



CLINICAL TESTING OF THE RUSSIAN VERSION OF THE SRS-22 QUESTIONNAIRE FOR ADULT SCOLIOSIS PATIENTS

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Objective. To analyze the clinical approbation of the Russian-language version of the SRS-22 questionnaire for adult patients with scoliosis, to assess its reliability using Cronbach's alpha criterion for internal consistency, and to determine its efficacy and specificity by correlation matching with the ODI results and numerical pain scale's scores.

Material and Methods. A survey of 196 patients aged over 18 years with spinal pathology was carried out using the SRS-22 questionnaire. The questionnaire results were compared with the Oswestry Disability Index and numerical pain scale. Cronbach's alpha reliability index was used to measure internal consistency of the questionnaire. Variation statistics method was used: calculation of the arithmetic mean and the mean deviation, Pearson correlation coefficient with evaluation according to the Chaddock scale. To evaluate consistency of mean differences, the Student t-test with determination of statistical consistency index was used.

Results. The Cronbach's alpha reliability index within domains in adult scoliosis patients was more than 0.7 and demonstrated satisfactory internal consistency of the questionnaire. Comparative analysis of SRS-22 scores revealed that scores of deformity-specific domains (Function, Self-image, Mental health, Satisfaction with management) were higher in patients with scoliosis. High correlation between the SRS-22 Function domain and the ODI was detected. Correlation between the SRS-22 Pain domain and numerical pain scale was moderate.

Conclusion. The proposed Russian version of the SRS-22 questionnaire is reliable, specific and effective tool for self-assessment of health status in adult scoliosis patients and can be further used to evaluate the results of surgical treatment.

Key Words: adult scoliosis patients, Scoliosis Research Society-22, SRS-22, domains, function, pain, self-image, mental health, ODI, analog pain scale.

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Adult scoliosis is governed by two major pathogenetic mechanisms, idiopathic and degenerative [28, 30]. Both types of curvature lead to asymmetric disc degeneration, changes in the joints and spine [30]. Degenerative progressive nature of adult scoliosis causes instability of spinal motion segments, spondyloarthrosis, spondylosis, and spinal stenosis [5, 30].

Major clinical manifestations of adult scoliosis include pain of various etiologies, pronounced neurologic disorders, and intermittent claudication associated with significant functional disorders [2, 15]. An objective assessment of patient's condition is carried out based on radiographic and clinical parameters, while the subjective functional evaluation is based on various questionnaires: Short

Form-36 (SF-36), Short Form-12 (SF-12), Oswestry Disability Index (ODI), Scoliosis Research Society-24 (SRS-24), Scoliosis Research Society-30 (SRS-30), Scoliosis Research Society-22 (SRS-22) [2, 3]. Visual analog scales are used to evaluate the intensity of pain.

Although SF-36, SF-12, and ODI questionnaires provide assessment of the functional state of patients with various spinal diseases, specific techniques more sensitive precisely to the vertebral deformities are required for patients with scoliosis [2, 9, 15, 17, 30]. For this purpose, SRS-22, SRS-24, and SRS-30 questionnaires have been developed.

Adoption of English questionnaires necessitates the compliance with numerous conditions during their translation. Terms, semantic and grammatical rules

should be uniform and clear. Questionnaires should be easy to fill and written in plane language, so that the questions could be answered by patients of any age and any education level; the questionnaire must be reliable, require no additional financial costs, and easy to interpret [1, 6]. Furthermore, the impact of socio-economic factors on the manifestation and duration of any functional disorders and their relation to disability should be born in mind. After translation, the questionnaires should pass clinical trials to determine their reliability and consistency with the original version. Therefore, qualified translators, general practitioners, doctors of certain specialties, and psychologists should be involved in preparation of the translated version [1].

Here we propose an adapted Russian version of the SRS-22 questionnaire for adult patients with scoliosis. Translation and adaptation of the questionnaire was carried out by a team of professional translators, clinical psychologist, outpatient vertebrologist, and doctors of the hospital spinal surgery department. Double translation was made by independent translators, different specialists were involved in discussion during the adaptation stages and final version of the questionnaire was agreed. It turned out that we repeated the steps proposed by Beaton [13] for the procedure of the clinical use of translated questionnaires.

The research was aimed at analyzing the clinical testing of the Russian version of SRS-22 questionnaire in adult patients with scoliosis to assess its reliability based on the Cronbach's alpha internal consistency criterion and assessing the efficacy and specificity using the correlation comparison with the result of ODI index and numeric pain scale.

Material and Methods

The questionnaire survey was carried out based on the Russian version of SRS-22 (Annexure), obtained by translation of the English version of SRS-22 questionnaire [29]. The questionnaire consists of 22 questions combined into five groups (domains): Function, Back Pain, Self-image, Mental Health, and Satisfaction with the Results of Surgical Treatment. Each question is rated on a 5-point system (1 is the lowest score, 5 is the highest score).

Disability was assessed based on the ODI score and pain was assessed based on the Wong-Baker numerical pain scale (2011) in order to compare the results of SRS-22 questionnaire.

A total of 196 patients older than 18 years with spinal pathology were questioned. The studies complied with the Helsinki Declaration 1957 and its revised version 1983.

The inclusion criteria were as follows: age older than 18 years, presence of degenerative or idiopathic scoliosis with the deformity angle of more than 10° (scoliosis group), and degenerative

spine disease with clinical presentation (group without scoliosis).

Exclusion criteria were as follows: age below 18 years, spinal deformity due to injury, tumor, or infection.

We questioned 96 outpatients and 100 inpatients. Both patients with and without scoliosis with underlying degenerative spine disease (osteoarthritis) were questioned in order to assess the reliability of questionnaire. The total number of patients with scoliosis was 140 (Table 1).

Inclusion of patients without scoliosis in the study is required for comparative assessment of the reliability of the studied parameters in patients with spine curvature disorders.

Cronbach's alpha test was used to assess the internal consistency of the questionnaire, where the variation within each element was compared to variation within the whole scale [4]. Variation statistics method was used, including the calculation of the arithmetic mean (M) and average deviation ($\pm$ m), evaluation of Pearson correlation coefficient (r) against the Chaddock scale; Student's t-test with statistical confidence level was used to assess the significance of the difference between averages.

Results

Evaluation of the Cronbach's alpha within the domains in patients with scoliosis showed internal consistency of the questionnaire in all cases [4, 14]. Cronbach's alpha was higher than 0.7 in all domains (Fig. 1).

A comparative analysis of the SRS-22 questionnaire values showed that deformity-specific domain (Function, Self-image, Mental Health, Satisfaction with Treatment) values were higher in patients with scoliosis compared to those without scoliosis. Pain syndrome was characterized by the similar values in patients with and without scoliosis (Fig. 2).

Analysis of questionnaire survey of outpatients and inpatients with scoliosis is shown in Table 2.

Table 2 shows that patients questioned in the hospital had lower scores of Function, Pain, and Mental Health, but higher scores of ODI and pain on the

Wong-Baker pain scale compared to the outpatients.

Evaluation of the Function score of the SRS-22 questionnaire and ODI showed strong correlation between these values ($r = 0.61$), indicating that the result of the Function domain questioning is comparable to ODI score (Fig. 3).

Correlation between the Back Pain domain and Wong-Baker pain score was moderate ($r = 0.5$; Fig. 4).

When comparing the Self-image and Mental Health domains, Pearson coefficient was 0.5, which is indicative of moderate correlation between these values.

Discussion

Assessment of patient's state and clinical outcomes of surgical procedures are of great importance. For this reason, questionnaires have been developed for self-assessment of patients' state according to different parameters. Spinal deformity specifically affects patient's condition in connection with cosmetic and neurological problems and, as a result, altered mental status.

The SRS-22 questionnaire developed by Asher et al. [9] represents a variant of SRS-24 questionnaire for idiopathic scoliosis and was primarily used in the treatment of adolescents. The questionnaire has passed clinical testing in many countries and it is internationally recognized [7, 19, 21, 22, 24, 25, 27]. Spinal deformity in adults is characterized by high level of disability, including pain and functional impairment, as well as altered self-image and mental health [12, 14, 17, 31]. Questioning tool for adults should reflect current patient's state, the possibility of clinical evaluation of surgical intervention, characteristic features of the disease, and personal aspects, should be sensitive, specific, and reliable. The paper by Baldus et al. [11] demonstrated the effectiveness of SRS-22 questionnaire in different age groups of patients from 20 to 80 years. Modified SRS-22 questionnaire was suggested for adult patients with scoliosis [14, 15, 20, 28, 30, 31].

Clinical testing of the Russian version of SRS-22 questionnaire involved 196 adult patients.

Table 1

General characteristics of patients questioned using SRS-22

Assessed characteristics	Outpatients (n = 96)		Inpatients (n = 100)	
	with scoliosis (n = 68)	without scoliosis (n = 28)	with scoliosis (n = 72)	without scoliosis (n = 28)
Age, years	57.5 ± 8.9* (from 23 to 75)	36.4 ± 8.2** (from 22 to 60)	53.8 ± 10.0* (from 26 to 83); p = 0.075	43.3 ± 6.7** (from 26 to 66); p = 0.013
Males : females, n	10 : 58	11 : 17	23 : 49	14 : 8
Cobb's angle, degrees	25.1 ± 10.1* (from 14 до 65)	—	24.5 ± 8.9* (from 12 to 110); p = 0.081	—
Idiopathic scoliosis/degenerative scoliosis, n	9/59	—	7/65	—
The number of spinal surgeries, n (%)	27 (39.7)	7 (25.0)	57 (79.1)	15 (53.5)

*Significance of the differences in the groups with scoliosis as assessed by Student's t-test;

**Significance of the differences in the groups without scoliosis as assessed by Student's t-test.

Internal consistency of personal questionnaires is determined by the relationship between each individual test element and the overall result, the discrepancies between the elements, and the level to which extent each individual question measures the target characteristic of the entire test. The test is not valid, unless it is consistent [4]. According to the researchers, the SRS- 22 questionnaire and its adaptations have high internal consistency in terms of Cronbach's alpha [10, 14, 15, 22, 26, 30] (Table 3).

In our study, Cronbach's alpha index was above 0.7 in all domains, which is indicative of the reliability and validity of the Russian version of the questionnaire [4, 14].

The values of all domains were lower in inpatients than in outpatients, which was due to more severe manifestations of the disease and confirms the reliability of the proposed questionnaire. The patients were hospitalized with clinical and radiological indications for surgical treatment. Questioned outpatients either had no indications for surgery or underwent follow-up examination after surgery. The publications of Bridwell et al. [16] noted that variation of values within the domains reliably reflects changes in the health status of patients.

Like other researchers, we have included patients with and without scoliosis to our survey in order to determine the specificity of the questionnaire on

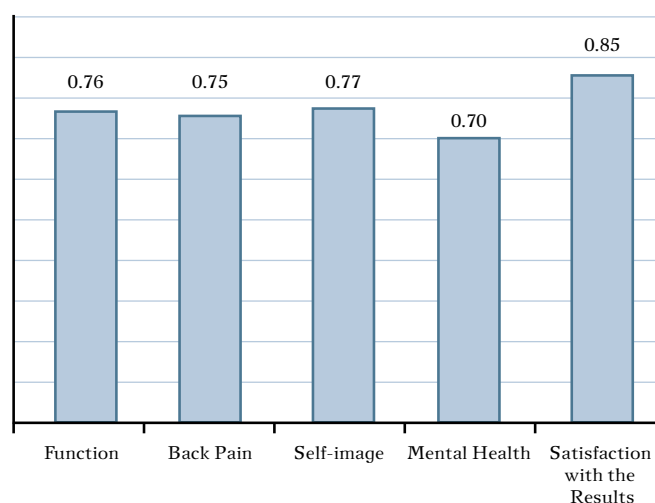


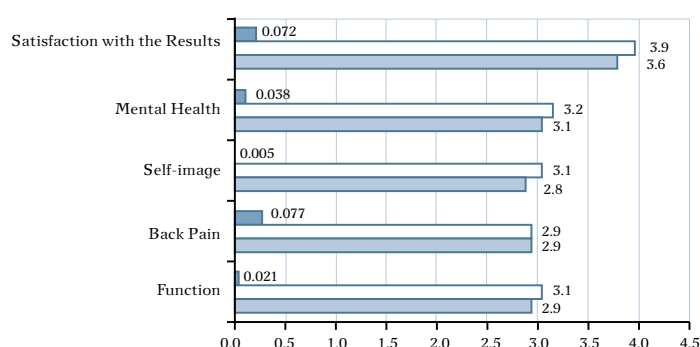
Fig. 1

Cronbach's alpha within the domains of the SRS-22 questionnaire

the basis of the differences in the characteristics specific to spinal deformities [11, 14, 20]. The values of Function, Self-image, Mental Health, and Satisfaction with the Results of Surgical Treatment domains were significantly lower in patients with scoliosis, which demonstrated the specificity of the proposed Russian-language version of the questionnaire for patients with deformities. The same results were demonstrated by Bal-

dus et al. [11], Berven et al. [14], Iida et al. [23], Theis et al. [30]. Back Pain domain had similar values for patients with and without scoliosis, but this symptom is not specific for spinal deformities.

Many investigations assessing the performance of SRS-22 questionnaire studied correlation between its parameters and other questionnaires. The authors have confirmed the correlation between the values of SRS-22 domains and SF-36

**Fig. 2**

Scores of the domains within the SRS-22 questionnaire in patients with and without scoliosis

questionnaire and found that the SRS-22 tool is more consistent and effective for patients with scoliosis [7, 9, 14, 25, 27].

Bridwell et al. [16] compared SRS-22 values with those of SF-12 and ODI ques-

tionnaires. The correlation coefficient for these scales was 0.7. When comparing Function domain of the SRS-22 and ODI in our study, Pearson coefficient was 0.61, which indicates that the results of

the Russian version of SRS-22 and ODI are comparable. Comparative analysis of the Back Pain domain of SRS-22 and pain rating scale showed moderate correlation ($r = 0.5$), which was associated with imprecise wording of some questions and led to the subsequent revision. However, even this value was comparable to the existing analog scale.

Existing functional disorders and pain due to the disabling consequences alter self-image and psycho-emotional status of patients with scoliosis. Moderate correlation between these domains shows the need for interaction with clinical psychologist during the treatment of adult patients with spinal deformities.

Conclusion

The proposed Russian version of the SRS-22 questionnaire is a reliable, specific, and effective tool for self-assessment of health status in adult patients with scoliosis and can be tested for assessment of the results of surgical treatment.

Table 2

Values obtained using the SRS-22 questionnaire, ODI, and Wong-Baker pain scale in patients with scoliosis

Indicator	Patients with scoliosis (n = 140)	Outpatients (n = 68)	Inpatients (n = 72)
Function (SRS-22)	2.9 ± 0.5 (from 1.2 to 4.8)	3.1 ± 0.6 (from 1.2 to 4.8)	2.7 ± 0.4 (from 1.4 to 4.2); $p = 0.001$
Back pain (SRS-22)	2.9 ± 0.4 (from 1.4 to 5.0)	3.0 ± 0.4 (from 1.4 to 4.2)	2.9 ± 0.5 (from 1.4 to 5.0); $p = 0.044$
Self-image (SRS-22)	2.8 ± 0.4 (from 1.0 to 4.4)	2.8 ± 0.5 (from 1.0 to 4.4)	2.8 ± 0.4 (from 1.6 to 4.0); $p = 0.081$
Mental Health (SRS-22)	3.1 ± 0.5 (from 1.0 to 4.8)	3.1 ± 0.5 (from 1.0 to 4.4)	3.0 ± 0.5 (from 1.8 to 4.8); $p = 0.085$
Satisfaction with the results of surgery (SRS-22)	3.6 ± 0.7 (from 1.2 to 4.8)	3.6 ± 0.6 (from 2.0 to 4.0)	3.5 ± 0.8 (from 1.0 to 5.0); $p = 0.050$
ODI	38.9 ± 13.7 (from 0.0 to 96.0)	33.4 ± 12.9 (from 4.0 to 96.0)	44.2 ± 12.7 (from 0.0 to 84.0); $p = 0.0002$
Wong-Baker Numeric rating scale pain	4.3 ± 1.3 (from 0.0 to 10.0)	4.0 ± 1.1 (from 0.0 to 10.0)	4.5 ± 1.4 (from 0.0 to 10.0); $p = 0.106$

p — significance of differences in outpatients and inpatients with scoliosis as assessed by Student's t-test.

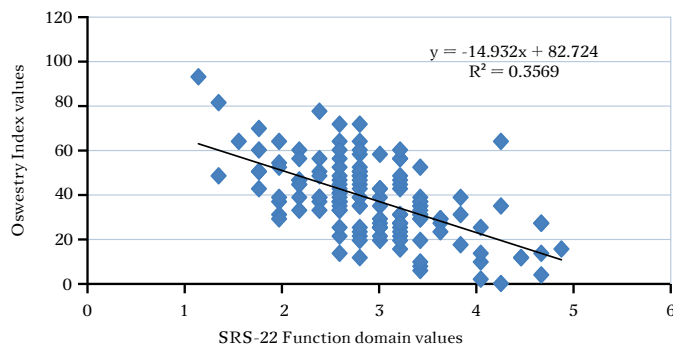


Fig. 3
Regression line of the Function score as assessed by SRS-22 and Oswestry index

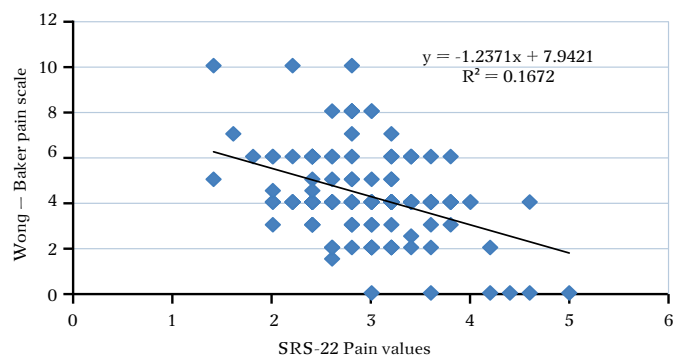


Fig. 4
Regression line of the Pain score as assessed by SRS-22 and Wong-Baker scale

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Table 3

Comparative data on the of Cronbach's alpha coefficient for adult patients with scoliosis

References, patient age	Cronbach's alpha, Function domain	Cronbach's alpha, Back Pain domain	Cronbach's alpha, Self-image domain	Cronbach's alpha, Mental Health domain	Cronbach's alpha, Satisfaction with Treatment domain
Asher et al. [10], up to 21 years	0.86	0.92	0.75	0.90	0.88
Alanay et al [7], 14–31 years	0.48	0.72	0.81	0.71	0.83
Cheung et al. [18] 18–28	0.86	0.87	0.78	0.87	0.53
Bridwell et al. [15], 18–71 years	0.79	0.67	0.76	0.83	—
Niemeyer et al. [26], 13–78 years	0.67	0.75	0.84	0.88	0.61
Antonarakos et al. [8], 16–27 years	0.67	0.85	0.83	0.87	0.67
Qiu et al. [27] 18 years and older	0.57	0.73	0.71	0.79	0.5
Iida et al. [23], 20–79 years	0.84	0.78	0.86	0.92	—
The authors of this article	0.76	0.75	0.77	0.70	0.85

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Patient questionnaire (SRS-22)

Patient Name: _____ Date of Birth: _____ Date of filling out: _____
 Date of spinal surgery (if any): _____

Instructions: we are carefully evaluating the condition of your back and it is important that you answer each of these questions yourself. Please circle the one best answer to each question

1. Which one of the following best describes the amount of pain you have experienced during the past 6 months?

5 — None; 4 — Mild; 3 — Moderate; 2 — Moderate to severe; 1 — Severe

2. Which one of the following best describes the amount of pain you have experienced over the last month?

5 — None; 4 — Mild; 3 — Moderate; 2 — Moderate to severe; 1 — Severe

3. During the past 6 months have you been a very nervous person?

5 — None of the time; 4 — A little of the time; 3 — Some of the time; 2 — Most of the time; 1 — All of the time

4. If you had to spend the rest of your life with your back shape as it is right now, how would you feel about it?

5 — Very happy; 4 — Somewhat happy; 3 — Neither happy nor unhappy; 2 — Somewhat unhappy; 1 — Very unhappy

5. What is your current level of activity?

1 — Bedridden; 2 — Primarily no activity; 3 — Light labor and light sports; 4 — Moderate labor and moderate sports;
 4 — Full activities without restriction

6. How do you look in clothes?

5 — Very good; 4 — Good; 3 — Fair; 2 — Bad; 1 — Very bad

7. In the past 6 months have you felt so down in the dumps that nothing could cheer you up?

1 — Very often; 2 — Often; 3 — Sometimes; 4 — Rarely; 5 — Never

8. Do you experience back pain when at rest?

1 — Very often; 2 — Often; 3 — Sometimes; 4 — Rarely; 5 — Never

9. What is your current level of work/school activity?

5 — 100 % normal; 4 — 75 % normal; 3 — 50 % normal; 2 — 25 % normal; 1 — 0 % normal

10. Which of the following best describes the appearance of your trunk, defined as the human body except for the head and extremities?

5 — Very good; 4 — Good; 3 — Fair; 2 — Poor; 1 — Very Poor

11. Which one of the following best describes your pain medication use for back pain?

5 — None; 4 — Non-narcotics weekly or less (e.g., aspirin, Tylenol, Ibuprofen); 3 — Non-narcotics daily; 2 — Narcotics weekly or less (e.g. Tylenol III, Lorcet, Percocet); 1 — Narcotics daily.

12. Does your back limit your ability to do things around the house?

5 — Never; 4 — Rarely; 3 — Sometimes; 2 — Often; 1 — Very Often.

13. Have you felt calm and peaceful during the past 6 months?

5 — All of the time; 4 — Most of the time; 3 — Some of the time; 2 — A little of the time; 1 — None of the time..

14. Do you feel that your back condition affects your personal relationships?

5 — None; 4 — Slightly; 3 — Mildly; 2 — Moderately; 1 — Severely

15. Are you and/or your family experiencing financial difficulties because of your back?

1 — Severely; 2 — Moderately; 3 — Mildly; 2 — Slightly; 1 — None.

16. In the past 6 months have you felt down hearted and blue?

5 – Never; 4 – Rarely; 3 – Sometimes; 2 – Often; 1 – Very often

17. In the last 3 months have you taken any days off of work, including household work, or school because of back pain?

5 – 0 days; 4 – 1 day; 3 – 2 days; 2 – 3 days; 1 – 4 or more days

18. Does your back condition limit your going out with friends/family?

5 – Never; 4 – Rarely; 3 – Sometimes; 2 – Often; 1 – Very often

19. Do you feel attractive with your current back condition?

5 – Yes, very; 4 – Yes, somewhat; 3 – Neither attractive nor unattractive; 2 – No, not very much; 1 – No, not at all.

20. Have you been a happy person during the past 6 months?

1 – None of the time; 2 – A little of the time; 3 – Some of the time; 4 – Most of the time; 5 – All of the time

21. Are you satisfied with the results of your back management?

5 – Very satisfied; 4 – Satisfied; 3 – Neither satisfied nor unsatisfied; 2 – Unsatisfied; 1 – Very unsatisfied.

22. Would you have the same management again if you had the same condition?

5 – Definitely yes; 4 – Probably yes; 3 – Not sure; 2 – Probably not; 1 – Definitely not.

Thank you for completing this questionnaire. Please comment if you wish.

Key to SRS-22 questionnaire

Domain (subject area)	Questions	The cumulative value of the answers (A)	The number of answered questions (A)	The average score (A/B)
Function	5, 9, 12, 15, 18			
Pain	1, 2, 8, 11, 17			
Self-image	4, 6, 10, 14, 19			
Mental Health	3, 7, 13, 16, 20			
Satisfied/Not satisfied with treatment	21, 22			
Total				

Unanswered questions should be subtracted from the sum of the answered questions. Remove the questions with more than one answer. Domain (subject area) cannot be assessed unless at least three questions are answered.

