ORIGINAL RESEARCH

Developing clinical observation items for nursing assessment of dysphagia in dementia: An exploratory multicentre pilot study

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ABSTRACT

Introduction: Dysphagia is common in dementia and can lead to aspiration pneumonia and malnutrition. Early identification is essential; however, established assessments are often impractical in dementia care because they require active patient cooperation and may be limited by care-resistant behaviour. This study aimed to assess initial diagnostic signals of nurse-observed clinical items for identifying dysphagia in this population.

Methods: An exploratory multicentre pilot study was conducted on two geriatric wards in Austria. Nurses observed participants during mealtime using a 23-item checklist developed through a prior Delphi process. Dysphagia status was subsequently assessed by speech-language pathologists. Statistical analyses included chi-square tests, *t*-tests, Mann–Whitney U tests, and exploratory decision tree modelling to explore indicators.

Results: Thirty-seven participants (mean age 79.1 $\pm$ 5.5 years) were included, of whom 27% were diagnosed with dysphagia. Eleven of the 23 observed items showed variation within the sample. "Cough while eating" was significantly associated with dysphagia (p = .003), while "Clears throat" did not reach statistical significance (p = .056) but may warrant further investigation in larger samples. In an exploratory decision tree analysis, "Cough while eating" and "Voice sounds throaty – wet voice" emerged as potentially informative items in this pilot sample, achieving 60% sensitivity, with a 13.5% overall misclassification rate.

Conclusions: Two nurse-observed clinical items, "Cough while eating" and "Wet voice", may represent promising indicators of increased dysphagia risk in people with dementia. These preliminary findings provide a rationale for developing and testing a brief observation-based screening approach. Further research is required to validate these indicators in larger and more diverse samples.

Key Words: Dementia, Dysphagia, Early screening, Nursing observation

1. INTRODUCTION

Dementia poses an urgent global health challenge, with an estimated 51.6 million people affected in 2019, a figure projected to more than double by 2040.[1,2] In recent years, high-income countries such as Germany, along with other parts of Europe and North America, have seen a slight decrease in dementia prevalence and incidence.[3,4] Yet, the overall global burden of dementia continues to grow, primarily due to aging populations worldwide.[1,2]

Among the challenges faced by patients with dementia is dysphagia, which is highly common in this population; stud-

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ies indicate that up to 90% of hospitalized dementia patients experience oropharyngeal dysphagia (OD).[5,6] Additionally, patients with Alzheimer's disease are particularly vulnerable to developing dysphagia.[7] Dysphagia substantially increases the risk of 90-day and 180-day mortality for older adults with dementia.[8] Also, dysphagia is strongly associated with the occurrence of aspiration pneumonia and patients with dysphagia are also at greater risk of developing pressure injuries due to their compromised health status.[6,8] Additionally, dysphagia often results in malnutrition and dehydration, further complicating the health of patients with dementia.[6,9]

Feeding tubes are often used when swallowing function is severely impaired or unknown, but they are not recommended for dementia patients, as evidence shows no improvement in survival, weight, aspiration pneumonia prevention, or pressure ulcer outcomes, and they are linked to increased restraint use.[10,11] Therefore, dysphagia assessment is essential to prevent complications like aspiration pneumonia, which can result in prolonged hospital stays and increased economic burdens for acute care facilities.[12]

Dysphagia assessment in dementia patients generally combines clinical evaluations with diagnostic tools. Common methods include the Eating Assessment Tool-10 (EAT-10), bedside water swallow tests, and more advanced techniques such as fibreoptic endoscopic evaluation of swallowing (FEES) and video fluoroscopic swallow studies (VFSS).[9,13,14] While instrumental methods allow for accurate swallowing assessment but are limited by factors such as high costs, radiation exposure, and the need for specialized equipment, bedside assessments provide a practical alternative as they require no special equipment or radiation exposure and involve presenting foods of various consistencies (e.g., liquid, solid, or pudding-like) but still avoiding mixed consistencies.[15–17] Also given patients' cognitive limitations, FEES may be less feasible for certain patients.[18,19] Instead, an assessment by a speech language pathologist (SLP), using structured food observation and systematic questioning of healthcare workers regarding eating behaviours, can provide a foundation for further swallowing therapy interventions.[20] Research indicates that mixed consistencies pose a higher risk of aspiration for patients compared to individual consistencies like liquid, solid, or pudding-like.[21–23] However, using only specific consistencies and amounts can compromise ecological validity in assessments.[24] Bedside swallowing tests require trained healthcare professionals, often unavailable outside regular hours.[25] Trained nurses, with 24-hour availability, can perform dysphagia screenings to help reduce related adverse outcomes.[26] But nursing screenings for identifying dysphagia encounter similar challenges as described above.[17] Additionally, care-resistant behaviour is an important factor in nursing interventions for patients with dementia, as it escalates significantly with the progression of dementia.[27] A suitable swallowing screening for dementia patients should prioritize comfort and be feasible for nurses to perform, ideally in a discreet manner so patients remain unaware of the testing. This approach helps prevent care-resistant behaviours and ensures more accurate results and recommendations.

Due to the lack of literature on care staff in this area, a Delphi study has taken an initial step towards addressing the issue.[28] This study identified 23 items that may aid in recognizing dysphagia in individuals with dementia. However, as these items are based solely on expert opinion, field observation is needed to determine which items reliably indicate dysphagia. The aim of this study, therefore, is to bring the 23 items into practical application and, through observation by nurses, diagnosis by SLPs, and subsequent analysis, to explore which items (alone or in combination) may signal increased dysphagia risk.

Therefore, the research question is: Which of the 23 items identified in the Delphi study are effective in identifying dysphagia through observation by nurses in individuals with dementia?

2. METHODS

This study was conducted at two sites – LKH Graz II in Graz, Austria and the Christian Doppler Klinik in Salzburg, Austria – on two comparable geriatric wards within these respective hospitals. Nurses used an observation sheet to monitor participants' initial food intake on the ward. Following this observation, patients were assessed for dysphagia by experienced SLPs through a clinical evaluation. According to the S3 guideline on dementia, clinical evaluations are preferred over other methods.[20] The reporting of methodology and results was informed by the TRIPOD Statement, aiming to support transparency and clarity.[29]

2.1 Participants

Participants in this study were individuals diagnosed with dementia (ICD-10 codes F00–F03). Patients with a history of stroke, head or neck tumours, chronic obstructive pulmonary disease (COPD), or asthma were excluded to prevent misleading observations of the items. If the inclusion criteria were met and none of the exclusion criteria were present, participants were approached by the nurses on the ward and informed about the study, allowing them to be included.

To determine the required sample size for the planned chi-square test, an a priori power analysis was conducted using

GPower 3.1.9.7. Assuming a medium effect size (w = 0.3), a significance level of $\alpha = 0.05$, and a desired power of 0.80, the analysis indicated that a total sample size of 88 would be required to detect a statistically significant effect.[30] Determining the proper sample size for the decision tree model was less straightforward. Unlike traditional hypothesis testing, decision trees lack a universally defined formula for sample size calculation.[31,32]

2.2 Data collection

The observation sheet used for data collection included sociodemographic data of the participants, the 23 items identified in the Delphi study,[28] the mini-mental state examination (MMSE) score, the length of observation (LOO), and the participant's body position during the meal (BPDM). The need for assistance while eating (NFAWE) was also recorded. The observation items were operationally defined as directly observable behaviours during the meal or, where applicable, within the specified three-minute post-swallowing period. Nurses were instructed to record an item as present only when the corresponding behaviour was observed. For example, "cough while eating" referred to any audible cough temporally associated with food or liquid intake; "voice sounds throaty – wet voice" referred to a perceptible gurgly or wet change in voice quality during or after intake; "clears throat" referred to audible throat clearing that was not coded as coughing; and "repeated hard swallowing attempts or repeated swallowing" referred to repeated visible or audible swallowing attempts after one bolus. Additionally, the observation sheet featured an Item 24, which could be selected if none of the 23 items were observed, ensuring that documentation errors or omissions were minimized. The observation was required to continue until the participant finished eating, plus an additional three minutes, as one of the 23 items specified monitoring for coughing attacks up to three minutes after swallowing food or liquid. The results of the SLP assessment were also documented on the observation sheet.

2.3 Ethics consideration

For the exploratory multicentre pilot study, ethical approval was obtained from two independent ethics committees: the Ethics Committee of the Medical University of Graz (Ref. No. 1120/2024) and the Ethics Committee of the State of Salzburg (Ref. No. 1122/2022). Written informed consent was obtained from all participants or their legal representatives if needed, and all procedures followed the approved protocols.

2.4 Data analysis

Descriptive statistics were calculated for all variables. Means and standard deviations (SD) were reported for continuous variables when appropriate, while medians and ranges were used for ordinal or non-normally distributed variables. Frequencies and percentages were calculated for categorical variables. The choice of statistical tests was guided by the level of measurement, distributional assumptions, expected cell frequencies, and the exploratory pilot design of the study. Associations between categorical clinical observation items and the presence of dysphagia were examined using chi-square tests. When expected cell frequencies were small, Fisher's exact test was used, as it is more appropriate for sparse contingency tables in small samples. This approach was also applied to BPDM and NFAWE, both of which were categorical variables with small cell frequencies.[33] Due to the small sample size, distributional assumptions for continuous variables were assessed using the Shapiro-Wilk test and visual inspection of Q-Q plots. Age showed no significant deviation from normality within the comparison groups and was therefore compared between participants with and without dysphagia using an independent-samples *t*-test.[34] In contrast, MMSE scores showed a deviation from normality in the dysphagia group; therefore, MMSE scores were compared between groups using the non-parametric Mann-Whitney U test.[35] In addition to these bivariate analyses, a decision tree model using R version 4.4.2 was employed as an exploratory multivariable approach to identify clinical observation items, or combinations of items, that were potentially informative for dysphagia. Given the small sample size and pilot character of the study, the decision tree was not intended to provide a validated prediction model, but rather to generate preliminary hypotheses. All other statistical analyses were performed using IBM SPSS Statistics version 30.0.0.

3. RESULTS

3.1 Participant characteristics

A total of 37 participants with a mean age of 79.14 years ($\pm$ 5.48) were included in the study. The participants had a median MMSE score of 17 (range 24) and a mean Body Mass Index (BMI) of 24.37 ($\pm$ 4.51). Dysphagia was identified in 10 participants (27%), and 11 out of the 23 clinical items were observed with varying frequencies (Frequency of observed items (FOOI)) (see Table 1).

3.2 Statistical results

To explore group differences and potential associations with dysphagia, age, MMSE, BPDM, and NFAWE were compared between participants with and without dysphagia, as shown in Table 2. The mean age in the dysphagia group was 80.20 $\pm$ 5.51 years, compared to 78.74 $\pm$ 5.52 years in the non-dysphagia group. An independent samples *t*-test revealed no statistically significant difference between the

groups ($t(35) = -0.715$, $p = .240$). There was no significant difference between the median MMSE scores of the dysphagia group (n = 15, range 11) and non-dysphagia group (n = 20, range 24) (Z = -0.894, $p = .389$). Fisher's exact test was used to determine if there was a significant association between BPDM and the presence of dysphagia. There was not a statistically significant association between the two variables ($p = .836$). Again, Fisher's exact test was used to determine if there was a significant association between NFAWE and the presence of dysphagia. Also, there was not a statistically significant association between the two variables ($p = .709$). Using the chi-square test and reporting exact significance values, only "Cough while eating" showed a statistically significant association with dysphagia ($\chi^2(1) = 10.638$, $p = .003$, $\varphi = 0.536$). "Clears throat" did not meet the conventional threshold for statistical significance and is therefore interpreted cautiously. However, given its potential clinical relevance, the result is reported descriptively ($\chi^2(1) = 4.934$, $p = .056$, $\varphi = 0.365$) (see Table 2).

Table 1. Demographics of participants

	Participants n = 37
Age, mean years (SD)	79.14 (± 5.48)
Female Sex, n (%)	22 (59.5)
BMI, mean (SD)	24.37 (± 4.51)
MMSE, median (range)	17 (24)
BPDM, Position, n (%)	Seated on a chair at the table, 24 (64.9) In a wheelchair at the table, 11 (29.7) In bed with elevated upper body and bedside table, 2 (5.4)
NFAWE, n (%)	4 (10.8)
Dysphagia, n (%)	10 (27)
LOO, minutes (SD)	17.16 (± 6.57)
FOOI, Item, n (%)	Mouth not empty after swallowing, 3 (8.1) Cough while eating, 11 (29.7) Voice sounds throaty - wet voice, 7 (18.9) Throaty voice after/during eating and/or drinking food/liquids (wet voice), 4 (10.8) Shortness of breath after eating/drinking, 2 (5.4) Person reports increased effort when swallowing, 1 (2.7) Clears throat, 15 (40.5) Repeated hard swallowing attempts or repeated swallowing, 4 (10.8) Coughing attack (up to 3 min after swallowing liquid or food), 1 (2.7) Throaty breathing that occurs only after eating and/or drinking, 1 (2.7) Time from ingestion to swallowing is over 10 seconds for solid food, 1 (2.7)

Table 2. Statistical comparison of demographic and observational measures by dysphagia status

	Dysphagia Yes n = 10	**Dysphagia No n = 27**	***p* value**
Age, mean years ± SD	80.20 ± 5.51	78.74 ± 5.52	.240
MMSE, median (range)	15 (11)	20 (24)	.389
BPDM, Position, n (%)	Seated on a chair at the table, 6 (60) In a wheelchair at the table, 3 (30) In bed with elevated upper body and bedside table, 1 (10)	Seated on a chair at the table, 18 (66.6) In a wheelchair at the table, 8 (29.63) In bed with elevated upper body and bedside table, 1 (3.7)	.836
NFAWE, n (%)	1 (10)	3 (11.11)	.709
Cough while eating, n (%)	7 (70)	4 (14.8)	.003
Clears throat, n (%)	7 (70)	8 (29.6)	.056

Decision tree modelling was performed to explore which observation items, or combinations of items, were potentially informative for dysphagia status in this pilot sample. Prior to modelling, items with no variation across the dataset (i.e., identical values in all participants) were excluded. This reduced the item pool from 23 to 11. Twelve of the 23

Delphi-derived items were not observed in any participant (0/37) during the single-meal observation and therefore had to be excluded from further modelling due to zero variance. In a first step the most complex decision tree possible was built (using the R-function rpart ()), which was subsequently pruned using a cost/complexity criterion in a 10-fold cross-validation.

The final decision tree (see Figure 1) identified "Cough while eating" (Item 3) as the most informative predictor. Participants without this observation (Item 3 = 0) were predominantly dysphagia-free, with 23 out of 26 cases correctly classified in the left terminal node. For those with a positive observation (Item 3 = 1), the model further split the group based on the presence of "Voice sounds throaty - wet voice" (Item 4). If both signs were present, 6 out of 7 participants were correctly identified as having dysphagia (right terminal node). The middle terminal node included 4 participants, of whom one had dysphagia but was misclassified, contributing to the overall false negative rate. In total, the model classified participants into three terminal nodes, correctly identifying 6 out of 10 individuals with dysphagia, resulting in a sensitivity of 60%. Overall, 5 out of 37 cases (13.5%) were misclassified (4 false negatives and 1 false positive). The majority of false negatives were found in the left and middle nodes, while the single false positive occurred in the right node. Thus, while the model showed preliminary discriminatory patterns in this pilot sample, it also missed some true dysphagia cases and should not be interpreted as a validated diagnostic model.

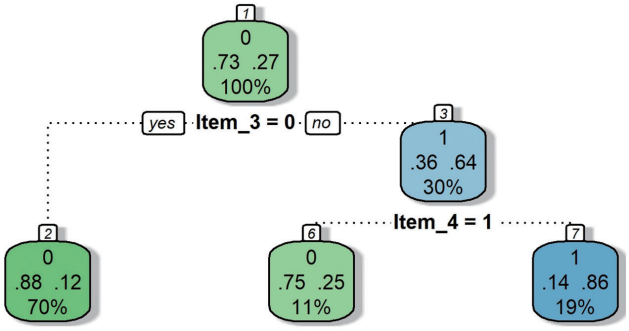

Figure 1. Decision tree model for identifying dysphagia based on nurse-observed indicators

4. Discussion

This exploratory pilot study examined the feasibility and initial diagnostic potential of 23 nurse-observed clinical items to identify dysphagia in dementia patients. After excluding items with no variance, two indicators, "Cough while eating" and "Voice sounds throaty - wet voice", emerged as the most potentially promising predictors. The exploratory decision tree model correctly classified 60% of dysphagia cases in this pilot sample with an overall misclassification rate of 13.5%. Among all items, only "Cough while eating" was significantly associated with dysphagia (p = .003). The finding for "Clears throat" did not reach statistical significance and should not be overinterpreted, although it may warrant further investigation in adequately powered studies.

A key observation was that 12 of the 23 Delphi-derived items were never recorded (0/37) during the single-meal observation. From an instrument-development perspective, this finding should not be interpreted as directly invalidating the content validity established through the previous Delphi process. In line with Messick's understanding of validity as a unified construct and DeVellis' principles of scale development, content-valid item generation and empirical item performance represent related but distinct sources of validity evidence.[36,37] The absence of item variability therefore raises important questions regarding empirical observability, item sensitivity, and context dependency. Some items may be theoretically relevant but occur only rarely, under specific circumstances, or in particular subgroups of patients, for example in relation to fatigue, food consistency, disease stage, or repeated mealtime exposure. Thus, the present findings suggest that, although the current item pool is grounded in expert consensus, it may be overinclusive at the theoretical level and may not yet demonstrate sufficient empirical performance under single-meal real-world observation conditions in acute geriatric settings. Items that do not manifest during such observations may have limited practical utility for a brief nursing screening tool, even if they remain relevant from a theoretical or content-validity perspective. Therefore, the present study should be understood as an initial field-screening of expert-derived items rather than as a definitive item reduction. Further refinement should include repeated observations across different meals and food consistencies, larger samples, and psychometric evaluation of item performance before conclusions are drawn regarding the practical relevance or exclusion of individual items.

The observed association between "Cough while eating" and dysphagia is consistent with previous studies indicating that coughing is one of the most observable and reliable indicators of impaired swallowing.[16] The conditional relevance of "Voice sounds throaty - wet voice" in the decision tree suggests that vocal quality changes may warrant further investigation as an indirect sign of residue or aspiration as it is highly specific but not sensitive.[38] These findings are particularly important for dementia care, where patients may be unable to cooperate with instrumental assessments. Observation-based tools that rely on visible or audible signs, like coughing or voice changes, may offer a practical and

resource-efficient screening approach for nurses, especially in settings with limited access to SLPs. Since nurses are continuously present, they are ideally positioned to notice subtle signs early, facilitating timely referral to speech-language pathologists and preventing complications such as aspiration pneumonia or malnutrition.[26]

Interestingly, "Voice sounds throaty - wet voice" (Item 4), which did not reach statistical significance in the bivariate chi-square analysis (p = .647), was nonetheless retained as a relevant predictor in the decision tree model. This discrepancy can be explained by the different underlying statistical logic: while the chi-square test assesses the independent association between a single variable and dysphagia, the decision tree evaluates variables conditionally, in relation to others. In this case, Item 4 only became relevant for classifying cases when "Cough while eating" (Item 3) was already present. This highlights the added value of multivariate modelling for capturing complex interactions and hierarchical relationships between variables, insights that traditional bivariate statistics may miss.

Conversely, "Clears throat" approached conventional levels of statistical significance in the chi-square test (p = .056) but was not included in the final decision tree model. This suggests that while the item may show a weak overall association with dysphagia, it did not add enough additional discriminatory power once the more informative variables (Items 3 and 4) were included. This finding illustrates how decision tree analysis can generate clinically interpretable hypotheses about item combinations, although such patterns require validation in larger samples. A hypothetical tree excluding Item 4 would result in only two terminal nodes, reducing model complexity but increasing misclassifications. While sensitivity would slightly improve to 70% (7 of 10 dysphagia cases correctly identified), the number of false positives would rise to four, lowering overall accuracy to 81%. This highlights the trade-off between sensitivity and specificity in clinical decision models.

In this study, neither age nor cognitive status, as measured by the MMSE, showed a statistically significant association with the presence of dysphagia. This finding is somewhat unexpected, as previous studies have suggested that increasing age and cognitive decline are risk factors for swallowing impairments, particularly in neurodegenerative diseases such as dementia.[9, 34] One possible explanation is that the sample was relatively homogeneous in terms of age and severity of dementia, limiting the ability to detect such associations. Similarly, no significant influence of body position during meals on the occurrence of dysphagia could be demonstrated. While prior studies have highlighted that upright positioning may reduce the risk of aspiration,[33] the current study did not replicate these findings. Again, this may be due to limited variation in body position across the sample or to the observational nature of the study, which did not involve experimental manipulation of posture.

A notable strength of this study is its real-world clinical setting. Observations were conducted during normal mealtimes on geriatric wards by regular nursing staff, not creating a laboratory environment for the participants. This increases the ecological validity of the findings and suggests that the identified items are not only theoretically relevant but also observable under practical conditions.

Study limitations and implications for further research

This study faces several limitations that may influence its findings.

Observer bias could have been introduced, as the observation sheet relied on nurses to document behaviours, which might vary based on individual training and experience. Additionally, the exclusion of patients with conditions such as COPD or a history of stroke may limit the generalizability of the results to a broader population of individuals with dementia.

The observation period, restricted to a single meal, may not have captured symptoms that manifest less frequently or under different conditions. Furthermore, clinical evaluations, while preferred, may not detect all forms of dysphagia, particularly silent aspiration, potentially leading to underreporting in the outcome data.[39, 40] Challenges related to patient cooperation, particularly in individuals with advanced dementia, could also impact the accuracy of observations.[27]

Furthermore, the limitations of the MMSE must be acknowledged. Although it is widely used, the tool often fails to identify subtle cognitive impairments, particularly in healthy or highly educated individuals, because ceiling effects lead many to score near the maximum despite mild deficits. In addition, the MMSE shows low sensitivity to impairments in executive functioning, abstract reasoning, and visuoconstructional skills, which means that certain conditions, such as amnestic syndromes, may remain undetected.[41]

A central limitation of this study is that the planned sample size was not reached. Although the a priori power analysis indicated that 88 participants would be required, only 37 participants could be included. This substantially limits its statistical power and increases the risk of Type II error, meaning that potentially relevant associations may not have been detected. The small sample also reduces the stability of effect estimates and limits the reliability and generalizability of the findings. This limitation is particularly relevant for the decision tree analysis, as tree-based models are susceptible

to overfitting when applied to small datasets, with models capturing noise rather than true patterns. This leads to strong performance on training data but poor predictive accuracy on new cases. The resulting variance in performance estimates is often high, making findings unstable and difficult to reproduce. In addition, small samples tend to yield inflated and overly optimistic accuracy estimates. This not only undermines the reliability of reported results but also restricts the model's ability to generalize to wider populations, as the limited data fails to represent the full variability of the problem space and may encourage the learning of spurious associations.[42,43] The smaller-than-planned sample size was due to difficulties in recruiting a sufficient number of participants, primarily because of the acute shortage of nursing staff.[44] This shortage poses significant challenges for conducting nursing science projects in clinical settings. As a result, certain observation items may not have appeared during the study. Therefore, the decision tree should not be interpreted as a validated prediction model, but as an exploratory, hypothesis-generating approach to identify potentially relevant item combinations for future investigation. With a larger sample size or repeated observations, these items might have been observed and included in the analysis, potentially impacting the study's findings. The finding that two easily observable clinical signs, "Cough while eating" and "Wet voice", were involved in the exploratory classification of dysphagia cases suggests that a simplified observation-based tool for nurses may be feasible, but its effectiveness must be tested in future validation studies. Future iterations of this tool should prioritize practicality, ease of training, and incorporation into existing meal routines to improve early dysphagia detection in dementia care. Also, future studies should aim to replicate these findings in larger, more heterogeneous populations, evaluate the interrater reliability of nurse observations, and investigate the potential of a structured screening tool to improve early dysphagia detection and referral rates to SLPs.

5. Conclusion

In conclusion, this pilot study provides preliminary evidence that nurse-led observations focusing on just two key indicators, "Cough while eating" and "Wet voice", may offer a viable basis for early dysphagia screening in dementia care. These findings support further validation and development of a structured, observation-based screening tool to enhance safety and care quality in this vulnerable population.

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Authors contributions

Christoph Palli contributed to the conception and planning of the study, coordinated contact with the participating hospitals, was responsible for data collection, and drafted the initial manuscript. Dr. Michael Melcher performed the statistical analyses, including the decision tree analysis. Prof. Gerhard Müller supervised the study planning and manuscript preparation process. All authors critically reviewed and revised the manuscript, approved the final version, and agreed to its publication.

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Conflicts of Interest Disclosure

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Association for Health Sciences and Education. The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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