

The 2012 User's Guide to: **Knee injury and Osteoarthritis Outcome Score** **KOOS**

This guide is intended to serve as an introduction for clinicians and researchers wishing to use the KOOS. For more detailed information, please refer to the FAQ section at www.koos.nu or to the scientific papers referred to in the different sections in that website. KOOS scoring instructions are available in a separate document from the website www.koos.nu.

The KOOS questionnaire was developed in the 1990s as an instrument to assess the patient's opinion about their knee and associated problems. Since the first publication in 1998, the psychometric properties of the KOOS have been assessed in more than twenty individual studies from all over the world. Furthermore, KOOS has been evaluated and compared to other instruments in several reviews [1-8].

KOOS is widely used for research purposes in clinical trials, large-scale databases and registries. KOOS is also extensively used for clinical purposes. In the clinic, KOOS is used to monitor groups and individuals over time. Due to its comprehensiveness, when the questionnaire is completed prior to a consultation, it can be used to guide the consultation as to the symptoms and difficulties experienced by the patient.

KOOS is intended to be used for knee injury that can subsequently result in post-traumatic osteoarthritis (OA); i.e. ACL (anterior cruciate ligament) injury, meniscus injury, chondral injury, etc.

KOOS is also used in knee OA. An advantage of the KOOS is the inclusion of two different subscales of physical function relating to daily life, and sport and recreation. This enhances the instrument's validity for patients with a wide range of current and expected physical activity levels.

KOOS is intended to be used over short- and long-term time intervals; to assess changes from week to week induced by treatment (medication, operation, physical therapy) or over years following a primary injury or OA.

KOOS can be used in research to assess groups and to monitor individuals.

KOOS' content validity was based upon a literature search, a pilot study and an expert panel (from US and Sweden) consisting of patients, orthopedic surgeons and physical therapists.

KOOS consists of 5 subscales; **Pain**, other **Symptoms**, **Activites of Daily Living (ADL)**, **Sport and Recreation Function (Sport/Rec)** and **knee-related Quality of Life (QOL)**. The previous week is the time period considered when answering the questions. Standardized answer options are given (5 Likert boxes) and each question is assigned a score from 0 to 4. A normalized score (100 indicating no symptoms and 0 indicating extreme symptoms) is calculated *for each subscale* (KOOS scoring

instructions are available in a separate document from www.koos.nu). A total score has not been validated and is not recommended. For the purpose of an RCT, KOOS subscale scores can be aggregated and averaged as the primary outcome. The five individual KOOS subscale scores are then given as secondary outcomes to enable clinical interpretation. Please see FAQ for further information on this procedure. The results of the 5 subscales can be plotted as an outcome profile (order of subscales from left to right: Pain, Symptoms, ADL, Sport/Rec and QOL), preferably in a graph with scores from 0-100 on the y-axis and the five subscales on the x-axis (an example is presented later in this User's Guide, under the heading of KOOS Profile).

KOOS is patient-administered, the format is user-friendly, and takes about 10 minutes to complete.

KOOS is self-explanatory and can be administered in the waiting room or used as a postal or electronic survey. Paper-based and computerized versions are comparable with regard to psychometrics [9].

The KOOS is free to use for non-funded and funded academic users. A permission is however always required. Corresponding fees will be required, which is dependent on the type of user ranging from non-for-profit healthcare organizations, for-profit healthcare organizations and commercial users. Submit your request through Mapi Research Trust's [ePROVIDE™ platform](#).

KOOS has been used in patients 13-79 years of age. The KOOS child version for children aged 9-12 years is also available [here](#).

KOOS **reference values** are available from several groups including a population-based sample [10], a group of active soccer players [11], a group of healthy female soccer players [12], male and female patients following ACL reconstruction [13], and from another population-based group of 50 participants (mean 53 years, 37-79) who had no previous and no current clinical signs of injury to the ACL or menisci and no radiographic signs of OA [14].

KOOS has high **test-retest reliability**. In patients with knee injury, ICCs for the Pain subscale range from 0.85-0.93, the Symptoms subscale from 0.83-0.95, the ADL subscale from 0.75-0.91, the Sport/Rec subscale from 0.61-0.89 and the QOL subscale from 0.83-0.95. In patients with knee OA, ICCs for the Pain subscale range from 0.8-0.97, the Symptoms subscale from 0.74-0.94, the ADL subscale from 0.84-0.94, the Sport/Rec subscale from 0.65-0.92 and the QOL subscale from 0.6-0.91 [3].

The **Minimal Detectable Changes** in patients with knee injury were for Pain 6-6.1, for Symptoms 5-8.5, for ADL 7-8, for Sport/Rec 5.8-12, and for QOL 7-7.2. The Minimal Detectable Changes in patients with knee OA were for Pain 13.4, for Symptoms 15.5, for ADL 15.4, for Sport/Rec 19.6, and for QOL 21.1 [3].

The **Minimal Important Change (MIC)** is currently suggested to be 8-10. However, the current understanding is that MIC is dependent on factors such as patient group, intervention and time to follow-up. Thus most likely there is no such thing as one MIC value for an instrument. Research is ongoing; please refer to FAQ on the website for more complete information.

KOOS includes **WOMAC Osteoarthritis Index LK 3.0** [15] in its complete and original format (with permission), and WOMAC scores can be calculated (how to

calculate WOMAC scores is presented in the document "KOOS scoring", available from www.koos.nu). WOMAC is valid for elderly subjects with knee OA.

KOOS subscales 'Sport and Recreation function' and 'Quality of Life' were more sensitive and discriminative than the WOMAC subscales 'Pain', 'Stiffness', and 'Function' when studied in subjects meniscectomized 21 years prior and with definite radiographic signs of OA (mean 57 years, range 38-76) compared to age- and gender-matched controls [16].

KOOS' **convergent and divergent construct validity** has been determined in multiple studies in comparison to several instruments including the different subscales of SF-36 and the Lysholm knee scoring scale [3].

KOOS is **responsive to change** following non-surgical and surgical interventions. KOOS' responsiveness has been reported following surgical procedures including ACL reconstruction, meniscectomy, cartilage repair procedures, tibial osteotomy, total knee replacement, physical therapy, as well as nutritional and pharmaceutical interventions. Following orthopedic surgery, including total knee replacement, QOL is usually the most responsive subscale [8].

The English and Swedish versions were developed concurrently. For a full list of available language versions please visit: <https://eprovide.mapi-trust.org/instruments/knee-injury-and-osteoarthritis-outcome-score>

Questions?

For information on, or permission to use the instruments, please contact Mapi Research Trust via the [ePROVIDE™ platform](https://eprovide.mapi-trust.org)

KOOS Profile

To visualize differences in the five different KOOS subscores and change between different administrations of the KOOS (e.g. pre-treatment to post-treatment), KOOS Profiles can be plotted. The example from Nilsson et al. [17] shows KOOS profiles prior to and at three time points following total knee replacement (TKR).

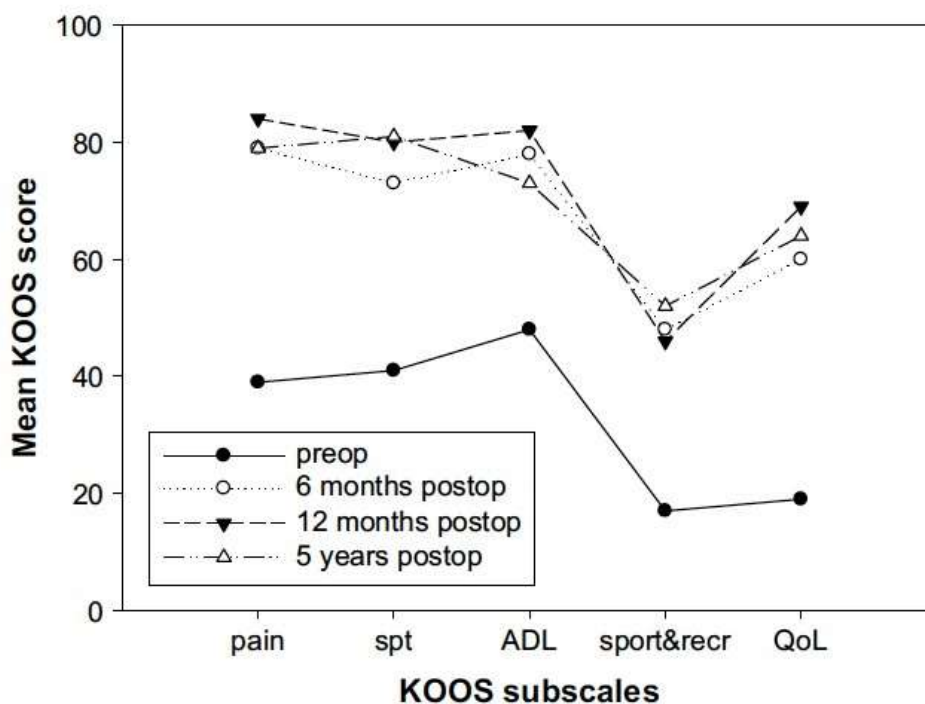


Fig. 1. KOOS profiles prior to and up to 5 years after TKR. Mean KOOS scores ($n=80$) at the preoperative, 6 months, 12 months and 5 year assessments after TKR.

REFERENCES

1. Roos EM, Lohmander LS. Knee injury and Osteoarthritis Outcome Score (KOOS): from joint injury to osteoarthritis. *Health Qual Life Outcomes* 2003;1:64.
2. Rodriguez-Merchan EC. Knee instruments and rating scales designed to measure outcomes. *Journal of orthopaedics and traumatology : official journal of the Italian Society of Orthopaedics and Traumatology* 2012;13:1-6.
3. Collins NJ, Misra D, Felson DT, Crossley KM, Roos EM. Measures of knee function: International Knee Documentation Committee (IKDC) Subjective Knee Evaluation Form, Knee Injury and Osteoarthritis Outcome Score (KOOS), Knee Injury and Osteoarthritis Outcome Score Physical Function Short Form (KOOS-PS), Knee Outcome Survey Activities of Daily Living Scale (KOS-ADL), Lysholm Knee Scoring Scale, Oxford Knee Score (OKS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Activity Rating Scale (ARS), and Tegner Activity Score (TAS). *Arthritis care & research* 2011;63 Suppl 11:S208-28.

4. Alviar MJ, Olver J, Brand C, Hale T, Khan F. Do patient-reported outcome measures used in assessing outcomes in rehabilitation after hip and knee arthroplasty capture issues relevant to patients? Results of a systematic review and ICF linking process. *Journal of rehabilitation medicine : official journal of the UEMS European Board of Physical and Rehabilitation Medicine* 2011;43:374-81.
5. Wright RW. Knee injury outcomes measures. *The Journal of the American Academy of Orthopaedic Surgeons* 2009;17:31-9.
6. Garratt AM, Brealey S, Gillespie WJ. Patient-assessed health instruments for the knee: a structured review. *Rheumatology (Oxford)* 2004;43:1414-23.
7. Roos E, Engelhart L, Ranstam J, Anderson A, Irrgang J, Marx R, et al. ICRS Recommendation Document: Patient-reported outcome instruments for use in patients with articular cartilage defects. *Cartilage* 2011;2:122-36.
8. Collins NJ, Roos EM. Patient-reported outcomes for total hip and knee arthroplasty: commonly used instruments and attributes of a "good" measure. *Clinics in geriatric medicine* 2012;28:367-94.
9. Gudbergson H, Bartels EM, Krusager P, Waehrens EE, Christensen R, Danneskiold-Samsoe B, et al. Test-retest of computerized health status questionnaires frequently used in the monitoring of knee osteoarthritis: a randomized crossover trial. *BMC Musculoskeletal Disorders* 2011;12:190.
10. Paradowski PT, Bergman S, Sunden-Lundius A, Lohmander LS, Roos EM. Knee complaints vary with age and gender in the adult population. Population-based reference data for the Knee injury and Osteoarthritis Outcome Score (KOOS). *BMC Musculoskeletal Disord* 2006;7:38.
11. Frobell RB, Svensson E, Gothrick M, Roos EM. Self-reported activity level and knee function in amateur football players: the influence of age, gender, history of knee injury and level of competition. *Knee Surg Sports Traumatol Arthrosc* 2008;16:713-9.
12. Ostenberg A, Roos E, Ekdahl C, Roos H. Physical capacity in female soccer players - does age make a difference? *Advances in Physiotherapy* 2000;2:39-48.
13. Ageberg E, Forssblad M, Herbertsson P, Roos EM. Sex differences in patient-reported outcomes after anterior cruciate ligament reconstruction: data from the Swedish knee ligament register. *Am J Sports Med* 2010;38:1334-42.
14. Roos EM, Klassbo M, Lohmander LS. WOMAC osteoarthritis index. Reliability, validity, and responsiveness in patients with arthroscopically assessed osteoarthritis. Western Ontario and MacMaster Universities. *Scand J Rheumatol* 1999;28:210-5.
15. Bellamy N, Buchanan WW, Goldsmith CH, Campbell J, Stitt LW. Validation study of WOMAC: a health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. *J Rheumatol* 1988;15:1833-40.
16. Roos EM, Roos HP, Lohmander LS. WOMAC Osteoarthritis Index--additional dimensions for use in subjects with post-traumatic osteoarthritis of the knee. Western Ontario and MacMaster Universities. *Osteoarthritis Cartilage* 1999;7:216-21.
17. Nilsson AK, Toksvig-Larsen S, Roos EM. A 5 year prospective study of patient-relevant outcomes after total knee replacement. *Osteoarthritis Cartilage* 2009;17:601-6.