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Knee injury and osteoarthritis outcome score (KOOS): Validity and reliability of an Indonesian version

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Abstract

Background: One of the health problems that often occurs in old age is musculoskeletal disorder, especially osteoarthritis which is a disorder of the joint cartilage. Knee injury and osteoarthritis outcome score is one of the measuring tools uses to access the function of patient with knee injuries and knee osteoarthritis.
Purpose: To determine the cross-cultural adaption of modifications to the Indonesia version of the knee injury and osteoarthritis outcome score questionnaire by conducting validity and reliability tests.
Method: This research was conducted in September 2023 at RSUI Kustati and RS UNS with a sample size of 55 participant. Sampling was carried out using purposive sampling technique. The KOOS instrument was given 2 times with an interval of 2 weeks.
Results: The test-retest reliability result of the Indonesia version of the KOOS instrument between the two measurement sessions were very good (ICC 0.965, p<0.001, and 95% CI: 0.939-0.979). Internal consistency was confirmed to be very good with the Cronbach's alpha test of 0.974.
Conclusion: Based on the content validity result shown, there are 39 items with corrected correlation item values above 0.3 the conclusion was the Indonesia version of the KOOS instrument declaring reliable, but the content validity of the 2 items needs to be re-examined.

Keywords: Knee Injury and Osteoarthritis Outcome Score; Osteoarthritis; Psychometric Test.

INTRODUCTION

Osteoarthritis (OA) is a chronic musculoskeletal disease that frequently affects the large weight-bearing joints and may eventually lead to the need for total joint replacement. Important known risk factors for knee OA are older age, overweight or obesity, female sex, high physical occupational load and joint injury. Knee injury that occurs in adolescence and young adulthood is an important risk factor for the development of knee OA. However, the majority of studies that investigate knee injury as a risk factor typically include middle-aged or older populations and are based primarily on retrospective analyses (Snoeker, Turkiewicz, Magnusson, Frobell, Yu, Peat, & Englund, 2019).

Osteoarthritis (OA) is a chronic degenerative disease characterized damages the cartilage causing swelling, pain, muscle weakness, joint stiffness and reduced postural balance. The Functional Reach Test (FRT) is one of tests that can be used to measure static balance, unfortunately the reliability of FRT in Indonesia has not published as well including in patient with knee OA (Komalasari, & Amalia, 2023).

The knee injury and osteoarthritis outcome score (KOOS) is a PROM intended for young, middle-aged, and older adults with knee injury and/or knee osteoarthritis (OA), and can be used to monitor disease course and outcomes following surgical, pharmacological and other interventions. The KOOS

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has five subscales: (1) pain (9 items); (2) other symptoms (7 items); (3) activities of daily living (ADL, 17 items); (4) sports and recreation function (sports/recreation, 5 items); and (5) quality of life related to the knee (quality of life, 4 items) (Collins, Prinsen, Christensen, Bartels, Terwee, & Roos, 2016).

To date, interventions for pain and loss of function associated with hip and knee OA have largely focused on end-stage OA, with total joint replacement (TJR) considered the most effective treatment for severe hip and knee OA. However, due to its slow progression over time, research aimed at examining and understanding the natural course of hip and knee OA, which can lead to TJR, is limited. This lack of knowledge makes it difficult to assess the progression of OA severity and test interventions that might alter the course of disease, pain and disability in these individuals (Perruccio, Lohmander, Canizares, Tennant, Hawker, Conaghan, & Davis, 2008).

The interpretation of longitudinal changes in PROs in the years following a knee injury is critical to identifying individuals who may be on a trajectory to post-traumatic OA. This can be achieved using the minimal detectable change (MDC), to judge the change that surpasses the instrument test–retest reliability. These values may help to identify patients whose scores worsen over time and require an early post-traumatic OA intervention. It may also be helpful for clinicians to understand the baseline variables of other physiology (body composition) and performance (knee strength and function) outcomes in those who worsen over time, as this may aid with identification of at-risk individuals and mechanisms to target during intervention (Toomey, Whittaker, Palacios-Derflingher, & Emery, 2021).

In the lower extremities, osteoarthritis most often affects the knee joints. Data from Al-Islam Hospital Bandung in 2014 showed that 487 patients experienced primary knee OA and 82.54% of them were female, and most often occurred in the 56-65 years age group. Meanwhile, data on the Medical Rehabilitation Installation at RSUP Prof. Dr. R.D. Kandou Manado in 2016 showed that OA was in 4th place on the list of most diseases with a total of 348 visits (Soeryadi, Gesal, & Sengkey, 2017).

Knee osteoarthritis usually affects women more than men and has a prevalence of between 10-15% at the age of 35 and 35 years. -45% by age 65. The knee is the joint most commonly involved in OA. It has been shown that muscle strength and functional capacity are reduced in patients dealing with this disease, and the functional consequences of knee OA are associated with limitations in lower extremity mobility. Decreased quadriceps function may occur. causes balance and gait disorders, thereby reducing mobility and function in knee OA patients (Widyasari, 2021).

Tools for diagnosing knee ligament injuries and osteoarthritis, such as the Lysholm Knee Scoring Scale and the West ern Ontario and McMaster Universities Osteoarthritis Index (WOMAC), focus only on the short-term or long-term consequences of knee ligament injuries. Consequently, Roos and Lohmander developed an independent questionnaire as an extension of the WOMAC Knee Injury and the Osteoarthritis Outcome Score (KOOS) to assess both short-term and long-term symptoms and function in patients with knee ligament injuries and osteoarthritis (Phatama, Bimadi, Oktafandi, Cendikiawan, & Mustamsir, 2021).

The challenge of knee osteoarthritis (OA) is greater in Japan due to the high number of patients, likely due to lifestyle factors such as kneeling, as well as anatomical predisposition due to varus deformity. High tibial osteotomy (HTO) is one of the most common surgical procedures used to correct this tendency. Patient-reported outcomes (PROs) are widely established in assessing function, pain, and quality of life after surgical interventions such as arthroplasty or osteotomy. Validated instruments are needed to demonstrate the effects or monitor the outcomes of interventions, enable comparisons between different populations and facilitate clinical decision making. Despite the high burden of knee OA, there is no validated and internationally accepted PRO measure for knee OA except WOMAC which was available in Japanese until a few years ago. To fill this gap, two PROs are most widely used (Goldhahn, Takeuchi, Nakamura, Nakamura, & Sawaguchi, 2017).

Internal consistency reliability was above 0.70 for all KOOS-12 scales and ≥0.90 for the KOOS-12 Summary score. The validity and responsiveness of the KOOS-12 Pain, Function and quality of life scales were satisfactory and reached the same conclusions as comparable full-length KOOS scales.

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The KOOS-12 Summary Score was most responsive in differentiating groups that differed in global ratings of post-TKR change in physical ability and had the highest effect size and standardized response mean. The KOOS-12 is a reliable and valid alternative to KOOS in TKR patients with moderate to severe OA and provides three domain-specific knee impact scores and a summary knee impact score that substantially reduces responder burden (Gandek, Roos, Franklin, & Ware, 2019).

Physiotherapy can provide treatment for cases of osteoarthritis using physiotherapy modalities in the form of Infrared (IR), Transcutaneous Electrical Stimulation (TENS) and Neuro Muscular Taping (NMT). Infrared can increase metabolic processes in the superficial layers of the skin, thereby providing a calming effect that can reduce pain. TENS can also reduce pain because the effect of electrical stimulation which can be applied to nerve fibers will result in dilation of blood vessels and suppression of sympathetic activation thereby increasing blood flow. And NMT can increase the range of motion of joints, increase muscle strength and increase functional activity because the effects obtained are improving blood circulation, relaxing muscles, maintaining muscle strength, increasing muscle strength so that it can increase functional activity (Elvira, Aulia, Fauziyah, Sukaris, & Rahim, 2021).

The purpose of this research is to determine the validity and reliability of the Knee Injury and Osteoarthritis Outcome Score (KOOS) questionnaire in its Indonesian version for osteoarthritis genu conditions.

RESEARCH METHOD

This research was conducted based on research permission from the Research Ethics Committee of RSUD Dr. Moewardi Surakarta with number 1.602/VIII/HREC/2023. This research was conducted at the Rumah Sakit Umum Islam Kustati (RSUI) and UNS Hospital in September 2023 with a population of osteoarthritis genu patients. The research design used an observational research type with a methodological study approach to determine the validity and reliability of the knee injury and osteoarthritis outcome score (KOOS) instrument. The dependent variables in this research are internal consistency, correlation coefficient test-retest reliability, corrected item-total correlation. Meanwhile, the independent variable is osteoarthritis genu. Before data collection was carried out, the KOOS questionnaire received permission from the owner of the questionnaire to be translated and modified.

The sampling technique used in this research was purposive sampling. The sample size was calculated using sample size calculation software using minimum acceptable 0.6, expected reliability 0.8, significance level 0.05, power 80, dopout 10. the sample size in this study was 55 participants. The inclusion and exclusion criteria for the research sample were patients aged >50 years, diagnosed with osteoarthritis genu with grade 2-4, communicated both verbally and in writing, had no visual or hearing problems, and were willing to fill out the questionnaire twice.

The KOOS questionnaire has 5 relevant categories, namely 9 question items about pain, 7 question items about symptoms, 17 question items about daily life function, 5 question items about sports function ability and 4 question items about quality of life. The subject's interpretation ranged in age from 35-75 years (average 56 years) and showed radiological signs of genu osteoarthritis due to joint space narrowing and osteophytes. Each question item has 5 possible answers rated from 0 (no problem) to 4 (extreme problem) with each score calculated as the sum of the included categories. The score will be converted to a scale of 0-100, with zero being an interpretation of extreme knee problems and 100 being an interpretation of no knee problems.

The first stage in the cross cultural adaptation process was to carry out a translation process, starting with a forward translation carried out by two Indonesian physiotherapists who were fluent in English and unfamiliar with knee injury and osteoarthritis outcome scores. The questionnaire assessed whether there was an equivalent in the Indonesian cultural and language context. Furthermore, it was carried out by an independent translator who was fluent in English, had never been familiar with knee injury and osteoarthritis outcome scores and had no medical background. The translation results were synthesized and verified with the original definition of knee injury and osteoarthritis outcome score so that they were appropriate. The final process in this second stage with the results of the forward and backward translation was handed

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over to all translators and two other experienced physiotherapists to review the original and translated versions for somatic, idiomatic, experiential and conceptual equivalence. Discussions were held for each question until a final agreement was reached.

In the second stage, a psychometric test was carried out by giving a knee injury and osteoarthritis outcome score (KOOS) questionnaire to participant who met the inclusion and exclusion criteria to answer each question item according to their condition. Participants completed their own questionnaires adapted to the clinical setting. However, if there are participant who have difficulty reading, the researcher will help to read the question items. A repeat test of filling out the same questionnaire will be carried out within 2 weeks after the first filling in with the same rules.

RESEARCH RESULT

Table 1. Characteristic of Participants (N=55)

Variables	Result
Age (Mean ±SD) (Range)	(61.67±8.8) (43-88)
40-49	3/5.5
50-59	20/36.4
60-69	23/41.7
≥70	9/16.4
Gender (n/%)	
Male	9/16.4
Female	46/83.6
OA Status (n/%)	
Unilateral	26/47.3
Bilateral	29/52.7
Body Weight (n/%)	
50-59	13/23.6
60-69	33/60.0
>70	9/16.4
OA Grade (n/%)	
Grade 2	19/34.5
Grade 3	28/51.0
Grade 4	8/14.5

Table 1 shows that the age of the participants with a mean and standard deviation (61.67±8.8) and a range between 44-88 years. The majority of participants were female, namely (83.6) while male (16.4). The participant with the highest OA status was bilateral, namely (52.7) while the OA status was unilateral (47.3). Based on body weight, the majority of participants weigh 60-69 kg, namely (60.0), while participants with a body weight of 50-59 kg are only (23.6) and participants with a body weight of >70 kg (16.4). Grade OA 3 has the highest percentage, namely (51.0), for grade 2 (34.5) and grade 4 (14.5).

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Table 2. Validity and Reliability

Question	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Question 1	0.038	0.976
Question 2	0.120	0.976
Question 3	0.576	0.974
Question 4	0.530	0.974
Question 5	0.631	0.974
Question 6	0.458	0.974
Question 7	0.484	0.975
Question 8	0.438	0.974
Question 9	0.795	0.973
Question 10	0.767	0.973
Question 11	0.835	0.973
Question 12	0.750	0.973
Question 13	0.694	0.974
Question 14	0.825	0.973
Question 15	0.677	0.974
Question 16	0.751	0.973
Question 17	0.753	0.973
Question 18	0.814	0.973
Question 19	0.760	0.973
Question 20	0.813	0.973
Question 21	0.738	0.973
Question 22	0.806	0.973
Question 23	0.863	0.973
Question 24	0.764	0.973
Question 25	0.845	0.973
Question 26	0.745	0.973
Question 27	0.841	0.973
Question 28	0.797	0.973
Question 29	0.818	0.973
Question 30	0.815	0.973
Question 31	0.808	0.973
Question 32	0.811	0.973
Question 33	0.857	0.973
Question 34	0.773	0.973
Question 35	0.795	0.973
Question 36	0.857	0.973
Question 37	0.777	0.973
Question 38	0.813	0.973
Question 39	0.746	0.974
Question 40	0.214	0.975
Question 41	0.409	0.974
Question 42	0.401	0.975

Table 2 shows that the reliability of each question item is considered good or very reliable. Correlation coefficient based on product moment (r= 0.939). In the corrected item total correlation value for items and the total score which has been confirmed with a value above 0.3 (range: 0.038-0.863) there are 39 question items and 3 question items with values below 0.3, namely items 1.2 and 40.

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Table 3. KOOS Reliability Test

Variables	Cronbach's alpha	Information
Reliability KOOS	0.974	Excellent
reliability retest Test	0.965	Excellent

Table 3 shows that the KOOS instrument is declared reliable with a Cronbach's alpha value of 0.974. After two repetitions of the test-retest reliability test, the results were obtained (ICC 0.965; $p < 0.001$; and 95% CI: 0.939-0.979), where the test-retest results were very good (excellent). Furthermore, the KOOS instrument does not have a floor and ceiling effect with a minimum score of 21 and a maximum of 58 with a percentage of 1.8% of the total participants.

Table 4. Standard Error of Measurement Statistics

Variables	Statistical value
SEM	9.731
MDC95	19.266

Table 4 shows the results of the standard error measurement (SEM) on the KOOS questionnaire instrument is (9,731) and the MDC95 results are (19,266).

Table 5. Anti-image Matrices & Communalities

Question	Anti Image Matrices	Communalities
Are your knee swollen?		0.792
Do you experience any grinding, clicking, or any sound when your knee moves?		0.537
Does your knee feel lifted or hanging when in motion?		0.821
Can you fully straighten your knee?		0.822
Can you fully bend your knee?	0.836	0.769
How stiff are your knees when you first wake up in the morning?	0.644	0.665
How stiff are your knees after sitting, lying down, or resting later in the day?	0.764	0.809
How often do you feel pain in your knees?	0.572	0.595
Twisting/rotating your knees?	0.750	0.690
Fully straightening your knees?	0.636	0.821
Fully bending your knees?	0.828	0.847
Walking on a flat surface	0.590	0.790
Going up and down stairs	0.660	0.693
Nighttime while in bed	0.767	0.827
Sitting or lying down	0.751	0.858
Standing upright	0.793	0.873
Going downstairs	0.726	0.782
Going upstairs	0.734	0.775
Rising from a sitting position	0.632	0.813
Standing	0.880	0.854

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Question	Anti Image Matrices	Communalities
Bending down to the floor/picking up something	0.778	0.788
Walking on a flat surface	0.740	0.839
Getting in/out of a car	0.805	0.865
Going shopping	0.805	0.786
Wearing socks/stockings	0.940	0.905
Getting out of bed	0.693	0.848
Taking off socks/stockings	0.853	0.924
Lying down in bed (turning over, maintaining knee position)	0.656	0.918
Getting in/out of the bathroom	0.801	0.888
Sitting	0.662	0.787
Using the toilet	0.800	0.928
Heavy household chores (moving heavy boxes, scrubbing the floor, etc.)	0.903	0.839
Light household chores (cooking, dusting, etc.)	0.667	0.830
Squatting	0.721	0.795
Running	0.784	0.933
Jumping	0.845	0.951
Twisting/rotating using your affected knee	0.904	0.909
Kneeling	0.763	0.850
How often do you notice your knees?	0.870	0.801
Have you changed your lifestyle to avoid activities that could worsen your knees?		0.744
How much does your lack of confidence due to your knees bother you?	0.645	0.671
In general, how much difficulty do you experience because of your knees?"	0.591	0.758

Factor analysis requires criteria that meet the requirements of exploratory factor analysis sufficiency. Barlett's test yielded significant criteria (X2=3120.882, p<0.001), and the Kaiser-Meyer-Olkin (KMO) sample adequacy value was acceptable (0.733). Anti-image matrices and communalities from 42 question items revealed that 38 items exceeded 0.50, indicating that 4 question items did not meet the sample sufficiency criteria in the KOOS questionnaire. All items had communalities above 0.40, signifying their adequate correlation with factors being measured.

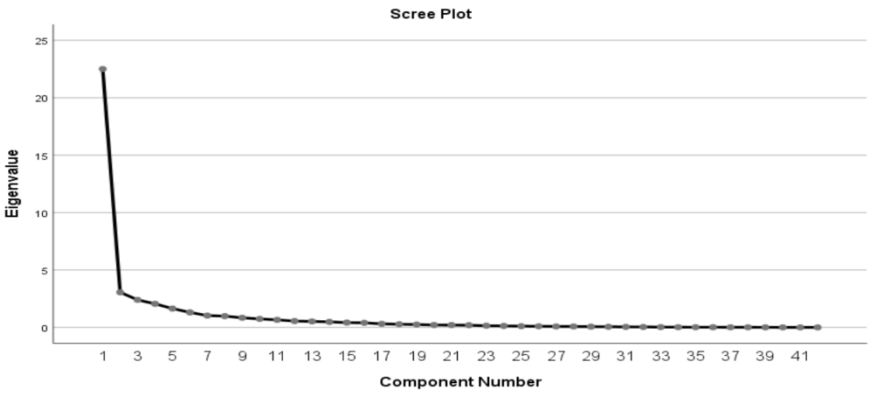

Figure 1. Scree Plot

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Table 6. Principal Component Analysis with Varimax Rotation

	Component						
	1	2	3	4	5	6	7
Are your knees swollen?					0.839		
Do you feel any grinding, clicking, or any sound when your knees move?					0.473		
Do your knees feel lifted or hanging when in motion?				0.729			
Can you fully straighten your knees?				0.805			
Can you fully bend your knees?				0.626			
How stiff are your knees when you first wake up in the morning?				0.720			
How stiff are your knees after sitting, lying down, or resting later in the day?				0.833			
How often do you feel pain in your knees?							
Do you rotate your knees?	0.521	0.406					
Can you fully straighten your knees?		0.492					0.487
Can you fully bend your knees?	0.472		0.621				
Walking on a flat surface			0.649				
Going up and down stairs	0.471		0.475				
Nighttime while in bed			0.576				
Sitting or lying down			0.744				
Standing upright			0.758				
Going downstairs		0.741					
Going upstairs	0.658						
Rising from a sitting position			0.611				
Standing	0.455		0.648				
Bending down to the floor / picking up something		0.490	0.558				
Walking on a flat surface	0.489		0.666				
Getting in / out of a car		0.664	0.415				
Going shopping	0.728						
Wearing socks / stockings	0.419	0.798					
Getting out of bed		0.704					
Taking off socks / stockings	0.425	0.812					
Lying down in bed (turning over, maintaining knee position)		0.854					
Going in / out of the bathroom	0.442	0.778					
Sitting		0.641	0.450				
Using the toilet	0.423	0.828					
Heavy household chores (moving heavy boxes, scrubbing floors, etc.)	0.724	0.442					
Light household chores (cooking, dusting, etc.)	0.582	0.532	0.431				
Squatting	0.707	0.457					
Running	0.875						
Jumping	0.842						
Twisting / rotating using your affected knees	0.867						
Kneeling	0.780	0.406					

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	Component						
	1	2	3	4	5	6	7
How often do you notice your knees?	0.795						
Have you changed your lifestyle to avoid activities that could potentially worsen your knees?						0.837	
How much does your lack of confidence due to your knees bother you?						0.601	
Overall, how much difficulty do you experience because of your knees?	0.485				0.605		

The scree plot on the Knee Injury and Osteoarthritis Outcome Score items indicate a 7-component matrix (Figure 1). The absolute values of factor loadings with several item correlation coefficients are above the threshold of 0.40 (Table 6). Factor component 1, consisting of pain, comprises 16 items with a maximum variance of 20.7% and an eigenvalue of 8.7. Factor 3, specific OA symptoms, consists of 13 items with a maximum variance of 14.9% and an eigenvalue of 6.2. Factor 4, functionality, consists of 5 items with a maximum variance of 10.5% and an eigenvalue of 4.4. Factor 5, quality of life, consists of 3 items with a maximum variance of 5.2% and an eigenvalue of 2.2. Factor 6, activity level, consists of 2 items with a maximum variance of 4.2% and an eigenvalue of 1.8. Factor 7, satisfaction, comprises 1 item with a maximum variance of 2.8% and an eigenvalue of 1.2.

DISCUSSION

Osteoarthritis is a serious public health problem with symptomatic disease occurring frequently in 9% of Osteoarthritis is a serious public health problem with symptomatic disease occurring frequently in 9% of men and 11% of women. Osteoarthritis is one of the main causes of pain and disability in patients' bones and is the most common type of inflammation of the hip joint. The incidence of osteoarthritis increases with age and indirectly increases the demand for Hip Arthroplasty because when conservative treatment fails to reduce the pain and hip dysfunction caused by osteoarthritis, Total Hip Arthroplasty (THA) or hip joint replacement surgery is one of the surgical treatments that can be used. relieves significant pain and can improve physical function (Basri, 2020).

Osteoarthritis is also called degenerative joint disease, which is a disorder of the cartilage (joint cartilage) characterized by clinical, histological, and radiological changes. Functional activity ability is the ability of the patient to carry out daily activities, limited activity in patients due to pain (Kurniawan, Widodo, Fis, Rahayu, & Fis, 2015).

Complaints of pain in the bones are a common thing found in older people aged over 40 years. However, this incident does not rule out the possibility that it could happen to someone younger. Complaints of pain in the bones are also often interpreted incorrectly by the public, and the most common conclusion is gout. In fact, joint pain can occur as a result of various other diseases, one of which is osteoarthritis (Ministry of Health of The Republic of Indonesia, 2021).

The manifestation of osteoarthritis symptoms reduces the individual's desire to perform physical activity in the form of regular exercise. But on the other hand, physical inactivity threatens to reduce general fitness, one of which is cardiorespiratory fitness which is the most important component in a person's physical fitness for optimizing daily activities for a long period of time without experiencing significant fatigue (Rahman, Widyaningrum, Kasumbung, Puspitaningrum, & Budi, 2021).

Clinical symptoms of OA consist of pain, morning stiffness, tenderness in the joints, swelling, crepitus, restriction, joint displacement and bone enlargement. These clinical symptoms have an effect on quality of life, function and psychological parameters. OA management consists of pharmacological therapy and non-pharmacological therapy. Non-pharmacological interventions are an inseparable part of OA therapy planning. One non-pharmacological therapy is physical exercise. Physical exercise can build muscle strength and

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endurance, increase flexibility and joint movement, increase aerobic activity, and increase joint mobility in OA (Putri, Hassan, & Rachmawati, 2022).

Osteoarthritis is a common disease that has become one of the main causes of disability and is ranked fourth as a contributing factor of disability. In Indonesia, many healthcare professionals, including physiotherapists, treat patients with various stages of osteoarthritis. Physiotherapists have a crucial role in improving the functional ability of patients with knee osteoarthritis. However, many of them do not use appropriate outcome measures to document patient improvements (Thanaya, Agatha, & Sundari, 2021).

Cross-cultural adaptation represents only slight cultural differences and is well received by patients. For construct validity, high to moderate Spearman Correlation Coefficients were found between the KOOS subscales and the WOMAC, SF-36, and Pain-NRS subscales. Cronbach's alpha ranged from 0.79 to 0.96 for all subscales indicating acceptable internal consistency. Test-retest reliability was good to excellent, with Intraclass Correlation Coefficients ranging from 0.73 to 0.86 for all KOOS subscales. Minimum detectable changes ranged from 17 to 34 at the individual level and 2 to 4 at the group level. No floor or ceiling effects were observed. This research produced a translated and culturally adapted Finnish version of the KOOS and demonstrated good validity and reliability (Multanen, Honkanen, Häkkinen, & Kiviranta, 2018).

In support of convergent and discriminant validity, KOOS scale scores were worse for patients using an assistive device but only declined weakly with increasing comorbid conditions. While all knee-specific scales discriminated between BSW groups, the KOOS quality of life (QOL) scale was significantly better ($P < 0.05$) than all measures except the SF-36 physical component summary. KOOS QOL also had the highest effect size, while SF-36 measures had lower effect sizes and standardized response means. KOOS pain and symptoms scales discriminated better than WOMAC pain and stiffness scales among BSW groups. KOOS scales were valid and responsive in this cohort of US TKR patients. KOOS QOL performed particularly well in capturing aggregate knee-specific outcomes (Gandek, & Ware, 2017).

One commonly used score is the Knee Injury and Osteoarthritis Outcome Score (KOOS). KOOS is a standardized and validated instrument developed to evaluate the knee and related knee problems. Although the influence of obesity on osteoarthritis is well known, little is known about the influence of obesity on KOOS in the absence of osteoarthritis. To determine the effect of obesity, KOOS scores are needed from obese patients without a history of osteoarthritis (Larsen, Engberg, Motahar, Ostgaard, Lementowski, Zelicof, & Jiranek, 2019).

Two-year HOOS/KOOS pain and ADL function correlated with health-related quality of life (KOOS pain and Physical Component Scale 12 Short Form $\rho = 0.54$; function $\rho = 0.63$). Comparing quality of life by quartiles of pain and function, the highest levels of pain relief and function were associated with the greatest improvement in quality of life. MCID for pain was estimated to be ≥20, and RID ≥29; MCID for function ≥14, and RID ≥23. The measures were responsive to change with large effect sizes (≥1.8). We confirmed that the HOOS/KOOS pain and ADL function subscales are valid measures of critical patient-centered domains after THR/TKR, and achievable thresholds for improving quality of life. Its free availability and brevity make it feasible for use in the core set of measurements in total joint replacement trials (Goodman, Mehta, Mandl, Szymonifka, Finik, Figgie, & Singh, 2020).

A total of 874 (41%) patients were included (male, 51.5%; median age at the time of ACL reconstruction, 27.5 years [range, 11.2-61.5 years]). An increase in the severity of concomitant articular cartilage injuries resulted in a reduced KOOS on 4 subscales (odds ratio, 0.64-0.80; $P < .05$). A higher preoperative KOOS pain score increased the odds of a higher score on the pain, symptoms, and sport subscales and the $KOOS_4$. In addition, a higher preoperative body mass index was a significant risk factor for lower scores on 3 KOOS subscales and the $KOOS_4$. No patient- or surgery-related predictor was significant across all KOOS subscales (Hamrin Senorski, Svantesson, Spindler, Alentorn-Geli, Sundemo, Westin, & Samuelsson, 2018).

The evaluation results using the KOOS score showed that the average value of the pain component was 77.7; complaint component = 70.3; daily activity component = 76.2; sports and recreation component = 47.9; and quality of life component = 74.1. In the KSS score, the average knee score was 70.8 and the average functional

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score was 61.6. Meanwhile, for the HSS score, the average functional score was 81.5. This research produces each score with a good average value. This shows that the choice of High Tibial Osteotomy surgical technique provides satisfactory surgical results. The High Tibial Osteotomy surgical technique can be an option in cases of Osteoarthritis. With so many types of surgery to choose from for Osteoarthritis sufferers, High Tibial Osteotomy can be a good choice for patient satisfaction (Limbong, & Utomo, 2020).

CONCLUSION

The efforts of this research resulted in the Indonesian version of the Knee Injury and Osteoarthritis Outcome Score instrument, declared reliable or consistent. However, in terms of content validity with corrected-total item correlation, there were 3 question items that were deemed invalid, thus necessitating further research on knee injury or osteoarthritis patients.

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