Portuguese Cross-Cultural Adaptations of the Pediatric International Knee Documentation Committee Score

Adaptação Transcultural do Pediatric International Knee Documentation Committee Score para Português

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ABSTRACT

Introduction: The aim of this study was to translate the Pediatric International Knee Documentation Committee Score (Pedi-IKDC) into European Portuguese language. The Pedi-IKDC was originally developed in the English language and its main construct is functional assessment of knee disorders in children and adolescents.
Material and Methods: The original English version of the questionnaire was translated to European Portuguese using the forward-backwards method. Patients aged eight to 17 with knee disorders were considered eligible for the study. An online platform was implemented to collect patient responses, including general patient information, the questionnaires Pedi-IKDC, EuroQol-5 Dimension Youth and Childhood Health Assessment Questionnaire. Three surveys were sent: at the moment of first evaluation (T0), after two (T1) and ten (T2) weeks. These surveys followed the Consensus-based Standards for the Selection of Health Measurement Instruments - COSMIN Checklist recommendations. The internal consistency, reliability, error of measurement, structural and construct validity (by means of correlation with previously validated scales), responsiveness and interpretability (floor/ceiling effects, MIC and ROC curve) were evaluated.
Results: Forty-seven patients completed T0, 42 patients completed T1 and 40 patients completed T2. The factorial analysis confirmed that the scale has one dimension. Cronbach alpha (α) was 0.94; interclass correlation coefficient was 0.92; smallest detectable change was 19.04 for individuals and 3.31 for groups; standard error of measurement was 6.87; minimum important change was 18.48; floor and ceiling effects were absent. More than 75% of the hypotheses tested for construct validity were confirmed, showing its adequacy. The variation of scores between T0 and T2 correlated with the clinical evolution of the participants (r = 0.421, *p* < 0.05).
Conclusion: The Portuguese version of Pedi-IKDC demonstrated good psychometric properties, being a valuable tool for clinical assessment of pediatric patients with knee disorder.
Keywords: Child; Knee; Knee Injuries; Patient Outcome Assessment; Psychometrics; Surveys and Questionnaires

RESUMO

Introdução: O objetivo deste estudo foi traduzir o questionário *Pediatric International Knee Documentation Committee* (Pedi-IKDC) para Português Europeu. O questionário Pedi-IKDC foi originalmente desenvolvido na língua inglesa e o seu construto permite a avaliação funcional de patologia do joelho, em crianças e adolescentes.
Material e Métodos: A versão original do questionário em inglês foi traduzida para português pelo método tradução e contratradução. Foram considerados elegíveis para o estudo pacientes com idade entre os oito e os 17 anos, com patologia do joelho. Foi implementada uma plataforma *online* para recolher as respostas dos pacientes, incluindo informação geral demográfica, os questionários Pedi-IKDC, *EuroQol-5 Dimension Youth* e *Childhood Health Assessment Questionnaire*. Foram enviados três inquéritos: no momento da avaliação inicial (T0), após duas (T1) e dez (T2) semanas. Estes inquéritos seguiram as recomendações da *Checklist da Consensus-based Standards for the Selection of Health Measurement Instruments* - COSMIN. Foram avaliadas a consistência interna, fiabilidade, erros de medida, validade estrutural e de construto (através da correlação com escalas previamente validadas), responsabilidade e interpretabilidade (efeitos de chão e teto, mudança mínima importante e curva ROC).
Resultados: Quarenta e sete pacientes completaram T0, 42 completaram T1 e 40 completaram T2. A análise factorial confirmou a unidimensionalidade da escala. O coeficiente de correlação entre os itens (alfa de Cronbach) foi 0,94, o coeficiente de correlação intraclasse foi 0,92, a mudança mínima detetável foi 19,04 a nível individual e 3,31 a nível de grupos de indivíduos; o erro padrão de medida foi 6,87; a mudança mínima detetável foi 18,48; não se verificaram efeitos de chão ou de teto. Mais de 75% das hipóteses testadas para a validade de construto foram aceites, demonstrando-se adequada. A variação das pontuações entre T0 e T2 correlacionou-se com a evolução clínica dos participantes (r = 0,421, *p* < 0,05).
Conclusão: A versão portuguesa do Pedi-IKDC demonstrou boas propriedades psicométricas, sendo uma ferramenta útil na avaliação clínica de pacientes pediátricos com patologia do joelho.
Palavras-chave: Avaliação de Resultados da Assistência ao Doente; Criança; Inquéritos e Questionários; Joelho; Lesões do Joelho; Portugal; Psicometria

INTRODUCTION

Patient-reported outcome measures (PROMs) are subjective questionnaires administered to patients to evaluate the impact of their disorders on their health status or function, not only globally, but also for specific body regions. Moreover, they allow for prospective follow-up of clinical status as well as treatment results, from the patients' perspective.[1] Knee-specific PROMs were created for function assessment, including the International Knee Documentation Committee (IKDC) subjective knee form, which evaluates symptoms, articular function, and impact on sports

activities. Although these tools have become widespread in sports medicine studies, current evidence suggests that using adult PROMs in pediatric patients can lead to lack of validity.[2,3]

As such, and since the incidence of knee injury in the pediatric population, especially in adolescents, has seen an abrupt increase in the last few decades, partially due to the increasing level of physical and sports activities,[4-8] the availability of specific PROMs for the pediatric population that are translated and validated in different languages is of utmost importance. It is essential to use PROMs with tested psychometric properties in the pediatric population such as reliability, validity, interpretability, and responsiveness, since these metrics are useful not only as a complementary instrument in the clinical practice, but also for research purposes, so that a 'common language' can be used when reporting results.

Therefore, the Pediatric International Knee Documentation Committee Subjective Knee Form (Pedi-IKDC),[9,10] a modified version of the IKDC score, was recently developed, and was designed specifically for the pediatric population. It consists of 19 questions about knee symptoms, function and impact on physical activities. This survey has been extensively used in the literature,[11-15] and a recently published systematic review showed that Pedi-IKDC is the most studied PROM and has the best psychometric properties and, as such, should be preferred in detriment of other instruments.[12]

The Pedi-IKDC was already validated in many other languages,[15-17] with the validation studies being conducted in pediatric populations affected by a broad spectrum of knee injuries and disorders. However, to date there were no knee-specific PROMS validated for the Portuguese-speaking pediatric population.

Thus, the aim of the present study was to translate, cross-culturally adapt, and validate the Pedi-IKDC score in the Portuguese pediatric population, by means of the Consensus-based Standards for the selection of health Measurement Instruments (COSMIN) checklist.[18-20]

MATERIAL AND METHODS
Translation and cross-cultural adaptation
The questionnaire was translated into Portuguese using the forward-backwards method (Fig. 1).[21] First, the original version of the questionnaire[10] was independently translated into Portuguese by an official translator and a member of the research group, who is proficient in English (V1 and V2). The drafts were checked and compared by an independent senior expert researcher who synthesized them, creating a preliminary translated version (V1-2). This preliminary version was then translated backward into English by two independent official translators who did not know the

original English version of the questionnaire (BT1 and BT2), to ensure the same meaning of the questionnaire in both languages. Finally, the research team, including the same senior author, compared the BT1 and BT2 versions with the original English version to assess unresolved comprehension issues and to approve a pre-final version of the questionnaire (VpF).

The pre-final version was pilot tested on five patients aged eight to 17 with different knee conditions, to ascertain any issue with acceptance and comprehension.

Clinical study
A longitudinal prospective cohort study was designed. It was evaluated and approved by the Ethics Committee for Research in Life and Health Sciences (CEICVS) of the University of Minho and the Ethics Committee of Braga Hospital (CEHB). Between June and September 2020, all patients aged eight to 17 affected by knee disorders, including
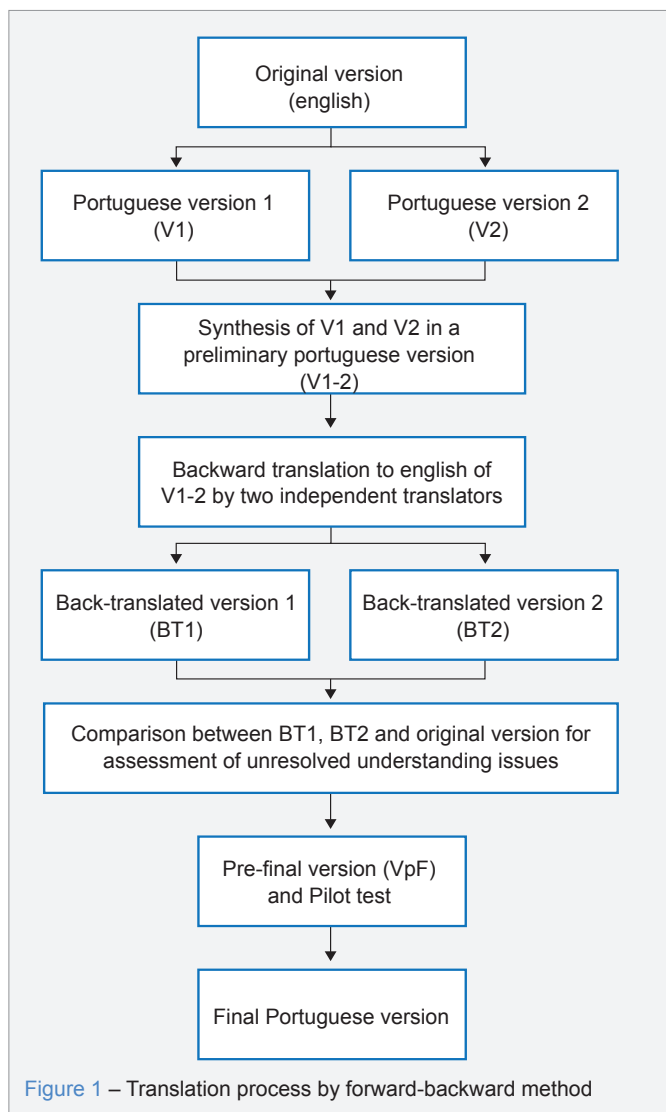

Figure 1 – Translation process by forward-backward method

trauma or deformities, who were assisted in the emergency department or referred to the orthopedics and traumatology outpatient clinic were considered eligible.

The inclusion criteria were having a knee disorder diagnosed by an orthopedic surgeon, with physical and/or functional limitation. Patients with significant comorbidities that could devalue knee symptoms and non-Portuguese speaking patients were excluded.

Complete information about the study was either given to parents on admission or later by phone contact. Those who gave consent were included in the study. Parents were advised to let the patients answer by themselves and to help them only when needed.

An open-source platform (via Google Forms®) was implemented to collect the responses. Three surveys were created (T0, T1 and T2); the translated Pedi-IKDC and the Portuguese versions of the EuroQol-5 Dimension Youth (EQ-5D-Y)(22,23) questionnaire and the Childhood Health Assessment Questionnaire (CHAQ)(24,25), which included general information (sex, age, body mass index, diagnosis).

The patients were asked to complete the surveys via e-mail initially on admission or first evaluation (T0), then two to three weeks later, under stable clinical conditions (T1), and a third time, 10 weeks later, after completion of surgical or conservative treatment (T2). An anchor-question about the patients' clinical status was included in T1 and T2 ("In relation to the previous survey, how would you consider your affected knee today?" with a multiple-choice answer: "much better", "better", "somewhat better", "same status", "somewhat worse", "worse" or "much worse").

There is evidence that electronic-based and paper-and-pencil surveys provide equivalent results[26,27] and it was also recently demonstrated that PROMs can be administered via electronic platforms in pediatric sports medicine.[28]

Questionnaires

The Pedi-IKDC score is a knee-specific questionnaire consisting of 17 Likert-based questions and four VAS-based questions on knee symptoms, sport activities, and function. The final score ranges from 0 to 100, and it is a measure of function, meaning that a higher score represents less pain, less symptoms, and a higher level of physical functioning.

The EQ-5D-Y is a questionnaire adapted for children and it measures health-related quality of life by evaluating five dimensions: mobility problems, self-care problems, problems during usual activities and the level of pain and anxiety. Each dimension is scored from 1 to 3 and it also includes a VAS-based question (0 to 100) as a quantitative health measure. Even though not specifically for knee disorders, it has shown highly valid and reliable for orthopedic problems.[29,30]

The CHAQ questionnaire was developed to evaluate the functional status of children with idiopathic juvenile arthritis, and it includes eight dimensions to evaluate their difficulty in performing usual activities and a VAS question about pain.[25]

Instruments validated in the pediatric population and translated into Portuguese are scarce. These last two questionnaires were selected to evaluate construct validity because they fulfilled the previous conditions.[24]

Statistical analysis

Data were automatically extracted on a Microsoft Excel spread sheet (Microsoft Corporation, Redmond WA). Analyses were performed in Excel or SPSS – Statistical Package for the Social Sciences v26.0 (IBM®SPPS® Statistics). Descriptive statistics were used to report demographics data as mean ± standard deviation. The significance level was considered as 5%. The normal distribution of variables was assessed by asymmetry and kurtosis values (normal if between -1 and 1) of the Komolgorov-Smirnov and Shapiro-Wilk tests and the histogram analysis.[31]

Psychometric properties

• Structural validity

Descriptive statistics were analysed for each item. The one-dimensionality of the scale was confirmed by the principal component analysis (PCA) and the eigenvalue above 1.[18,19] The Bartlett test was used to assess sphericity and the Kaiser-Meyer-Olkin (KMO) index to assess the sample consistency; a KMO above 0.6 was considered adequate.[7] Factor weights below 0.3 were considered for item deletion.

• Internal consistency

Internal consistency represents the homogeneity of the items within a score. The alpha coefficient (α) of Cronbach (range 0 – 1) as well as the correlation item-total were calculated for the responses on T0. The higher the coefficient, the more consistent is the score, and values α > 0.70 were considered acceptable.[32]

• Reliability and measurement error

Reliability represents the precision of an outcome measure and evaluates whether it produces consistent results when repeatedly administered under stable conditions.[20] The overall scores of T0 and T1 were used to calculate the reliability. For this purpose, patients who answered "somewhat better", "same status" or "somewhat worse" on the anchor-question of T1 were considered stable and included for reliability analysis.

Test-retest reliability was assessed by means of the interclass correlation coefficient (ICC); an ICC > 0.75 was considered excellent.[33,34]

The standard error of measurement (SEM), which indicates the measurement error for every measurement,

and the smallest detectable change (SDC), which indicates the measurement error at individual level (SDC.ind) and at group level (SDC.group), were also calculated.[19,35]

• Construct validity

Construct validity is the degree to which the scores of the instrument measure the construct to be measured and three aspects were evaluated: structural validity, which concerns the internal relationships; hypotheses testing, based on the assumption that the instrument validly measures the construct to be measured (concerning the relationships to scores of other instruments or differences between relevant groups); and discriminative validity.[20]

Hypothesis testing was performed by establishing hypothesis *a priori* to correlate the Pedi-IKDC scores with previously validated instruments, i.e., EQ-5D-Y subscale scores and specific CHAQ questions, related to lower limb function. The Spearman coefficient (ρ) was used to measure correlations ($\rho < 0.3$ low, $0.3 < \rho < 0.5$ moderate, $0.5 < \rho < 0.8$ strong and $\rho > 0.8$ excellent).[36] Construct validity was considered adequate if 75% of the hypothesis were accepted.[36]

The following hypothesis were tested: 1) the final scores of Pedi-IKDC would negatively correlate with the EQ-5D-Y and CHAQ subscale scores; 2) the final scores of Pedi-IKDC would positively correlate with the VAS-Health score of EQ-5D-Y; and 3) the Spearman coefficient is > |0.4|.

Discriminative validity was determined by the low correlation between Pedi-IKDC score and the subscale "Grip" of the CHAQ questionnaire.

• Responsiveness

Responsiveness is defined as the ability to detect clinically important changes over time. It was determined with a distribution-based method from the overall scores T0 and T2 of those patients who reported a minimal clinical improvement (answers "much better", "better", "worse" and "much worse" in the anchor-question).[18]

Effect size was calculated with the formula (mean T2 score - mean T0 score/ standard deviation of T0 score); small effects were considered > 0.20, moderate effect > 0.50, and large effect > 0.80.[9] The standardized response mean (SRM) was calculated with the formula (mean T2 score − mean T0 score/standard deviation of the change in score).[18]

A priori hypothesis that the change in score between the first and last states would positively correlate with the patients' answer to the anchor-question was tested, as well as the Spearman coefficient would be greater than 0.3.[37]

• Interpretability

Interpretability is the degree to which one can assign qualitative meaning to a quantitative score. The interpretability was assessed at T0 by examining the distribution of the Pedi-IKDC score, the floor and ceiling effects and the minimal important change (MIC).[18]

Floor and ceiling effects were considered present if more than 15% of the patients scored the Pedi-IKDC with, respectively, 0 to 5 or 95 to 100. The interpretability of the Pedi-IKDC was given a positive rating if floor or ceiling effects were absent.

The MIC represents the change in score that can be considered clinically relevant. It was calculated by means of dividing the sample into two groups, based on the anchor-question: better (answers "much better"/"better") and stable ("somewhat better"/"same status"/"somewhat worse"). Then, the optimal cut-off of the receiver operating characteristic (ROC) curve was used to determine MIC.[38] The area under the curve was considered adequate if it was greater than or equal to 0.70.[39]

RESULTS
Translation and cross-cultural adaptation

The final Portuguese version of the Pedi-IKDC is shown in Appendix 1 (Appendix 1: https://www.actamedicaportuguesa.com/revista/index.php/amp/article/view/18425/Appendix_01.pdf). The translation process of the questionnaire, including the pilot-test, did not raise any discrepancies or comprehension problems. In the item 11.d, the phrase "squat down like a baseball catcher" was modified to "agachar (posição de cócoras)" [i.e., "squat down (squatted position)"], since the practice of baseball is uncommon in Portugal and it could have raised comprehension issues. Also, the expression "saltar ao pé-coxinho" (i.e. the action of jumping repeatedly and landing on only one foot) was added to the item 11.h, since it is a very common expression among Portuguese children.

Demographics

In total, 47 patients completed the T0 survey, 42 patients completed the T1 survey, and 40 patients completed the T2 survey; demographic data and diagnoses of the patients are shown in Table 1.

The total scores obtained from the surveys were: 54.90 ± 23.99 for T0; 59.27 ± 25.47 for T1; and 65.32 ± 26.58 for T2. There were no statistically significant differences in the scores obtained between male and female patients or between diagnoses.

Structural validity

All 19 items were introduced in the PCA. The factorial analysis showed a total explained variance of 54.82% and the eigenvalue was stabilized after the first component, showing that the scale is one-dimensional. Bartlett test was

Table 1 – Demographic data of the patients

		Value
Sex (n, %)	Male	15 (32%)
	Female	32 (68%)
Age (years) (mean ± SD; min. - max.)		14.04 ± 2.25 (9.0 - 17.0)
BMI (kg/m^2) (mean ± SD; min. - max.)		21.60 ± 3.26 (16.4 - 32.0)
Diagnosis (n, %)	Patellar instability	21 (44.7%)
	Osgood-Schlatter	9 (19.1%)
	Meniscal injury	5 (10.6%)
	ACL failure	4 (8.5%)
	Valgus knee	3 (6.4%)
	Patellar fracture	1 (2.1%)
	Osteochondritis	1 (2.1%)
	Patellar syndrome	1 (2.1%)
	Intra-articular free body	1 (2.1%)
	Medial collateral ligament injury	1 (2.1%)
Duration of symptoms (n, %)	Less than 2 weeks	2 (4.3%)
	2 to 8 weeks	10 (21.3%)
	2 to 6 months	3 (6.4%)
	6 to 12 months	7 (14.9%)
	More than 1 year	25 (53.2%)

n: number of participants; SD: standard deviation; BMI: body mass index; ALC: anterior cruciate ligament.

significant ($p < 0.001$) and KMO index was adequate (KMO = 0.894). Every item had a factor loading greater than 0.3, so all items from the original version were maintained.

Internal consistency

Cronbach α was excellent (α = 0.941) and correlation item-total was greater than 0.3 for every item, indicating high internal consistency and correlation between items.

Reliability and measurement error

Retest was filled-in by 89.4% of the participants, after a mean of 16 days (12 to 24 days) from T0. Thirty-three (78.6%) participants were eligible for the reliability analysis. Test-retest was excellent (ICC = 0.92).

The SEM was 6.87 and the SDC at individual and group level was 19.04 and 3.31, respectively.

Construct validity

The Pedi-IKDC score was negatively correlated with EQ-5D-Y and CHAQ subscale scores and positively correlated with the VAS-Health score (Table 2), with ρ > |0.4|.

A significant ($p < 0.05$) correlation was found between the overall Pedi-IKDC score and the CHAQ domains walking (ρ = -0.656), activities of daily living (ρ = -0.547) and pain (ρ = -0.668), and the questions on running and playing activities (ρ = -0.866) and bending to reach the floor

(ρ = -0.775); as well as the EQ-5D-Y domains mobility (ρ = -0.617), self-care (ρ = -0.459), usual activities (ρ = -0.690), pain (ρ = -0.608), anxiety (ρ = -0.456) and the VAS health scale (ρ = 0.589) (Table 2). The correlations found were mostly strong or, in some cases (self-care and anxiety domains of EQ-5D-Y), moderate.

Discriminative validity was confirmed by the absence of correlation between Pedi-IKDC score and the CHAQ subscale "Grip" (ρ = -0.177, $p > 0.05$).

Over 75% of the hypotheses were confirmed, so construct validity was considered adequate.

Responsiveness

The T2 questionnaire was filled-in by 85.1% of the participants, after a mean of 10 weeks (9 to 12 weeks) from T0. The Pedi-IKDC score variation between T0 and T2 showed a positive correlation (ρ > 0.3, $p < 0.05$) with the score of the anchor-question. The Pedi-IKDC showed a moderate effect size (0.671) and SRM of 1.14.

Interpretability

Floor effect was 0% for all questionnaires. Ceiling effect was 0%, 2.38% and 5.0% for T0, T1 and T2, respectively. So, both floor and ceiling effects were considered absent. The AUC of the ROC curve was adequate (AUC = 0.725) and MIC was 18.48.

Table 2 – Construct validity analysis by Spearman correlation between Pedi-IKDC and domains of EQ-5D-Y and CHAQ

		Pedi IKDC Score
		(ρ)
EQ-5D-Y Domain score	Mobility	-0.617*
	Self-care	0.459*
	Pain	-0.608*
	Usual activities	-0.690*
	Anxiety	-0.456*
	VAS – Health	0.589*
CHAQ Domain score	Walk	-0.656*
	Bend	-0.775*
	Grip	-0.177
	ADL	-0.547*
	Activities (run and play)	-0.866*
	VAS -Pain	-0.668*

* $p \leq 0.05$; EQ-5D-Y: EuroQol-5 Dimension Youth; Pedi-IKDC: Pediatric International Knee Documentation Committee Subjective Knee Form; CHAQ: Childhood Health Assessment Questionnaire; ρ: Spearman correlation coefficient; ADL: activities of daily life; VAS: visual analogue scale.

DISCUSSION

In this study, parents or caregivers were allowed to assist participants with completion of the questionnaire and the instruments applied. Although this does create a potential bias related with outcome assessment by proxy, the authors believe that this is a typical and transversal approach in pediatric outcome assessment.

The psychometric properties studied revealed that the Portuguese version is a valuable instrument to measure knee function and symptoms in the Portuguese-speaking pediatric population.

In particular, since the content validity by means of PCA showed that the scale is one-dimensional, all items from the original version were preserved on the final version. Internal consistency demonstrated excellent results and that there are no redundant items. Moreover, we demonstrated an excellent test-retest reliability, confirming the reproducibility of the questionnaire in pediatric patients with knee musculoskeletal disorders.

Construct validity aims to assess the relationship of the instrument with an accepted outcome instrument, ideally, a gold standard, if one exists. Considering that, in the case of knee symptoms, function and activities evaluation there is no gold-standard nor any other available knee-specific scale validated for the Portuguese-speaking pediatric population, construct validity was analysed by means of 'hypotheses testing' by correlations to EQ-5D-Y and CHAQ scores. The EQ-5D-Y is a health-related quality of life questionnaire which was shown to be valid for orthopedic problems, even if not specifically for knee disorders, and its adult version has shown highly valid and reliable in knee osteoarthritis or patients undergoing arthroscopic knee surgery.[40] The

CHAQ is a well-established outcome instrument, and it has been used to validate other outcome tools in the pediatric literature. Therefore, these two generic instruments were the most appropriate validated scales available for the analysis. Additionally, in order to increase the accuracy of the validation, specific items and domains related with the lower limb function were selected to perform this analysis. The tested items and domains showed a significant moderate to strong correlation with the overall Pedi-IKDC score in more than 75% of the hypotheses tested, indicating that Pedi-IKDC follows accepted hypotheses and produces results consistent with children's perceptions on their symptoms, function, limitations on their activities and expectations.

The analysis of responsiveness, as generated by completion of the Pedi-IKDC in different moments of the diagnosis and treatment, showed a moderate effect size and a moderate SRM, indicating that this instrument is responsive. When comparing these two measures (effect size and SRM) to other previous translations of the same instrument, we can verify that they variate considerably and our values are in between the previous reported outcomes (Table 3).

Finally, concerning interpretability analysis, floor and ceiling effects were absent, which is excellent, and the area under the ROC curve was adequate. These psychometric characteristics of our observed data for the Pedi-IKDC in the Portuguese pediatric population were comparable with those found in previous studies of validation in other languages.[9,10,15-17]

However, as for measurement errors, our analysis showed slightly higher values than some of the previous validation studies, even if comparable to those reported by Jacobsen et al[16] and Van der Velde et al.[15] According to our

Table 3 – Summary of the psychometric properties demonstrated by Pedi-IKDC in the currently available translations and adaptations

	n (T0, T1, T2)	Internal consistency	Reliability	Measurement error	Structural validity	Construct validity	Responsiveness	Interpretability
English (original)[9,10]	589	α = 0.91	ICC = 0.91	n.r.	Adequate	Adequate - CHAQ	Good SRM = 1.35 ES = 1.39	Floor and ceiling effects 30%
Danish[16]	99, 53, 94	α = 0.9	ICC = 0.9	SEM = 11.3 SDC.ind = 4 SDC.group = 11	n.r.	n.r.	Good SRM = 0.9 ES = 0.2	MIC = 12.0
Dutch[15]	100, 54, 71	n.r.	ICC = 0.8	SEM = 8.6 SDC.ind = 23.8	Adequate	Adequate - NRSP - Lysholm Knee Score - EQ-5D - KOOS-Child	Good SRM = 1.25 ES = 1.5	Absent floor and ceiling effects
Italian[17]	89, 81, 49	α = 0.92	ICC = 0.96	SEM = 4.4 SDC.ind = 12.3	n.r.	n.r.	SRM = 0.86 ES = 0.79	Ceiling effect 22%
Portuguese	47, 42, 40	α = 0.94	ICC = 0.92	SEM = 6.87 SDC.ind = 19.06 SDC.group = 3.31	Adequate	Adequate - CHAQ - EQ-5D-Y	Good SRM = 1.14 ES = 0.671	Absent floor and ceiling effects; MIC = 18.48

n: number of participants; T0: initial evaluation; T1: re-test evaluation; T2: evaluation after treatment; α: Cronbach alpha coefficient; ICC: interclass correlation coefficient; SEM: standard error of measurement; SDC.ind: smallest detectable change at individual level; SDC.group: smallest detectable change at group level; SRM: standardized response mean²; ES: effect size; MIC: minimum important change; n.r.: not reported; CHAQ: Childhood Health Assessment Questionnaire; NRS: Numeric Rating Score for pain; EQ-5D: EuroQol-5 Dimension; EQ-5D-Y: EuroQol-5 Dimension Youth; KOOS-Child: Knee Injury and Osteoarthritis Outcome Score for children.

results, in the clinical and research setting, the score variations needed to detect true clinically significant differences are not the same when analysing an individual or a group of patients: between two assessment points, a mean score variation of three points in a group of patients is clinically significant. However, when evaluating a single individual a variation of 19 Pedi-IKDC score points is needed in order to detect a clinically significant status modification. As such, in the clinical setting, the use of Pedi-IKDC is more limited when assessing one patient, when a higher score variation is needed to identify a clinically significant variation. In the research setting, however, when assessing groups of patients, the measurement error is minimal, meaning that the validated instrument is adequate for group analysis.

Even though there is no consensus on the recommended sample size for cross-cultural adaptation and validation studies of PROMs,[39,41,42] one of the determinants of the measurement error analysis is the sample size, so this limitation of individual score interpretation could be due to our relatively small sample size. However, the results of our analysis are in line with other validations of the Pedi-IKDC score. Although not all the authors systematically reported their measurement errors, SDC at the individual level varied berween 4.0 to 23.8, SDC at the group level was 11 as reported by Jacobsen *et al* and SEM varied between 4.4 and 11.3, suggesting that the measurement errors obtained are mirroring the instrument limitations and not really the small sample limitations.

Among the strengths of this study, there is the fact that the instrument was translated, adapted, and validated according to the COSMIN Checklist recommendations, allowing our methodology to be reproductible for other studies. Another aspect is that this study was conducted in a population affected by a broad spectrum of knee disorders, keeping in mind that the questionnaire was not designed as 'disease-specific' tool.

The study presents some limitations. As previously reported, the smaller sample size could have influenced our measurement errors, as well as effect size measurements. Secondly, the construct validity analysis was compromised since there are no validated instruments in the studied population available as a 'gold standard' for knee disorders. Therefore, we decided to use two general health instruments, which were already used in other translations of this questionnaire and obtained similarly adequate results.

CONCLUSION

The Pedi-IKDC was successfully translated into Portuguese and, based on the psychometric properties, it is a reliable, valid, and responsive tool to assess outcomes[1] in children and adolescents with a broad range of knee disorders. As a result, Pedi-IKDC seems to be an acceptable and valuable tool for assessment of patients aged eight to 17 with knee disorders in the clinical and research setting.

PREVIOUS PRESENTATIONS

This paper was presented as a communication at the 40th Portuguese National Congress of Orthopedic Surgery and Traumatology, which took place as a virtual conference on the 21st and 22nd of October 2021.

AUTHOR CONTRIBUTIONS

All authors declare that they had a substantial, direct intellectual contribution in the design and elaboration of the article, participated in the analysis and interpretation of data, participated in the writing of the manuscript, revision of versions and critical review of the content; approval of the final version and agree that they are responsible for the accuracy and completeness of the entire work.

PROTECTION OF HUMANS AND ANIMALS

The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and to the Helsinki Declaration of the World Medical Association updated in 2013.

DATA CONFIDENTIALITY

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

COMPETING INTERESTS

The authors have declared that no competing interests exist.

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