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## Validation of Pedi-IKDC scale and intercultural adaptation to Ukrainian language

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*There are no questionnaires available in Ukrainian that can be used to objectify the results of treatment of orthopaedic and traumatological pathology of the knee joint in children. In world practice, subjective Pedi-IKDC and KOOS-Child scales are used for this purpose. Objective. Validation, intercultural adaptation and translation of the Pedi-IKDC scale in English (original) into Ukrainian for paediatric patients. Methods. Translation and adaptation agreed with the copyright holder of the AOSSM test and performed according to the requirements of the Recommendations for the Cross-Cultural Adaptation of Health Status Measures of the American Academy of Orthopaedic Surgeons Institute for Work & Health. The translated and adapted questionnaire has been tested on a heterogeneous group of 10 children treated for knee pathology. The questionnaire has been adjusted. The participants (both sexes, aged 10–18 years) have been divided into two groups for validation: I — without knee pathology, tested once; II — with knee injuries and physical limitations, tested before and after treatment. Results. We obtained 50 questionnaires in group I (50 children). Student's t-test has been chosen for the analysis of results. To compare the accuracy of the translation, a comparison has been made with the results of A.Y. Nasreddine's study (unpaired Student's t-test). The resulting differences between the original questionnaire and its translation have not been statistically significant ( $p = 0.966$ ). Group II received 200 questionnaires. A paired Student's t-test has been chosen for analysis. Test results before and after treatment have been significantly different ( $t_2 > t_{crit}$ ,  $p < 0.001$ ). The appropriateness and objectivity of the Pedi-IKDC questionnaire have been confirmed. Conclusions. The Pedi-IKDC test has been successfully translated into Ukrainian and adapted for use. The quality of adaptation has been confirmed and no statistically significant difference has been found compared to the results of the world studies. Pedi-IKDC is recommended to be used in children with knee pathology for clinical and scientific purposes.*

*На українськомовному просторі на даний момент немає анкет, за допомогою яких можна об'єктивізувати результати лікування ортопедичної та травматологічної патології колінного суглоба в дітей. У світовій практиці для цього використовують суб'єктивні шкали Pedi-IKDC і KOOS-Child. Мета. Валідація, міжкультурна адаптація та переклад шкали Pedi-IKDC з англійської мови (оригінальна) на українську для пацієнтів дитячого віку. Методи. Переклад та адаптацію узгоджено з правовласником тесту AOSSM та проведено згідно з вимогами Recommendations for the Cross-Cultural Adaptation of Health Status Measures від American Academy of Orthopaedic Surgeons Institute for Work & Health. Перекладену й адаптовану анкету апробовано на неоднорідній групі з 10 дітей, які отримували лікування з приводу патології колінного суглоба. Зроблено корекцію анкети. Для валідації учасників (обидві статі, вік 10–18 років) розподілили на дві групи: I — без патології колінного суглоба, тестували один раз; II — із травмами коліна та фізичними обмеженнями, протестовані до та після лікування. Результати. Отримано 50 анкет у I групі (50 дітей). Для аналізу результатів обрали t-критерій Стьюдента. Для порівняння точності перекладу провели порівняння з результатами дослідження А. У. Nasreddine (непарний t-критерій Стьюдента). Отримані розбіжності за умов тестування за оригінальною анкетною та її українським перекладом статистично не значущі ( $p = 0,966$ ). У II групі отримано 200 анкет. Для аналізу обрали парний t-критерій Стьюдента. Результати тестування до та після лікування суттєво відрізнялися ( $t_2 > t_{crit}$ ,  $p < 0,001$ ). Підтверджено адекватність та об'єктивність оцінок, отриманих за допомогою опитувальника Pedi-IKDC. Висновки. Тест Pedi-IKDC успішно перекладений на українську мову та адаптований для використання. Підтверджено якість адаптації та порівняно з результатами світових досліджень не знайдено статистично значущої різниці. Pedi-IKDC рекомендовано використовувати під час лікування дітей із патологією колінного суглоба в клінічних і наукових цілях. Ключові слова. Коліно, нестабільність, дитяча травма, дитяча ортопедія.*

**Key words.** Knee, knee instability, IKDC, pedi IKDC

## Introduction

In practice, pediatric orthopedists-traumatologists often observe cases when, in knee joint damage, the indicators of clinical examination or instrumental methods of diagnosis do not correlate with the subjective feelings of the patient and the functional outcomes of treatment [1, 2]. Because of this, subjective scales are used to objectify the results and compare different groups of patients (by age, gender, type of injury, treatment method or type of surgical intervention). Pedi-IKDC and KOOS-Child [3–15] are the main ones for use in pediatric orthopedics and traumatology.

M. Dietvorst et al. [8] conducted a systematic review of articles on knee injuries in children based on patient-reported outcomes (PROMs). The authors proved that IKDC and KOOS lose reliability when examining children due to unclear questions. At the same time, Pedi-IKDC and KOOS-Child proved to be reliable and sensitive, so they are recommended to be used to assess the functional state of the knee joint in children.

C. A. van der Velden et al. [2] investigated and compared the Pedi-IKDC and the KOOS-Child tests during the transcultural adaptation of the Pedi-IKDC to the Dutch language and validation.

The authors concluded that the Pedi-IKDC is psychometrically superior to the KOOS-Child for patients.

The clinical significance of the validation and cross-cultural adaptation of the Pedi-IKDS scale to the Ukrainian language is based on the fact that in our country there are currently no questionnaires that can be used to measure the activity and functionality of the knee joint in a child. Also, transcultural adaptation and validation will allow domestic orthopedic traumatologists to systematize and evaluate the state of the joint, the results of treatment, and compare the results with foreign colleagues.

*The purpose of the study:* validation, cross-cultural adaptation and translation of the Pedi-IKDS scale from English (original) to Ukrainian for pediatric patients.

## Material and methods

Today, the development of Ukrainian-language standards for assessing the state of the knee joint in children's patients after an examination is extremely necessary; therefore it was decided to translate and adapt the Pedi-IKDS for use by domestic specialists.

### *Translation*

The translation and adaptation was coordinated with the test rights holder AOSSM (American Ortho-

pedic Society for Sports Medicine) and was carried out in accordance with international requirements (Recommendations for the Cross-Cultural Adaptation of Health Status Measures from the American Academy of Orthopedic Surgeons Institute for Work & Health) [2].

In accordance with the requirements of the specified protocol, the translation of the original test was performed by an orthopedic traumatologist proficient in English (his translation is directed more towards the clinical content of the questionnaire) and a professional English translator (the so-called «naive translator», whose work is not influenced by clinical/medical knowledge).

Then, the two translations were synthesized into a joint version by the team (translators of the questionnaire and the research curator). All controversial issues regarding the translation were resolved by consensus of the parties in order to achieve clinical accuracy and comprehensibility for children.

After that, two native English speakers without medical education, independently of each other, who did not know the original of the test, translated the created general Ukrainian translation back into English. These two translations were compared with the original English versions. All inconsistencies were discussed and adjustments were made.

The questionnaire and further research were approved by the decision of the Bioethics Committee at the State Institution Professor M. I. Sytenko Institute of Spine and Joint Pathology of the National Academy of Medical Sciences of Ukraine (Protocol No. 217 of 14.06.2021).

Subsequently, the questionnaires were tested on a heterogeneous group of 10 children aged 5 to 15 years who were treated for knee joint disorders in the Department of Pediatric Orthopedics of the State Institution Professor M. I. Sytenko Institute of Spine and Joint Pathology of the National Academy of Medical Sciences of Ukraine. Each respondent was interviewed about the difficulty of the task. In case of ambiguity or incomprehensibility, adjustments were made. The final Ukrainian versions of Pedi-IKDC were obtained. Patients of the pilot study were not included in the validation study.

### *Participants*

The participants were selected from the outpatient clinic and the inpatient unit of the State Institution Professor M. I. Sytenko Institute of Spine and Joint Pathology of the National Academy of Medical Sciences of Ukraine from March 2021 to December 2021 and were divided into two groups:

– patients of both sexes, aged 10–18 years, without disorders of the lower extremities, with a sufficient command of the Ukrainian language, were selected for the first group;

– the second group included children aged 10–18 with knee injuries and physical limitations.

The study aimed to include a heterogeneous patient population that would be representative of children with a wide range of orthopedic disorders of the knee joint. Patients with any accompanying diseases, the symptoms of which prevailed over the symptoms of disorders in the knee joint, or with poor command of the Ukrainian language were not included.

If necessary, parents or guardians were allowed to help the child fill in the questionnaires.

*Procedure for conducting the study*

The children of the first group were asked to fill in the Pedi-IKDC questionnaire.

Patients of the second group filled out the Pedi-IKDC questionnaire before the start of treatment and 5 months after a preliminary questionnaire during a control examination. This time point was chosen because clinical changes could be expected. If necessary, patients were reminded by e-mail and phone about the next examination.

*Statistical analysis*

Statistical analysis consisted of three stages. At the first stage a general analysis was performed, standard basic indicators were calculated and their distribution was evaluated. Based on the information received, methods and criteria were chosen for solving the tasks. To determine the accuracy of the translation, a comparison was made with the results of the study by A. Y. Nasreddine [5], where a large cohort of patients (1,921 children without knee joint disorders) was analyzed and the criteria for the normality of Pedi-IKDC outcomes were determined. At the second stage, the validity of the survey was determined, and at the third stage, the objectivity of the clinical outcomes was checked.

**Results and their discussion**

An example of the Ukrainian version of Pedi-IKDC is presented in the Figure.

*Validation*

As a result of the study, 50 questionnaires were filled in by 50 patients of the first group. In the second group, 200 questionnaires were received, 102 children took part in the initial testing, and 100 in the second one (2 patients did not show up for the control examination, so they were excluded from the study). Using the Excel® software, a template for calculating test results was created and all 250 questionnaires were analyzed using it.

The main statistical parameters for each group were calculated, namely: the arithmetic mean of the sample, the standard deviation and the sampling error (representativeness error).

Since the distribution of test results turned out to be normal, the methods of mathematical statistics, namely the Student's t-test, were chosen for further analysis.

To compare the accuracy of the translation and the efficiency of the test, the results of the first group and the data of A. Y. Nasreddine's study [5] were analyzed using the unpaired Student's t-test (Table 1).

Calculations showed that the value of the t-criterion was 0.04; the number of degrees of freedom f was 1969; the critical value of the Student's t-test was 1.972; provided the level of significance  $\alpha$  was 0.05. The differences obtained when testing the original questionnaire and its Ukrainian translation were not statistically significant ( $p = 0.967$ ).

To analyze the results of the second group, we used the Student's paired t-test, comparing the data obtained from the questionnaires of patients with knee joint disorders before and after surgical treatment (Table 2).

The study implied determination of the value of the paired t-criterion (36.165) and the number of degrees of freedom f (99). The critical value of the Student's t-test for such a number of degrees

*Table 1*  
**Comparison of the results of own study with findings of A. Y. Nasreddine [5]**

Indicator	Ukrainian translation	A.Y Nasreddine's findings
Number of participants	50	1921
Arithmetic mean by sample	86.6	87.4
Standard deviation	7.2	16.3
Representativeness error	1.01	0.37

*Table 2*  
**Results of comparison of data from questionnaires of patients with knee joint disorders before and after surgical treatment**

Indicator	Before treatment	5 months after treatment
Number of participants	100	100
Arithmetic mean by sample	46.226	89.092
Standard deviation	9.280	7.357
Representativeness error	0.928	0.736

Section A. General information

1. Full name \_\_\_\_\_  
 Medical history No. \_\_\_\_\_

2. Date of examination \_\_\_\_\_  
 day month year

Section B. History taking

Date of knee joint injury \_\_\_\_\_  
 day month year

**We would like to know more about your knee joint injury. Therefore, please answer the following questions**

**Action symptoms**

1. Which of the following actions can you perform without feeling pain in the knee joint?

- 1. Very intense loads, such as jumping or fast turnovers, like in basketball or football
- 2. Intense loads, such as weightlifting, skiing or tennis
- 3. Loads of medium intensity, associated with fast walking or jogging
- 4. Light exertion, such as walking at a normal speed
- 5. I cannot perform any of the above actions, because I feel pain

2. How many times have you felt pain in the injured knee joint (within the last 4 weeks or post-injury)?

Did not feel pain    1 2 3 4 5 6 7 8 9 10    Constant pain

3. How much does the damaged knee joint hurt now?

Does not hurt at all    1 2 3 4 5 6 7 8 9 10    Unbearable pain

4. How difficult was it to move or bend the injured knee joint within the last 4 weeks or after an injury?

- 1. Not difficult at all (no restrictions)
- 2. Minor difficulty (discomfort)
- 3. Medium difficulty
- 4. Difficult
- 5. Very difficult

5. How swollen was the affected knee during the last 4 weeks or after the injury?

- 1. There was no swelling
- 2. Slight swelling
- 3. Visible swelling
- 4. Severe swelling
- 5. Very strong swelling

6. Which of the most difficult actions proposed below can you perform without provoking the appearance of swelling in the knee joint?

- 1. Very intense activities such as jumping or quick turns, as in basketball or football
- 2. Intense loads, such as weightlifting, skiing or tennis
- 3. Moderate loads associated with fast walking or jogging
- 4. Light exertion, such as walking at a normal speed
- 5. I cannot perform any of the exercises now because the injured knee joint swells even during rest

7. In the past 4 weeks or since the moment of injury, has your injured knee joint been locked (fixed) so that it was not possible to move it?    Yes No  
   

8. In the last 4 weeks or since the moment of injury, did you feel that something was stuck or sticking in your injured knee joint, but you could move the joint?    Yes No  
   

9. Which of the following are the most difficult activities you can safely perform without harming the knee joint?

- 1. Very intense activities such as jumping or quick turns, like in basketball or football
- 2. Intense loads, such as weightlifting, skiing or tennis
- 3. Loads of medium intensity associated with fast walking or jogging
- 4. Light exertion, such as walking at a normal speed
- 5. I can't do a single task right now, because my injured knee joint doesn't allow me to do sports

**Sports activity**

10. What loads can a damaged knee joint withstand for a long time?

- 1. Very intense loads, such as jumping or fast turnovers, like in basketball or football
- 2. Intense loads, such as weightlifting, skiing or tennis
- 3. Loads of medium intensity associated with fast walking or jogging
- 4. Light exertion, such as walking at a normal speed
- 5. Most of the time I cannot perform the listed exercises

11. How does the knee joint injury affect your ability to:

	No, freely	Yes, slightly	Yes, in a small way	Yes, quite difficult	I can't do it
a. Climb the stairs	1	2	3	4	5
b. Go down the stairs	1	2	3	4	5
c. Stand on the damaged knee joint	1	2	3	4	5
d. Squat to a right angle in the knee joint	1	2	3	4	5
e. Sit down on a chair, bent the knees and put the feet on the floor	1	2	3	4	5
f. Get up from the chair	1	2	3	4	5
g. Run	1	2	3	4	5
h. Jump and land on the injured knee joint	1	2	3	4	5
i. Move and stop quickly	1	2	3	4	5

**Function**

12. How well did your knee joint function before the injury?

I couldn't do anything at all    1 2 3 4 5 6 7 8 9 10    I could do whatever I wanted

13. How well is your injured knee functioning now?

I can't do anything at all    1 2 3 4 5 6 7 8 9 10    I can do whatever I want

14. Who filled out this questionnaire?     1. Only a child     2. Child with the help of parents/adult

15. Date of filling out the questionnaire    \_\_\_\_\_  
 day month year

Figure. Ukrainian version of Pedi-IKDC



of freedom was 1.987. Differences obtained as a result of the analysis of test results before and after treatment were statistically significant ( $t_2 > t_{crit}$ ;  $p < 0.001$ ).

The high correlation of the results of determining the condition of patients confirms the adequacy and objectivity of the assessments obtained using the Pedi-IKDC questionnaire.

#### Discussion

Assessment of the patient's functional status is of great importance both in the case of conservative and surgical treatment. Pedi-IKDC is an adapted version for pediatric patients of the IKDC questionnaire, which is the gold standard test for determining the state of the knee joint and is actively used in global practice. The Ukrainian version of the Pedi-IKDC test can be downloaded from the official website of AOSSM [14]. Statistical analysis was performed to verify the correctness of the translation. For subsequent validation and cultural adaptation, the tested questionnaires as controls will provide greater reliability for statistical analysis data. Summarizing the results of the conducted statistical analysis, it was established that the Ukrainian version of Pedi-IKDC allows obtaining reliable, adequate and objective indicators.

#### Conclusions

The Pedi-IKDC test was successfully translated into Ukrainian and adapted for use. With the help of statistical methods, the quality of adaptation was confirmed and compared to the results of world studies, no statistically significant difference was found.

Pedi-IKDC is recommended for use in children with knee joint disorders for clinical and scientific purposes.

**Conflict of interest.** The authors declare no conflict of interest.

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## VALIDATION OF PEDI-IKDC SCALE AND INTERCULTURAL ADAPTATION TO UKRAINIAN LANGUAGE

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