Cultural adaptation and validation of the Boston Carpal Tunnel Syndrome Questionnaire in Kazakhstan

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Abstract

The Boston Carpal Tunnel Questionnaire is designed for use by patients with carpal tunnel syndrome. However, its use in the Republic of Kazakhstan among the Kazakh-speaking population is unavailable due to the lack of a translated version. The aim of this study was to translate and culturally adapt The Boston Carpal Tunnel Questionnaire into the Kazakh language, as well as to evaluate its reliability and validity. The study included 64 Kazakh-speaking patients with clinically confirmed carpal tunnel syndrome. Statistical analysis involved descriptive statistics and psychometric analysis to assess reliability (internal consistency) and construct validity. The Kazakh version of the Boston Carpal Tunnel Questionnaire demonstrated high reliability with Cronbach's alpha ranging from 0.974 to 0.985. Content validity revealed ceiling effects and less pronounced floor effects. Construct validity was acceptable for several Boston Carpal Tunnel Questionnaire items along with the corresponding subscales of EQ-5D-5L. The results of this study confirm the high reliability and satisfactory validity of Boston Carpal Tunnel Questionnaire for assessing patients with carpal tunnel syndrome in the Kazakh-speaking population. However, identified limitations highlight the need for further refinement of the instrument and additional research on a more diverse sample.

Keywords: carpal tunnel syndrome, questionnaire, adaptation, validation.

1. Introduction

Hand disorders negatively affect a person's quality of life, and both professional and domestic activities. One of the most common hand disorders is carpal tunnel syndrome (CTS) [1]. This condition occurs when the median nerve is compressed as it passes through the wrist [2]. Clinically, this manifests as pain, numbness, tingling in the hand, and, in severe cases, allodynia and weakness of the fingers may be present [3,4]. The prevalence of CTS among the general population is approximately 3% in women and 2% in men. CTS is more common among women than men, with a female-to-male ratio of 3:1 [5,6]. Bilateral involvement is more common than unilateral (60%), but it often begins or is more pronounced in the dominant hand [7]. There is also evidence of a correlation between CTS and shorter stature [8].

Risk factors for the development of CTS include a previous fracture of the distal radius or carpal bones, rheumatoid arthritis, osteoarthritis, obesity, and diabetes [9]. Diagnosis of CTS is often based on the patient's subjective complaints, a physical examination, and instrumental methods of investigation [10,11]. The use of scales and questionnaires is important to provide an objective measure of patient complaints.

Questionnaires for patients with upper extremity dysfunction and neuropathic pain are mostly available in English, which makes their use difficult for other, non-English speaking countries. Incorrect interpretation and use of these questionnaires can lead to errors in subjective assessment of the condition, rendering the questionnaires ineffective. Careful translation and cultural adaptation of questionnaires and scales is necessary [12].

A specific questionnaire for CTS is the Boston Carpal Tunnel Questionnaire (BCTQ), developed in 1993 by Levine et al. [13]. The BCTQ has been translated into many languages and tested in several countries, and it has been shown to be a valid and reliable assessment tool [14–17,18-21]. However, there is no translation and cultural adaptation of the BCTQ into the Kazakh language. Therefore, the aim of this study was to translate and culturally adapt the BCTQ into Kazakh and to evaluate its reliability and validity.

2. Materials and methods

Participants

This study is a single-center, observational, cross-sectional study conducted between October 1, 2024 and May 31, 2025. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Approval was obtained from the local ethics committee of the National Scientific Centre of Traumatology and Orthopaedics named after academician Batpenov N. D. on October 9th, 2024, No. 3/2. The cultural adaptation and validation study presented in this article was part of a broader research project approved by this committee. All participants were informed about the study before providing written informed consent. This study did not involve any clinical intervention and does not meet the criteria of a clinical trial requiring registration. The inclusion criteria were: (1) aged 18 years or older; (2) a diagnosis of CTS; (3) the ability to read, write, or understand Kazakh fluently. Exclusion criteria were: (1) the presence of acute mental illness or other significant cognitive impairment; (2) concomitant infection; (3) the presence of upper extremity trauma; (4) the presence of other concomitant neuropathies of the upper extremities. A total of 64 Kazakh-speaking patients hospitalized for surgical treatment of CTS were included in the study. The diagnosis of CTS was confirmed in all patients by hand surgeons based on symptoms, a physical examination, and the results of instrumental examination. All patients were interviewed using the BCTQ questionnaire translated into Kazakh (BCTQ-KLV).

Boston Carpal Tunnel Questionnaire

The questionnaire consists of two scales, the Symptom Severity Scale (SSS) and the Function Status Scale (FSS), and covers 6 main symptoms of CTS (pain, paresthesia, numbness, weakness, nighttime symptoms, and functional status). The SSS scale has 11 items, and the FSS scale has 8 items. Scores range from 1 to 5, depending on the severity of the symptoms. The sum of the scores on both scales is calculated as the arithmetic mean of the scores; the scores from both scales are not summed together.

EQ-5D-5L

Currently, there are very few questionnaires suitable for assessing the condition of patients with upper extremity lesions that have been translated and culturally adapted into Kazakh. To assess validity, we used the Kazakh version of the EuroQol – 5 Dimension - 5 Level questionnaire (EQ-5D-5L), obtained from the official EuroQol website [22]. The EuroQol group developed the EQ-5D-5L questionnaire for assessment in 2009. The EQ-5D-5L consists of two parts, a descriptive part and a visual analog scale. The descriptive part consists of five items that assess the following criteria: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Scores for each item range from 1 to 5, where 1 = no difficulty and 5 = extreme difficulty. The numbers for the five items are combined into a 5-digit number, which characterizes the patient's overall health status. The visual analog scale is a scale from 0 to 100, where 0 = the worst imaginable health state, 100 = the best imaginable health state.

Translation and Cultural Adaptation

The study was conducted according to five recommended stages of cultural adaptation: translation, synthesis, back-translation, expert review, and pre-testing [18]. In the first stage, two native Kazakh speakers, one of whom was a hand surgeon and the other a professional translator, translated the questionnaire into Kazakh. The two translations were then combined into one version. A native English speaker fluent in Kazakh translated this version back

into English. The resulting version was compared with the original at a meeting of the expert committee.

The translated and committee-approved version of the BCTQ-KLV was tested on a focus group of 12 patients to obtain feedback on the correct understanding of the questionnaire's content. During the preliminary testing, patients did not misunderstand any items or answer choices. After all stages of cultural adaptation and preliminary testing, the final version of the BCTQ-KLV scale in Kazakh was adopted. The process of cultural adaptation and content validation of the Kazakh version of the BCTQ was conducted according to the COSMIN (Consensus-based Standards for the selection of health Measurement INstruments)

guidelines for evaluating the content validity of patient-reported outcome measures [23].

Statistical Analysis

The IBM SPSS V. 30.0 software package was used for statistical data analysis. Descriptive statistical analysis was performed for patient characteristics and questionnaire results. To compare with the BCTQ subscales, the EQ-5D-5L questionnaire subscales (already translated and culturally adapted into Kazakh) were used. A summary of the statistical analysis and measurement characteristics is presented in Table 1.

Table 1 – Measurement characteristics and definitions

Measurement Property	Definition / Calculation	Result	Data Used
Floor and ceiling effects	The percentage of patients with the lowest or highest possible score	A significant floor effect (>15%) in p1q3 (18.8%) and p1q8 (20.3%). Significant ceiling effects in multiple items (e.g., p1q6: 42.2%)	Single measurement (T1)
Internal consistency	Cronbach's Alpha value (acceptable >0.70)	Cronbach's α = 0.985 (p1 section). 0.974 (p2 section) - Excellent internal consistency	Single measurement (T1)
Construct validity	Spearman's rank correlation coefficient (r); strength classified as high (r>0.6), moderate (0.3<r<0.6) and low (r<0.3)	Moderate correlations observed: p2q3 with Mobility (0.27), p2q6 with Mobility (0.22) and p2q3 with Self-care (0.23)	Single measurement (T1)

Note: Values are presented as median (range), number (%) or coefficient values as indicated

Psychometric Analysis

Internal consistency was assessed using Cronbach's alpha coefficient, which measures the degree of correlation between questionnaire items. Ranging from 0 to 1, Cronbach's alpha values above 0.7 indicate satisfactory correlation, values of 0.8 indicate good correlation, and values of 0.9 indicate excellent correlation. Construct validity was assessed using

Spearman's rank correlation coefficient to compare the SSS and FSS subscales of the BCTQ-KLV questionnaire with the EQ-5D-5L subscales for all patients. Content validity was assessed using floor and ceiling effects, which are given when more than 15% of respondents select the maximum or minimum scores. Floor and ceiling effects were investigated at a single time point, T1 (day 0).

3. Results

As shown in Table 2, the study involved 64 patients with a median age of 58 years (interquartile range 51–67.3). Of the 64 patients, 61 (95.3%) were female and 3 (4.7%) were male. The median height was 160 cm (interquartile range 156.8–165). For 29 (45.3%) patients, their right side was affected; for 21 (32.8%), their left side was affected, and for 14 (21.9%) patients,

the lesion was bilateral. Of the 64 patients, 5 (7.8%) had a history of previous trauma (fracture of the distal radius metaphysis). The most common comorbidities were arterial hypertension (23 (35.9%) patients), type 2 diabetes mellitus (9 (14.1%) patients), and coronary artery disease (4 (6.3%) patients).

Table 2 – Demographic data for the study participants

Demographic variables	Values
Age (years)	Median: 58.0 (IQR[a]: 51.0–67.3)
Sex (n (%))	Female: 61 (95.3%), Male: 3 (4.7%)
Height (cm)	Median: 160.0 (IQR: 156.8–165.0)
Weight (kg)	Median: 70.0 (IQR: 65.0–82.3)
BMI[b], (kg/m²)	Median: 28.25 (IQR: 24.82–30.86)
Affected side (n (%))	Right: 29 (45.3%), Left: 21 (32.8%), Bilateral: 14 (21.9%)
Previous trauma (Distal radius fracture) (n (%))	5 (7.8%)
Most common associated conditions	Arterial hypertension: 23 (35.9%), DM[c] type 2: 9 (14.1%), CAD[d]: 4 (6.3%)
Note: Continuous data is presented as median with interquartile range (IQR), and categorical data is presented as frequency (n) and percentage (%)	

Table 3 demonstrates the mean, standard deviation (SD), median, and range (minimum - maximum) for each item of the BCTQ-KLV questionnaire at time point T1. Scores are distributed across the entire scale (1–5), ranging from 2.77 (p1q8) to 4.11 (p1q6). The average scores are mainly concentrated around 3 or 4, indicating that the typical response tended towards moderate severity.

Table 3 – Summary of BCTQ-KLV scores at T1

Item	Mean ± SD[a]	Median	Minimum - Maximum
p1q1	3.58 ± 1.26	4.0	1–5
p1q2	3.11 ± 0.98	3.0	1–5
p1q3	2.88 ± 1.15	3.0	1–5
p1q4	3.06 ± 1.28	3.0	1–5
p1q5	3.03 ± 1.26	3.0	1–5
p1q6	4.11 ± 0.99	4.0	1–5
p1q7	3.59 ± 1.09	3.0	1–5
p1q8	2.77 ± 1.23	3.0	1–5
p1q9	3.64 ± 1.25	4.0	1–5
p1q10	3.2 ± 1.13	3.0	1–5
p1q11	3.03 ± 1.08	3.0	1–5
p2q1	3.11 ± 0.98	3.0	1–5
p2q2	3.36 ± 1.09	3.0	1–5
p2q3	3.47 ± 1.04	4.0	1–5
p2q4	3.02 ± 1.11	3.0	1–5
p2q5	3.83 ± 1.12	4.0	1–5
p2q6	3.42 ± 1.05	3.5	1–5
p2q7	3.56 ± 1.18	4.0	1–5
p2q8	3.27 ± 1.14	3.0	1–5
Note: Values are presented as mean ± standard deviation, median, or range, depending on the variable distribution			

Floor and Ceiling Effects

Analysis of the distribution of patient responses revealed the presence of floor and ceiling effects in several items on the BCTQ-KLV questionnaire. Ceiling effects, reflecting the proportion of patients choosing the maximum possible score, exceeded the generally accepted threshold of 15% for 13 of the 20 items (65%). The most pronounced values were recorded for items p1q6 (42%), p1q8 (29%), p2q4 (32%), and p2q6 (27%). This suggests a potential decrease in the sensitivity of these items to detect clinical improvements, especially

in cohorts of patients with milder cases of the disease or after treatment (Figure 1).
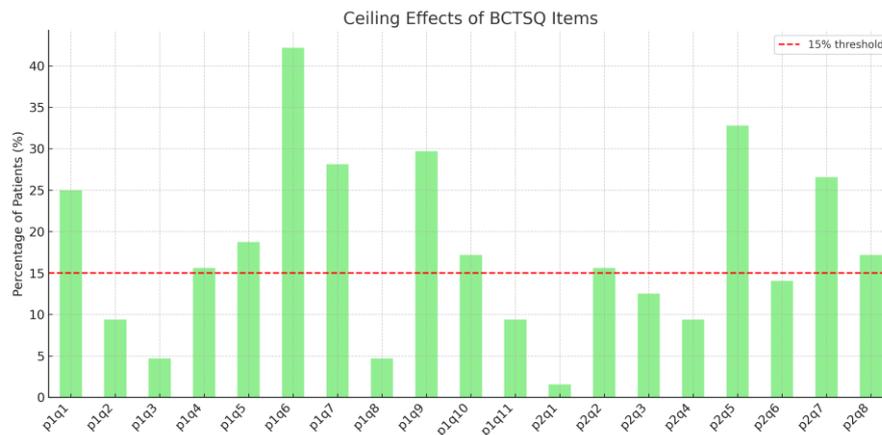

Figure 1 – Ceiling effects of the subscales of the BCTQ used in patients in T1

Floor effects were less pronounced. Only two items (p1q4 (18%) and p1q9 (20%)) exceeded the 15% threshold. However, the proximity of values to the threshold level for some items, such as p1q3, p1q5, and p1q6, requires attention in subsequent psychometric assessment (Figure 2).
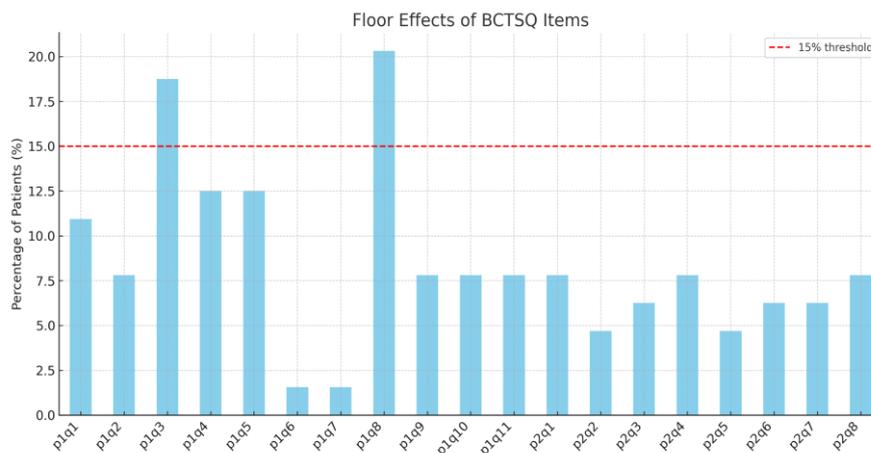

Figure 2 – Floor effects of the subscales of the BCTQ used in patients in T1

The SSS subscale of the BCTQ questionnaire demonstrated excellent internal consistency (Cronbach's α 0.985). The FSS functional status subscale also showed excellent internal consistency (Cronbach's α 0.974) (Table 4).

Table 4 – Internal Consistency of BCTQ subscales (Cronbach's α)

Subscale	Number of Items	Cronbach's α
BCTQ[a] - p1 section (Symptom Severity Scale)	11	0.985
BCTQ - p2 section (Functional Status Scale)	8	0.974

Note: Data for T=1 was used. Number of items and Cronbach's alpha coefficients for each BCTQ subscale are presented

Construct validity

Table 5 shows the Spearman correlation coefficient

between selected items on the FSS subscale of the BCTQ and the EQ-5D-5L.

Table 5 – Hypothesized correlations between BCTQ items and EQ-5D-5L for construct validity in patients

Questionnaire Item	EQ-5D-5L[a] Dimension	Spearman r
p2q3	Mobility	0.27
p2q6	Mobility	0.22
p2q3	Self-care	0.23
p2q6	Pain/discomfort	0.2
p2q2	Anxiety/depression	0.21
Note: Values are presented as Spearman's correlation coefficients (rho)		

These correlations indicate the strength and direction of associations. p2q3 (Mobility) on the BCTQ has moderate positive correlations with mobility on the EQ-5D-5L (0.27) and self-care (0.23)). P2q6 (Mobility) shows weaker positive correlations with mobility (0.22) and pain/discomfort (0.20). P2q2 (Anxiety/depression) shows a small positive correlation (0.21). All correlations are positive, suggesting that higher scores on the BCTQ items are associated with greater problems in the corresponding dimensions of the EQ-5D-5L. The strength of the correlations ranged from moderate to weak, indicating some significant associations, but not very strong ones.

4. Discussion

In this study, the validity and reliability of the Kazakh-translated version of the Boston Carpal Tunnel Questionnaire (BCTQ-KLV) was evaluated. The results of the study showed high internal consistency for both the Symptom Severity Scale (SSS) ($\alpha = 0.985$) and the Function Status Scale (FSS) ($\alpha = 0.974$). Such a high Cronbach's α coefficient may be due to the homogeneity of the sample (61 out of 64 subjects were elderly women with pronounced symptoms). A high Cronbach's α (0.80–0.95) was also obtained in a Swedish study [21], and in studies in other countries (Korea, Spain, Portugal, Russia) this indicator was somewhat lower [14, 16, 17].

One of the important problems identified in the study is the presence of ceiling effects for several items on the BCTQ-KLV questionnaire. The most pronounced ceiling effects were recorded for items assessing nighttime symptoms and pain intensity. It is worth considering this as an important aspect related to the patient population; since the recruitment of study participants was carried out in a hospital setting, most patients had a pronounced degree of CTS and were preparing for surgical treatment. Floor effects were less pronounced, but the proximity of values to the threshold level for some items also requires attention through further analysis and possible improvement of the questionnaire version.

Construct validity was measured by comparing the BCTQ-KLV subscales with the EQ-5D-5L subscales. Moderate positive correlations were obtained between several BCTQ items and the corresponding EQ-5D-5L subscales, assessing mobility and self-care. At the same time, it should be taken into account that patients choosing "unsatisfactory" mobility were generally older and may have had limited mobility initially, unrelated to CTS, which could have influenced the result.

The strength of the correlations was relatively weak (from 0.20 to 0.27), which may mean that the BCTQ focuses more on specific symptoms of the disease, while the EQ-5D-5L covers a wider range of health statuses. In most previous studies, DASH or SF-36 instruments were used to assess the validity of the BCTQ [19–21]. However, at the time of the present study, these questionnaires had not yet been translated into Kazakh. In addition to the present study, a comparison of the BCTQ with the EQ-5D scale was performed in Korea by Park et al., and the correlation between the BCTQ and the DASH questionnaire was also studied in parallel. According to the results of this study, the strength of the correlation between the BCTQ and the EQ-5D was weaker than between the K-BCTQ and K-DASH, which also emphasizes the greater universality of the EQ-5D scale in relation to the BCTQ [16]. One limitation of this study is that test–retest reliability was not assessed, since the questionnaire was administered only once. Including a follow-up assessment would allow better evaluation of the instrument's reproducibility over time.

5. Conclusions

The results of our study indicate the high reliability and satisfactory validity of the Kazakh version of the BCTQ for assessing CTS. However, the ceiling effects obtained and the weak correlation between the BCTQ and EQ-5D-5L questionnaires require attention and indicate directions for further improvement of this version of the questionnaire. Taking into account the identified limitations, further work should be carried out to adapt the instrument for a more accurate and comprehensive assessment of the condition of patients, especially in cases with a mild course of the disease.

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Appendix 1

Boston Carpal Tunnel Questionnaire - Kazakh Language Version translated into English language

Table 1A – Symptom Severity Scale

Question	1	2	3	4	5
1. How severe is your wrist or hand pain at night?	No pain	Mild	Moderate	Severe	Very Serious
2. How often have you awakened in the night because of hand/wrist pain in the last 2 weeks?	Never	Once	2-3 times	4-5 times	More than 5 times
3. Do you have pain in your hand/wrist during the day?	No pain	Mild	Moderate	Severe	Very Serious
4. How often do you have hand/wrist pain during the day?	Never	1-2 times	3-5 times	More than 5 times	Constantly
5. How long does the average episode of daytime pain last?	No pain	Less than 10 minutes	10-60 minutes	More than 60 minutes	Constantly
6. Do you have numbness in your hand/wrist?	No	A little bit	Moderate	Severe	Very Serious

| 7. Do you have weakness in your hand/wrist? | No | A little bit | Moderate | Severe | Very Serious |
| 8. Do you have tingling in your hand/wrist? | No | A little bit | Moderate | Severe | Very Serious |

Continuation of Table 1A - Symptom Severity Scale

Question	1	2	3	4	5
9. How severe is your numbness or tingling at night?	No numbness /tingling	Mild	Moderate	Severe	Very Serious
10. How often have you awakened because of numbness or tingling in the last 2 weeks?	Never	Once	2-3 times	4-5 times	More than 5 times
11. Is it difficult to grasp and use small objects (such as key, pen)?	No	A little bit	Moderate	Severe	Very serious

Table 1 B – Symptom Severity Scale

Question	No Difficulty	A Little Difficulty	Moderate Difficulty	Severe Difficulty	Very Serious Difficulty
1. Writing	1	2	3	4	5
2. Buttoning on clothes	1	2	3	4	5
3. Holding a book while reading	1	2	3	4	5
4. Holding a cell phone	1	2	3	4	5
5. Opening bottles	1	2	3	4	5
6. Housework	1	2	3	4	5
7. Carrying bags with groceries	1	2	3	4	5
8. Washing and dressing	1	2	3	4	5

Қазақстандағы білезік өзегі синдромын бағалауға арналған Бостон сауалнамасын мәдени бейімдеу және валидациялау

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Түйіндеме

Boston Carpal Tunnel Questionnaire сауалнамасы білезік өзегі синдромы бар науқастарға қолдануға арналған. Дегенмен оның Қазақстан Республикасында қазақ тілді популяция арасында аударылған нұсқасының болмауына байланысты қолданылуы қолжетімді емес. Зерттеудің мақсаты Boston Carpal Tunnel Questionnaire сауалнамасын қазақ тіліне валидациялацияған және мәдени бейімделген нұсқасын дайындау, сондай-ақ оның сенімділігі мен валидтілігін бағалау болды. Зерттеуге клиникалық расталған білезік өзегі синдромы бар 64 қазақ тілді науқас қатысты. Статистикалық талдау сенімділік (ішкі үйлесімділік) пен құрылымдық валидтілікті бағалау үшін сипаттамалық статистиканы және психометриялық талдауды қамтыды. Boston Carpal Tunnel Questionnaire сауалнамасының қазақша нұсқасы жоғары сенімділікті көрсетті (α Кронбах = 0,974-0,985). Мазмұндық валидтілікті талдау барысында «әсердің төбесі» (ceiling effects) және төмен дәрежеде «әсердің едені» (floor effects) анықталды. Boston Carpal Tunnel Questionnaire бірқатар тармақтары тұжырымдамалық валидтілігі бойынша EQ-5D-5L сауалнамасының ішкі шкалаларымен салыстырғанда қанағаттанарлық деңгейде болды. Бұл зерттеудің нәтижелері Boston Carpal Tunnel Questionnaire қазақша нұсқасы сауалнамасының қазақ тілді популяциядағы білезік өзегі синдромымен ауыратын науқастардың жағдайын бағалауда жоғары сенімділік пен қанағаттанарлық валидтілікке ие екенін растайды. Дегенмен, анықталған шектеулерге байланысты аударманы одан әрі жетілдіру және әртүрлі науқастар тобына негізделген іріктемеде қосымша зерттеулер жүргізу қажеттігін көрсетеді.

Түйін сөздер: білезік өзегі синдромы, Boston Carpal Tunnel Questionnaire, сауалнама, мәдени бейімдеу, валидациялау.

Культурная адаптация и валидация Бостонского опросника по оценке синдрома запястного канала в Казахстане

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Резюме

Опросник Boston Carpal Tunnel Questionnaire предназначен для использования пациентами с синдромом запястного канала. Однако его использование в Республике Казахстан среди казахскоязычной популяции недоступно из-за отсутствия переведенной версии. Целью данного исследования была валидация и культурная адаптация опросника Boston Carpal Tunnel Questionnaire на казахский язык, а также оценка его надежности и валидности. В исследование были включены 64 казахскоязычных пациентов с клинически подтвержденным синдромом запястного канала. Статистический анализ включал описательную статистику и психометрический анализ для оценки надежности (внутренней согласованности) и конструктной валидности. Казахская версия опросника Boston Carpal Tunnel Questionnaire продемонстрировала высокую надежность с α Кронбаха 0,974–0,985. Контентная валидность показала выявленные «эффекты потолка» (ceiling effects) и менее выраженные «эффекты пола» (floor effects). Конструктная валидность была приемлемой для ряда пунктов Boston Carpal Tunnel Questionnaire по сравнению с соответствующими подшкалами опросника EQ-5D-5L. Результаты данного исследования подтверждают высокую надежность и удовлетворительную валидность казахской версии опросника Boston Carpal Tunnel Questionnaire для оценки состояния пациентов с синдромом запястного канала в казахоязычной популяции. Однако выявленные ограничения подчеркивают

необходимость дальнейшего совершенствования инструмента и проведения дальнейших исследований на более разнообразной выборке.

Ключевые слова: синдром запястного канала, Boston Carpal Tunnel Questionnaire, опросник, культурная адаптация, валидация.