The Albanian version of the Oswestry Disability Index: translation, cross-cultural adaptation, validity, and reliability

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ABSTRACT

Purpose: The aim of this study was to assess the translation, validation, and reliability of the Albanian ODI (ODI-A) version 2.1b.

Methods: Standardized guidelines for evaluation of psychometric properties were followed. Participants were recruited from a national center with orthopedic-traumatological specialty of an Albanian region. The construct validity, internal consistency, and the reliability of ODI-A measured by seven days test–retest method across two repeated measures were considered.

Results: In total, 200 patients completed the ODI-A 2.1b version: 43% had low back pain, 36% had rheumatoid arthritis as principal diagnosis and the other participants had trauma, luxation, discal hernia, and fractures as diagnosis accompanied by back pain. There were no missing items. The Kaiser–Meyer–Olkin was 0.613 and Bartlett's test of sphericity was found to be significant ($p < 0.001$). ODI-A showed excellent test–retest reliability of each item (ICC = 0.707–0.959). Cronbach's α for the first completion was 0.684, ICC for ODI-A was 0.629, the SEM was 1.701, and $MDC_{95\%}$ was 4.71.

Conclusions: ODI-A, adapted from a linguistic and cultural perspective, meets validity and reliability requirements necessary for its use in the Albanian population with back pain.

KEYWORDS

Albanian Oswestry Disability Index; measurement validity; internal consistency; item statistics; back pain

➢ IMPLICATIONS FOR REHABILITATION

- The Oswestry Disability Index (ODI) was cross-culturally translated and adapted for the first time into Albanian language.
- This study demonstrated that Albanian ODI (ODI-A) version had construct validity properties, good internal consistency, and test–retest reliability.
- The ODI-A stability allows rehabilitation professionals to track changes over time and assess the effectiveness of interventions.

Introduction

The Oswestry Disability Index (ODI) is the most used outcome measures in the past 30 years with good psychometric properties for both acute and chronic low back pain (LBP) [1,2]. The most studied measures in back pain research and clinical practice include chronic pain, disability, return to work, and quality of life [3]. These variables are assessed using various scales in studies evaluating back pain treatments, including nonsteroidal anti-inflammatory drugs (NSAIDs), opioids, alternative therapies, and educational programs [4–8].

The ODI is the most used outcome measures with good psychometric properties for both acute and chronic LBP in the past 30 years [1,2]. The first version was developed and published by Fairbank et al. [9]. In 1985, a team of researchers from the Medical Research Council developed the second version of the ODI by removing the reference to analgesic intake in item 1, "pain intensity," and adding an option of "no pain" [10].

In the same year, Fairbank changed few words in the last description statement in the "Traveling" section. He modified the phrase "to the doctor or hospital" to "to receive treatment" and established ODI version 2.1. In the advanced version named ODI version 2.1a, the phrase "is affected" in the opening sentence of ODI version 2.1 was revised to "effects" [11].

The latest version, ODI 2.1b, includes a minor modification in the physical layout of the index. The ODI 2.1b version is now used and distributed by the copyright holder, MAPI Research Trust website.

The different ODI versions have already been translated and validated in many languages as: German, Arabic, Spanish, Turkish, Italian, Chinese, Japanese, Greek, French-Canadian, French-Swiss, Indian, Polish, Iranian, Yoruba, Indonesian, Persian, Korean, Croatian, Brazilian Portuguese, Danish, Norwegian, and Hungarian [3, 12–31].

To this day, as per ODI 2.1b version, only Law et al. have done the cross-cultural adaptation in Cantonese/Chinese language [1].

The proposed index uses clear language, easy to answer, with phrases and terms that fit the Albanian social context.

It is a methodological tool and a working instrument that allows doctors, psychologists, rehabilitators, and related specialties to easily evaluate the disability level generated by back pain.

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As per content, construct, and criterion validity, the ODI covers all the relevant aspects of disability due to back pain. Also, the correlations with other established measures of disability, pain, and quality of life are generally strong ($r > 0.70$), supporting the ODI's validity [32,33].

Regarding the ODI's reliability, internal consistency was assessed using Cronbach's alpha in numerous studies. Most language versions of the ODI demonstrated high internal consistency, with alpha values typically ranging from 0.80 to 0.90. This indicates that the items consistently measure the same construct [32, 34].

Test–retest reliability evaluated through intraclass correlation coefficients (ICCs) suggests that the instrument produces stable results over time when the patient's condition has not changed reporting high ICC values (often above 0.85) [14].

Higher ODI scores are associated with greater observed disability. The ODI is sensitive to changes in a patient's condition, with effect sizes often above 0.50 and standardized response means (SRMs) indicating moderate to large responsiveness [35–37].

Additionally, Rasch analysis has been used to further assess the ODI's performance. While the ODI generally fits a unidimensional model, some items occasionally show misfit, indicating they may not fully align with the overall construct [38].

The ODI generally displays a wide range of item difficulty, effectively covering various levels of disability. Nonetheless, certain items might be too easy or too challenging for particular groups.

The ODI shows well-functioning categories, though some studies suggest minor adjustments to improve clarity and discrimination between categories [38–40].

Studies utilizing Rasch analysis typically found high internal consistency, confirming it as a reliable measure of disability; good fit to the Rasch model; and adequate, well-functioning response categories [40–42].

Summarizing, the ODI is a robust and reliable tool for assessing disability in back pain patients across different languages and cultures. Its psychometric properties are generally strong, and Rasch analysis supports its validity and responsiveness, though continuous refinement can further improve its accuracy and applicability [39].

Translating the ODI into Albanian will facilitate more accurate, reliable, and culturally sensitive assessments of disability due to back pain, given that no adaptation of the ODI currently exists in Albanian. This is crucial for clinical measurement and data collection involving the Albanian population. With the growing number of multinational and multicultural research projects, adopting standardized and widespread health status measures in Albanian is essential.

The high prevalence of patients with chronic back pain who are treated through multidisciplinary consultations (including orthopedic and rehabilitation specialties), combined with the frequent disabilities caused by this condition, highlights the need for validating and standardizing tools like the ODI. This ensures effective decision-making and appropriate treatment planning [2, 16].

Thus, an Albanian version of the ODI (ODI-A), version 2.1b, with good psychometric properties and comprehensive cross-cultural adaptation, is necessary. Therefore, the aim of this study was to assess the translation, validation, and reliability of ODI-A 2.1b version.

Method

Design

A cross-cultural adaptation study was conducted. Before the data collection, the permission of Ethics Committee was received in line with Helsinki Declaration. The study was registered at clinical trial.gov before the data collection. Permission to translate the ODI into Albanian was obtained from MAPI, copyright owner of the English ODI 2.1b version.

Translation and cultural adaptation

Beaton et al. and Acquadro et al. guidelines for evaluation of psychometric properties were followed [43,44].

Forward translation step

The forward translation into Albanian was performed independently by two translators who were bilingual in Albanian and English. The first translator had medical background and was aware about ODI. The second translator did not have medical background and was unaware about ODI. Two forward translations were done in this stage. Both forward translated versions were compared and analyzed between two translators and the authors, and they formed a common synthesis.

Backward translation

After the version of two official translators, a discussion took place about the topics on the grammar and the way the survey is designed. The decision was made to refer to it as a survey and index in the Albanian language. Both the translators were blinded to the original version of ODI.

Expert committee review

The expert committee included the authors and the translators, where all the errors and conflicts were removed. Also, the committee discussed issues of cultural adaptations of original English version of the ODI, based on which a pre-final Albanian version of ODI was prepared.

Test of the pre-final version

Fifty participants were interviewed at this phase to complete the pilot testing. Participants were all Albanians and were guided and assisted during the entire process of the interview. Participants with orthopedic problems associated with back pain were invited to participate in the study. The survey's language was selected considering the age and the pavilion where the data were collected. The main encountered issue was the description and the explanation of the survey ahead of the participant's interview. In author's opinion, this issue was caused by the survey's title, which did not provide enough information to participants about the nature of the study.

Difficulties arose in the second section dealing with the understanding and patient's answers regarding their current back pain level and everyday activities. It was agreed on the need to modify the way phrases were constructed. The English-Albanian Expert Committee revised the material and modified a few expressions: in section 2 – sentence 3 was modified (It is difficult to take care of myself; thus, I try to be slow and careful). Also, other modifications were done for the sentence 4 and 6.

Proof reading

In this phase, the survey was improved for the last time, including the presentation, clarity of sentences, and design. Sections 3, 6, and 8 were modified. Modifications dealt with the way sentences were designed in the Albanian language without altering the sentence's meaning. No difficulties or other issues were encountered as the survey had been analyzed several times. The decision

was made by expert committee to keep as the final version the attached version.

Appendix 1 describes in detail the translation process submitted to MAPI Research Trust and the ODI-A final version.

Psychometric testing

Participants

For construct validity analysis, COSMIN recommends a sample of 100–200 participants, or around 5–10 participants per item, adjusted according to the model's complexity and the analysis type. For test–retest reliability, COSMIN suggests a minimum of 50 participants, though using a larger sample can yield more reliable estimates of measurement stability over time [45].

In our study, the expected sample size consists in 200 participants aged between 50 and 80 years old, with LBP symptoms (chronic, acute, or subacute conditions); mild to moderate mobility functional impairment; ability to read and speak Albanian fluently and ability to consent. Patients with recent lumbar surgery, infection, tumor, severe cardiovascular, neurological/psychiatric disorders, and metabolic disease were excluded.

The ODI-A was tested at Trauma and Orthopedic Specialty. Before data collection, the informed written consent was taken from all the participants.

Three physiotherapists and three nurses assessed the recruitment site for feasibility of being able to deliver the questionnaires. Version 2.1b of the ODI-A was subjected to psychometric property analysis following the COSMIN guidelines [45].

ODI scores

The ODI is a 10 items questionnaire. The first item rates the intensity of pain and the remaining ones cover the disabling effect of pain on typical daily activities: personal care, lifting, walking, sitting, standing, sleeping, sex life, social life, and traveling. Each item ranges from 0 to 5 and the total score is expressed as a percentage of the sum score × 2, varying from 0 (no disability) to 100 (maximum disability). The questionnaire is completed in about 5 min and scored in less than 1 min [11, 46].

The latest version, ODI 2.1b, is now used and distributed by the copyright holder, the MAPI Research Trust website without amending any single word but only a minor change in the physical layout of the questionnaire. This version served for the ODI-A translation, adaptation, and validity [1].

Validity

Structural validity was performed through factor analysis, by principal components. The factorial construction was verified using Bartlett's sphericity test where $p \leq 0.05$ was adopted as a criterion to consider it. Subsequently, the selection of the components to be retained was made following the Kaiser normalization criterion (value >1) [3].

Factor analysis was executed through quartimax rotation by means of principal component factor analysis. Cattell's Scree test was used to determine the number of extracted factors (eigenvalues >1). A factor loading value of 0.4 or higher was considered acceptable [47].

The threshold for the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was greater than 0.50 [48].

KMO values exceeding 0.50 were regarded as acceptable. Previous translation studies of the ODI into various languages have demonstrated a one- or two-factor structure [15, 27, 49].

Reliability

Test–retest reliability was assessed by calculating intra-class correlation coefficient (ICC) using two-way mixed analysis of variance. The acceptable reliability coefficient value of this measure ranges from 0.7 to 0.8, higher than 0.8 is excellent [32, 34]. As per temporal stability, patients were stable in the measurement period and version 2.1b of the ODI-A was applied on two successive occasions to all participants (n = 200) with an interval of seven days.

The standard error of measurement (SEM) was also determined ($SEM = SD \times \sqrt{1 - r}$) with acceptance within 10% of full marks in ODI-A with the cutoff values in individual items at 0.5 and ODI-A score at 10.

The SEM was used to assess the minimum detectable change (MDC) at 95% confidence interval calculated as the product of SEM times 1.96 and square root of 2 ($MDC = 1.96 \times \sqrt{2} \times SEM$) [1, 50,51].

Statistics

The data analysis was carried out with IBM Statistical Package for Social Science (SPSS) version 25 (Chicago, IL) software for windows. Descriptive statistics were utilized to examine the characteristics of the participants, with the data presented as mean values and standard deviations (SDs). The 95% confidence intervals were obtained.

Results

A total sample of 200 participants were included in this study; 43% had LBP with an average of 3-h pain duration per day (mean = 3.023, SD = 0.54); 36% had rheumatoid arthritis as principal diagnosis accompanied by back pain with an average of 4 h pain duration per day (mean = 3.96, SD = 0.91); 9% had lumbar trauma (contusion, commotion, etc.) with an average 2 h of pain per day (mean = 2.333, SD = 0.970); 7% had lumbar fracture with an average of 4 h of pain per day (mean = 4.142, SD = 0.534); 2.5% had lumbar discal hernia with an average of 4 h pain per day (mean = 4.600, SD = 0.894) and the last 2.5% of participants had coxo-femoral luxation accompanied with a LBP average of 3.8 h per day duration (mean = 3.800, SD = 1.09). As per pain decrease, 89 participants had NSAID as medication prescription; 90 participants had analgesics prescription and 21 participants had corticosteroid prescription. From total sample, 42.5% practiced walking as physical activity (mean = 3.92, SD = 0.963); 23.5% practiced aerobic exercises (mean = 3.91, SD = 1.09), 19% practiced swimming (mean = 4.73, SD = 0.34), and 15% frequented gym (mean = 4.40, SD = 0.49). The participants had a mean age of 69.76 years old with SD = 6.33 where 62% were retired (n = 124) (Table 1).

There were no missing items in both the test and the retest. The KMO measure of sampling adequacy showed that the KMO value was 0.613. Bartlett's test of sphericity was found to be significant ($p < 0.001$) with a Chi-square statistic of 600 533 and with 45° of freedom. A one factor structure of ODI-A was established based on eigenvalues >1. This factor described 30.28% of total variance. Item-factor loadings are reported in Table 2.

The interclass correlation coefficient and test–retest reliability are reflected in Table 3.

Cronbach's α of each item demonstrated the homogeneous nature of the test and an excellent internal consistency for the translated ODI-A (Cronbach's α for the baseline assessment was 0.684).

Table 1. Participant characteristics.

	Category	*N*	Mean (SD)	%
Gender	Male	106		53
	Female	94		47
	Total	200		100
Age		200	69.760 (6.330)	100
Pain duration	Back pain	86	3.023 (0.547)	43.0
	Lumbar discal hernia	5	4.600 (0.894)	2.5
	Lumbar trauma	18	2.333 (0.970)	9.0
	Coxo-femoral luxation	5	3.800 (1.095)	2.5
	Lumbar fracture	14	4.142 (0.534)	7.0
	Rheumatoid arthritis	72	3.958 (0.910)	36.0
	Total	200	3.435 (0.958)	100
Medication	NSAID	89		44.5
	Analgesic	90		45.0
	Corticosteroid	21		10.5
Professional status	Worker	76		38.0
	Retired	124		62.0
Physical activity	Walking	85	3.929 (0.961)	42.5
	Swimming	38	4.736 (0.343)	19
	Aerobic exercises	47	3.914 (1.099)	23.5
	Gym	30	4.400 (0.498)	15

NSAID: non-steroidal anti-inflammatory drugs; SD: standard deviation; pain duration: duration of pain in hours per day; physical activity: frequency of physical activity in hours per week.

Table 2. Factor loading values for single factor solution of ODI-A.

ODI items	ODI-A items	Factor 1
Pain intensity	*Intensiteti dhimbjes*	0.794
Personal care	*Kujdesi personal*	0.770
Lifting	*Ngritja*	0.839
Walking	*Ecja*	0.838
Sitting	*Të ulurit*	0.819
Standing	*Qëndrimi në kembë*	0.610
Sleeping	*Gjumi*	0.818
Sex life	*Jeta seksuale*	0.769
Social life	*Jeta shoqërore*	0.769
Traveling	*Udhëtimi*	0.860

ODI: Oswestry Disability Index; ODI-A: Albanian Oswestry Disability Index. Extraction method: principal component analysis.

With 200 participant responses, ODI-A showed good test–retest reliability (ICC 2,1 = 0.629; 95%CI = 0.536–0.706), and the ICC for each item is reflected in Table 3.

The SEM was 1.701 and MDC95% was 4.71. Table 4 gives the SEM and MDC of ODI-A items.

Discussion

The purpose of this study was to translate and evaluate the Albanian version of ODI for Albanians.

Translating the ODI into Albanian language had no difficulties. The ODI-A modifications in the translation phases were as follows: finding the precise Albanian term for "Index"; the term "soft pain" was replaced with "light pain"; "the worst imaginable pain" was replaced with "unsupportable pain"; and after the expert committee verification of the ODI-A, it was decided to modify a few expressions (It is difficult to take care of myself; thus, I try to be slow and careful; I need help, but I manage most of my personal care; I have trouble dressing, washing, and thus, lie in bed).

The ODI-A was easy to complete, highly accepted and allowed active patient participation. Because it is easy scoring and wide acceptance by the participants, ODI-A can be recommended as a valid outcome measure instrument for the research area and clinical routine [12, 18].

All the ODI-A items were filled out. This fact made easier the score calculation of each participant. The same situation was presented also in other cross-cultural adaptation studies [14, 21, 52].

In accordance with our results, numerous studies confirmed the validity of the ODI in general populations suffering from LBP [11, 16, 31, 50]. Other studies have examined the validity of the ODI specifically within clinical environments compared to community-based samples, similar to our research [2, 9, 11].

German Version of Osthus et al. found satisfactory psychometric properties for the validation of the ODI for German-speaking populations [12]. The results of the Spanish adaptation of the ODI demonstrated strong construct validity [53]. Similarly, the Polish version of the ODI showed comparable results, indicating strong construct validity in this population as well [14].

Table 3. Test–retest reliability results.

		Test	Retest	Summary item means			Intraclass correlation coefficient (ICC)						
ODI	AODI	Mean (SD) (*n* = 200)	Mean (SD) (*n* = 200)	Mean	Min	Max	ICC	Total ICC (95% CI)	95% CI	*F*	*p* Value	Cronbach's *α*	Total Cronbach's *α*
Pain intensity	*Intensiteti dhimbjes*	2.70 (0.724)	2.69 (0.706)	2.69	2.685	2.695	0.959	0.629 (0.536–0.706)	0.946–0.969	24.476	0	0.959	0.684
Personal care	*Kujdesi personal*	2.81 (0.685)	2.76 (0.712)	2.78	2.755	2.805	0.767		0.692–0.823	4.29	0	0.767	
Lifting	*Ngritja*	2.53 (0.584)	2.43 (0.545)	2.478	2.43	2.525	0.893		0.851–0.922	9.942	0	0.899	
Walking	*Ecja*	2.81 (0.397)	2.65 (0.490)	2.725	2.645	2.805	0.710		0.575–0.797	3.817	0	0.738	
Sitting	*Të ulurit*	2.68 (0.565)	2.53 (0.657)	2.605	2.539	2.68	0.707		0.605–0.781	3.56	0	0.719	
Standing	*Qëndrimi në kembë*	2.89 (0.538)	2.90 (0.585)	2.895	2.89	2.9	0.914		0.886–0.935	11.571	0	0.914	
Sleeping	*Gjumi*	2.84 (0.434)	2.76 (0.451)	2.798	2.76	2.385	0.896		0.855–0.924	10.248	0	0.902	
Sex life	*Jeta seksuale*	3.33 (0.470)	3.47 (0.520)	3.395	3.325	3.465	0.740		0.638–0.811	4.128	0	0.758	
Social life	*Jeta shoqërore*	3.01 (0.516)	3.15 (0.422)	3.077	3.005	3.15	0.800		0.697–0.863	5.605	0	0.822	
Traveling	*Udhëtimi*	3.33 (0.471)	3.26 (0.437)	3.293	3.255	3.3	0.902		0.862–0.929	10.851	0	0.908	

ODI: Oswestry Disability Index; ODI-A: Albanian Oswestry Disability Index; SD: standard deviation; min: minimum; max: maximum; ICC: interclass correlation coefficient; CI: confidence interval.

Table 4. Standard measurement error and the minimal detectable change calculation for the ODI-A items.

	SEM	MDC
ODI-A	1.701	4.710
Pain intensity	0.020	0.055
Personal care	0.043	0.119
Lifting	0.024	0.067
Walking	0.029	0.08
Sitting	0.041	0.114
Standing	0.022	0.061
Sleeping	0.019	0.053
Sex life	0.031	0.086
Social life	0.026	0.072
Traveling	0.019	0.053

ODI-A: Albanian Oswestry Disability Index; SEM: standard measurement error; MDC: minimal detectable change.

Additionally, Koivunen et al. further confirmed the validity of the ODI in their study involving patients undergoing lumbar spinal surgery [54].

Yao et al. identified 27 versions of the ODI in 24 different languages and reported that only the Danish version went through the cross-cultural translation procedure [2]. In our study, standardized guidelines were carefully followed.

The findings of the psychometric testing revealed that ODI-A had high internal consistency aligning with previous studies [1, 20,21]. Likewise, Cronbach's alpha for the Albanian version of the questionnaire demonstrated very good internal consistency [28, 55–57].

Excellent internal consistency has been found also in French, German, Spanish, Turkish, Chinese, and Japanese ODI versions (Cronbach's α values ranged from 0.83 to 0.93), with very good test–retest reliability (ICC ranges: 0.87–0.96) [12, 16,17, 20, 53, 57].

These data suggest that the ODI maintains good to excellent reliability across various languages and cultural contexts, highlighting the robustness of this scale as a tool for assessing disability related to low-back pain.

With respect to the with test–retest reliability of the instrument, the data confirm that the instrument is reliable in relation to its stability over time.

Comparing the results of our study with other ODI versions, it can be said that the original version had also a good to excellent reliability with Cronbach's α range from 0.80 to 0.90 with a high stability over time [11].

A reflective point during the first and second ODI-A measurements was the participants medication. The professionals who collected the data of ODI-A did not ask the participants if they were into medication effect while responding.

This study was focused on different pathologies affecting the back pain, in an orthopedic-traumatological specialty.

As far as we know, this article describes the first attempt at translation and validation of the ODI in Albania.

The results of the current study show that it is possible to translate a functional status questionnaire into Albanian without losing the psychometric properties of the original (English) versions. Therefore, this instrument seems to be valid and reliable outcome measure for assessing the functional status of patients with low back disorders in Albania.

Conclusions

Cross-cultural adaptation of ODI-A was carried out according to standardized international methodology (MAPI guidelines for 2.1b version and Beaton et al. [43]). Reliability was assessed by test–retest reliability. The results obtained allow us to conclude that the ODI, adapted from a linguistic and cultural perspective, meets the validity and reliability requirements necessary for its use in the Albanian population with back pain.

Author contributions

JT and OL designed the experiment; followed the participant's recruitment and recorded data process; analyzed and interpreted the results; created the first draft of the manuscript; improved the results and contributed in literature review. Both authors read and approved the final manuscript.

Ethical approval

This study was approved by the Ethics Committee of the Catholic University of Murcia "San Antonio" with Protocol No. CE052107 and Ethics Committee of Health Ministry and Social Defense, Tirana, Albania (prot. nr. 147/35). The study was registered at clinical trial.gov before the data collection with ID. NCT04131998.

Consent form

All the participants firmed the consent.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

All relevant data are within the study, and raw data are available on request by the corresponding author.

References

[1] Law KKP, Lee PL, Kwan WW, et al. Cross-cultural adaptation of Cantonese (Hong Kong) Oswestry Disability Index version 2.1b. Eur Spine J. 2021;30(9):2670–2679. doi: 10.1007/s00586-021-06922-0.

[2] Yao M, Wang Q, Li Z, et al. A systematic review of cross-cultural adaptation of the Oswestry Disability Index. Spine (Phila Pa 1976). 2016;41(24):E1470–E1478. doi: 10.1097/BRS.0000000000001891.

[3] Payares K, Lugo LH, Morales V, et al. Validation in Colombia of the Oswestry Disability Questionnaire in patients with low back pain. Spine (Phila Pa 1976). 2011;36(26):E1730–E1735. doi: 10.1097/BRS.0b013e318219d184.

[4] Roelofs PD, Deyo RA, Koes BW, et al. Nonsteroidal anti-inflammatory drugs for low back pain: an updated Cochrane review. Spine (Phila Pa 1976). 2008;33(16):1766–1774. doi: 10.1097/BRS.0b013e31817e69d3.

[5] Chaparro LE, Furlan AD, Deshpande A, et al. Opioids compared to placebo or other treatments for chronic low-back pain. Cochrane Database Syst Rev. 2013;2013(8):CD004959. doi: 10.1002/14651858.CD004959.pub4.

[6] Boff TA, Pasinato F, Ben ÂJ, et al. Effectiveness of spinal manipulation and myofascial release compared with spinal manipulation alone on health-related outcomes in individuals with non-specific low back pain: randomized controlled trial. Physiotherapy. 2020;107:71–80. doi: 10.1016/j.physio.2019.11.002.

[7] Castro-Sánchez AM, Lara-Palomo IC, Matarán-Peñarrocha GA, et al. Short-term effectiveness of spinal manipulative therapy versus functional technique in patients with chronic non-specific low back pain: a pragmatic randomized controlled trial. Spine J. 2016;16(3):302–312. doi: 10.1016/j.spinee.2015.08.057.

[8] Parreira P, Heymans MW, van Tulder MW, et al. Back schools for chronic non-specific low back pain. Cochrane Database Syst Rev. 2017;8(8):CD011674. doi: 10.1002/14651858.CD011674.pub2.

[9] Fairbank JC, Couper J, Davies JB, et al. Convergent correlations. Physiotherapy. 1980;66:271–273.

[10] Fairbank JCT. Use and abuse of Oswestry Disability Index. Spine (Phila Pa 1976). 2007;32(25):2787–2789. doi: 10.1097/BRS0b013e31815b9e9d.

[11] Fairbank JCT, Pynsent PB. The Oswestry Disability Index. Spine (Phila Pa 1976). 2000;25(22):2940–2952; discussion 2952. doi: 10.1097/00007632200011150000017.

[12] Osthus H, Cziske R, Jacobi E. Cross-cultural adaptation of a German version of the Oswestry Disability Index and evaluation of its measurement properties. Spine (Phila Pa 1976). 2006;31(14):E448–E453. doi: 10.1097/01.brs.0000222054.89431.42.

[13] Guermazi M, Mezghani M, Ghroubi S, et al. The Oswestry Index for low back pain translated into Arabic and validated in an Arab population. Ann Readapt Med Phys. 2005;48:1–10.

[14] Miekisiak G, Kollataj M, Dobrogowski J, et al. Validation and cross-cultural adaptation of the Polish version of the Oswestry Disability Index. Spine (Phila Pa 1976). 2013;38(4):E237–E243. doi: 10.1097/BRS.0b013e31827e948b.

[15] Monticone M, Baiardi P, Ferrari S, et al. Development of the Italian version of the Oswestry Disability Index (ODI-I): a crosscultural adaptation, reliability, and validity study. Spine (Phila Pa 1976). 2009;34(19):2090–2095. doi: 10.1097/BRS.0b013e3181aa1e6b.

[16] Yakut E, Düger T, Oksüz C, et al. Validation of the Turkish version of the Oswestry Disability Index for patients with low back pain. Spine (Phila Pa 1976). 2004;29(5):581–585; discussion 585. doi: 10.1097/01.brs.0000113869.13209.03.

[17] Furuya H, Ito T, Hirohata K, et al. Construct validity and reliability of the Japanese version of the Lumbar Stiffness Disability Index. Spine (Phila Pa 1976). 2021;46(5):E333–E337. doi: 10.1097/BRS.0000000000003772.

[18] Boscainos PJ, Sapkas G, Stilianessi E, et al. Greek versions of the Oswestry and Roland-Morris Disability Questionnaires. Clin Orthop Relat Res. 2003;411:40–53. doi: 10.1097/01.blo.0000068361.47147.79.

[19] Denis I, Fortin L. Development of a French-Canadian version of the Oswestry Disability Index: cross-cultural adaptation and validation. Spine (Phila Pa 1976). 2012;37(7):E439–E444. doi: 10.1097/BRS.0b013e318233eaf9.

[20] Vogler D, Paillex R, Norberg M, et al. Cross-cultural validation of the Oswestry Disability Index in French. Ann Readapt Med Phys. 2008;51:379–385.

[21] Joshi VD, Raiturker PP, Kulkarni AA. Validity and reliability of English and Marathi Oswestry Disability Index (version 2.1a) in Indian population. Spine (Phila Pa 1976). 2013;38(11):E662–E668. doi: 10.1097/BRS.0b013e31828a34c3.

[22] Mousavi SJ, Parnianpour M, Mehdian H, et al. The Oswestry Disability Index, the Roland-Morris Disability Questionnaire, and the Quebec Back Pain Disability Scale: translation and validation studies of the Iranian versions. Spine (Phila Pa 1976). 2006;31(14):E454–E459. doi: 10.1097/01.brs.0000222141.61424.f7.

[23] Mbada CE, Idowu OA, Ogunjimi OR, et al. Cross-cultural adaptation, reliability, and validity of the Yoruba Version of the Roland-Morris Disability Questionnaire. Spine (Phila Pa 1976). 2017;42(7):497–503. doi: 10.1097/BRS.0000000000001899.

[24] Phedy P, Djaja YP, Tobing SDAL, et al. Cross-cultural adaptation and psychometric validation of the Indonesian version of the Oswestry Disability Index. Eur Spine J. 2021;30(4):1053–1062. doi: 10.1007/s00586-020-06690-3.

[25] Baradaran A, Ebrahimzadeh MH, Birjandinejad A, et al. Cross-cultural adaptation, validation, and reliability testing of the Modified Oswestry Disability Questionnaire in Persian population with low back pain. Asian Spine J. 2016;10(2):215–219. doi: 10.4184/asj.2016.10.2.215.

[26] Jeon CH, Kim DJ, Kim SK, et al. Validation in the cross-cultural adaptation of the Korean version of the Oswestry Disability Index. J Korean Med Sci. 2006;21(6):1092–1097. doi: 10.3346/jkms.2006.21.6.1092.

[27] Domazet I, Nemir J, Barl P, et al. Validation of the Croatian version of the Oswestry Disability Index. Eur Spine J. 2018;27(11):2814–2822. doi: 10.1007/s00586-018-5757-z.

[28] Vigatto R, Alexandre NM, Correa Filho HR. Development of a Brazilian Portuguese version of the Oswestry Disability Index: cross-cultural adaptation, reliability, and validity. Spine (Phila Pa 1976). 2007;32(4):481–486. doi: 10.1097/01.brs.0000255075.11496.47.

[29] Lauridsen HH, Hartvigsen J, Manniche C, et al. Danish version of the Oswestry Disability Index for patients with low back pain. Part 1: cross-cultural adaptation, reliability and validity in two different populations. Eur Spine J. 2006;15(11):1705–1716. doi: 10.1007/s00586-006-0117-9.

[30] Grotle M, Brox JI, Vøllestad NK. Cross-cultural adaptation of the Norwegian versions of the Roland-Morris Disability Questionnaire and the Oswestry Disability Index. J Rehabil Med. 2003;35(5):241–247. doi: 10.1080/16501970306094.

[31] Valasek T, Varga PP, Szövérfi Z, et al. Reliability and validity study on the Hungarian versions of the Oswestry Disability Index and the Quebec Back Pain Disability Scale. Eur Spine J. 2013;22(5):1010–1018. doi: 10.1007/s00586-012-2645-9.

[32] Cook CE, Garcia AN, Wright A, et al. Measurement properties of the Oswestry Disability Index in recipients of lumbar spine surgery. Spine (Phila Pa 1976). 2021;46(2):E118–E125. doi: 10.1097/BRS.0000000000003732.

[33] Wittink H, Turk DC, Carr DB, et al. Comparison of the redundancy, reliability, and responsiveness to change among SF-36, Oswestry Disability Index, and Multidimensional Pain Inventory. Clin J Pain. 2004;20(3):133–142. doi: 10.1097/00002508-200405000-00002.

[34] Brodke DS, Goz V, Lawrence BD, et al. Oswestry Disability Index: a psychometric analysis with 1,610 patients. Spine J. 2017;17(3):321–327. doi: 10.1016/j.spinee.2016.09.020.

[35] Beurskens AJHM, de Vet HCW, Köke AJA. Responsiveness of functional status in low back pain: a comparison of different instruments. Pain. 1996;65(1):71–76. doi: 10.1016/0304-3959(95)00149-2.

[36] Vishwanathan K, Braithwaite I. Construct validity and responsiveness of commonly used patient reported outcome instruments in decompression for lumbar spinal stenosis.

J Clin Orthop Trauma. 2021;16:125–131. doi: 10.1016/j.jcot.2021.01.002.

[37] Monticone M, Baiardi P, Vanti C, et al. Responsiveness of the Oswestry Disability Index and the Roland Morris Disability Questionnaire in Italian subjects with sub-acute and chronic low back pain. Eur Spine J. 2012;21(1):122–129. doi: 10.1007/s00586-011-1959-3.

[38] Rigoard P, Ounajim A, Goudman L, et al. A novel Multi-Dimensional Clinical Response Index dedicated to improving global assessment of pain in patients with persistent spinal pain syndrome after spinal surgery, based on a real-life prospective multicentric study (PREDIBACK) and machine learning techniques. J Clin Med. 2021;10(21):4910. doi: 10.3390/jcm10214910.

[39] Davidson M. Rasch analysis of three versions of the Oswestry Disability Questionnaire. Man Ther. 2008;13(3):222–231. doi: 10.1016/j.math.2007.01.008.

[40] Lu YM, Wu YY, Hsieh CL, et al. Measurement precision of the disability for Back Pain Scale-by applying Rasch analysis. Health Qual Life Outcomes. 2013;11(1):119. doi: 10.1186/1477-7525-11-119.

[41] Saltychev M, Mattie R, McCormick Z, et al. Psychometric properties of the Oswestry Disability Index. Int J Rehabil Res. 2017;40(3):202–208. doi: 10.1097/MRR.0000000000000226.

[42] Smeets R, Köke A, Lin CW, et al. Measures of function in low back pain/disorders: Low Back Pain Rating Scale (LBPRS), Oswestry Disability Index (ODI), Progressive Isoinertial Lifting Evaluation (PILE), Quebec Back Pain Disability Scale (QBPDS), and Roland-Morris Disability Questionnaire (RDQ). Arthritis Care Res. 2011;63(Suppl. 11):S158–S173. doi: 10.1002/acr.20542.

[43] Beaton DE, Bombardier C, Guillemin F, et al. Guidelines for process of cross-cultural adaptation of self-report measures. Spine (Phila Pa 1976). 2000;25(24):3186–3191. doi: 10.1097/00007632-200012150-00014.

[44] Acquadro C, Conway K, Giroudet C, et al. Linguistic validation manual for health outcome assessments. Mapi Institute; 2012.

[45] Mokkink LB, Terwee CB, Patrick DL, et al. The COSMIN checklist for assessing the methodological quality of studies on measurement properties of health status measurement instruments: an International Delphi Study. Qual Life Res. 2010;19(4):539–549. doi: 10.1007/s11136-010-9606-8.

[46] Roland M, Fairbank J. The Roland-Morris Disability Questionnaire and the Oswestry Disability Questionnaire. Spine (Phila Pa 1976). 2000;25(24):3115–3124. doi: 10.1097/00007632-200012150-00006.

[47] Amjad F, Mohseni-Bandpei MA, Gilani SA, et al. Urdu version of Oswestry Disability Index; a reliability and validity study. BMC Musculoskelet Disord. 2021;22(1):311. doi: 10.1186/s12891-021-04173-0.

[48] Yong AG, Pearce S. A beginner's guide to factor analysis: focusing on exploratory factor analysis. Tutor Quant Methods Psychol. 2013;9(2):79–94. doi: 10.20982/tqmp.09.2.p079.

[49] Pekkanen L, Kautiainen H, Ylinen J, et al. Reliability and validity study of the Finnish version 2.0 of the Oswestry Disability Index. Spine (Phila Pa 1976). 2011;36(4):332–338. doi: 10.1097/BRS.0b013e3181cdd702.

[50] Mohan V, Prashanth GS, Meravanigi G, et al. Adaptation of the Oswestry Disability Index to Kannada language and evaluation of its validity and reliability. Spine (Phila Pa 1976). 2016;41(11):E674–E680. doi: 10.1097/BRS.0000000000001368.

[51] Dean K, Walker Z, Jenkinson C. Data quality, floor and ceiling effects, and test–retest reliability of the mild cognitive impairment questionnaire. Patient Relat Outcome Meas. 2018;9:43–47. doi: 10.2147/prom.s145676.

[52] Sandal D, Jindal R, Gupta S, et al. Reliability and validity of Punjabi version of Oswestry Disability Index in patients with mechanical low back pain. J Clin Orthop Trauma. 2021;13:163–168. doi: 10.1016/j.jcot.2020.11.011.

[53] Selva-Sevilla C, Ferrara P, Gerónimo-Pardo M. Psychometric properties study of the Oswestry Disability Index in a Spanish population with previous lumbar disc surgery: homogeneity and validity. Spine (Phila Pa 1976). 2019;44(7):E430–E437. doi: 10.1097/BRS.0000000000002867.

[54] Koivunen K, Widbom-Kolhanen S, Pernaa K, et al. Reliability and validity of Oswestry Disability Index among patients undergoing lumbar spinal surgery. BMC Surg. 2024;24(1):13. doi: 10.1186/s12893-023-02307-w.

[55] Terwee CB, Bot SD, de Boer MR, et al. Quality criteria were proposed for measurement properties of health status questionnaires. J Clin Epidemiol. 2007;60(1):34–42. doi: 10.1016/j.jclinepi.2006.03.012.

[56] Lue YJ, Hsieh CL, Huang MH, et al. Development of a Chinese version of the Oswestry Disability Index version 2.1. Spine (Phila Pa 1976). 2008;33(21):2354–2360. doi: 10.1097/BRS.0b013e31818018d8.

[57] Mannion AF, Junge A, Fairbank JCT, et al. Development of a German version disability index. Part 1. Eur Spine J. 2006;15(1):55–65. doi: 10.1007/s00586-004-0815-0.