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REVIEW ARTICLE

Patient-reported outcome measures in rehabilitation after knee surgery: a rapid systematic review

José Moreira[1,2] · Susana Miguel[3] · Bruno Delgado[4] · Paulo Boto[2,5]

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Abstract

Aim Musculoskeletal conditions impact our society owing to the associated burden, with significant implications for health systems and people's quality of life. Patient-reported outcome measures (PROMs) are used to optimize the results of rehabilitation programs. The study aims to identify the PROMs used in rehabilitation programs after knee surgery.

Subject and methods This rapid systematic review was conducted using MEDLINE® and CINAHL® databases, considering all studies carried out until December 2023, with a registered protocol (PROSPERO reference: CRD42024504263). Studies were included with adult participants undergoing knee surgery and using PROMs to measure outcomes before and after rehabilitation programs.

Results Sixteen studies with 3469 participants in rehabilitation programs after knee surgery were included. Methodologically and according to the criteria recommended by the Joanna Briggs Institute, more than half of the studies were of high quality, with values of more than 80%, including randomized controlled trials, cohorts, and quasi-experimental designs. Outcomes were assessed before and after rehabilitation programs, using general ($n=6$) and knee-specific ($n=11$) PROMs. Of all the PROMs identified in the different studies selected for this systematic review, the ones used the most were KOOS (in 14 studies), EQ5D-5L, and WOMAC (in 3 studies).

Conclusion This rapid systematic review shows the need to identify and implement PROMs during rehabilitation programs after knee surgery, measuring participants' health status, symptoms, treatment satisfaction, and physical and mental performance. In this way, it is possible to make value-based comparisons with other interventions, improving and tailoring rehabilitation care.

Keywords Patient-reported outcome measures · Patient-centered outcomes research · Systematic review · Knee surgery

Introduction

Musculoskeletal diseases are a public health problem, and in recent years, they have taken a significant economic toll on health systems (Nguyen et al. 2024). They are one of the consequences of an aging population. They are considered the leading cause of disability in four of the six regions of the world, thus having a real impact on our society, not only because of the burden associated with them but also because of the costs they entail (Vos et al. 2020). One of the main musculoskeletal conditions is related to the knee joint, which is considered complex and vulnerable owing to its susceptibility to various types of injuries, particularly those originating in the ligaments, meniscus, and cartilage (Barbosa de Almeida and Esteves 2023). In most situations, knee injury is associated with physical disability, stiffness, pain, restriction of movement, and impairment

✉ José Moreira
jose.moreira@uevora.pt

1 University of Évora, Évora, Portugal

2 NOVA National School of Public Health, Public Health Research Centre, Comprehensive Health Research Center, CHRC, REAL, CCAL, NOVA University Lisbon, Lisbon, Portugal

3 Centre for Interdisciplinary Research in Health, Catholic University of Portugal, Lisbon, Portugal

4 Institute of Health Sciences, Catholic University of Portugal, Porto, Portugal

5 National School of Public Health, NOVA University Lisbon, Lisbon, Portugal

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of the person's quality of life (Barbosa de Almeida et al. 2023; Truong et al. 2020). The implications for quality of life are significant, showing the influence of psychosocial and contextual factors on the process of recovering to carry out activities similar to before the traumatic event (Truong et al. 2020). After a knee injury, a few treatment options have been proposed, including surgery and rehabilitation programs. These forms of treatment are fundamental in the recovery process, improving the quality of life of people with musculoskeletal conditions by optimizing proprioception, strength, and muscle function, which are compromised immediately after surgery because of the reflex inhibition of motor neurons and immobilization (Khan et al. 2014). To tailor and individualize these rehabilitation programs to a given context, we evaluated the results obtained directly from those who have experienced this process. This evaluation uses patient-reported outcome measures (PROMs), which comprise tests applied since the 1960s (Churruca et al. 2021). These aim to obtain a standardized response, the coding of which leads to the knowledge (and quantification) of opinions, feelings, experiences, abilities, and perceptions (Deshpande et al. 2011). The evolution of PROMs has been significant in recent years, with the creation of dozens of scales that assess health status, functional status, symptoms and measures of symptom burden, experience with care, health behaviors, treatment satisfaction, economic impact, and specific dimensions of the patient experience such as physical performance, mental performance, anxiety, and depression (Deshpande et al. 2011). Despite the proliferation of PROMs and their development, which has led to better decisions in various areas of health, challenges remain when it comes to selecting these instruments for what you want to measure (Churruca et al. 2021). Therefore, in the research context, it is essential to look for the most objective measures so that the results can be comparable to make appropriate and objective clinical decisions. Given this need for knowledge regarding the selection of the different PROMs used in rehabilitation programs after knee surgery, we set out to identify the PROMs used in an outpatient rehabilitation program after knee surgery.

Methods

The methods for this study were established in the review protocol previously registered on the PROSPERO platform (CRD42024504263). This rapid systematic review was proposed in response to the need to update and produce scientific evidence on PROMs (Hamel et al. 2021) to answer the research question: what are the PROMs associated with rehabilitation programs after knee surgery in an outpatient setting? It was conducted according to the Rapid Review Guide of the World Health Organization (WHO) (Tricco et al. 2017) and followed the reporting guidelines of Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) (Page et al. 2021). The PCC strategy was used (Aromataris and Munn 2020): participants (patients who participated in a rehabilitation program after knee surgery), concept (PROMs used in rehabilitation programs), and context (outpatient rehabilitation intervention). On the basis of this search strategy, we present the eligible criteria for this review.

Eligibility criteria

Inclusion criteria – Studies were considered eligible if: 1. Participants were in rehabilitation programs after knee surgery; 2. Adult participants (> 18 years); 3. English-language publications; 4. Rehabilitation programs in which PROMs were applied. Exclusion criteria: 1. Studies with inpatient programs; 2. Previous surgeries on the ipsilateral knee; 3. Unconsolidated fractures; 4. Partial or total amputation of the lower limbs. Publications in book chapters, theses, literature reviews, editorials, or conference abstracts without a full paper were also excluded.

Search strategy

Terms indexed in MEDLINE® and CINAHL® were used, as shown in Table 1, with the respective Boolean operators, considering all the studies carried out until December 2023. When undertaking a rapid review, it is recommended to search a limited number of databases (Garritty et al. 2021).

Study selection

The selection of studies included randomized, prospective, and retrospective studies, both controlled and uncontrolled. All studies that used PROMs to evaluate participants in outpatient rehabilitation programs after knee surgery were considered. The results were uploaded and analyzed on the Rayyan® platform, duplicate studies were removed, and two reviewers blindly applied the eligibility criteria (JM & SM). The relevance of the studies to be included in the review was considered by analyzing the titles and abstracts. Then the full text of the articles was independently assessed and screened by the reviewers (JM & SM). Discrepancies during the screening process were discussed and resolved by a third independent reviewer.

Methodological quality assessment

The quality assessment of each of the included studies was based on the recommendations of the Joanna Briggs Institute, and the classification was summarized in a narrative and tabular format. Considering the recommendations, the

Table 1 Search strategy

CINAHL®	Knee injur*[a] *OR* Knee surgery[b] *OR* Knee joint[a]	*AND*	Patient-reported outcome measures [a] *OR* PROM[b] *OR* Patient -reported outcome[a] *OR* Patient outcome assessment[a]	*AND*	Program*[b] *OR* Intervent*[b] *OR* Rehab*[a] *OR* Treatment[b] *OR* Exercise therapy[a]
MEDLINE®	Knee injur*[a] *OR* Knee surgery[b] *OR* Knee joint[a]	*AND*	Patient-reported outcome measures [a] *OR* PROM[b] *OR* Patient-reported outcome[a] *OR* Outcome measures[a] *OR* Patient-centered outcomes research[b]	*AND*	Program*[b] *OR* Intervent*[b] *OR* Rehab*[a] *OR* Exercise therapy[a]

[a], exact subject heading; *[b]*, abstract

sum of the points was classified from 70% of the items present. Thus, a score between 70 and 79% of the checklist criteria was classified as medium quality, between 80 and 90% was assigned high quality, and a score greater than 90% of the criteria was classified as excellent quality (Barker et al. 2023; Munn et al. 2023).

Data extraction and analysis

A reviewer (JM) used an instrument aligned with the review's objective to extract data from the included studies. The data was summarized in tabular and narrative form using the Excel® platform, mapping the main results: country, participants, average age, type of surgery, methodology and study design, PROMs used and the times when they were applied, details of the rehabilitation programs and interventions. The different PROMs were grouped into two levels, general and specific to knee pathology, with evidence of the year in which they were constructed, number of items, and time taken to complete them. A second reviewer validated all the data extracted by the tool (SM).

Results

Sixteen studies met the inclusion criteria, reporting on PROMs applied to participants undergoing only knee surgery before and after rehabilitation programs in an outpatient setting (Arhos et al. 2020; Barker et al. 2021; Beynnon et al. 2011; Bigouette et al. 2019; Bruun-Olsen et al. 2013; Çelebi et al. 2015; DeJong et al. 2020; Hall et al. 2015; Hill and O'Leary 2013; Hsu et al. 2017; Jakobsen et al. 2014; Johnson et al. 2020; LeBrun et al. 2022; Markström et al. 2022; Moffet et al. 2015; Schache et al. 2019; Terradas-Monllor et al. 2021). Figure 1 shows the summary of the search results through the flowchart for this systematic review based on the current guidelines – PRISMA 2020.

After using the search strategy, 309 articles were identified, and duplicates were eliminated ($n=50$). After analyzing the title and abstract, some articles were excluded because they did not refer to rehabilitation ($n=272$). The entire text of the selected articles was analyzed. Some were excluded because the population was under 18 years old and with groups of participants also intervened in the hip ($n=5$), others did not identify the study design used ($n=2$), and others reported rehabilitation but did not apply PROMs before and after the rehabilitation program ($n=7$). Some did not present the intervention they used in the rehabilitation process ($n=7$).

The quality of all the studies included was high, with more than half scoring over 80% after applying the Joanna Briggs Institute evaluation criteria. In the experimental studies, the main weakness was that the outcome assessors were not blinded to the treatment assignment, while in the cohort studies, there was a lack of identification and strategies to deal with confounding factors.

The characteristics of the studies are structurally presented in Table 2 according to the year of publication, while the other variables (country, type of study, population, PROMs, and rehabilitation program) are presented in Table 1 in order of year of publication.

The 16 studies included in this review were carried out in different regions of the world, with Europe ($n=7$) and the USA ($n=5$) being the most prevalent, two studies in Australia and one each in Canada and Taiwan. The number of participants ranged from 24 to 980, with average ages ranging from 22 to 72. The types of surgery identified were anterior cruciate ligament reconstruction ($n=6$), total knee arthroplasty ($n=9$), and arthroscopic partial meniscectomy ($n=1$).

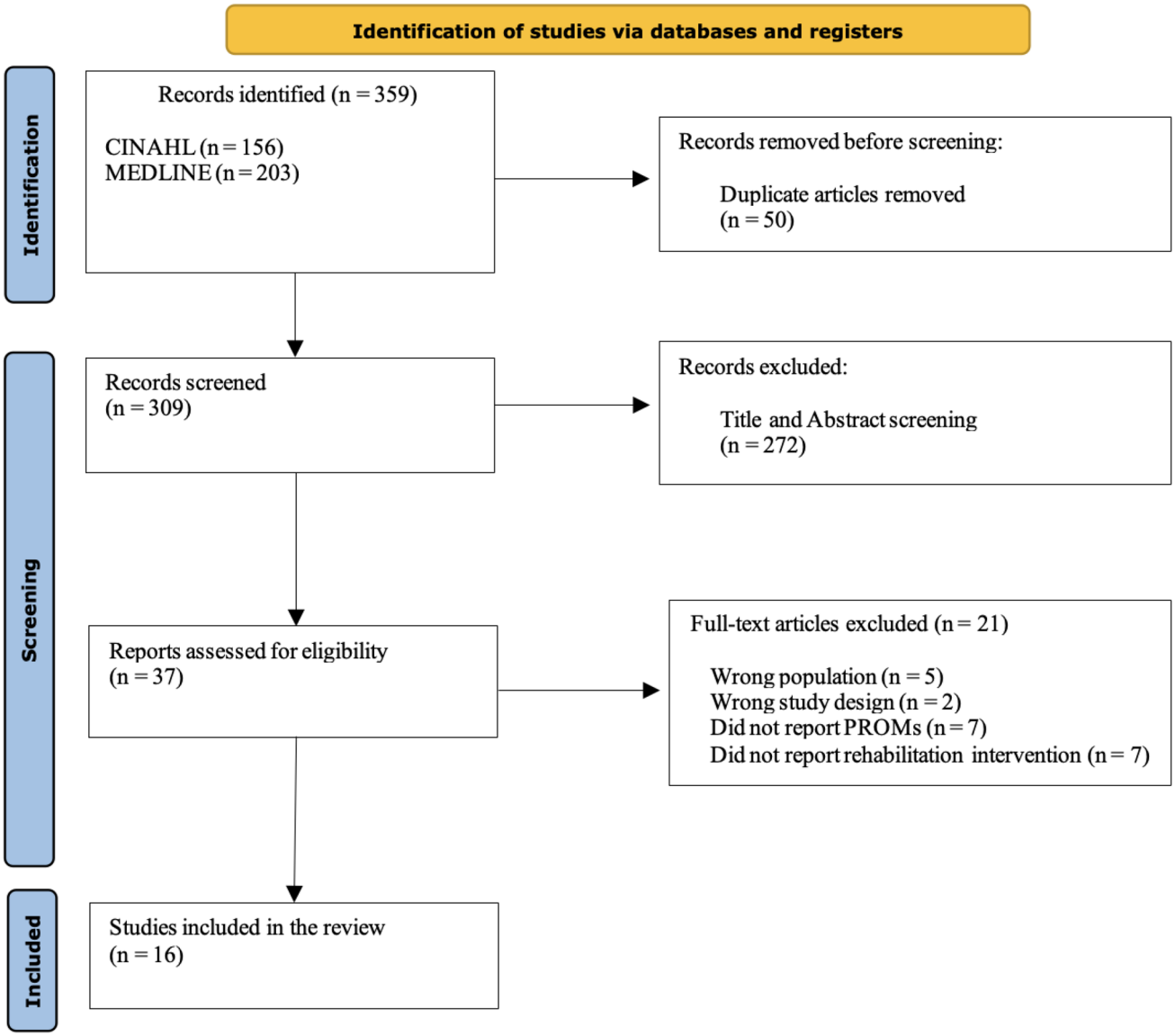

Fig. 1 PRISMA flowchart of study selection

In all the studies, the PROMs were administered to the participants at baseline, before the rehabilitation intervention began, and after it had ended. Assessments of outcomes after the end of the intervention varied over time, from 1 to 36 months. The PROMs identified take on a wide variety, differing in the number of questions/items, the time required to complete them, and the outcomes they measure. We can then group the PROMs into two sub-categories, classifying them as generic and specific to knee pathology. In this way, the results obtained from this rapid systematic review have been structured according to the year in which they were created, describing the specific characteristics of each PROM, such as the abbreviation, number of items, and completion time, as shown in Table 3.

Discussion

The most important results of this study show the diversity of PROMs used in rehabilitation programs after knee surgery. This variety is based on several particularities, namely the number and type of questions/items, the time needed to fill them in, the translations available for each one, the type of sub-scales, the cost/license required for their use, and the time lag in applying the PROMs (Hohmann et al. 2011; Park et al. 2018; Perez et al. 2017; Rolfson et al. 2016). Given this conceptualization and the results obtained in identifying the PROMs used in rehabilitation programs after knee surgery, it is recommended to collect the information reported by the participants through the

Table 2 Study characteristics

Author year, country	Study design (sample size)	Type of surgery	Age (years)	PROM(s)	Timing of PROM(s)	Type of intervention	JBI critical appraisal (total)
Beynnon, 2011, EUA (Beynnon et al. 2011)	RCT ($n=24$)	ACLR	29.7 ◊	KOOS	Baseline, at month 3, 6, 12, 24	Intervention with rehabilitation exercises after ACLR at two time intervals: 32-week non-accelerated program vs. 19-week accelerated program (with quadriceps contraction exercises alone with the knee close to extension, started earlier)	13/13(100%)
Hill, 2013, Scandinavian countries (Hill and O'Leary 2013)	Quasi-experimental ($n=165$)	ACLR	30.4 ◊	KOOS	Baseline, at month 3, 6, 12	After ACLR surgery, intervention with a rehabilitation program: early movement, full weight bearing as tolerated, with no bracing or immobilization, with running from 3 months, and with return to sport postponed until at least 6 months	7/9 (77%)
Bruun-Olsen, 2013, Norway (Bruun-Olsen et al. 2013)	RCT ($n=57$)	TKA	68 ◊	KOOS	Baseline, at weeks 9, 36	The patients in the control group receiving usual physiotherapy care participated in 12 individual physiotherapy sessions, which took place twice a week from 6 weeks to 12–14 weeks after the surgery; vs Experimental group: walking-skill program lasted from 6 weeks to 12–14 weeks after the surgery (walking-skill program emphasizing weight-bearing exercises)	13/13(100%)
Jakobsen, 2014, Denmark (Jakobsen et al. 2014)	RCT ($n=82$)	TKA	60 ◊	KOOS EQ5D-5L	Baseline, at month 1, 2, 6	Intervention with rehabilitation program: Control group without Progressive Strength Training (PST) vs PST group (supervised program with 2 sessions/week for 7 weeks, in which each session lasted 60 min (45-50 min of exercise and 10-15 min of conversation and transfer between training modalities)	12/13(92%)

Table 2 (continued)

Author year, country	Study design (sample size)	Type of surgery	Age (years)	PROM(s)	Timing of PROM(s)	Type of intervention	JBI critical appraisal (total)
Hall, 2015, Australia (Hall et al. 2015)	RCT ($n=60$)	APM	42.8 ◊	KOOS	Baseline, at weeks 13	Intervention with a 12-week, home-based, physiotherapist-guided neuromuscular exercise program at the time of knee adduction in the past 3 to 12 months: in the control group vs. the experimental group (standard program + six exercises with neutral mediolateral alignment of the lower limb while activating the trunk muscles during functional exercises)	10/13(77%)
Moffet, 2015, Canada (Moffet et al. 2015)	RCT ($n=205$)	TKA	65 ◊	KOOS WOMAC	Baseline, at month 2, 4	The rehabilitation intervention during 2 months after hospital discharge: standard rehabilitation program in the control group (30 min period—mobility, strengthening, function and balance) vs experimental group (16 sessions of 45 to 60 min, supervised by a trained physiotherapist, with intensity and increasing level of difficulty of the exercises according to each patient's tolerance)	13/13(100%)
Çelebi, 2015, Turkey (Çelebi et al. 2015)	Quasi-Experimental ($n=38$)	ACLR	26.84 ◊	HADS LKSS	Baseline, at weeks 6	All participants of this study followed a standard rehabilitation protocol. Two subsequent evaluations were given to the patients: the first immediately after ACLR and just prior to beginning the rehabilitation program; the second 6 weeks later	7/9 (77%)

Table 2 (continued)

Author year, country	Study design (sample size)	Type of surgery	Age (years)	PROM(s)	Timing of PROM(s)	Type of intervention	JBI critical appraisal (total)
Hsu, 2017, Taiwan (Hsu et al. 2017)	Cohort ($n=34$)	TKA	72.1 ◊	KOOS SF-36	Baseline, at month 3, 6	The rehabilitation intervention was supervised by the therapist in the following order: stretching/aerobic training/resistance training/aerobic training/resistance training/stretching (6 gym machines were chosen at random from ten machines for upper and lower limb exercises). Each exercise lasted 10 min with a 30-s rest interval between each exercise, three times a week, for 24 weeks	10/11 (90%)
Schache, 2019, Australia (Schache et al. 2019)	RCT ($n=105$)	TKA	70 ◊	KOOS SF-12	Baseline, at weeks 6, 26	Standard intervention with 12 days of rehabilitation immediately after surgery, followed by 6 weeks of outpatient physiotherapy in the control group vs experimental group with standard protocol + hip abductor strengthening exercises (exercises progressed to weight-bearing, gravity-resisted and TheraBand-resisted exercises (sideways walking, hip hitching and hip abduction while standing on the operated leg)	11/13(84%)
Bigouette, 2019, USA (Bigouette et al. 2019)	Cohort ($n=980$)	ACLR	26 ◊	KOOS IKDC WOMAC	Baseline, at month 24	After ACLR, the intervention was defined according to the number of sports. The participants were divided into 3 groups: 1 sport, 2 sports, multisport. PROMs were applied after surgery, before the program, and after 24 months	11/11(100%)

Table 2 (continued)

Author year, country	Study design (sample size)	Type of surgery	Age (years)	PROM(s)	Timing of PROM(s)	Type of intervention	JBI critical appraisal (total)
Arhos, 2020, USA (Arhos et al. 2020)	RCT ($n=79$)	ACLR	22.1 ◊	KOOS TSK-11 IKDC-SKF KOS-ADLS GRS	Baseline, at weeks 12, 24	After the ACLR, participants in the control group received 10 physiotherapy sessions with strengthening exercises, agility, plyometrics and secondary prevention (SAP) vs Experimental group with strengthening exercises, agility, plyometrics and secondary prevention plus perturbation training (SAP + PERT)	10/13(77%)
Johnson, 2020, Norway (Johnson et al. 2020)	Quasi-Experimental ($n=218$)	ACLR	25 ◊	KOOS KOS-ADLS GRS IKDC-SKF	Baseline, at month 6, 12, 24, 60	After ACLR, the participants completed progressive postoperative rehabilitation immediately after surgery based on standard criteria, and were followed up for 5 years	7/9 (77%)
DeJong, 2020, EUA (DeJong et al. 2020)	RCT ($n=386$)	TKA	63 ◊	KOOS AM-PAC	Baseline, at month 1, 2, 6	Patients received up to 12 weeks of outpatient physiotherapy and were divided into 4 groups with different interventions. Control group: standard intervention; Intervention group 1: used a recumbent bicycle normally seen in physiotherapy outpatient clinics; Intervention group 2: used a zippered lower body airbag, a body weight adjustable treadmill that uses air pressure to offload varying amounts of the patient's body weight when walking on the treadmill; Intervention group 3: used both recumbent bicycle and PENS (placed on the surgical leg); Intervention group 4: used both the body weight adjustable treadmill and the PENS during warm-up	10/13(77%)

Table 2 (continued)

Author year, country	Study design (sample size)	Type of surgery	Age (years)	PROM(s)	Timing of PROM(s)	Type of intervention	JBI critical appraisal (total)
Barker, 2021, England (Barker et al. 2021)	RCT ($n=621$)	TKA	70.67 ◊	KOOS EQ5D-5L	Baseline, at month 6, 12	Participants received a standard home-based rehabilitation intervention in the Control Group vs Experimental Group (CORKA) with multicomponent intervention in their own homes combining qualified technicians and rehabilitation assistants (exercise program, practice of functional tasks, adherence approaches and provision of appropriate aids or equipment with initial consultation and 6 follow-up sessions)	10/13(77%)
Terradas-Monllor, 2021, Spain (Terradas-Monllor et al. 2021)	Quasi-Experimental ($n=89$)	TKA	70.99 ◊	HADS WOMAC EQ5D-5L SOPA-B TSK-11	Baseline, at weeks 4, 12, 24	After TKA surgery, a home physiotherapy program was developed, with each participant being assessed by the physiotherapist in the 1st week after surgery, after 1 month, 3 months and 6 months	8/9 (88%)

Table 2 (continued)

Author year, country	Study design (sample size)	Type of surgery	Age (years)	PROM(s)	Timing of PROM(s)	Type of intervention	JBI critical appraisal (total)
LeBrun, 2022, USA (LeBrun et al. 2022)	Cohort ($n = 326$)	TKA	68.44 ◊	KOOS-JR VR-12 LEAS	Baseline, at weeks 6, 12	The intervention consisted of conventional or home physiotherapy according to the agency providing home care services, 2 to 4 weeks, with 10 to 20 visits in total during this period in the control group vs. experimental group: telerehabilitation 2–3 times a week for the first 2–3 weeks after surgery, then referred to outpatient rehabilitation or to an independent walking/home exercise program (prescribed exercises included ankle pumps, quadriceps series, gluteal series, seated active knee flexion and extension, and stair stretching with 10 repetitions and 3 times a day)	11/11(100%)

◊ mean; *ACLR*, anterior cruciate ligament reconstruction; *AM-PAC*, activity measure for post-acute care; *APM*, arthroscopic partial meniscectomy; *EQ5D-5L*, EuroQol5-dimension health outcome survey (5-level); *HADS*, Hospital Anxiety and Depression Scale; *IKDC-SKF*, International Knee Documentation Committee–Subjective Knee Form; *KOOS*, Knee injury and Osteoarthritis Outcome Score; *KOOS-JR*, Knee Injury and Osteoarthritis Outcome Score for Joint Replacement; *GRS*, Global Rating Scale; *LEAS*, Lower-Extremity Activity Scale; *LKSS*, Lysholm Knee Scoring Scale; *KOS-ADLS*, Knee Outcome Survey–Activities of Daily Living Scale; *PROMs*, patient-reported outcome measures; *RCT*, randomized controlled trial; *SF-12*, Short Form-12; *SOPA-B*, Survey of Pain Attitudes; *TKA*, total knee arthroplasty; *TSK*, Tampa Scale for Kinesiophobia; *VR-12*, Veterans RAND 12; *WOMAC*, Western Ontario and McMaster Universities Osteoarthritis Index

Table 3 Patient-reported outcome measures (generic and specific) tools used

Name of PROM(s)	Year developed	Abbreviation	Number of items	Time to complete (mins)	Number studies (n)
Generic					
Hospital Anxiety Depression Scale	1982	HADS	14	5–10	2 (Çelebi et al. 2015; Terradas-Monllor et al. 2021)
Short Form-36	1992	SF-36	36	10	1 (Hsu et al. 2017)
Short Form-12	1996	SF-12	12	2–3	1 (Schache et al. 2019)
Veterans Rand 12-item survey	1997	VR-12	12	2–3	1 (LeBrun et al. 2022)
Activity Measure for Post-Acute Care	2003	AM-PAC	6	2–3	1(DeJong et al. 2020)
EuroQol5-dimension health outcome survey (5-level)	2011	EQ5D-5L	6	2–3	3 (Barker et al. 2021; Jakobsen et al. 2014; Terradas-Monllor et al. 2021)
Specific					
Western Ontario and McMaster Universities Arthritis Index	1982	WOMAC	24	5–10	3 (Bigouette et al. 2019; Moffet et al. 2015; Terradas-Monllor et al. 2021)
International Knee Documentation Committee	1991	IKDC	7	3–5	1 (Bigouette et al. 2019)
Survey of Pain Attitudes	1997	SOPA-B	30	10	1 (Terradas-Monllor et al. 2021)
Knee Outcome Survey – Activities of Daily Living Scale	1998	KOS-ADLS	17	5–10	2 (Arhos et al. 2020; Johnson et al. 2020)
Knee Injury and Osteoarthritis Outcome score	1998	KOOS	42	10–15	13 (Arhos et al. 2020; Barker et al. 2021; Beynnon et al. 2011; Bigouette et al. 2019; Bruun-Olsen et al. 2013; DeJong et al. 2020; Hall et al. 2015; Hill and O'Leary 2013; Hsu et al. 2017; Jakobsen et al. 2014; Johnson et al. 2020; Moffet et al. 2015; Schache et al. 2019)
International Knee Documentation Committee subjective knee form	2000	IKDC-SKF	10	3–5	2 (Arhos et al. 2020; Johnson et al. 2020)
Lower-Extremity Activity Scale	2005	LEAS	12	3–5	1 (LeBrun et al. 2022)
Tampa Scale for Kinesiophobia Short form	2005	TSK-11	11	3–5	2 (Arhos et al. 2020; Terradas-Monllor et al. 2021)
Lysholm Knee Scoring Scale	2006	LKSS	8	3	1 (Çelebi et al. 2015)
KOOS short form (joint replacement)	2007	KOOS-JR	7	3	1 (LeBrun et al. 2022)
Global Rating Scale (perceived knee function)	2014	GRS	1	1	2 (Arhos et al. 2020; Johnson et al. 2020)

application of generic and specific PROMs (Moreira et al. 2024; Rolfson et al. 2016).

Generic PROMs

Generic measures make assessing general health and/or health-related quality of life possible, considering the person's physical, mental, and socio-cultural aspects (Rolfson et al. 2016). This study identified several generic PROMs, including the EQ5D-5L, HADS, SF-36, SF-12, VR-12, and the AM-PAC. The one most used in rehabilitation after knee surgery was the EQ5D-5L, a descriptive instrument that defines health in five dimensions: mobility, self-care, habitual activities, pain/discomfort, and anxiety/depression (Herdman et al. 2011). It was designed to be self-completed and allows you to assess your general health when filling it out using a vertical visual analogue scale from 0 to 100 (EQ-VAS). In the study carried out by Conner-Spady et al. (2015) on participants proposed for knee surgery, this instrument was considered essential in assessing the dimensions mentioned above, given the high convergent validity in the study population (Conner-Spady et al. 2015). Another of the general PROMs identified in this review was the HADS, which is an asset for researchers/health professionals to interpret emotional and cognitive characteristics related to symptoms of depression and anxiety (Çelebi et al. 2015; Terradas-Monllor et al. 2021). The scale consists of 14 questions, seven of which identify symptoms of depression, and the other seven identify symptoms of anxiety, with total scores ranging from 0 to 42 points. The application of this PROM is essential after knee surgery and during rehabilitation since throughout the recovery process, through the combination of the psychological process and the underpinnings of the fear-avoidance, fear-avoidance beliefs and behaviors are formed that drive some pain-related disability (Terradas-Monllor et al. 2021). The SF-36 was another PROM identified in one of the studies that applied for an exercise program after knee surgery (Hsu et al. 2017), or in a shorter version, the SF-12, which made it possible to assess health-related quality of life in its mental (MCS) and physical (PCS) components (Schache et al. 2019). Since it was developed, this tool has been used for studies in the field of rehabilitation (Moock et al. 2006). In recent years, several rehabilitation research studies have shown that this is a viable tool for measuring the health-related quality of life of patients taking part in rehabilitation programs (Moock et al. 2006; Moreira and Grilo 2019). Hsu et al. (2017) evaluated the eight domains of the SF-36 and showed that exercise improved all the domains of the physical element of the participants after knee surgery and only the domains of the mental component in the control group (Hsu et al. 2017). The VR-12 was one of the PROMs used, allowing the physical and mental components to be assessed in the same way as the SF-12 (Kazis et al. 1998) and emphasizing the usefulness of evaluating the health-related quality of life of participants in telerehabilitation programs after knee surgery (LeBrun et al. 2022). Another of the general PROMs identified, the AM-PAC, has been developed over the years for application in the context of clinical practice and research and is based on the conceptualization defined by the World Health Organization's International Classification of Functioning, Disability, and Health. This instrument allows for a comprehensive and accurate assessment of functional outcomes related to the participant in an acute and/or post-acute care environment (DeJong et al. 2020).

Joint specific PROM

In addition to generic PROMs, several knee pathology-specific PROMs are also used to measure specific outcomes, and for this study, only those used in rehabilitation programs following knee surgery were considered. The most used was KOOS (Arhos et al. 2020; Barker et al. 2021; Beynnon et al. 2011; Bigouette et al. 2019; Bruun-Olsen et al. 2013; DeJong et al. 2020; Hall et al. 2015; Hill and O'Leary 2013; Hsu et al. 2017; Jakobsen et al. 2014; Johnson et al. 2020; Moffet et al. 2015; Schache et al. 2019), allowing the outcomes to be assessed after self-completion of 42 items: pain (9 items), symptoms (7 items), activities of daily living (17 items), sport and recreation function (5 items), and knee-related quality of life (4 items) (Roos et al. 2024). All items are scored from 0 to 4; for each subscale, the scores are transformed into scales from 0 to 100 (0 representing extreme knee problems and 100 representing no knee problems) (Hsu et al. 2017; Roos et al. 2024). This is a reliable tool for the participants we included in this study, confirmed by statistically significant results when comparing two groups in a rehabilitation program after anterior cruciate ligament surgery (Bigouette et al. 2019; Bruun-Olsen et al. 2013; Hill and O'Leary 2013).

WOMAC was another specific PROMs identified, often used in a rehabilitation program after knee surgery. It consists of 24 items grouped into three dimensions (Terradas-Monllor et al. 2021). A 5-point Likert scale was used to determine the score by the sum of the aggregate scores for the pain, stiffness, and physical function dimensions (Escobar et al. 1982). The TSK-11, GRS (perceived knee function), IKDC-SKF, and KOS-ADLS were also used in at least two studies each (Arhos et al. 2020; Johnson et al. 2020; Terradas-Monllor et al. 2021). These specific PROMs made it possible to measure the effect of the rehabilitation intervention, namely health-related quality of life. The specific PROMs identified in smaller numbers in this study were the IKDC, SOPA-B, LEAS, LKSS, and KOOS-JR, which measure various dimensions, including functional results associated with the knee joint, the evolution of pain, and

physical performance throughout the rehabilitation program (Bigouette et al. 2019; Çelebi et al. 2015; LeBrun et al. 2022; Terradas-Monllor et al. 2021). Valuing these dimensions through specific PROMs, namely pain assessment, has been recommended in several studies as one of the aspects that can foster innovation and success in the implementation of interventions since it can make it possible to optimize procedures to reduce the level of chronic pain and improve health-related quality of life (Van Beest et al. 2022).

Analysis of the studies included in this rapid systematic review showed that specific PROMs were selected for a significant population of patients, including those participating in rehabilitation programs following knee surgery (Rolfson et al. 2016), and good measurement properties of the instrument. This rapid review shows the diversity of specific PROMs, which should be used with generic PROMs (Rolfson et al. 2016) to better respond to changes in the condition of interest and other coexisting conditions over time.

Limitations

This rapid review has some limitations, namely that only English language articles were included. This review included studies from several countries around the world, helping to increase the transferability of the conclusions; however, this can be considered a limitation given the specific context of each country and the different income levels in each country. It would be necessary in future studies to compare program participants and rehabilitation considering the PROMs specific to each type of surgery.

Conclusion

The use and diversity of PROMs have been increasing in rehabilitation programs after knee surgery, which is why it is essential to synthesize the instruments according to the outcomes they are intended to measure. By identifying the general and specific PROMs for each situation, it is possible to adapt each one more advantageously to the context and regional variations, guaranteeing the quality and continuous improvement of the care provided. Using this type of instrument to measure and compare outcomes before and after a rehabilitation program following the recovery process from knee surgery can be an asset for optimizing health practices, rationally allocating available resources, and improving care for people in need. In this sense, this systematic review can improve the consistency of the use of PROMs and enhance the results of a rehabilitation process after knee surgery.

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Authors' contributions JM and SM conceptualized the study, developed the research protocol, identified articles for full-text review, extracted data from studies that met the inclusion criteria, synthesized, and analyzed the data. JM wrote the manuscript. All authors approved the final submitted version of the manuscript.

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Data availability Available on request from the corresponding author.

Code availability Not applicable.

Declarations

Ethics approval This study was submitted and approved by the Ethics Committee of the Nacional School of Public Health – NOVA University of Lisbon (CE-ENSP n°3/2022). This work is a rapid systematic review and thus no ethical approval is required.

Consent to participate and publish All analyzed studies were responsible for acquiring written informed consent from the respective participants.

Consent for publication All analyzed studies were responsible for acquiring written informed consent from the respective participants.

Competing interests The authors have no conflicts of interest that are relevant to declare for the study that was designed.

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