.47–0.89), and an NPV of 79% (95% CI: 0.62–0.90), as well as LR+ of 4 and LR- of 0.4 (Table 5).

An overview of the results is given in Table 5.

The presence of risk factors and their significance in correlation to dysphagia were calculated using a chi-square (X^2) test as well as Cramér's V. Neurological or neuropsychological disease, recent pneumonia, and reported or observed dysphagia symptoms — such as drooling, coughing, or voice change — correlated

Table 2: Demographic Characteristics; ADL: Activities of Daily Life; CCI: Charlson Comorbidity Index

Demographic characteristics		N (%)
Gender	Female	18 (60)
	Male	12 (40)
Age	75–80	17 (56.7)
	81–85	4 (13.3)
	86–90	6 (20)
	90–100	3 (10)
Reason for Admission	Fall	2 (6.7)
	Acute Neurological Event	14 (46.7)
	Acute Internal Event	4 (13.3)
Dependency on help for ADL	Exacerbation	10 (33.3)
	None to light	22 (73.3)
	Moderate	5 (16.7)
CCI-Score	Severe	3 (10)
	0–1	9 (30)
	2–3	13 (43.3)
	4–5	7 (23.3)
	6	1 (3.3)

Table 3: Cross tabulation results for GEBS Water Swallow Test (GEBS WST) and Presence of Dysphagia (Dys)

	GEBS WST (+)	GEBS WST (-)
Dys (+)	7	5
Dys (-)	3	15

Table 4: Cross tabulation results for the full GEBS protocol (GEBS) and Presence of Dysphagia (Dys)

	GEBS (+)	GEBS (-)
Dys (+)	8	4
Dys (-)	3	15

significantly with diagnosed dysphagia assessed via FEES. In contrast, the presence of sarcopenia, unintentional weight loss and poor oral health did not show significant correlation (table 6).

DISCUSSION

The overall test performance of the full GEBS protocol of 67% sensitivity and 83% specificity seems promising, and does not differ widely from other screening tools that have been validated in geriatric patients — such as the DSTG, which reports a sensitivity of 60% and a specificity

Table 5: Validity results of GEBS Water Swallow Test only and full GEBS protocol; PPV: Positive Predictive Value; NPV: Negative Predictive Value; LR+: Positive Likelihood Ratio; LR-: Negative Likelihood Ratio

GEBS WST		CI (95%)
Sensitivity (%)	58.3	27.7-84.8
Specificity (%)	83.3	58.6-96.4
PPV (%)	70	42.8-87.9
NPV (%)	75	59.8-85.8
LR+	3.5	
LR-	0.5	
GEBS full		
Sensitivity (%)	66.7	34.9-90.1
Specificity (%)	83.3	58.6-96.4
PPV (%)	72.7	46.8-89
NPV (%)	79	62.1-89.6
LR +	4	
LR -	0.4	

Table 6: Correlation of Risk Factors with Dysphagia

	N	X ²	Cramér's V	p
Neurological disorder	20	5.36	0.34	0.018
Recent pneumonia	3	5	0.41	0.025
Sarcopenia	1	1.55	0.23	0.213
Unintentional weight loss	0	0	n/a	1
Dysphagia reported	10	10	0.58	0.002
Impaired oral health	1	1.55	0.23	0.213

of 88% (Thiem et al., 2023). The V-VST has also been validated in older patients against videofluoroscopy and reports a sensitivity of 88% and specificity of 65% (Clavé et al., 2008). Other widely used screening tools report varying levels of sensitivity and specificity, such as the Daniels Water Swallow Test (92% and 67%) (Daniels et al., 2013), Gugging Swallowing Screen (GUSS) (100% and 50%) (Trapl et al., 2007), and Toronto Bedside Swallowing Screening Test (TOR-BSST) (91.3% and 66.7%) (Martino et al., 2009). It needs to be noted that the last two were developed specifically for stroke patients, and thus may be underperforming in geriatric patients.

While the DSTG only relies on a water swallow test, the V-VST includes different viscosities. Both procedures have advantages and disadvantages, as water swallow tests are usually easier to administer and take little to no training, while the inclusion of multiple consistencies produces a more detailed picture of the swallowing abilities, but requires more training and time. Multi-consistency screenings like the V-VST also rely on standardized nomenclature for consistencies, which has still proven to be a challenge internationally (Wu et al., 2022). The GEBS tries to deliver an additional screening tool that

might fall in between these poles, with the inclusion of two consistencies but a very straight forward protocol.

High specificity is crucial to minimize unnecessary dietary restrictions, which can harm geriatric patients' nutritional status (Hansen et al., 2022; Umay et al., 2022). The full GEBS shows promise with 83% specificity, but its 67% sensitivity underscores the need for supplementary methods like mealtime observation and regular check-ups.

Limitations

The GEBS combines observational and self-reported elements — similar to tools like the V-VST, GUSS and TOR-BSST (Clavé et al., 2008; Martino et al., 2009; Trapl et al., 2007) — but this pilot study is limited by a small sample size (n = 30). This leads to very large confidence intervals, making it hard to judge the test's actual performance. Recruitment delays due to COVID-19, and the vulnerable nature of the geriatric population, hindered statistical reliability and generalizability. The long enrollment period further contributed to possible bias regarding a consecutive sample. Though the test results of the GEBS were blinded, there is the possibility of the investigators administering the FEES not being completely blinded due to knowing from their charts or rounds that certain participants were already considered to have dysphagia or have been put on a texture-modified diet. A randomized order of test application might have also reduced bias, but for administrative reasons, this was not possible with the necessary resources for obtaining informed consent, administering the GEBS and conducting the FEES.

Another limitation is the fact that the GEBS was not only administered by nurses and physicians but also by SLPs, who might unintentionally have assessed more than simply the findings of the GEBS.

Further studies in diverse populations are needed to evaluate the GEBS's full potential, including reliability testing, which was unfeasible here. Additionally, the tool was developed and validated in German, with the German version available in the [supplementary material](#).

Conclusions

Standardized dysphagia screening is vital in geriatric care (British Geriatrics Society, 2019; Deutsche Gesellschaft für Geriatrie, 2024; Umay et al., 2022; Ward & Reuben, 2024). The GEBS is feasible, user-friendly, and effective, even in patients with limited verbal communication. It achieved sensitivity of 67% and specificity of 83% in this pilot study, and stands out as a well-validated tool combining instrumental reference tests with observational assessments. Implementing GEBS in geriatric care may



improve healthcare outcomes for this population, even though further studies including more varied participants should be conducted.

Data availability

The datasets used in this study are available from the corresponding author on reasonable request.

Competing Interests

The authors have no relevant financial or non-financial interests to disclose. No funding was received for this study.

Author Contributions

This study was planned and conducted as Susanne Maria Javorszky's dissertation project under the primary supervision of Bernhard Iglseder and secondary supervision of Wilhelm Frank. Raphael Reiter was involved in planning and data collection. All authors contributed to and agreed on the final version of this manuscript.

Ethics Approval

The study was approved by the Ethics Committees for Vienna (EK 21-212-1021), Salzburg (EK 1040/2022) and Lower Austria (GS1-EK-4/848-2023).

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