

# Cross-cultural adaptation and psychometric validation of the Turkish version of Abbey Pain Scale in dementia patients

## Demans hastalarında Abbey Ağrı Ölçeği'nin Türkçe versiyonunun kültürlerarası uyarlaması ve psikometrik validasyonu

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### ABSTRACT

**Background:** The aim of this study was to culturally adapt the Abbey Pain Scale (APS-TR) into Turkish and to evaluate the validity and reliability of the scale in dementia patients.

**Patients and Methods:** Between September 16, 2020 and April 16, 2023, a total of 103 dementia patients aged  $\geq 65$  who were admitted to the intensive care units of a university hospital were included in the study. Pain levels were assessed 1 min before mobilization or repositioning, during the procedure, and 20 min afterward using the Turkish version of the APS, the Nonverbal Pain Scale (NVPS), and the Verbal Descriptive Scale (VDS). Construct validity was evaluated through exploratory and confirmatory factor analyses. Reliability was assessed using internal consistency analysis with Cronbach's alpha coefficient, and criterion validity was examined by analyzing correlations between APS-TR and the other pain scales using Pearson correlation analysis.

**Results:** Of a total of 103 patients, 37 were male and 66 were female with a mean age of  $71.7 \pm 5.67$  (range, 65 to 92) years. As a result of linguistic and cultural adaptation, the Turkish version of the scale was found to be appropriate. The content validity index was found to be 0.90. Exploratory factor analysis showed that the items formed a single-factor structure, and factor loadings ranged from 0.489 to 0.855. Confirmatory factor analysis fit indices ( $\chi^2/df = 1.21$ , root mean square error of approximation [RMSEA] = 0.046, standardized root mean square residual [SRMR] = 0.045, [comparative fit index] = 0.989) indicated that the model was acceptable. The Cronbach's alpha coefficient of the scale was calculated as 0.777, and positive and significant relationships were found between APS-TR and NVPS and VDS at all measurement times.

**Conclusion:** Our study results suggest that the Turkish version of the APS is a valid, reliable, and unidimensional measurement instrument which can be used to assess pain in dementia patients receiving treatment in intensive care.

**Keywords:** Abbey Pain Scale, dementia, intensive care, pain assessment, reliability, validity.

### ÖZ

**Amaç:** Bu çalışmada, demans hastalarında Abbey Ağrı Ölçeği'nin (APS-TR) Türkçe versiyonunun kültürlerarası uyarlaması yapıldı ve ölçeğin geçerlik ve güvenirlik özellikleri değerlendirildi.

**Hastalar ve Yöntemler:** 16 Eylül 2020 ile 16 Nisan 2023 tarihleri arasında, bir üniversite hastanesinin yoğun bakım ünitelerine kabul edilen 65 yaş ve üzeri toplam 103 demans hastası çalışmaya dahil edildi. Ağrı düzeyleri mobilizasyon veya yeniden pozisyonlandırmadan 1 dk. önce, işlem sırasında ve işlemten 20 dk. sonra, APS-TR, Sözel Olmayan Ağrı Ölçeği (NVPS) ve Sözel Tanımlama Ölçeği (VDS) kullanılarak değerlendirildi. Yapı geçerliği, açıklayıcı ve doğrulayıcı faktör analizleri ile değerlendirildi. Güvenirlik, Cronbach alfa katsayısı kullanılarak iç tutarlılık analizi ile değerlendirildi; ölçüt geçerliği ise APS-TR ile diğer ağrı ölçekleri arasındaki korelasyonlar Pearson korelasyon analizi kullanılarak incelenerek belirlendi.

**Bulgular:** Toplam 103 hastanın 37'si erkek, 66'sı kadın olup, yaş ortalaması  $71.7 \pm 5.67$  yıl (dağılım, 65-92) idi. Dilsel ve kültürel uyarlama sonucunda, ölçeğin Türkçe versiyonunun uygun olduğu belirlendi. Kapsam geçerlik indeksi 0.90 olarak bulundu. Açıklayıcı faktör analizi, maddelerin tek faktörlü bir yapı oluşturduğunu ve faktör yüklerinin 0.489 ile 0.855 arasında değiştiğini gösterdi. Doğrulayıcı faktör analizine ilişkin uyum indeksleri ( $\chi^2/df = 1.21$ , yaklaşık hataların ortalama karekökü [RMSEA] = 0.046, standartlaştırılmış artıkların ortalama karekökü [SRMR] = 0.045, karşılaştırmalı uyum indeksi [CFI] = 0.989), modelin kabul edilebilir uyum gösterdiğini ortaya koydu. Ölçeğin Cronbach alfa katsayısı 0.777 olarak hesaplandı ve tüm ölçüm zamanlarında APS-TR ile NVPS ve VDS arasında pozitif ve anlamlı ilişkiler bulundu.

**Sonuç:** Çalışma sonuçlarımız, APS'nin Türkçe versiyonunun, yoğun bakım ünitelerinde tedavi gören demans hastalarında ağrının değerlendirilmesinde kullanılabilecek geçerli, güvenilir ve tek boyutlu bir ölçüm aracı olduğunu göstermektedir.

**Anahtar sözcükler:** Abbey Ağrı Ölçeği, demans, yoğun bakım, ağrı değerlendirmesi, güvenirlik, geçerlik.

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Dementia develops under the influence of various factors, including aging, genetic makeup, sex, and other health conditions.<sup>[1]</sup> As life expectancy increases, the prevalence of age-related diseases, such as dementia, is also rising worldwide.<sup>[2]</sup> According to the World Health Organization (WHO), approximately 50 million individuals currently live with dementia, and this number is expected to triple by 2050.<sup>[3]</sup> Dementia is defined as a severe, progressive, and persistent decline in memory and other cognitive abilities that disrupts daily functioning.<sup>[4]</sup>

Older adults with dementia experience chronic, progressive impairments in memory, speech, perception, calculation, orientation, abstract thinking, and problem-solving skills.<sup>[1,5]</sup> Due to communication difficulties, pain assessment and management are significant challenges in this population.<sup>[1,2]</sup> Although evidence suggests that approximately 50% of dementia patients experience pain, it is often underrecognized or overlooked, as many patients cannot verbally express it.<sup>[1,2,6]</sup> Barriers to effective pain assessment include communication problems, lack of observation, inadequate training, time constraints, and limited awareness.<sup>[7,8]</sup> Therefore, a systematic approach to pain assessment using behavioral and observational instruments is necessary to improve pain management, patient quality of life, and caregiver burden.<sup>[2,7,8]</sup> Among existing instruments, the Abbey Pain Scale (APS) is specifically designed for patients with dementia and consists of six observable items.<sup>[9]</sup>

In the present study, we aimed to analyze the validity and reliability of the APS in Turkish population.

## PATIENTS AND METHODS

### Study design and study population

This descriptive, methodological study was conducted at Çukurova University Balcalı Hospital between September 16, 2020 and April 16, 2023. The study included dementia patients admitted to the Neurology, Coronary Care, Internal Medicine, and General Surgery Intensive Care Units (ICUs). The sample consisted of non-intubated patients over the age of 65 with Mini-Mental State Examination (MMSE) scores below 30 and family consent. As this was a psychometric validation study, the sample size was determined based on the recommended participant-to-item ratio rather than a power analysis. The literature recommends including at least 5 to 10 participants per item in scale validation

studies, while ratios of 15 to 20 participants per item are considered to provide more robust psychometric analyses.<sup>[10]</sup> Since the APS consists of six items, a sample of approximately 90 to 120 participants was considered adequate. Accordingly, 103 participants were included in the study, corresponding to approximately 17 participants per item and meeting the recommended sample size. Despite the absence of a dementia-specific pain assessment instrument, pain was assessed using only the Numeric Rating Scale (NRS).

A written informed consent was obtained from each patient and/or their legal guardians. The Turkish adaptation of the APS was approved by its developer on May 15, 2020. The study protocol was approved by the Çukurova University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee (Date: September 4, 2020, Decision No. 18). Institutional permissions from Çukurova University Balcalı Hospital and the relevant clinical units were completed on September 15, 2020. Data collection commenced after all required ethical and institutional approvals had been obtained and was conducted between September 2020 and April 2023. The study was conducted in accordance with the principles of the Declaration of Helsinki.

### Measurement instruments

*Demographic information form (DIF):* The patient identification form included the following information: age; sex; clinical presentation; medical diagnosis; physical limitations, as measured by the Modified Barthel Index; severity of delirium; MMSE score; limb paralysis; and analgesic treatment data.

*Abbey pain scale (APS):* This scale was developed by Abbey et al.<sup>[9]</sup> in 2004 to assess pain in patients with dementia and has not been validated in Turkish population. The APS is a measure designed to assess pain in individuals with dementia based on observable signs of pain. The scale assesses the patient's vocalizations (e.g., moaning, whining, or crying), changes in facial expression (looking tense, frowning, looking frightened), differences in body language (restless movements, rocking, tendency to protect a specific area, or withdrawal), behavioral changes (confusion, refusal to eat, or differences in usual behavior patterns), physiological signs (abnormal body temperature, pulse, or blood pressure, sweating, flushing, or pallor), and physical findings (impaired skin integrity, pressure areas, contractures, or injuries). Each item on the scale is assessed using a four-point scoring system; accordingly, "no pain" is

coded as 0, “mild pain” as 1, “moderate pain” as 2, and “severe pain” as 3. The sum of the scores obtained from the six items is used to determine the patient's overall pain level. A low total score indicates no pain or minimal pain, while a higher score indicates increased pain intensity; a total score range of 0-2 is interpreted as no pain or very mild pain, while a range of 14-18 is interpreted as severe pain.

**Verbal descriptor scale (VDS):** The VDS, developed by Herr and Mobily<sup>[11]</sup> in 1993 to assess pain in cognitively impaired elderly individuals, measures pain intensity from “no pain” to “unbearable pain.” It was used as a parallel scale in this study, as well as in many others, including the Turkish validity and reliability study of the APS.<sup>[9,12,13]</sup>

**NonVerbal pain scale (NVPS):** The NVPS, developed by Odhner et al.<sup>[14]</sup> in 2003 and based on the Face, Legs, Activity, Cry, Consolability (FLACC) scale, was adapted for adult patients. It is used to assess pain in non-verbal patients with burns, trauma, or who are in ICU during painful procedures. It consists of five sections, each scored from 0 to 2, for a total score of 0-10. Scores of 0-2 indicate no pain, 3-6 indicate mild pain, and 7-10 indicate severe pain. Its Turkish validity and reliability were established by Kaya and Erden<sup>[15]</sup> in 2019.

**Mini-mental state examination (MMSE):** The MMSE, developed by Folstein et al.<sup>[16]</sup> in 1975, is a brief screening instrument consisting of 11 questions. It takes about 10 min to complete, and it classifies cognitive status as normal (24-30), mild dementia (18-23), or severe dementia (< 17). The examination assesses multiple cognitive domains, such as orientation, memory, attention, calculation, language, and visuospatial skills.

### Data collection

The data were collected between September 2020 and April 2023, and pain scores of patients who met the sampling criteria were recorded during mobilization or repositioning procedures. The researcher observed the patients 1 min before the procedure, during the procedure, and 20 min after the procedure, and recorded the pain scores on the APS, NVPS, and VDS, which were used as parallel scales.

### Statistical analysis

Statistical analysis was performed using the PASS version 22 software (NCSS LLC, Kaysville, UT, USA). Continuous variables were presented in mean  $\pm$  standard deviation (SD) or median (min-max),

while categorical variables were presented in number and frequency. To assess the content validity of the scale, the opinions of academics specializing in the field were obtained, and the appropriateness of the items in terms of content was examined. In the process of determining construct validity, the suitability of the data set for factor analysis was first evaluated using the Kaiser-Meyer-Olkin (KMO) sample adequacy coefficient and Bartlett's sphericity test. Then, exploratory factor analysis (EFA) was applied to reveal the factor structure of the scale, and confirmatory factor analysis (CFA) was performed to validate the obtained structure. Internal consistency analyses were performed to determine the reliability of the scale, and Cronbach's alpha ( $\alpha$ ) coefficient was calculated in this context. Furthermore, Pearson's moment correlation coefficient was used to examine the scale's relationship with similar measurement instruments and the homogeneity among items. Pearson correlation analysis was selected, as the total scores of the APS-TR, NVPS, and VDS satisfied the assumptions for parametric analysis, including approximate normal distribution. A  $p$  value of < 0.05 was considered statistically significant.

## RESULTS

Of a total of 103 patients, 37 were male and 66 were female with a mean age of  $71.7 \pm 5.67$  (range, 65 to 92) years.

### Linguistic and cultural validity

The linguistic and cultural validity of the APS was ensured through forward and backward translation procedures involving six independent translators. Following expert review and backward translation, the scale developer evaluated the original and translated versions and reported no change in meaning. A pilot study with 10 patients then confirmed linguistic validity.

Content validity was assessed using the Lawshe method, incorporating the opinions of 10 academics who are experts in the field. The evaluation revealed that the content validity ratios of the items ranged from 0.00 to 1.00, and the scale's overall content validity index (CVI) was calculated as 0.90; this value indicates that the scale has a high level of content validity.<sup>[17]</sup> The EFA and CFA were performed to examine the construct validity of the scale. Before proceeding to factor analysis, the suitability of the data set was evaluated using the KMO sample adequacy coefficient and Bartlett's sphericity test. The analysis revealed a KMO

**Table 1.** Demographic and clinical characteristics of the patients (n = 103)

| Variables                      | n  | %    | Mean $\pm$ SD   | Median | Min-Max |
|--------------------------------|----|------|-----------------|--------|---------|
| Age (year)                     |    |      | 71.7 $\pm$ 5.67 | 70.5   | 65-92   |
| Sex                            |    |      |                 |        |         |
| Female                         | 66 | 64.1 |                 |        |         |
| Male                           | 37 | 35.9 |                 |        |         |
| ICU                            |    |      |                 |        |         |
| Neurology ICU                  | 39 | 37.9 |                 |        |         |
| Internal Medicine ICU          | 34 | 33.0 |                 |        |         |
| General Surgery ICU            | 20 | 19.4 |                 |        |         |
| Coronary ICU                   | 10 | 9.7  |                 |        |         |
| Modified Barthel Index Score   |    |      |                 |        |         |
| I (0-20)                       | 10 | 9.7  |                 |        |         |
| II (21-61)                     | 50 | 48.5 |                 |        |         |
| III (62-90)                    | 43 | 41.7 |                 |        |         |
| Delirium                       |    |      |                 |        |         |
| Calm                           | 76 | 73.8 |                 |        |         |
| Restless                       | 27 | 26.2 |                 |        |         |
| Mini Mental Status Test Scores |    |      |                 |        |         |
| Normal (24-30 points)          | 17 | 16.5 |                 |        |         |
| Mild dementia (18-23 points)   | 66 | 64.1 |                 |        |         |
| Severe dementia (< 17 points)  | 20 | 19.4 |                 |        |         |
| Analgesia                      |    |      |                 |        |         |
| Opioid                         | 31 | 30.1 |                 |        |         |
| Non-opioid                     | 72 | 69.9 |                 |        |         |
| Sedation                       |    |      |                 |        |         |
| Yes                            | 77 | 74.8 |                 |        |         |
| No                             | 26 | 25.2 |                 |        |         |

SD, standard deviation; ICU, intensive care unit.

value of 0.808 and Bartlett's test was statistically significant ( $p < 0.001$ ), indicating that the data were suitable for factor analysis (Table 2). The inter-item correlation coefficients ranged from 0.458 to 0.872 and that all were statistically significant ( $p < 0.001$ ). As a result of the EFA, the scale had a single-factor structure explaining 50.11% of the total variance. The factor loadings of the items ranged from 0.489 to 0.855 (Table 3). The results of the subsequent

CFA also supported the unidimensional structure of the scale, and the fit indices obtained were found to be acceptable (Table 2).

### Reliability

**Criterion validity:** Criterion validity of the APS-TR was evaluated by examining its correlations with the NVPS and VDS. The total scores obtained from the scales were compared using correlation

**Table 2.** Confirmatory factor analysis, KMO and Bartlett's test values of scale items

| KMO coefficient | Bartlett's test ( $\chi^2$ ) | Degree of freedom | $p$               |
|-----------------|------------------------------|-------------------|-------------------|
| 0.808           | 191                          | 15                | < 0.001           |
| Variables       | Values found                 | Normal values     | Acceptable values |
| $\chi^2$ /SD    | 1.21                         | < 2               | < 5               |
| RMSEA           | 0.0457                       | < 0.05            | < 0.08            |
| CFI             | 0.989                        | > 0.95            | > 0.90            |
| SRMR            | 0.045                        | < 0.05            | < 0.08            |

KMO, Kaiser-Meyer-Olkin; RMSEA, root mean square error of approximation; CFI, comparative fit index; SRMR, standardized root mean square residual.

**Table 3.** Factor loadings of scale items

| Items                        | Factor loading |
|------------------------------|----------------|
| Physiological changes        | 0.845          |
| Vocalization                 | 0.855          |
| Behavioral change            | 0.709          |
| Change in body language      | 0.655          |
| Facial expression            | 0.625          |
| Physical changes             | 0.489          |
| Total explained variance (%) | 50.11          |

analysis at three measurement points: before, during, and after mobilization or repositioning (Table 4). Pearson correlation values between APS and NVPS were as follows:  $r = 0.507$ ,  $p < 0.001$  before intervention;  $r = 0.885$ ,  $p < 0.001$  during and  $r = 0.993$ ,  $p < 0.001$  after intervention. According to these results, a positive, statistically significant relationship was determined between APS and NVPS. Pearson correlation values between APS and VDS were as follows:  $r = 0.502$ ,  $p < 0.001$  before intervention;  $r = 0.448$ ,  $p < 0.001$  during and  $r = 0.741$ ,  $p < 0.001$  after intervention. Thus, a positive, statistically significant relationship was detected between APS and VDS (Table 4).

**Internal consistency:** The internal consistency of the scale was evaluated with Cronbach's  $\alpha$  coefficient ( $> 0.70$ ) and item total score correlations ( $> 0.20$ ). The mean scores of the items, the total correlation of the items and the Cronbach's  $\alpha$  values in the case of item deletion are presented in Table 3. In our study, the Cronbach  $\alpha$  coefficient of the scale was calculated to be 0.777. The Cronbach  $\alpha$  coefficient

of 0.777 indicates acceptable internal consistency. Accordingly, the APS-TR demonstrated acceptable internal consistency.<sup>[18]</sup> According to this result, the APS was found to be quite reliable. The total item correlation is expected to be above 0.20.<sup>[19]</sup> The total item correlation ranged from 0.354-0.711 in our study (Table 4).

## DISCUSSION

In the present study, we analyzed the validity and reliability of the APS in the Turkish population. Our study results showed that the Turkish version of the APS had a unidimensional structure, acceptable internal consistency, and significant correlations with the NVPS and VDS. These findings suggest that the APS-TR is a valid and reliable instrument for assessing pain in patients with dementia in intensive care settings.

An objective assessment instrument is needed to provide pain control for dementia patients with impaired verbal and cognitive abilities. There is a limited number of studies in the literature on the psycholinguistic and psychometric analysis of the APS, an observational assessment instrument developed for use with dementia patients who are unable to communicate verbally.<sup>[9-12]</sup> The APS is a well-established assessment instrument that is recommended by the British Geriatrics Society, the Australian Pain Society and the Swedish National Palliative Care Clinical Practice Guide.<sup>[20]</sup> This study was conducted to adapt the APS to the Turkish language. In this section, the results of the validity and reliability analyses of the Turkish version of the APS are discussed.

**Table 4.** Pearson correlation values of scales

| Variables               | NVPS              |                        |                   | VDS                                                |                   |                   |
|-------------------------|-------------------|------------------------|-------------------|----------------------------------------------------|-------------------|-------------------|
|                         | T1                | T2                     | T3                | T1                                                 | T2                | T3                |
| APS                     |                   |                        |                   |                                                    |                   |                   |
| $r$                     | 0.507             | 0.885                  | 0.993             | 0.502                                              | 0.448             | 0.741             |
| $p$                     | <b>&lt; 0.001</b> | <b>&lt; 0.001</b>      | <b>&lt; 0.001</b> | <b>&lt; 0.001</b>                                  | <b>&lt; 0.001</b> | <b>&lt; 0.001</b> |
| Item (n = 103)          | Mean $\pm$ SD     | Total item correlation |                   | Cronbach's $\alpha$ value when the item is deleted |                   |                   |
| Vocalization            | 1.58 $\pm$ 0.76   | <b>0.711</b>           |                   | 0.701                                              |                   |                   |
| Facial expression       | 2.04 $\pm$ 0.85   | 0.452                  |                   | 0.762                                              |                   |                   |
| Change in body language | 1.95 $\pm$ 1.01   | 0.468                  |                   | 0.765                                              |                   |                   |
| Behavioral change       | 1.80 $\pm$ 0.77   | 0.552                  |                   | 0.738                                              |                   |                   |
| Physiological changes   | 1.59 $\pm$ 0.72   | 0.699                  |                   | 0.707                                              |                   |                   |
| Physical changes        | 2.07 $\pm$ 0.87   | <b>0.354</b>           |                   | 0.787                                              |                   |                   |

NVPS, NonVerbal pain scale; VDS, Verbal descriptor scale; T1, before intervention; T2, during intervention; T3, after intervention; SD, standard deviation.

In order to assess the construct validity of the APS, the adequacy and suitability of the data set were first examined with the KMO coefficient and Bartlett's test.<sup>[21]</sup> These results showed that the data set was appropriate for factor analysis. First, EFA and then CFA were performed. As part of the EFA, item factor loadings and total explained variance were evaluated. In accordance with the literature, item factor loadings above 0.30 indicate that the items adequately represent the construct. In our adaptation study, all item factor loadings were above this threshold; thus, the structural integrity of the scale was preserved.

The APS has been reported to have a one-dimensional structure in the original and other adapted languages.<sup>[9-12,22]</sup> The findings of the present study were consistent with previous reports. Both the total explained variance and the eigenvalue distribution indicated that the Turkish version also retained its one-dimensional structure.

The findings of this study are usually consistent with previous cross-cultural validity studies of the APS. Similar to the Japanese adaptation, the Turkish version also demonstrated acceptable internal consistency and significant correlations with established pain assessment instruments, thereby supporting its criterion validity. Although the Cronbach's  $\alpha$  coefficient obtained in our study (0.777) was higher than that reported in the Japanese validation study (0.645), both studies concluded that the instrument possesses sufficient reliability for assessing pain in older adults with dementia. Similarly, the Danish validation study reported lower internal consistency (Cronbach's  $\alpha = 0.52$ ), but good inter-rater reliability and concluded that the APS is a clinically useful instrument for assessing pain in older patients with severe cognitive impairment who are unable to communicate. Despite differences in study populations and clinical settings, these findings consistently support the APS's applicability across different languages and healthcare systems thereby reinforcing its cross-cultural robustness.

Findings from EFA were further supported by CFA, where the fit indices ( $\chi^2/df$ , root mean square error of approximation [RMSEA], standardized root mean square residual [SRMR], [comparative fit index]) were within acceptable ranges.<sup>[15,22]</sup> These results support that the six-item, one-dimensional model of the APS is theoretically and statistically appropriate.

The APS demonstrated positive correlations with NVPS and VDS, supporting criterion validity. The VDS and NVPS were deliberately chosen, as they

are commonly used in older adults, are easy to apply, and NVPS is validated for non-verbal patients. The variability in correlation levels across time points appears to be related to the patient's difficulty in providing verbal responses before and during the procedure and to similarities in the methods of scale application.

In the reliability studies of the APS, Cronbach's  $\alpha$  coefficient indicated that the scale has good internal consistency, consistent with findings from the literature.<sup>[9-12,22]</sup> The item-total correlations, all above the expected threshold, demonstrated that each item measured the same construct and supported the internal homogeneity of the scale. As in some previous studies, although certain items demonstrated relatively lower correlations, the overall evidence supported retaining all items. Therefore, retaining all items appears appropriate.

Nonetheless, this study has several limitations that should be acknowledged. First, it was conducted at a single center and included only patients with dementia admitted to ICUs. Therefore, the findings may not be directly generalizable to patients with dementia receiving care in other clinical settings or living in the community. Second, test-retest reliability, an important component of psychometric evaluation, could not be assessed. As the study population consisted of critically ill patients with dementia, their clinical conditions and pain experiences were expected to change over time, making repeated assessments under comparable conditions impractical. Therefore, the inability to evaluate test-retest reliability should be considered a limitation of this study. Future multi-center studies including different patient populations and evaluating test-retest reliability under more stable clinical conditions are recommended to further support the psychometric properties of the Turkish version of the APS.

In conclusion, the findings of this study suggest that the Turkish version of the APS is a valid, reliable, and unidimensional instrument for assessing pain in patients with dementia. The APS-TR exhibits positive correlations with the VDS and NVPS before, during, and after painful procedures. Nevertheless, further studies are warranted to evaluate its applicability in different patient populations.

#### Author Contributions

S.E., İ.T., P.K., S.K.: Idea/concept, design, control/supervision, data collection and/or processing, analysis and/or interpretation, literature review, writing the article, critical review, references and fundings, materials.

### Conflict of Interest

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### Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

### AI Disclosure

The authors declare that artificial intelligence (AI) tools were not used, or were used solely for language editing, and had no role in data analysis, interpretation, or the formulation of conclusions. All scientific content, data interpretation, and conclusions are the sole responsibility of the authors. The authors further confirm that AI tools were not used to generate, fabricate, or 'hallucinate' references, and that all references have been carefully verified for accuracy.

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