

## ■ Research paper

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## Metric Characteristics of the Croatian Translation of Two Hip Outcome Measures in Elderly People with Hip Disorders

**Abstract.** We wanted to provide and validate the Croatian version of two prominent hip outcome measures, the Harris Hip Score (HHS) and the Activities of Daily Living scale of the Hip Outcome Score (HOS ADL), for use in elderly people with hip disorders. The study was conducted in two institutions in Croatia. The sample comprised 94 people (36 men; mean age 72 years) with hip disorders (mainly hip osteoarthritis). Internal consistency was low to moderate for HHS ( $\sim 0.65$ ), but very high for the HOS ADL ( $> 0.95$ ). Overall, correlations of the HOS ADL scores with quality-of-life measures and pain ratings were low but statistically significant, and near-zero and not statistically significant for the HHS. Test-retest reliability of both hip outcome measures was nearly perfect ( $\sim 1.00$ ). The estimated minimum detectable change was 7.1 for HHS and 3.9 for HOS ADL. Floor and ceiling effects were absent from both scales. We found full support for reliability and validity of Croatian HOS ADL, so we recommend its use in research and clinical practice; the Croatian HHS is usable only for group-based research.

**Key words:** Harris Hip Score; Hip Outcome Score; elderly; reliability; validity.

## Merske lastnosti hrvaškega prevoda dveh mer izida kolka pri starejših osebah z okvaro kolka

**Povzetek.** Želeli smo pripraviti hrvaško različico dveh pomembnih mer izida kolka, Harrisove lestvice kolka (HHS) in lestvice dnevnih aktivnosti Ocene izida kolka (HOS ADL), in preveriti njuno veljavnost za uporabo pri starejših z okvaro kolka. Raziskavo smo izvedli v dveh ustanovah na Hrvaškem. V vzorec smo vključili 94 oseb (36 moških; povprečna starost 72 let) z okvarami kolka (večinoma osteoartrozo kolka). Notranja skladnost je bila nizka do zmerna za HHS ( $\sim 0,65$ ) in zelo visoka za HOS ADL ( $> 0,95$ ). V splošnem so bile korelacije dosežkov na HOS ADL z dosežki na lestvicah kakovosti življenja in ocenami bolečine nizke, a statistično značilne, ter skoraj ničelne in niso bile statistično značilne za HHS. Zanesljivost ponovnega testiranja obeh mer izida kolka je bila skoraj popolna ( $\sim 1,00$ ). Ocenjena najmanjša zaznavna sprememba je bila 7,1 za HHS in 3,9 za HOS ADL. Na nobeni od lestvic nismo zaznali učinka tal ali stropa. Potrdili smo zanesljivost in veljavnost hrvaške lestvice HOS ADL, zato priporočamo njeno uporabo v raziskavah in klinični praksi, hrvaška verzija HHS pa je uporabna zgolj za skupinske raziskave.

**Ključne besede:** Harrisova lestvica kolka; Ocena izida kolka; starejši; zanesljivost; veljavnost.

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## Introduction

Patient-reported outcome measures provide information to clinicians on the patient's health status that concern quality of life (QoL), including symptoms, functionality, and physical, mental and social health.<sup>1</sup> As the number of therapeutic hip interventions increases, so does the importance of outcome-related research, especially because of higher costs and risks associated with surgery in elderly patients with hip disorders.<sup>2,3</sup> A significant economic burden is associated with hip disorders, most notably hip osteoarthritis (OA), because of disability associated with musculoskeletal disorders, comorbid diseases and cost of treatment.<sup>4,5</sup>

Many outcome measures have been developed for the assessment of hip disorders, such as the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC),<sup>6</sup> the Oxford Hip Score (OHS),<sup>7</sup> the Harris Hip Score (HHS),<sup>8</sup> the Hip Disability and Osteoarthritis Outcome Score (HOOS),<sup>9</sup> and the Hip Outcome Score (HOS).<sup>10</sup>

The HHS is one of the most widely used health related QoL measures for the assessment of hip pathology.<sup>4,11</sup> It was developed for the assessment of the results of hip surgery and evaluation of various hip disabilities in an adult population. It has been shown to be a reliable and valid measure of hip function.<sup>12</sup> A comparison study showed excellent concordance between self-reported and surgeon-assessed HHS.<sup>13</sup>

The HOS, which was developed much later, is a commonly utilised patient-reported outcome measure in the assessment of activities of daily living (ADL) among the elderly with hip OA.<sup>14,15</sup> It comprises two domains: ADL and sports. Though primarily aimed at the general adult population, it is also widely used as a clinical assessment tool for patients with degenerative hip diseases.<sup>14,15</sup> The HOS has been validated in individuals after arthroscopy and those with acetabular labral tears. It exhibits high observer agreement, internal consistency (despite being short and thus easy to administer), test-retest reliability, construct validity and interpretability, and low measurement error.<sup>16,17</sup>

Even though the HHS and the HOS are widely used for the assessment of hip pathologies, their official Croatian versions have not been prepared and validated. Hence, the aim of our study was to provide a reliable and valid Croatian version of the HHS and the HOS ADL scale. We focused our effort only on the ADL scale of the HOS because hip pathology is most often present and assessed among the elderly,

where the most common indicators of functional limitations are changes in the ability to perform ADL.<sup>18</sup>

## Methods

Outcome measures are evaluated in terms of metric characteristics, the fundamental ones being reliability (further divided into internal consistency and test-retest reliability), validity (primarily construct and convergent validity), and responsiveness.<sup>19</sup> When an assessment tool is translated into another language and subsequently validated, a standardised methodology for cross-cultural adaptation should be followed.<sup>20</sup> Therefore, we translated the HOS ADL scale into the Croatian language in concordance with other translation studies for Spanish, Korean, Portuguese, German and Turkish<sup>21-25</sup>, and the same protocol was followed for the HHS.<sup>4,25-29</sup> For assessing construct validity, we chose the WOMAC and the Short Form Health Survey (SF-36),<sup>30</sup> which have been culturally adapted and validated in Croatian language, to be compared to the HOS ADL scale and HHS. In addition, we used a visual analogue scale (VAS)<sup>31</sup> for hip pain.

## Participants

The study was conducted from May to June 2023 on two locations in Croatia – in a nursing home in Zagreb and in a non-profit daily centre for elderly people in Matulji. The study was approved by the Ethics Committee of the Faculty of Health Studies, University of Rijeka (No. 602-04/23-01/67). The target population were elderly people with hip pathology. The inclusion criterion was one of the following disorders: hip OA, femoral fracture, osteoporosis, avascular necrosis, hip pain, congenital dislocation of hip, hip effusion, muscle tear, oedema of femoral head, or acetabular cystic lesion. The participants were initially contacted by telephone. All the eligible patients were asked to read and sign an informed consent form.

Out of the 99 people initially considered for inclusion, two were excluded from the study due to the inability to cooperate, understand and fulfil the questionnaires or understand the Croatian language, or being unable to participate in the study for medical reasons. Among the eligible patients, three refused to participate in the study. Hence, 94 elderly people with different hip pathologies were enrolled into the study. The sample size was sufficient according to general recommendations.<sup>32</sup>

## Instruments

The HOS is a self-administered instrument that evaluates the outcomes of treatment. Its two subscales, ADL and Sports, comprise 19 (two not scored) and 9 items, respectively, that are rated from 0 (“unable to do”) to 4 (“no difficulty”).<sup>10</sup> The total score is computed as the percentage of the maximum possible score, which depends on the number of answered items; at least 14 items must be answered for a valid score. The score therefore ranges from 0 to 100, whereby a higher score represents better function.<sup>16</sup>

The HHS is a clinician-based, joint-specific assessment tool. It requires the health-care professional to grade the patient’s hip-related pain (max. 44 points), mobility and walking (max. 47 points), range of motion (max. 5 points) and absence of deformities (max. 4 points). The overall score ranges from 0 (indicating extreme symptoms) to 100 (indicating no symptoms). A total HHS lower than 70 points is considered a poor result, 70 – 80 is fair, 80 – 90 is good, and 90 – 100 is excellent.<sup>4,11</sup>

The WOMAC is a self-administered measure. It contains subscales for pain, stiffness, and physical function; the global score (which we used) is the sum of the subscale scores, thus ranging from 0 to 96.<sup>4,6</sup> A higher score indicates a worse health state.

The SF-36 is a widely known and used measure of health-related QoL. It addresses eight domains: physical functioning (PF), role limitations due to physical function (RP), bodily pain (BP), general health perceptions (GH), vitality (VT), social function (SF), emotional function (RE), and mental health (MH).<sup>30</sup> Each domain score is expressed on a 0 – 100 scale.

The VAS is routinely used for assessing pain intensity in both facilities where the study was conducted. The score is obtained by measuring the distance (in mm) on the 10-cm line between the “no pain” anchor and the patient’s mark, thus yielding a score between 0 and 100 with a higher score indicating more intense pain.<sup>31</sup>

## Procedure

The translation was performed according to the guidelines for validation and cross-cultural adaptation<sup>19,20</sup> in four stages (initial translation, back-translation, preparing a consensus version, publishing the final version). Two Croatian physiotherapists fluent in English each translated the scale on their own. Their versions were compared and reviewed by

a bilingual person in order to establish the first Croatian version.

Next, two native English speakers with a good command of the Croatian language separately translated that translation back into English. Neither of the translators had access to the original HOS or HHS, or was acquainted with the aim of the study. The back-translated version was compared to the English original and corrected, so the final translation of the HHS and the HOS ADL scale into Croatian was created (Appendix 1 and 2, respectively). During the translation into Croatian, some adaptations had to be made. In the HHS, the American expression “blocks walked” had to be replaced by an equivalent Croatian expression denoting walking time or distance, so we adopted the term “nekoliko ulica (30 min)” (several streets) instead of “six blocks”, and “2 – 3 ulice (10 – 15 min)” (2 – 3 streets) instead of “two or three blocks”. In the HOS, the only small difference from the original was that in the Croatian version, the term “average” in the statement “Getting in and out of an average car” was replaced by the term for “usual” or “typical” (so the translated statement reads “Ulazak i izlazak iz običnog auta”).

During the first assessment, the participants completed all the instruments (HHS, HOS ADL, WOMAC, SF-36 and VAS). After ten days, they completed the HHS and the HOS ADL scale again. Two physiotherapists provided assistance to the participants with reading, writing, and explanation if requested.

## Data analysis

Descriptive statistics were calculated for all the variables. Reliability (internal consistency and test-retest reliability), responsiveness, construct validity, convergent validity, and ceiling and floor effects of the Croatian version of the HHS and the Croatian version of HOS ADL scale were assessed. IBM SPSS Statistics 26 software (IBM Corp., Armonk, NY, USA) was used for statistical analysis.

Internal consistency was assessed using Cronbach’s alpha ( $\alpha$ ) and Guttman’s lambda-2 ( $\lambda_2$ ) coefficient. Intra-class correlation coefficient (ICC, with 95 % confidence interval, CI; single-measure two-way random model for absolute agreement) was used to assess test-retest reliability.<sup>34</sup>

Standard error of measurement (SEM) and minimum detectable change (MDC) were estimated to assess responsiveness. SEM was estimated as the standard deviation of the initial scores multiplied by  $\sqrt{1 - \text{ICC}}$ . SEM was then used to estimate MDC at

the 95 % confidence level ( $MDC_{95\%}$ ) as  $SEM \times 1.96 \times \sqrt{2}$ .<sup>35</sup>

Pearson ( $r$ ) and Spearman ( $r_s$ ) correlations were calculated to assess construct validity and convergent validity. Construct validity of the translated HOS ADL scale and the HHS was assessed in relation to the WOMAC, the VAS and the Physical Component Summary (PCS) of the SF-36. Convergent validity was assessed in relation to the SF-36 domain scores and the SF-36 Mental Component Summary (MCS).<sup>4,21,35</sup>

Floor and ceiling effects were assessed by calculating the percentage of patients attaining the minimum (i.e., 0) and maximum (i.e., 100) possible score, respectively. The effects were considered present if the percentage exceeded 30 %; they were considered negligible if the percentage was below 15 %.<sup>4,35</sup>

## Results

The sample comprised 36 (38 %) men and 58 (62 %) women. The mean age of the participants was 72 years (range 60 to 91 years). The most frequent diagnosis was hip OA (52 %), followed by osteoporosis (17 %), femoral fracture (15 %), and partial (9 %) or total hip endoprosthesis (6 %), while one participant was suffering from hip fracture.

All the participants answered all items of all the questionnaires. Descriptive statistics and estimates of internal consistency for both assessments with HHS and HOS ADL are listed in Table 1. Internal consistency was low to moderate for HHS (about 0.65), but very high for the HOS ADL (above 0.95).

**Table 1** Descriptive statistics and estimates of internal consistency for assessments with the Harris Hip Score (HHS) and the Activities of Daily Living scale of the Hip Outcome Score (HOS ADL).

Statistic	HHS		HOS ADL	
	1 <sup>st</sup> ass.	2 <sup>nd</sup> ass.	1 <sup>st</sup> ass.	2 <sup>nd</sup> ass.
Mean	64.8	64.0	60.4	59.3
Median	68.0	65.0	66.9	66.2
Min	2	2	5.9	7.4
Max	99	97	97.1	94.1
SD	20.8	19.9	22.0	21.2
$\alpha$	0.64	0.59	0.96	0.95
$\lambda_2$	0.71	0.66	0.97	0.96

Correlations of HHS and HOS ADL scores with the WOMAC score, VAS ratings and SF-36 scores are reported in Table 2. Overall, the correlations were low, and near-zero for the HHS. The correlations of the two hip outcome measures with WOMAC and VAS were negative, as expected. The only strong

correlation was observed between HOS ADL and WOMAC.

Test-retest reliability of both hip outcome measures was nearly perfect (ICC = 0.98, 95 % CI 0.97 to 0.98 for HHS; ICC = 1.00, 95 % CI 0.99 to 1.00 for HOS ADL). Hence, the estimated SEM was relatively small (2.5 points for HHS, 1.4 points for HOS) despite the large variability of the scores. The estimated MDC was 7.1 points for HHS, and 3.9 points for the HOS ADL.

**Table 2** Correlations of initial HHS and HOS ADL scores with the WOMAC score, VAS ratings and SF-36 scores.

Correlation with	HHS		HOS ADL		
	$r$	$r_s$	$r$	$r_s$	
WOMAC	-0.20	-0.12	-0.62	-0.55	
VAS	-0.07	-0.09	-0.29	-0.28	
SF36	PF	0.06	0.03	0.23	0.23
	RP	0.03	0.00	0.36	0.32
	BP	0.08	0.11	0.21	0.22
	GH	0.09	0.08	0.37	0.36
	VT	0.04	0.04	0.26	0.28
	SF	0.04	0.06	0.16	0.20
	RE	0.06	0.06	0.27	0.28
	MH	-0.01	0.04	0.31	0.30
	PCS	0.08	0.08	0.41	0.41
	MCS	0.06	0.09	0.36	0.40

Note: correlation with associated  $p \leq 0.01$  are shaded; see text for disambiguation of instrument-name abbreviations.

No participant attained either the minimum or the maximum possible score either on the HHS or the HOS either upon first or second assessment, so floor and ceiling effects were absent.

## Discussion

In a study conducted in two centres, we set to prepare and validate the Croatian version of two hip outcome measures, the HHS and the HOS ADL scale.

The observed internal consistency of the Croatian HHS is barely sufficient for group-based research, but insufficient for individual clinical judgment. A similarly underwhelming internal consistency has already been observed with the Greek (albeit modified) version of the HHS.<sup>36</sup> In contrast, internal consistency of the HOS ADL scale was very high, which parallels the findings for the original scale.<sup>16,17</sup>

The very high test-retest reliability of both Croatian versions of the studied hip outcome measures is encouraging. However, because both have the same score range (0 to 100), the smaller SEM and MDC speak in favour of the HOS ADL scale over the HHS.

With the QoL and pain measures that we applied, we found sufficient support for both construct and convergent validity of the Croatian HOS ADL scale, but no convincing proof of validity of the Croatian HHS.

To summarise, the Croatian HOS ADL scale was found to be highly reliable in terms of internal consistency and test-retest reliability, and exhibited construct and convergent validity, whereas the Croatian HHS exhibited high test-retest reliability, but only moderate internal consistency and a lack of construct and convergent validity.

The observed metric characteristics of the two instruments in question depend at least to some extent on the chosen sample. Nevertheless, as far as we can judge, the sample composition in terms of gender, age and diagnosis was not advantageous for the HOS ADL as compared to the HHS.

A potential limitation of our study is that we did not assess responsiveness of the two translated hip outcome measures in relation to an intervention. However, that would require either an intervention that sufficiently quickly (to prevent sample attrition) exhibits a clear effect on all the participants with various hip disorders, which is unfortunately not available; or limiting the scope of the study to a single disorder, thus losing the generalisability of the findings to the whole population of elderly people with hip disorders.

## Conclusion

Our study involving 94 elderly people with hip disorders from Croatia provided full support for reliability and validity of the translated Activities of Daily Living scale of the Hip Outcome Score, so we can recommend its use in research and clinical practice. The metric characteristics of the translated Harris Hip Score were not encouraging, so we find it potentially usable only for group-based research, but not for individual application in clinical practice.

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## Appendix 1

### Croatian translation of the Harris Hip Score

#### 1. Dio

<b>BOL</b>		
Bez bolova		44
Blaga, povremena bol, bez ograničenja aktivnosti		40
Umjerena bol, bez ograničenja uobičajenih aktivnosti; kod nesvakodnevne aktivnosti umjerena bol, uzima aspirin		30
Bol koja djelomično ograničava uobičajene aktivnosti, no bolesnik i dalje radi, uzima jače analgetike		20
Jaka bol koja ograničava aktivnost		10
Izrazita bol koja u potpunosti onemogućuje aktivnost, bolesnik je u krevetu		0

<b>POMAGALA ZA HODANJE</b>		
Ne koristi		11
Štap / štaka za dugo hodanje		7
Štap / štaka za većinu vremena		5
Jedna štaka		3
Dvije štake		2
Dvije štake ili ne može hodati		0

<b>UDALJENOST KOJU MOŽE PREHODATI</b>		
Neograničeno		11
30 minuta		8
10-15 minuta		5
Unutar kuće		2
U krevetu ili do stolice		0

<b>ŠEPANJE</b>		
Ne šepa		11
Blago		5
Umjereno		2
Izrazito ili ne može hodati		0

<b>CIPELE I ČARAPE</b>		
Oblači s lakoćom		4
Otežano oblači		2
Ne može obući čarape niti vezati cipele		0

<b>STEPENICE</b>		
Normalno, bez pridržavanja		4
Normalno, sa pridržavanjem		2
Na bilo koji način		1
Ne može hodati po stepenicama		0

<b>JAVNI PRIJEVOZ</b>		
Može koristiti javni prijevoz		1
Ne može koristiti javni prijevoz		0

<b>SJEDENJE</b>		
Može sjediti udobno na običnoj stolici 1 sat		5
Može sjediti na visokoj stolici 30 minuta		3
Ne može sjediti udobno ni na kojoj stolici		0

## 2. Dio

<b>IMA LI PACIJENT SVE OD NAVEDENOG (sva četiri odgovora moraju biti ista)</b>			
DA	Manje od 30° fleksije	4	
	Manje od 10° interne rotacije u ekstenziji		
NE	Manje od 10° adukcije		0
	Odstupanje duljine uda manje od 3,2 cm		

## 3. Dio

<b>OBSEG POKRETA – FLEKSIJA</b>		
Nema je		0
0 > 8		0,40
8 > 16		0,80
16 > 24		1,20
24 > 32		1,60
32 > 40		2,00
40 > 45		2,25
45 > 55		2,55
55 > 65		2,85
65 > 70		3,00
70 > 75		3,15
75 > 80		3,30
80 > 90		3,60
90 > 100		3,75
100 > 110		3,90

<b>OBSEG POKRETA – ABDUKCIJA</b>		
Nema je		0
0 > 5		0,20
5 > 10		0,40
10 > 15		0,60
15 > 20		0,65

<b>OBSEG POKRETA – EKSTERNA ROTACIJA</b>		
Nema je		0
0 > 5		0,1
5 > 10		0,2
10 > 15		0,3

<b>OBSEG POKRETA – ADDUKCIJA</b>		
Nema je		0
0 > 5		0,05
5 > 10		0,10
10 > 15		0,15

UKUPAN BROJ BODOVA: \_\_\_\_\_



## Appendix 2

### Croatian translation of the Activities of Daily Living scale of the Hip Outcome Score

4. Kuk koji se evaluira (molimo zaokružite):  Lijevi kuk  Desni kuk
- Prijeoperacijski pregled  Postoperativna kontrola nakon:  3 mj  6 mj  12 mj  24 mj
5. Molimo odaberite za svako pitanje jedan odgovor koji najbolje opisuje Vaše stanje **u prethodnom tjednu**. Ako je aktivnost za koju se postavlja pitanje ograničena zbog nekog drugog razloga, a ne Vašeg kuka, označite “neprimjenjivo”.

Koliko poteškoća imate zbog kuka pri sljedećem:	bez poteškoća	blage	umjerene	izrazite	neizvedivo	neprimjenjivo
1. Stajanje 15 min						
2. Ulazak ili izlazak iz običnog auta						
3. Oblačenje čarapa ili cipela						
4. Hodanje uzbrdo						
5. Hodanje nizbrdo						
6. Penjanje na 1 kat						
7. Silaženje 1 kat						
8. Hod uz ili niz stepenice						
9. Duboki čučnjevi						
10. Izlazak i ulazak iz kade						
11. Sjedenje 15 min						
12. Na početku hodanja						
13. Nakon 10 min hoda						
14. Nakon 15 min ili više hoda						
15. Okretanje						
16. Okretanje u krevetu						
17. Lakši do umjereni poslovi (stajanje, hodanje)						
18. Zahtjevniji poslovi (guranje, potezanje, penjanje, nošenje)						
19. Rekreacija						

6. Kako biste ocijenili svoju trenutnu razinu sposobnosti pri obavljanju uobičajenih svakodnevnih aktivnosti od 0 do 100 (100 je najviša moguća obzirom na Vaš kuk, 0 je potpuna nemogućnost u obavljanju bilo koje od aktivnosti)?

, 0 %