Psychometric properties of the Pediatric Nurses' Knowledge and Attitudes Survey Regarding Pain (PNKAS). An Italian multisite cross-sectional validation study

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Abstract

Background and aim. *Several studies have highlighted a lack of nursing knowledge regarding the assessment and management of pediatric pain. Because there is currently no specific tool for the assessment of pain knowledge in pediatric nursing professionals in Italy, the aim of the study was to translate into Italian, adapt, and validate the questionnaire "Pediatric Nurses' Knowledge and Attitudes Survey Regarding Pain, in order to analyze its psychometric properties, providing a suitable tool for the assessment of pain.*

Study design. *A multisite cross-sectional validation study was conducted and a convenience sample of italian nurses was enrolled.*

Results. *A total of 233 nurses responded. Analyses demonstrated the "Pediatric Nurses' Knowledge and Attitudes Survey Regarding Pain" factorial validity and internal consistency. The overall Cronbach's alpha coefficient of the scale was 0.728. Pearson's correlation coefficient was calculated between the test and retest phase, obtaining a value of r = 0.712 (p < .001). The intraclass correlation coefficient was 0.801 (95% confidence interval = 0.428-0.806). The Infit and Outfit statistical analysis fell within*

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acceptable ranges from 0.85 to 2.50. The item difficulty ranged from −2.64 to 2.51. Out of total of 9,553 questions, 5,717 were answered correctly (correct answer rate 59.8%). No questionnaire had 80% or less of the correct answers.
***Conclusion.** The scale designed in this study is valid and reliable for use in the Italian context and is applicable where one wants to evaluate nursing knowledge on the subject of pediatric pain.*

Introduction

The current International Association for the Study of Pain' (IASP) definition of pain as "An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" was recommended by the Subcommittee on Taxonomy and adopted by the IASP Council in 1979 (1). This definition has become accepted widely by health care professionals and researchers in the pain field and adopted by several professional, governmental, and nongovernmental organizations, including the World Health Organization (WHO). In recent years, some in the field have reasoned that advances in our understanding of pain warrant a re-evaluation of the definition and have proposed modifications (1). Therefore, in 2018, the IASP formed a 14-member, multinational Presidential Task Force, including individuals with broad expertise in clinical and basic science related to pain, to evaluate the current definition and accompanying notes, and to recommend whether they should be retained or changed. This review provides a synopsis of the critical concepts, the analysis of comments from the IASP membership and the public, and the committee's final recommendations for revisions to the definition and notes, which were discussed over a 2-year period. The task force ultimately recommended that the definition of pain be revised to "An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage," and that the accompanying notes be updated to a bulleted list that included the etymology (1).

There is a growing awareness on the etiology of pain, together with the advancement of pharmacological management of pain (2).

Despite this awareness and pharmacological advancement, patients still experience intolerable pain which hampers the physical, emotional, and spiritual dimension of the health (2,3).

The level of pain experienced by a patient can be affected significantly by the nurse's attitude and level of knowledge, to the point that unrelieved pain is one of the most common patient complaints (3,4).

It is well known that pain assessment and management is the responsibility of health professional nurses, in particular nurses whose duty is to protect the wellbeing of those patients who are entrusted to their care (4). In Italy, the last code of ethics of nurses was published in 2019. In article 18 it is mentioned that the nurse prevents, detects and documents the pain during the treatment path. The nurse works applying good practices for the pain management and related symptoms, in accordance with the patient's wishes (Ethic Code of Italian Nurses, 2019) (5).

Limited knowledge and negative attitude of nurses toward pain management were reported as major obstacles in the implementation of effective pain management (6,7). Some, like the political and cultural issues, are difficult to modulate and modify, while others are easier to influence and overcome, such as the shortage of appropriate training programs for healthcare professionals (HCPs) (8).

Knowledge deficit about pain management is not uncommon among HCPs. It is estimated that around 50% of them reported lack of knowledge in relation to pain assessment and management (9,10).

The existing medical literature is abundant with reports referring to patients' dissatisfaction with pain assessment and management and many focus on nurses employed in the oncological setting or in palliative care (11,12). In addition, there are recent studies that have also compared the knowledge and attitudes of nurses about pain in multiple hospital settings (13).

The American Academy of Pediatrics (AAP) and the American Pain Society (APS) relate the lack of knowledge about pain management and the underestimation of infant pain to the myths that exist on this subject. One myth that still exists is that infants and young children feel less pain because of an underdeveloped nervous system, do not remember it in the long term, or it cannot be evaluated in a real way (14,15). Multiple studies show that nursing professionals have a lack of knowledge about pain, its assessment, and treatment (16-19). To evaluate their competence in this aspect, McCaffery and Ferrell designed in 1987 a questionnaire on knowledge of pain management, Nurses' Knowledge and Attitude Survey

Regarding Pain (NKASRP) (20). It analyzes aspects related to the assessment of pain, its pharmacologic and non-pharmacologic treatment, side effects of medications, and the interdisciplinary work involved in the comprehensive care of the patient with pain. It has been uploaded and validated in several languages such as Italian, Icelandic, and Spanish (17,21,22). In 2001 Manworren adapted the questionnaire to assess the knowledge of pediatric nurses, the Pediatric Nurses' Knowledge and Attitudes Survey Regarding Pain (PNKASRP) (16), which has been validated only in Norwegian (23) and Spanish (17). Unlike the adult version, this one contains specific items on pain in neonates, children, and adolescents, as well as a dosage adaptation in the items related to pharmacologic aspects.

It consists of 41 questions distributed as follows: 24 true/false items; 13 multiple-choice questions; and 2 clinical cases with 2 questions each. In its original version, construct validity (Chronbach's alpha 0.72) and reliability (Pearson's r 0.62) were established through the study of nursing professionals in a pediatric hospital center; in addition, the need to analyze it in global terms was established, not focusing on knowledge or attitude domains because there are questions that interrelate both domains. Although initially no minimum cut-off score was established, the authors later considered 80% of correct answers as an adequate level of knowledge (17). On the other hand, having questionnaires adapted and validated in different languages makes it possible to compare results between different centers and countries, as well as to adapt training to the deficits found in a given population. Therefore, before generalizing the use of a questionnaire, it is necessary to evaluate its reliability and validity for the language and specific population in order to avoid making the mistake of cultural differences that may exist (17). Because there is currently no specific tool for the assessment of pain knowledge in pediatric nursing professionals in Italy, the aim of the study was to translate into Italian, adapt, and validate the questionnaire "Pediatric Nurses' Knowledge and Attitudes Survey Regarding Pain", in order to analyze its psychometric properties, providing a suitable tool for the assessment of pain.

Method

Design

This paper presents the results of a methodological research that tested the psychometric properties and validation of the PNKAS scale. The "COnsensus-based Standards for the Selection of health Measurement Instruments" (COSMIN) reporting guidelines were used for the study performed (24).

Procedure

We conducted a two-step procedure for the development. The first step was a content and linguistic validation from English to Italian. The second step was a construct and reliability validation using a test-retest procedure.

Questionnaires

The questionnaire is made up of individual and multiple choice questions and is structured in two sections (a total of 49 items).

The first section concerned the collection of the nurses' general characteristics, that were surveyed using a self-administered questionnaire covering 1: age; 2: sex; 3: level of education; 4: nursing specialty (nurse or pediatric nurse)xperience in pediatrics or pediatric settings; 7: update on pain (last 5 years); 8: update on pediatric pain (last 5 years); in total, 8 items.

The second section concerned the administration of the PNKAS (41 items) (16-18). The PNKAS is designed to assess nursing knowledge in the field of pediatric pain assessment and management.

The scale includes 41 items/statements divided into: 24 True or False questions; 13 multiple choice questions; 2 short clinical cases with 2 questions for each clinical case.

A recent validation study showed a Cronbach's alpha of 0.701 (17). Pearson's correlation coefficient was calculated between the test and retest phase, obtaining a value of r = 0.703 (p < .001). The intraclass correlation coefficient was 0.783 (95% confidence interval [CI] = 0.537-0.898). Comparison of the different groups surveyed showed that the professionals in the neonatal intensive care group scored higher (59.52%, SD = 5.78) than the pediatric intensive care (59.23%, SD = 3.51), emergency (55.71%, SD = 5.10). and hospitalization (51.28%, SD = 3.66), these differences being statistically significant between the neonatal intensive care and hospitalization (p = .012), and pediatric intensive care and hospitalization (p = .022) groups.

Linguistic Validity and Adaptation Back Translation Method

The translation and linguistic validation process followed the principles of good practice for translation and cultural adaptation providedby the International

Society for Outcomes Research (ISFOR) guidelines (25), which contain a ten-step approach, from preparation to final reporting, which we have adhered to and described below (25). Figure 1 contains a flowchart of the translation and validation process.

A semantic and conceptual translation was carried out. Initially, three independent translators were asked to translate the questionnaire with a faithful translation (semantic analysis). Subsequently, the aesthetic style of the translation and the individual words and concepts used were considered and valorized more (conceptual analysis) during a reconciliation meeting between the three translators on January 10, 2025. To resolve any discrepancies, it was decided to vote for the most correct version or word or concept by at least 2/3 translators. If there were still doubts, a fourth researcher was also involved for his opinion. However, it was never necessary to involve the fourth voter.

Sample and Procedure

A cross-sectional design was used in which a convenience sample of nurses was enrolled from different geographical areas of Italy.

Convenience sampling was based on the availability of nurses who spontaneously decided to participate in the study. The authors of the study sent the questionnaires to colleagues who worked in their own organizations, trusts or in nearby organizations and territories having contacts with them.

To reach a sufficient number of subjects, the help of the Italian Association for the study of pain (AISD) was requested and the Nursing Professions Orders (OPI) of several provinces on the national territory, the network of 'La Nostra Famiglia' and Pediatric pain therapy and palliative care network, Mar were contacted. The AISD sent an email to all the departments and hospitals registered with the AISD
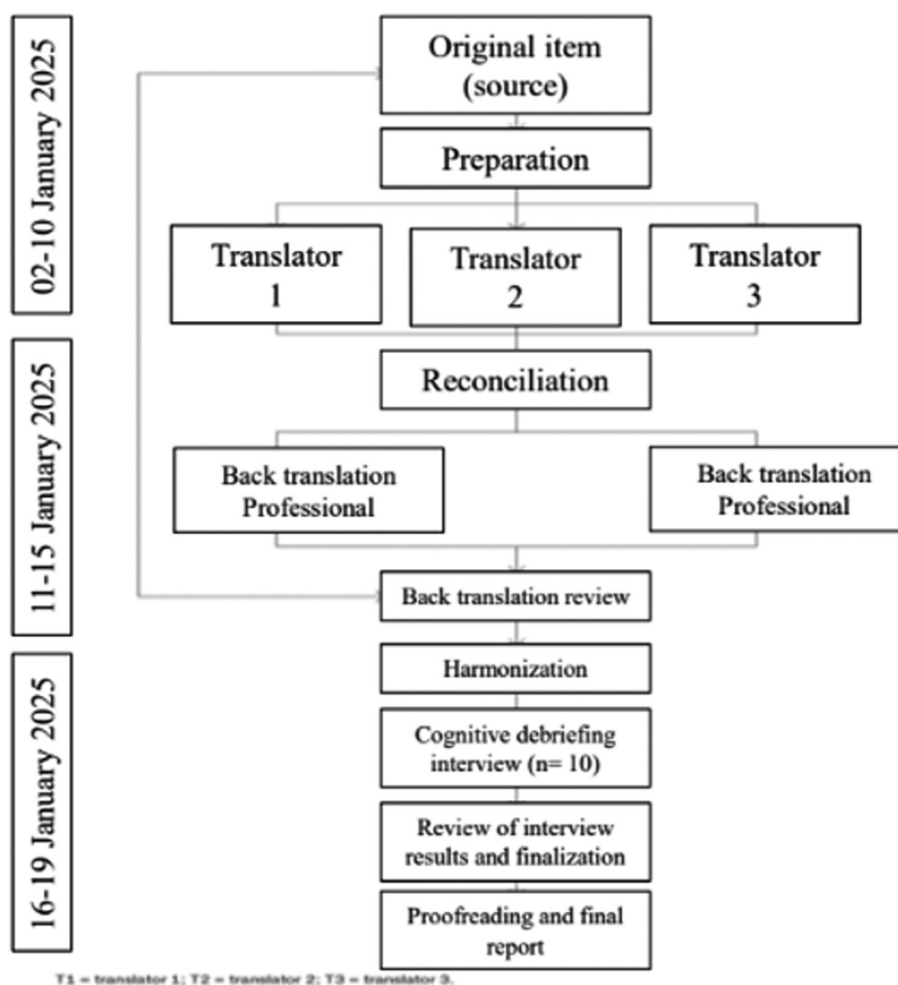

Figure 1 - Flow chart summarising the translation and validation process according to ISPOR Task Force for Translation and Cultural Adaptation model 2005.

network, while the provincial OPIs published on their online pages the request to fill out the questionnaire.

The information was collected through an online form. The inclusion criteria were verified and guaranteed with an initial question. Before starting to fill out the questionnaire, nurses had to consent to participate in the study. If the nurse clicked on "Yes", the socio-demographic data and the questionnaire were filled out. If the answer was "No", our question did not give the possibility to proceed with filling out the questionnaire.

Data collection

After defining the final version of the Italian questionnaire, we tested the instrument on Italian nurses.

Data collection was conducted from January 20th to February 20th, 2025 and was conducted by seven nurses through the administration of an online questionnaire via Google Form (26) as explained below.

These nurses received training on the aims and protocol of the study and were trained by the first author to collect data using an excel dataset.

The first author was always available by telephone during data collection and met every 2 weeks via Google Meet with data collectors to monitor study progress.

The research team distributed questionnaires via computerized software (Google Form) already used for previous studies (27).

A short letter which explained the project and a link to click to access the compilation of the questionnaire was sent. The letter was presented by the five main authors. The information is then collected and automatically connected to a spreadsheet. The spreadsheet is populated with the survey and quiz answers. The editors were V.D., I.B. and A.L. Participants responded to the survey on a voluntary basis.

Data analysis

A descriptive analysis was used to study the frequency distribution of all variables of interest. For normally distributed data, mean and standard deviation (SD) were applied.

Descriptive statistics were calculated to summarize quantitative data. The internal consistency reliability was identified using Cronbach's alpha (α). Exploratory factor analysis with principal component analysis and varimax rotation was used to investigate the construct validity of the PNKAS (17-19).

Pearson correlation coefficient was calculated by the critical ratio method and correlation coefficient method for item analysis, and the scale reliability was described by Cronbach's α coefficient.
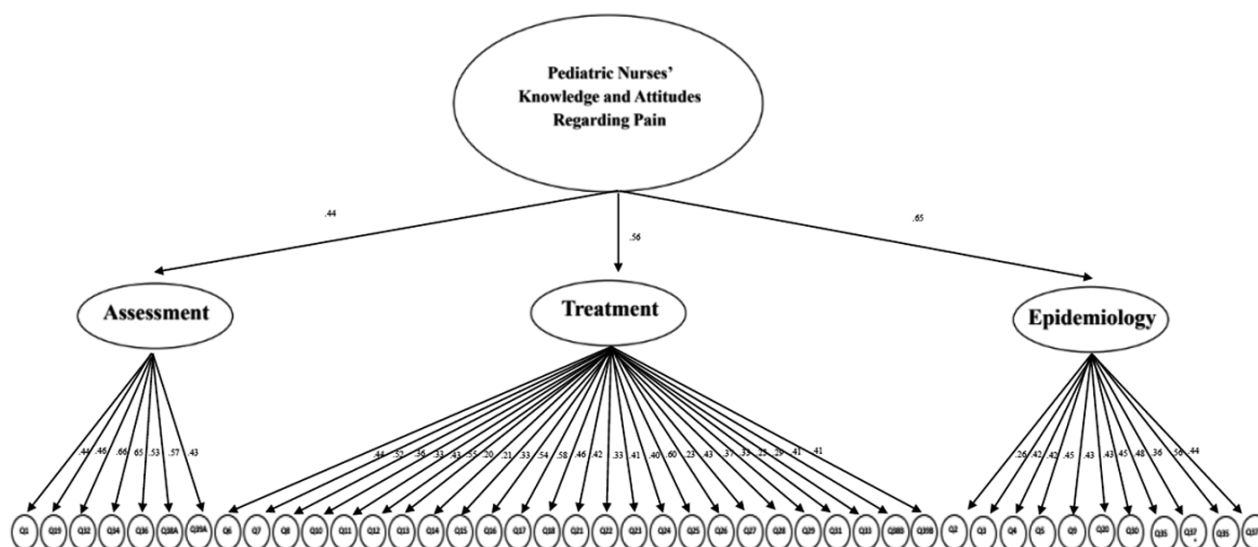
Figure 2. Confirmatory factor analysis of the Pediatric Nurses Knowledge and Attitudes Regarding Pain.
Item Assessment:1, 19, 32, 34, 36, 38A, 39A.
Item Treatment: 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 21, 22, 23, 24, 25, 26, 27, 28, 29, 31, 33, 38B, 39B.
Item Epidemiology: 2, 3, 4, 5, 9, 20, 30, 35, 37.

Item level content validity index (I-CVI) and Scale level content validity index (S-CVI) in the expert evaluation were adopted. S-CVI evaluated the content validity of the scale and evaluated the structural validity of the scale through exploratory factor analysis and confirmatory factor analysis. The test level is α= 0.05.

The factorial structure of the scale was examined using confirmatory factor analysis (CFA) for each separate PNKAS scale, a crucial step in construct validity testing. Testing of the theoretical assumptions began with an examination of the factor structure of the Italian version of the PNKAS.

Reliabilities for each factor and each scale derived from the CFA were estimated using factor score determinacy coefficients (23,28). These coefficients represent an estimate of the internal consistency of the solution, the certainty with which factor axes are fixed in the variable space (5).

They represent the squared multiple correlations (SMCs) of factor scores predicted from scores on observed variables (17).

In a good solution, SMCs range between 0 and 1; the larger the SMCs, the more stable the factors. A high SMC (say, .70 or better) means that the observed variables account for substantial variance in the factor scores. A low SMC means the factors are poorly defined by the observed variables.

The reliability of the PNKAS was also tested with the intraclass correlation coefficient (ICC). This coefficient gives an estimate of the test-retest stability of the scale scores; thus, it provides complementary information to that given by the internal consistency reliability.

Additionally, exploratory factor analysis of the study was performed using the KMO test and the 2 value of Bartlett's spheroid test to examine the strength of the partial correlation (how the factors explain each other) between the variable and for measures sampling adequacy for each variable in the model and the complete model.

The P value was fixed at .05. Statistical analysis was performed using SPSS 21.0 software package (28), except for the CFA, which was performed with Mplus 6.1 (29) as already used for another validation study (30).

Ethical considerations

Nurses who showed interest in the study were recruited and asked to sign the informed consent prior to participating in the study and completing the questionnaires.

Recruitment of nurses began immediately after the lead author's approval of the creation of the PNKAS scale. The approval email was sent to us on January 3th, 2024 by Doctor Stahulak.

The study questionnaire was introduced to each participant, and each participant was asked to answer the questions. The study protocol was in line with the Declaration of Helsinki, as revised in 2013 (31).

The nurses belonging to the different geographical areas completed the survey and were offered the possibility to remain anonymous. Data were collected in completely anonymous form. Therefore, the approval of an Ethics Committee was not necessary and the GDPR EU 2016/679 in force in Italy since 2018 does not apply for our study design (32).

Results

Sample

A total of 233 nurses responded. Of the responding nurses, 48.1% (n=112) were pediatric nurses. The sample was predominantly female (81.1%), average age was 40 years and 76.8 % had a Bachelor's Degree in Nursing. Work experience was approximately 11 years but the experience in a pediatric context approximately 8 years (Table 1).

Pain Management Educational Needs/Resources.

Of the 233 participating nurses, only 52 (22.3%) declared having attended a course on pain in the last 5 years. There are 6 nurses who declared having attended a specific update on pain for pediatric pain in the last 5 years (2.6%) (Table 1).

Confirmatory factor analysis of the PNKAS

Figure 2 gives a graphical description of the final pediatric nurses' knowledge and attitudes regarding pain models, which fit the data well. The analysis was carried out only among pediatrics nurses (n= 121).

The results showed that the chi-square degree of freedom ratio (χ2 /df) was 2.583, the goodness-of-fit index (GFI) was 0.867, the root mean square of approximate error (RMSEA) was 0.041, the value-added fitting index (IFI) was 0.882, the comparative fitting index (CFI) was 0.911. This model shows that the factorial structure of the Pediatric Nurses' Knowledge and Attitudes Survey Regarding Pain, although multidimensional at the level of primary factors, is unidimensional at the level of the secondary, higher order factor.

Table 1 - General Characteristics of Italian Nurses Sample (N= 233).

Variable	Results
Age (year)	
Mean, SD	39.9 (+ 13.6)
Range, n, %	
25-29	36 (15.5)
30-39	103 (44.2)
40-49	43 (18.4)
50-60	51 (21.9)
Sex n, %	
Male	44 (18.9)
Female	189 (81.1)
Level of Education n, %	
Diploma in Nursing	59 (25.3)
Bachelor's Degree in Nursing	179 (76.8)
Master's Degree in Nursing Science	15 (6.4)
1st level Master degree	61 (26.2)
Nursing specialty n, %	
Nurse	121 (51.9)
Pediatric Nurse	112 (48.1)
Work experience (year)	
Mean (SD)	10.8 (+ 14.3)
Range n, %	
2-4	52 (22.3)
5-10	101 (43.3)
11-19	45 (19.3)
20-30	35 (15.1)
Work experience (year) in pediatric context	
Mean (SD)	8.3 (+ 15.7)
Range n, %	
2-4	70 (30.1)
5-10	125 (53.6)
11-19	8 (3.4)
20-30	30 (12.9)
Refresher course on pain for the last 5 years[1] n, %	
Yes	52 (22.3)
Not	181 (76.7)
Refresher course on pediatric pain for the last 5 years[1] n, %	
Yes	6 (2.6)
Not	227 (97.4)

N=number; SD=standard deviation.
1 It includes participation in courses, conferences and research relating to pain in the last 5 years.

Person and item reliability

The person reliability was 0.85, and the person separation was 2.38. The item reliability was 1.00, and the item separation was 15.02.

Item fit and item difficulty

The Infit and Outfit statistical analysis fell within acceptable ranges from 0.85 to 2.50. The item difficulty ranged from −2.64 to 2.51. Table 2 shows the response choices, item difficulty and item fit statistics of the PNKAS. The questionnaires with at least 70% of correct answers were 137 (58.8%). Of a total of 9,553 questions, 5,717 were answered correctly (correct answer rate 59.8%). No questionnaire had 80% of correct answers (Table 2).

Reliability and validity

The overall Cronbach's alpha coefficient was 0.728, and factors 1 through 3 were 0.702, 0.751 and 0.716, respectively (Table 3). Pearson's correlation coefficient was calculated between the test and retest phase, obtaining a value of $r = 0.712$ ($p < .001$). The intraclass correlation coefficient was 0.801 (95% confidence interval [CI] = 0.428-0.806).

Scale Validity Analysis

The item content validity index (I-CVI) of this scale was 0.787- 1.000, and the S-CVI value was 0.903, based on the results of the expert consultation. Additionally, the study's exploratory factor analysis revealed that the KMO test value was 0.856 and the Bartlett's spheroid test 2 value was 2029.171 ($p < .001$), meeting the requirements for the analysis. The factors were extracted using principal component analysis, then the maximum variance method was utilized to rotate the factors. They extracted common components with eigenvalue > 1 and factor load value > 0.400. Four common factors in all were extracted, according to the results, and no items were removed. The cumulative variance contribution rate was found to be 71.562%, and the factor load value of the 41 items in their dimensions ranged from 0.759 to 0.807, which was consistent with the original scale.

Table 3 shows the comparison between the mean scores of educated versus uneducated nurses over 5 years in pain management.

Educated nurses did not demonstrate more competence in responses than uneducated nurses with regard to competence in assessment (p= .9962), treatment (p= .9642) and epidemiology (p= .9959) (Table 3).

Table 2 - Response choices, item difficulty and item fit statistics of PNKAS (n=233)

Item	Correct response	Observed % Correct	Item difficulty (logits)	Item Fit (Mean squares) Infit	**Outfit**
1	29	12.4	2.43	0.98	0.97
2	117	50.2	0.03	0.90	0.80
3	166	71.2	-1.12	1.01	0.96
4	30	12.9	2.44	1.08	1.11
5	212	91.0	-2.59	1.07	1.04
6	152	65.2	-0.86	0.92	0.88
7	83	35.6	0.78	1.07	1.09
8	91	39.1	0.60	0.98	1.13
9	92	39.5	0.58	0.97	1.12
10	49	21.0	1.73	1.03	1.34
11	129	55.4	-0.31	1.23	1.30
12	28	12.0	2.45	0.98	0.97
13	46	19.7	1.79	1.03	1.35
14	214	91.8	-2.62	1.06	1.03
15	151	64.8	-0.83	0.91	0.88
16	164	70.4	-1.09	1.01	0.96
17	189	81.1	-1.86	0.99	0.96
18	198	85.0	-2.43	1.12	1.35
19	196	84.1	-2.37	1.11	1.29
20	197	84.5	-2.39	1.12	1.28
21	194	83.3	-2.31	1.06	1.19
22	195	83.7	-2.41	1.10	1.33
23	215	92.3	-2.64	1.05	1.38
24	201	86.3	-2.52	1.11	1.31
25	202	86.7	-2.55	1.12	1.35
26	165	70.8	-1.12	1.01	0.96
27	152	66.7	-0.86	0.92	0.88
28	151	64.8	-0.83	0.91	0.88
29	122	52.4	-0.16	0.85	0.81
30	222	95.3	-2.72	1.06	1.04
31	92	39.5	0.58	0.97	1.12
32	130	55.8	-0.32	1.08	1.07
33	211	90.5	-2.52	1.07	1.04
34	214	91.8	-2.62	1.06	1.03
35	194	83.3	-2.31	1.06	1.19
36	164	70.4	-1.09	1.01	0.94
37	129	55.4	-0.31	1.08	1.08
38 A	47	20.2	1.82	1.03	1.29
38 B	27	11.6	2.51	0.96	2.50
39 A	129	55.4	-0.31	1.08	1.09
39 B	28	12.0	2.45	0.98	0.97

Table 3 – Comparison of Mean Scale Scores (each correct answer = 1 point) between Nurses Educated on pediatric pain assessment/management Versus Nurses Not Educated during the last 5 years.

Factors identified	Educated Nurse (n= 52)	Non-educated Nurse (n= 181)	Mean differences	Standard Error	t-value	P
Cronbach's alpha total = 0.728						
Factor 1: Assessment (α = 0.702).						
Factor 1: Assessment, Mean; DS	0.89 (13.4)	0.88 (13.3)	0.01	2.096	0.0048	.9962
Factor 2: Treatment (α = 0.751).						
Factor 2: Treatment, Mean; DS	0.85 (12.1)	0.77 (11.1)	0.08	1.782	0.049	.9642
Factor 3: Epidemiology (α = 0.716).						
Factor 3: Epidemiology, Mean DS	0.84 (9.4)	0.83 (13.2)	0.01	1.961	0.0051	.9959

Table 4 - Post hoc analysis of differences of the PNKAS scores.

Sample 1 vs	Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.
Experts*	Bachelors	3.709	8.560	0.428	0.651	1.000
Experts*	Masters	-12.108	8.611	-1.104	0.129	0.789
Experts*	Pediatric Nurse	20.562	8.021	2.856	0.011	0.021
Bachelors	Pediatric Nurse	-19.943	5.727	-3.482	0.000	0.003
Masters	Pediatric Nurse	22.752	8.046	2.952	0.003	0.019
Bachelors	Masters	-9.231	6.619	-1.399	0.159	0.970

Each row tests the null hypothesis that the sample 1 and sample 2 distributions are the same.
Asymptotic significance (2-sided tests) is displayed. The significance level is .05.
Std Error = standard error; Sig. = significance; Adj. = adjusted.
*Experts: Nurses who have been working in pediatrics or pediatric/neonatal intensive care for at least 5 years.

Construct validity

We have found statistically significant differences between the PNKAS score and the variable pediatric nurse. In the post hoc analysis, being a pediatric nurse showed better scores in pediatric pain knowledge than experts (p= .021) or bachelors nurses (p= .003) or masters (.019) (Table 4).

Stability of the PNKAS

Table 5 shows the test-retest reliability (stability) of the PNKAS. This analysis was done with the complete sample and repeated in the subgroup of non-pediatric nurses. The ICCs were calculated for each factor and scale. All ICCs demonstrated excellent test-retest reliability, with most values greater than 0.90 for every item and scale.

Discussion

The main purpose of this study was to evaluate the validity and reliability of the PNKAS in its Italian version. The internal consistency of the questionnaire (α = 0.728) is in line with that of the original version (α = 0.720) (16) and its validation to Norwegian (α = 0.710) (23) and to Spanish (α = 0.701) (17) versions. We can also consider that the Italian version of the questionnaire has adequate reliability, our test-retest correlation (r = 0.712) being higher than that of the original questionnaire (r = 0.67) (16) and Spanish version (r = 0.703) (17) and lower than that of the Norwegian version (r = 0.830) (23). Likewise, the intraclass correlation coefficient data (ICC = 0.801) indicate that the PNKAS is a reliable instrument.

The study carried out reveals that the knowledge of the pediatric nursing professionals in Italy is low, with no questionnaire exceeding the 80% of correct answers considered adequate. Nevertheless, the mean percentage of correct questions in the Italian version of the PNKAS (59.8%) was higher than in similar studies carried out in Spain (56.07%) (17) and China (35.43%) (33).

The statistically significant relationships obtained between the test score and experts or bachelors nurses or with masters, confirm the discriminant validity of the Italian version of the PNKAS, making it possible to discern between levels of knowledge as effectively

Table 5 – Test-Retest Reliability of PNKAS (Full Sample and only non-pediatric nurse).

Item	ICC (95% CI)	
	Full sample (n= 233)	Only non-pediatric nurse (n= 102)
Item 1	0.91 (0.90-0.92)	0.93 (0.90-0.96)
Item 2	0.91 (0.90-0.92)	0.93 (0.89-0.95)
Item 3	0.92 (0.91-0.94)	0.93 (0.91-0.95)
Item 4	0.93 (0.91-0.94)	0.94 (0.91-0.96)
Item 5	0.94 (0.92-0.93)	0.94 (0.92-0.96)
Item 6	0.92 (0.90-0.94)	0.93 (0.90-0.95)
Item 7	0.91 (0.90-0.92)	0.92 (0.90-0.94)
Item 8	0.92 (0.90-0.94)	0.92 (0.90-0.94)
Item 9	0.92 (0.91-0.94)	0.93 (0.91-0.96)
Item 10	0.92 (0.90-0.94)	0.92 (0.91-0.95)
Item 11	0.93 (0.91-0.95)	0.93 (0.89-0.95)
Item 12	0.90 (0.87-0.92)	0.92 (0.90-0.94)
Item 13	0.92 (0.90-0.94)	0.92 (0.90-0.94)
Item 14	0.92 (0.91-0.93)	0.97 (0.95-0.99)
Item 15	0.94 (0.91-0.96)	0.96 (0.94-0.98)
Item 16	0.92 (0.91-0.94)	0.92 (0.90-0.94)
Item 17	0.92 (0.91-0.94)	0.93 (0.91-0.95)
Item 18	0.94 (0.92-0.93)	0.94 (0.92-0.96)
Item 19	0.92 (0.91-0.93)	0.93 (0.91-0.94)
Item 20	0.93 (0.92-0.94)	0.94 (0.92-0.96)
Item 21	0.92 (0.91-0.94)	0.92 (0.91-0.94)
Item 22	0.92 (0.91-0.94)	0.93 (0.91-0.95)
Item 23	0.94 (0.92-0.93)	0.94 (0.92-0.96)
Item 24	0.93 (0.92-0.94)	0.92 (0.90-0.94)
Item 25	0.92 (0.90-0.94)	0.93 (0.91-0.94)
Item 26	0.95 (0.93-0.97)	0.96 (0.92-0.98)
Item 27	0.95 (0.93-0.96)	0.96 (0.91-0.99)
Item 28	0.92 (0.91-0.94)	0.93 (0.91-0.95)
Item 29	0.94 (0.92-0.93)	0.94 (0.92-0.96)
Item 30	0.92 (0.90-0.94)	0.93 (0.91-0.94)
Item 31	0.94 (0.91-0.96)	0.94 (0.92-0.96)
Item 32	0.92 (0.91-0.94)	0.92 (0.91-0.94)
Item 33	0.94 (0.91-0.96)	0.94 (0.92-0.96)
Item 34	0.92 (0.91-0.94)	0.96 (0.91-0.99)
Item 35	0.92 (0.91-0.94)	0.94 (0.91-0.96)
Item 36	0.91 (0.90-0.93)	0.97 (0.95-0.99)
Item 37	0.92 (0.90-0.92)	0.92 (0.90-0.94)
Item 38A	0.94 (0.91-0.96)	0.94 (0.92-0.96)
Item 38 B	0.92 (0.90-0.94)	0.93 (0.91-0.94)
Item 39A	0.94 (0.91-0.96)	0.94 (0.92-0.96)
Item 39 B	0.92 (0.90-0.94)	0.93 (0.90-0.94)

Test-retest reliability was calculated with the ICC correlating the Pediatric Nurses' Knowledge and Attitudes Survey Regarding Pain scores collected twice with a 15-day interval between testing. Test-retest for the nursing knowledge pediatric pain was computed only with 102/121 non-pediatric nurses at both intervals.
P< .001 for each correlation. Abbreviations: 95% CI, 95% confidence interval; ICC, intraclass correlation coefficient.

as the original adult version (16) and its Spanish version (17). These differences correspond to those obtained in other studies in the United States and China (16,33), which show how intensive care personnel had a higher level of knowledge. Similarly, we agree with the results from Norway (23), since, having a similar training to that of Italy or Spain, its professionals categorized as "specialists" have better knowledge of pain than the rest of the groups related to academic training. However in the case of Italy, specialist´s and master´s degree do not have a broader theoretical and practical training exclusively for pediatric patients than professionals with generalist training. It should also be noted that other authors from non-European continents have also found significance in those with higher or specific training (32,33), however, an exact comparison could not be established because of the differences in the academic models that separate these countries.

The best answered questions were those related to general concepts of pain. This attitude of avoiding children's suffering is common in several professionals who have participated in other studies worldwide (34), so it seems that nursing is sensitized to children's pain. It is striking that 91.8% considered that parents should be present during painful procedures, which is very satisfactory since it has been demonstrated that their presence reduces the suffering of children (17). The responses with the worst percentage of correct answers, as in other studies (17,19), were mainly related to pharmacology (items: 4, 12, 13, 38B, 39B). The stigma of fear of adverse effects of opioids including respiratory depression and addiction also continues among a large part of our sample. On the other hand, it is striking that only 12.4% responded correctly to the concept that changes in vital signs are not a method of verifying the presence of severe pain and that only 12.9% knew that children and adolescents can sleep even with high levels of pain, in line with the Spanish validation (17) so it seems that another of the shortcomings among our staff is the correct identification of pain. These data are not surprising given that in Italy the prescription of drugs has so far been the exclusive responsibility of the medical profession.

Several authors (17,19,35) agree on the poor results reported in clinical cases. This means that the professionals do not correctly evaluate the pain referred by the patient, but rather their own evaluation is conditioned by the appearance that the child may have or show at that moment. It is in the second case, in which the child appears more prostrate or affected, where the number of correct answers

increased, referring to the belief that pain in children cannot be evaluated in a real way. It is important to remember that this is an individual experience that not everyone externalizes in the same way, so we should not be concerned about self-interpretations, since on many occasions we unintentionally cause potentially avoidable suffering.

Limitations

The first and most important limitation is the convenience and non-random sampling model, which makes the results influenced by the strict selection of cases. Random sampling would have allowed the instrument to be validated in a more heterogeneous nursing group.

This may have influenced the averages that emerged in the responses, as it is likely that the respondents were the greatest number of nurses motivated by advocacy practice and therefore offered the best responses.

Face validity was not performed. Face validity refers to what the test appears to measure rather than what the test actually measures. This can affect the motivation a test taker may apply.

Being the first study in Italy that tried to evaluate pediatric nurses' knowledge and attitudes regarding pain, we had difficulty comparing our results and we do not know how generalizable they are.

It is currently not possible to perform the criterion control verification of the local version of the scale, nor are there any other relevant instruments or translated versions available to assess the pain knowledge among nursing personnel in Italy. We should broaden the sample size and geographical reach of nurses in the future, add to the validation analysis, and investigate the use of this scale in Italy.

We consider our study design as a limitation due to its inability to establish causal relationships and its focus on analyzing potential predictors. Additionally, acknowledge that the self-assessment tool may introduce response biases influenced by social desirability. Studies using randomized sampling and being able to establish causal relationships by focusing on the analysis of potential predictive factors are necessary.

Conclusion

The Italian version of the PNKAS is a valid tool to determine the knowledge and attitudes about pain of nursing professionals and thus be able to focus

future training actions in areas in which a low level of knowledge is detected. In our opinion, the scale is valid and reliable for use in the Italian context. Italian nurse practitioners were not found to have sufficient knowledge or an appropriate attitude regarding pediatric pain management. A new standardized training project of pain management that is closely related to clinical practice for children should be conducted in the future.

Riassunto

Proprietà psicometriche della Pediatric Nurses' Knowledge and Attitudes Survey Regarding Pain (PNKAS). Uno studio di validazione trasversale multicentrico italiano

Introduzione e obiettivo. Diversi studi hanno evidenziato una mancanza di conoscenze infermieristiche in merito alla valutazione e alla gestione del dolore pediatrico. Poiché attualmente non esiste uno strumento specifico per la valutazione della conoscenza del dolore negli infermieri pediatrici in Italia, l'obiettivo di questo studio era quello di tradurre, adattare e convalidare il questionario Pediatric Nurses' Knowledge and Attitudes Survey Regarding Pain in italiano per analizzarne le proprietà psicometriche, fornendo uno strumento idoneo per la valutazione del dolore.

Disegno dello studio. È stato condotto uno studio trasversale di validazione multisito ed è stato arruolato un campione di convenienza di infermieri italiani.

Risultati. Hanno risposto 233 infermieri in totale. Le analisi hanno dimostrato la validità fattoriale e la coerenza interna del Pediatric Nurses' Knowledge and Attitudes Survey Regarding Pain. Il coefficiente alfa di Cronbach complessivo della scala era 0,728. Il coefficiente di correlazione di Pearson è stato calcolato tra la fase di test e di retest, ottenendo un valore di r = 0,712 (p < 0,001). Il coefficiente di correlazione intraclasse era 0,801 (intervallo di confidenza del 95% = 0,428-0,806). L'analisi statistica di Infit e Outfit rientrava in intervalli accettabili da 0,85 a 2,50. La difficoltà degli item variava da -2,64 a 2,51. Su un totale di 9.553 domande, 5.717 hanno ricevuto risposta corretta (tasso di risposta corretta 59,8%). Nessun questionario aveva l'80% o meno delle risposte corrette.

Conclusioni. La scala progettata in questo studio è valida e affidabile per l'uso nel contesto italiano ed è applicabile laddove si vogliono valutare le conoscenze infermieristica in tema di dolore pediatrico.

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