ORIGINAL RESEARCH

DOI: 10.4274/ejgg.galenos.2025.2024-11-9
Eur J Geriatr Gerontol 2025;7(3):150-158

The Turkish Version of Hydration Risk Assessment Tool in Older Patients: Cross-Cultural Adaptation and Psychometric Evaluation

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Abstract

Objective: Dehydration is a common and serious issue among older adults, with significant implications for their health and well-being. Preventing dehydration in older adults requires a multifaceted approach that involves early identification of risk factors, accurate detection methods, targeted interventions, and ongoing monitoring to ensure adequate hydration. For this reason, the study was designed to assess the validity and reliability of the Turkish adaptation of the Northumbria Assessment of Hydration (T-NoAH) among older patients.

Materials and Methods: A methodological and descriptive approach was utilized in this investigation. After establishing linguistic validity, the study was conducted with a convenience sample of 360 older patients within 24 hours of admission to the hospital, using a descriptive information form and T-NoAH for data collection. The analyses performed included exploratory factor analysis, confirmatory factor analysis (CFA), discriminant validity assessment, internal consistency evaluation via Cronbach's alpha, item-total correlation analysis, examination of ceiling and floor effects, and Hotelling's T-squared test. Predictive accuracy was examined in the sample using a receiver operating characteristic curve, with serum osmolality as the reference test.

Results: The tool had sufficient linguistic validity. The instrument consisting of 8 items and one factor was identified. This factor explained 39.24% of the total variance. Model fit indices were ≥0.90, as per CFA. Cronbach's alpha was determined to be 0.73. There was no response bias identified, and there were no floor or ceiling effects. The optimal cut-off point (5 or more) showed sensitivity (70%) and specificity (89%) (area under the curve =0.795, 95% confidence interval, p<0.001) compared to non-dehydration group.

Conclusion: This tool is a short, easily understandable and applicable measurement for assessing older patients' hydration risk. It can be used by nurses to evaluate the risk of dehydration in older patients and to implement and evaluate effective interventions according to risk situations.

Keywords: Hydration, older adults, psychometrics, risk assessment

Introduction

Dehydration is a common health issue among older adults, leading to significant economic and social challenges (1-3). Studies provide evidence for the view that dehydration is prevalent among hospitalized older patients and is linked to higher mortality rates (4,5). A meta-analysis showed that 24% of older individuals dehydrated based on directly measured osmolality levels exceeding 300 mOsm/kg, which is regarded as the most accurate assessment method. The study by Parkinson et al. (6) revealed a high likelihood of dehydration among both long-term care residents and community-dwelling older adults. The study conducted in Türkiye found that dehydration affected 31% of 300 older patients admitted to a geriatric clinic (7). Aging-related changes, including increased body fat and decreased muscle mass, result in reduced body water percentage from its level of 60% in adulthood (8,9). The aging process is characterized by declines in physical, cognitive, and social functions, impacting various aspects of well-being, thereby affecting adequate fluid intake (10,11). Reduced thirst sensation, presence of incontinence, side effects of medications,

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Received: 29.11.2024 **Accepted:** 20.06.2025 **Epub:** 28.08.2025

Cite this article as: Atasoy E, Akyol MA, Akpınar Söylemez B, Küçükgüçlü Ö. The Turkish version of Hydration Risk Assessment Tool in older patients: cross-cultural adaptation and psychometric evaluation. Eur J Geriatr Gerontol. 2025;7(3):150-158

and chronic conditions contribute to inadequate fluid intake among older adults, leading to disruptions in fluid balance and often resulting in dehydration (5,12,13).

Dehydration is a significant risk factor for challenging health issues in older adults, highlighting the importance of addressing proper hydration in this population to prevent adverse outcomes. Related health problems include electrolyte imbalances, urinary tract infections, kidney issues, pressure ulcers, constipation, medication toxicity, respiratory infections, cognitive decline, muscle weakness, and falls (5,13,14). The study by Lacey et al. (15) revealed that older adults with dehydration have a 40% increased risk of mortality over 8 years and a two-times higher risk of disability over 4 years compared to those with adequate hydration. Schettino et al. (16) observed that dehydration, identified through biochemical parameters, was linked to the onset of venous thromboembolism during hospitalization. Dehydration tends to worsen rather than improve after hospital admission, highlighting the critical importance of effective hydration management in hospitalized patients. This underscores the necessity of early implementation of strategies during hospitalization to mitigate adverse outcomes and complications associated with inadequate hydration. Therefore, with the aging population, prevention of this problem has become increasingly important globally (3,17). Using a screening tool to identify older adults at risk of dehydration can facilitate the restoration of adequate fluid balance, prevent potential complications or fatal outcomes, and reduce healthcare costs (5,18,19). Thus, it is critically important to be able to conduct a rapid and uncomplicated assessment of older patients' hydration status.

In clinical practice, dehydration associated with insufficient fluid intake in older adults is typically evaluated through direct measurement of serum or plasma osmolality (20). However, the test for serum osmolality, considered the gold standard, is invasive method. Such invasive approaches may not always be practical or sustainable for regular hydration assessment, particularly in older adults. Some studies suggest that, in older adults with adequate renal function, urine color and specific gravity can serve as simple, cost-effective, and efficient indicators of hydration status (21). However, factors such as medication use, dietary influences on urine color, limitations in patients' ability to accurately observe changes, and impaired renal function in conditions like chronic kidney disease may affect the reliability of these measurements. Consequently, evidence-based research emphasizes that these parameters alone are insufficient for diagnosing dehydration (17,20).

In younger adults, signs such as reduced skin turgor, sunken eyes, and dry mucous membranes are considered more clinically relevant indicators of dehydration. However, in older adults, age-related changes in skin and mucosa reduce the diagnostic value of these clinical signs (6). Therefore, relying solely on skin or mucosal changes for dehydration diagnosis is not recommended (22,23). The early identification of older adults at risk of dehydration, using an appropriate screening tool, can facilitate the restoration of optimal fluid balance, prevent complications and mortality, and contribute to cost savings in healthcare (17,19).

A review of the literature reveals that some Dehydration Screening Tool (DST) have limited diagnostic accuracy in detecting dehydrated older adults (17,24,25). To assess dehydration risk in community-dwelling and institutionalized older adults, the DST was developed. Developed by Vivanti et al. (26), this instrument includes 11 items, covering four physical indicators of dehydration (such as a decrease in systolic blood pressure, dryness of the tongue, skin turgor, and variations in body weight) along with seven items evaluating thirst perception, pain, and mobility status. The tool classifies individuals as "dehydrated" or "not dehydrated" based on these criteria (27).

Rosi et al. (19) evaluated a diagnostic approach based on the Geriatric DST-modified, which includes survey questions on drinking behavior, pain, and mobility, as well as clinical signs such as axillary dryness, body mass index, and dry mouth. The tool showed a sensitivity of 0.62 and a specificity of 0.47 when assessed against calculated serum osmolarity. Although this screening tool offers higher diagnostic accuracy compared to standalone methods, it does not represent a definitive breakthrough in hydration assessment (22).

Recent literature has explored non-invasive hydration assessment methods, such as smartphone imaging and wearable devices, in the general population, highlighting the need for further pilot studies on their applicability and long-term reliability (28).

In Türkiye, no widely accepted, validated, and reliable hydration risk screening scale is currently available for use in clinical settings for older adults at risk of dehydration. The Water Balance Questionnaire, developed by Malisova et al. (29), was adapted into Turkish and underwent a validity and reliability study, conducted by Sen and Aktac (30) in 2021. This questionnaire is recognized as a dependable and valid instrument for evaluating hydration status in the general population. In contrast, the Northumbria Hydration Assessment Tool (NoAH) was specifically designed to assess hydration risk in older adults by considering their health parameters. It is a brief, easy-to-administer screening tool suitable for clinical settings. The NoAH tool enables the identification of older individuals at risk of inadequate fluid intake, allowing for the implementation of appropriate interventions and the prevention of dehydration. NoAH protocol, introduced by Oates et al. (31), is suggested as an easy-to-use screening method to evaluate insufficient fluid intake in this age group and promote adequate hydration. This tool can facilitate the restoration of adequate fluid balance, prevent potential complications or fatal outcomes, and reduce

healthcare costs. This scale offers not only a quick and easy-to-use tool for nurses but also potential benefits in practice because nursing interventions can be determined according to the hydration risk assessment scores.

Nurses, particularly those in direct patient care, play a crucial role in recognizing and early detection of hydration status in older adults, which is essential for planning interventions and preventive measures to mitigate complications. In Türkiye, it is essential to identify a screening tool designed which nurses can use to assess hydration status in older adults for early detection of dehydration and effective intervention planning. The study aimed to evaluate the validity and reliability of the Turkish version of the NoAH (T-NoAH) for older adults. This assessment tool is crucial for identifying hydration status and implementing appropriate interventions to ensure adequate hydration levels and prevent complications.

Materials and Methods

Aim

This research aimed to translate the T-NoAH into Turkish and to evaluate the psychometric characteristics of the T-NoAH in older patients within 24 hours of their hospital admission.

Design

The psychometric characteristics of the T-NoAH were evaluated through a descriptive, methodological, and cross-sectional study design. The study followed recognized reporting standards for developing and validating scales in health, social sciences, and behavioral research (32). The NoAH was first translated into Turkish, then back-translated into English, followed by linguistic validation to ensure the translation's accuracy and consistency. Subsequently, its construct validity and reliability were evaluated.

Linguistic Validation

The tool's original creator, Dr. Lloyd Oates, gave permission to translate the NoAH and assess the psychometric properties of the T-NoAH. The tool was independently translated into Turkish by the research team from the original version in English. The translation process involved back-translation from Turkish into English to ensure accuracy and equivalence. This translation process was conducted by two bilingual professional translators who had no prior knowledge of the tool (33). The team met to examine the translations during the last phase of adaptation.

The English translation was compared with the original version, and Dr. Lloyd Oates validated the back-translation via email. No alterations were made to any items in the tool. For content validity evaluation, input was gathered from seven experts: two nursing academicians (one specialist in psychometric research and the other with expertise in both psychometrics and geriatric nursing), three clinical nurses (two with six years of experience in geriatric care and one with five years in neurology), and two geriatric specialists. Each expert rated the items on a four-point scale, ranging from 1 (inappropriate) to 4 (appropriate).

Construct Validation and Reliability Assessment

Setting and Sample

For scale development and validation studies, it is generally recommended to have a sample size of 10 participants per survey item or a sample size of between 200 and 300 observations (32). In this study, at least 160 older adults were required to perform exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), equating to approximately 20 responses per item for the 8-item scale. The research was carried out in Türkiye between April and June 2024 in medical wards specializing in neurology, cardiology, pulmonary medicine, and general internal medicine.

The participants were 360 older patients who were recruited within 24 hours of admission to hospital. The samples were chosen using convenience sampling. The criteria for inclusion in the study were as follows: volunteering to participate in the study, being 65 years of age or older, being hospitalized in medical wards, being within the first 24 hours of admission to the clinic, and being literate in Turkish. The following were the exclusion criteria: having visual or hearing disability, not knowing Turkish, and being illiterate.

Patients' sodium (Na), blood glucose, and blood urea nitrogen laboratory values at the time of their arrival at the clinic were obtained from their medical records. Various free online tools were available for calculation (34). Serum osmolality values were used to assess discriminant validity.

Data Collection

Data were collected using a descriptive information form alongside the T-NoAH.

Sociodemographic Data

The form was created to collect descriptive information about older patients, including age, sex, marital and formal education status, hospitalization clinic, and serum osmolality. In the current European Society for Clinical Nutrition and Metabolism guideline, it has been shown that serum osmolality is the gold standard for evaluating the dehydration status of older adults, and a calculated serum osmolality ≥295 mOsm/L is sufficient to detect dehydration (35). In this study, serum osmolality served as the measure for evaluating discriminant validity.

Northumbria Assessment of Hydration

The NoAH tool was created by Dr. Christopher Price and his team at Northumbria Healthcare NHS Foundation Trust. The tool was designed to assess the risk of dehydration in older

patients admitted to hospitals. It was part of an effort to create a nurse-led protocol to identify dehydration risks and implement timely interventions (31). The development involved contributions from healthcare professionals like Oates, Riddell, and Plank. The NoAH tool, revised by Oates and Price (24) in 2017, is a nurse-led assessment designed to help staff evaluate the risk of inadequate oral fluid intake in hospitalized patients aged 65 and older, ensuring that they remain well-hydrated. This tool consists of 4 screening questions (designed to exclude patients receiving palliative care, those on intravenous fluid therapy, those unable to eat orally, or those with oral fluid restrictions, respectively) and 8 risk assessment questions. If the answer to one of these four screening questions is positive, the risk assessment is abandoned. The first 6 items of the risk assessment questions are scored between 0 and 1. Items 7 and 8 are scored between 0 and 2. The overall score is calculated by adding the results of 8 risk assessment items, with possible scores ranging between 0 and 10. Risk categories are defined as low (0 or 1 point), moderate (2-4 points), and high (5 or more points). Each risk category is represented by a specific colour and geometric shape for clarity: a green circle for low risk, an amber square for moderate, and a red triangle for high. The screening tool recommends specific nursing interventions according to category. All patients were visited personally before the study, were informed about the study, and were provided signed consent. Psychometric properties of the screening tool are not included in the published protocol (31). Researchers met with each patient before the survey began to give information about the study and obtain written consent.

Ethics

The primary author of the original questionnaire granted written authorization for the psychometric assessment of the T-NoAH. The study received approval from the Dokuz Eylül University Non-invasive Research Ethics Committee (decision number: 2024/12-08, date: 27.03.2024). In addition, all patients gave their informed consent to participate after being fully briefed on the study's objectives and methodology.

Statistics

Analysis of Moment Structures 25.0 and Statistical Package for the Social Sciences 24.0 were used to conduct the analysis. We determined a confidence interval of 95% ($p<0.05$).

Seven experts confirmed the content validity. Expert feedback was assessed using the item Content Validity Index (I-CVI) and the scale-level content validity index (S-CVI) (36,37). To calculate the I-CVI, the number of experts who rated each item as "3" or "4" was divided by the total number of experts. The S-CVI was determined by summing the proportions of items that received ratings of 3 or 4 from the experts. The Kendall W analysis was used to assess the level of expert agreement. Construct validity was evaluated through EFA, CFA, and discriminant validity. The study sample was randomly split using participant entry codes. One half was analyzed with EFA to explore the measurement model, while CFA was performed on the other half to verify the model. The suitability of the data for factor analysis was assessed using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity. The suitability of the data for factor analysis was assessed using the KMO measure and Bartlett's test of sphericity. EFA with Varimax rotation was applied to identify the main components of the domains. The skewness and kurtosis indices were used to evaluate the assumption of normality in the data. Factors and items were deemed sufficiently retained when their eigenvalues were equal to or greater than one, and their factor loadings were at least 0.20. For CFA, the following variables were examined: degrees of freedom, Pearson chi-square (χ^2), Goodness-of-Fit Index (GFI), Root Mean Square Error of Approximation (RMSEA), and Comparative Fit Index (CFI) (36,38,39).

The tool's reliability was evaluated through Cronbach's alpha (19,20,21), item-total correlations, analysis of ceiling and floor effects, and Hotelling's T-squared test to detect response bias (37,40). The number of patients who could obtain the lowest score (floor, 0/10) and the highest score (ceiling, 10/10) on the tool was totaled to determine the floor and ceiling effects. These numbers were then calculated as a percentage of the total sample. The reliability analysis was performed using Cronbach's coefficient, and a result of 0.60 or higher was considered satisfactory (36).

The predictive accuracy of the T-NoAH to discriminate dehydration risk was determined through analysis of the area under the receiver operating characteristic curve. $p<0.05$ was considered statistically significant. Values for the area under the curve (AUC) ≤ 0.70 were considered low, $0.70< AUC <0.90$ as moderate, and $AUC >0.90$ as high, following recommendations by Henderson (41) in 1993. Specifically, a sensitivity of 0.70, combined with a specificity not lower than 0.50, is frequently regarded as the acceptable threshold necessary for a screening instrument to be clinically useful (42).

Results

Linguistic Validation

Following the translation and back-translation process, the items closely matched the originals, and no modifications were required (Supplementary Material 1).

The scores given for each item by seven experts for language and content validity showed no statistically significant differences (Kendall W=0.20, p=0.16). I-CVI for eight items ranged from 0.85 to 1, and S-CVI was 0.99. As a result, all items were retained.

Construct Validation and Reliability Tests

The mean age of patients (n=360) was 74.99±7.57 years (range=65-94); 50.6% (n=182) were male, 64.4% (n=232) were married, and 52.8% (n=190) were literate or had an elementary education level. The largest group of patients was in the cardiology service (28.3%, n=101) (Table 1). Patients in this survey were classified for dehydration risk as follows: low risk, n=96 (26.7%), medium risk, n=151 (41.9%), high risk, n=113 (31.4%). The mean risk score was 3.43±2.55 (range=0-10).

The KMO coefficient was found to be 0.78 and had a Bartlett's sphericity test χ^2 of 349.64 (p<0.001), indicating the suitability of the data for factor analysis. Within the EFA, one factor was identified. This factor explained 39.24% of the total variance. Factor loadings of the tool ranged from 0.21 to 0.86 (Table 2).

Model suitability was demonstrated by the CFA applied to the one-factor solution. CCFI= 0.96, GFI =0.96, χ^2/degree of freedom (df) =1.169, p<0.001, and RMSEA =0.06 were the determined model fit indices. CFA indicated satisfactory factor loadings, which ranged between 0.35 and 2.87 (Figure 1). When discriminant validity was examined, it was found between the two groups (t=-10.554, p<0.001). Dehydrated patients (serum osmolality ≥295 mOsml/L) had higher T-NoAH risk scores (5.25±2.58) than non-dehydrated patients (2.47±1.94).

The overall Cronbach's alpha was 0.73. No response bias was indicated by Hotelling's T-squared test result of 629.26, p<0.001. There were no floor or ceiling effects found (=11.1%). All item-total correlation values were acceptable, varying between 0.31 and 0.86 (Table 3).

Table 1. Descriptive characteristics of the sample (n=360)

Variables	n	%
Sex		
Female	178	49.4
Male	182	50.6
Marital status		
Married	232	64.4
Single	128	35.6
Education		
Illiterate	30	8.3
Literate/elementary school	190	52.8
High school	85	23.6
University	55	15.3
Clinics		
Pulmonary medicine	86	23.9
Neurology	76	21.1
Cardiology	102	28.3
General internal medicine	96	26.7
Hydration risk groups		
Low risk	96	26.7
Medium risk	151	41.9
High risk	113	31.4
	X	**SD**
Age (years)	74.99	7.57

X: Mean, SD: Standard deviation

Table 2. Exploratory factor analysis with Varimax rotation for T-NoAH (n=180)

Items*	Factor loadings
1. Is the patient receiving thickened fluids?	0.71
2. Does the patient have a severe visual problem?	0.57
3. Would the patient be unable to communicate their needs?	0.67
4. Is the patient prescribed furosemide or bumetanide?	0.22
5. Is the patient prescribed antibiotics?	0.21
6. Does the patient have a dry tongue and/or mouth?	0.52
7. Does the patient appear to be confused?	0.86
8. Please observe the patient and identify if they can locate a drink, pick it up, take a drink. Could she/he complete this?	0.81
Explained variance (%)	38.24

*The Turkish version of the tool was administered to the patients.
T-NoAH: Turkish adaptation of the Northumbria Assessment of Hydration

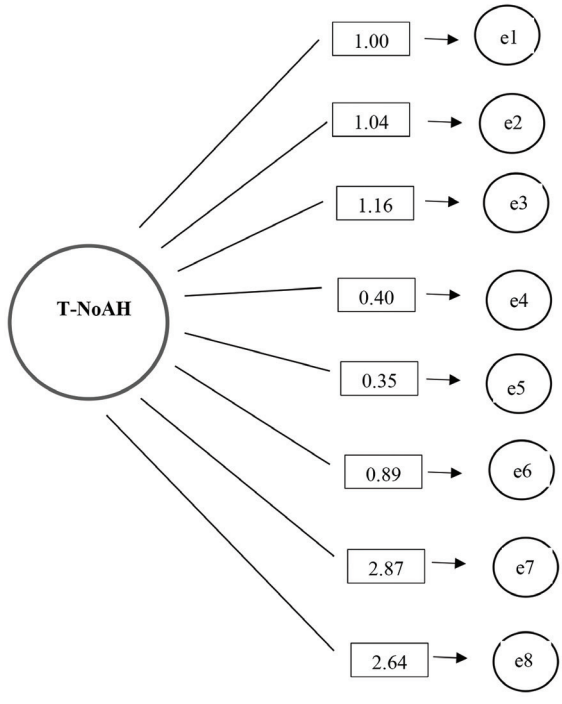

Figure 1. Confirmatory factor analysis of T-NoAH

T-NoAH: Turkish adaptation of the Northumbria Assessment of Hydration

The Predictive Accuracy

The optimal cut-off point (5 or more) showed sensitivity (70%) and specificity (89%) (AUC=0.795, 95% CI, p<0.001) compared to the non-dehydration group (Figure 2). T-NoAH has acceptable psychometric properties, to screen the dehydration risk in Turkish older adults.

Table 3. Item-total correlation scores (n=360)

Items*	Item-total correlation (r)*
1. Is the patient receiving thickened fluids?	0.58
2. Does the patient have a severe visual problem?	0.50
3. Would the patient be unable to communicate their needs?	0.65
4. Is the patient prescribed furosemide or bumetanide?	0.36
5. Is the patient prescribed antibiotics?	0.31
6. Does the patient have a dry tongue and/or mouth?	0.54
7. Does the patient appear to be confused?	0.86
8. Please observe the patient and identify if they can: Locate a drink, pick it up and take a drink? Could she/he complete this?	0.82

*p<0.001

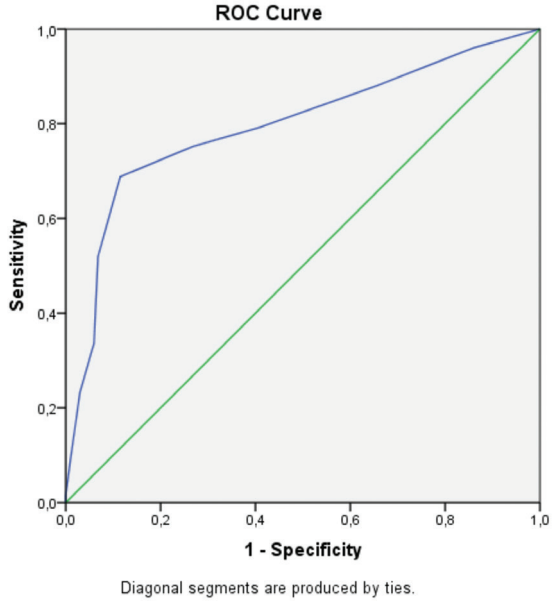

Figure 2. ROC test analysis (dehydrated and non-dehydrated). ROC test analysis showed a sensitivity of 70% and a specificity of 89%, with a cut-off of 5. The area under the ROC curve is 0.795 (95% CI: p<0.001)

ROC: Receiver operating characteristic, CI: Confidence interval

Discussion

Dehydration poses a significant concern for older adults admitted to hospitals, impacting both individual health outcomes and healthcare system costs (4,5,16). Recognizing the risk of inadequate oral fluid intake in older adults during hospitalization and implementing strategies to address this issue are vital for optimizing patient outcomes and reducing healthcare burdens.

The validity and reliable scales are needed to reveal hydration risk in older patients. The development of a nurse-led risk assessment protocol, NoAH, by Oates et al. (31) in 2017, is a significant advancement in addressing the issue. This protocol aims to provide a standardized approach to assess the risk of dehydration in hospitalized older adults, allowing for early identification and intervention to prevent adverse outcomes associated with dehydration. The original study showed that involving staff in the development of NoAH increased their awareness of hydration issues and encouraged them to improve care. The main objective of this paper was to report the reliability and validity of the T-NoAH in a sample of older adult Turkish patients.

The scale was initially developed in English, and its psychometric characteristics were not reported in the existing publication. To our knowledge, the psychometric properties of the scale have not been examined in another language. This first examination of the psychometric properties of the NoAH in a different language and cultural context presents a unique challenge due to the lack of comparative variables. According to the results, the questionnaire was well-understood and considered appropriate by the target sample, with no issues reported regarding the questions. The study on the T-NoAH scale demonstrated that all content validity scores exceeded the minimum required levels, indicating its capability to effectively measure the intended concept (39). This suggests that the T-NoAH scale is a valid tool for assessing the targeted construct.

The study on the T-NoAH scale, similar to the original (31), maintained an 8-item, single-factor structure with significant correlations observed among the items. This consistency in the factor structure and item correlations suggests that the T-NoAH scale is capable of effectively measuring the intended concept in a manner consistent with the original study. The current study concluded that the instrument's factor structure provided an appropriate fit, with all factor loadings and fit indices derived from CFA within the specified ranges. This suggests that the current scale effectively measures the intended concept, with the factor structure aligning well with the underlying construct. The lack of CFA in the initial study hindered the ability to compare variables. A crucial role in the

validation process was played by establish whether the concept being measured by the T-NoAH scale is distinct from other constructs (32). The study aimed to assess whether the T-NoAH risk scores were statistically different between dehydrated and non-dehydrated groups, and dehydrated groups indeed had higher scores. The discriminant validity results from the study on the tool suggest that it can provide valid data on hydration risk assessment for older patients. However, it is important to note that the questionnaire alone may not be sufficient to detect dehydration.

The study on the T-NoAH tool found reliable results with a Cronbach's alpha of 0.73. Results from the Hotelling T-squared test showed no significant risk of response bias, suggesting that participants answered the questions based on their personal views rather than outside influences (37,43). The floor and ceiling effect of 11.1% observed in the study is significantly lower than the commonly accepted limit of 20%, suggesting the lack of substantial bias in responses towards the lowest or highest possible scores, and indicating a more balanced distribution of responses across the scale.

The Cronbach's alpha value of 0.73, while slightly below the commonly accepted threshold of 0.80, remains within an acceptable range for newly validated clinical screening tools, particularly those designed for brief risk assessment (44,45). Several factors may have contributed to this reliability score. Despite the moderate Cronbach's alpha value, the T-NoAH demonstrates strong structural validity and discriminatory power, supporting its clinical applicability for early hydration risk assessment in older adults.

T-NOAH is a useful tool for dehydration risk screening. The optimal cut-off for screening was 5, with 89% specificity and 70% sensitivity.

Study Limitations

Participants in the survey were older adults over the age of 65 who were admitted to medical wards, including neurology, cardiology, pulmonary medicine, and general internal medicine, in Türkiye. The use of a non-random sampling approach in this study may limit the generalizability of the findings due to potential bias. Additionally, the scale was designed to be administered within the first 24 hours of hospitalization, preventing a test-retest reliability analysis and leaving the long-term stability of the scale unknown. Furthermore, as older adults were informed about the survey before participation, response bias may have been introduced. To enhance the reliability and validity of the tool, future research should consider employing a larger and more diverse sample size, as well as assessing potential variations in the tool's duration.

Moreover, the study focused on evaluating the psychometric properties of the T-NoAH scale rather than assessing hydration risk in specific patient groups; therefore, reasons for hospitalization were not initially included. Only patients' current diagnoses were recorded, which may have limited the scope of analysis. Future studies could further investigate the impact of hospitalization reasons, specific diagnoses, and comorbidities on hydration risk, allowing for a more refined adaptation of the T-NoAH scale for targeted patient populations.

Lastly, a key limitation of the study is that it evaluates hydration risk only within the first 24 hours, whereas long-term hydration monitoring is crucial for patient care. Overcoming these limitations in future studies may offer a deeper and more complete insight into assessing hydration risk among hospitalized older adults.

Conclusion

The results demonstrate that T-NoAH offers a strong single-factor structure and produces accurate and dependable conclusions about the risk of dehydration for older patients within 24 hours of hospital admission. As the number of older people with dehydration in Türkiye and around the world rises, using T-NoAH will be beneficial for nurses in evaluating older patients' risks of dehydration, and determining appropriate interventions. Given its practicality, ease of use, and rapid results, it is anticipated that this measuring tool will be used with increasing frequency by health professionals.

Ethics

Ethics Committee Approval: The study received approval from the Dokuz Eylül University Non-invasive Research Ethics Committee (decision number: 2024/12-08, date: 27.03.2024).

Informed Consent: All patients gave their informed consent to participate after being fully briefed on the study's objectives and methodology.

Footnotes

Authorship Contributions

Concept: E.A., M.A.A., B.A.S., Ö.K., Design: E.A., M.A.A., B.A.S., Ö.K., Data Collection or Processing: E.A., Analysis or Interpretation: E.A., M.A.A., Literature Search: E.A., M.A.A., B.A.S., Ö.K., Writing: E.A., M.A.A., B.A.S., Ö.K.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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Supplementary Material 1. Link: https://d2v96fxpocvxx.cloudfront.net/cf9d60d6-523c-458a-a2e6-78728d3ffbb0/content-images/f881424b-9ec2-47b3-b2f1-25f893e0b6d7.pdf