ORIGINAL RESEARCH

Questionnaires assessing knowledge and beliefs about musculoskeletal conditions are potentially suitable for use, but further research is needed: a systematic review

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Abstract

Objectives: To evaluate the measurement properties of Patient-reported outcome measures (PROMs) for knowledge and/or beliefs about musculoskeletal conditions.

Study Design and Setting: A systematic review was performed according to the COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) guidelines. This review was prospectively registered on PROSPERO — ID: CRD42022303111. Electronic databases, reference lists, forward citation tracking, and contact with experts were used to identify studies. Eligible studies were reports developing or assessing a measurement property of a PROM measuring musculoskeletal condition specific-knowledge and/or beliefs. We assessed the methodological quality and measurement properties of included studies. A modified Grading of Recommendations Assessment Development and Evaluation approach was used to rate the quality of evidence for each PROM.

Results: The literature search was performed from inception to 11th September 2023. Sixty records were included, reporting 290 individual studies, and provided information on 25 PROMs. Five PROMs presented sufficient structural validity, three presented sufficient cross-cultural validity, ten presented sufficient reliability, three presented sufficient criterion validity, six presented sufficient hypothesis-testing, and four presented sufficient responsiveness. No PROM presented sufficient evidence for content validity, internal consistency, and measurement error. Based on the available evidence, no PROM was classified as *suitable for use* according to the COSMIN recommendations. Twenty-four PROMs are *potentially suitable for use*, and one PROM is *not recommended for use*.

Conclusion: No PROM designed to assess knowledge and/or beliefs about musculoskeletal conditions meets the COSMIN criteria of *suitable for use*. Most PROMs identified in this systematic review were considered as *potentially suitable for use* and need further high-quality research to assess their measurement properties. © 2024 The Author(s). Published by Elsevier Inc. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

Keywords: Knowledge; Beliefs; Musculoskeletal condition; Patient-reported outcome measures; Psychometrics; Systematic review

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Plain language summary

We checked the literature to see if surveys that assess knowledge and beliefs about musculoskeletal conditions are of high quality. We found 60 studies reporting about 25 surveys. We decided that 24 surveys were potentially suitable for use, and one survey was not recommended for use.

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What is new?

Key findings
- No available questionnaire was classified as *suitable for use* to assess knowledge and/or beliefs about musculoskeletal conditions.

- Twenty-four questionnaires were classified as *potentially suitable for use.*

- The content validity of all available questionnaires presented inconclusive results.

What this adds to what was known?
- This is the first systematic review evaluating the measurement properties of questionnaires about knowledge and/or beliefs in musculoskeletal conditions. We identify priorities for future research to create suitable questionnaires to be used in clinical and research practice.

What is the implication and what should change now?
- This review identifies that although these questionnaires are used in clinical and research practice, professionals should be aware of their limitations and should use current questionnaires with caution.

1. Introduction

Pain is a preeminent cause of clinical and social problems globally [1], and musculoskeletal conditions (eg, low back pain, neck pain, osteoarthritis) are the leading cause of years lived with disability [2,3]. Musculoskeletal pain management has shifted from a biomedical model, focusing on biomechanics and tissue damage, to a multidimensional approach addressing a wide range of biopsychosocial factors known to contribute to pain and associated disability (eg, nociceptive input, emotional factors, social contingencies, and cognitive process) [4].

Cognitive factors, including knowledge and beliefs, play an important role in pain and associated disability for people with musculoskeletal conditions [4]. Knowledge and beliefs impact physical, social, and emotional experiences [5−8]. Recent evidence suggests that patients with musculoskeletal pain present to physiotherapy with a poor level of knowledge about pain [9]. Guidelines recommend patient education should include advice to stay active, avoid prolonged bed rest, and provide reassurance of a favorable prognosis, helping patients to understand the processes involved in the pain experience [10−13]. There is limited evidence about how pain education can improve pain and disability [14,15], but previous studies demonstrated that pain education can reduce negative psychological factors known to be associated with pain [16,17].

Instruments to assess disease-specific knowledge and beliefs can inform pain education by facilitating a tailored management plan, or these instruments can be used to measure the outcome of education interventions. However, the assessment of knowledge and beliefs about musculoskeletal pain is typically not considered by clinicians and researchers [8]. Patient-reported outcome measures (PROMs) are used to assess the patients' own views about their health, and existing PROMs are available to assess knowledge and beliefs about pain in general [18−20]. It is currently not known which are the best PROMs for measuring knowledge and/or beliefs about specific musculoskeletal conditions.

The assessment of measurement properties of PROMs is important to determine the quality of the instruments and is an essential component in choosing a suitable instrument [21]. A systematic review of measurement properties of PROMs to assess knowledge and beliefs about musculoskeletal conditions has not been conducted. Therefore, this systematic review aims to investigate the measurement properties of PROMs that measure knowledge and/or beliefs about musculoskeletal conditions to guide clinicians and researchers.

2. Material and methods

2.1. Study design

This systematic review was prospectively registered (PROSPERO − ID: CRD42022303111), followed the COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) guidelines [22], and is reported according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines [23]. Figure 1 shows an overview of the COSMIN methodological steps conducted in this review.

2.2. Search strategy

The electronic databases MEDLINE, EMBASE, CINAHL, and Web of Science were searched from inception to September 11, 2023. The search strategy included terms representing construct, population, and type of instrument, in addition to a filter developed by COSMIN to find studies on measurement properties [24]. The search strategy was devised in consultation with librarians and adapted for each database (Appendix 1). Our adaptation of the COSMIN filters for each database is available on the COSMIN website (https://www.cosmin.nl/tools/pubmed-search-filters/).

There were no restrictions on language, publication date or publication status. Google translation software was used for non-English studies.

One author (LAC) performed forward and backward citation tracking (via Scopus) of included studies.
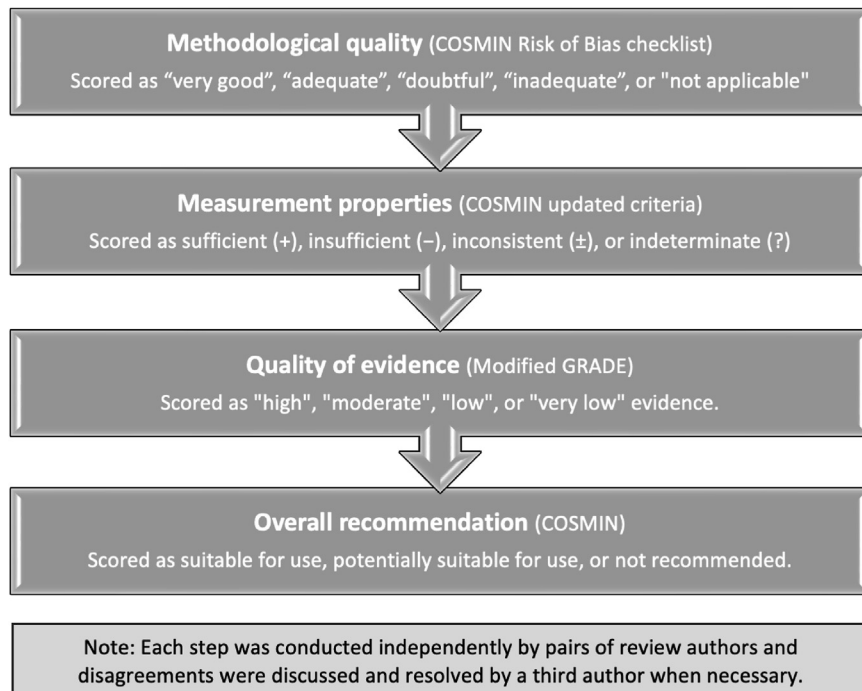
Figure 1. Methodological steps performed to assess the measurement properties of questionnaires. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

Investigators also contacted experts and reviewed reference lists of systematic reviews, protocols, and conference abstracts retrieved in the search.

2.3. Eligibility criteria

Primary studies developing or investigating any measurement property of PROMs aimed to assess knowledge and/or beliefs about musculoskeletal conditions (eg, low back pain, osteoarthritis) in adults were included. Modified, shortened, translated, or cross-culturally adapted versions of eligible questionnaires were also included. We considered ankylosing spondylitis (AS) and fibromyalgia to be musculoskeletal conditions. Because the terms for "knowledge", "beliefs", and "attitudes" are used interchangeably with no clear definitions, we included PROMs where most items assessed disease-specific cognitive factors/understanding/convictions, regardless of the term used in the PROM title. We excluded PROMs measuring awareness, fear-avoidance, catastrophizing, and self-efficacy as they did not address knowledge and beliefs about the specific condition. We excluded PROMs developed and tested exclusively for clinicians, or for participants who had a recent history of physical trauma or injury. Studies were also excluded if full text was not available after contacting authors.

2.4. Screening

Duplicate removal and literature screening were performed using EndNote ×20 software. One author (LAC) removed duplicates automatically and manually, and screened titles to remove clearly irrelevant studies. A second author (SDF and SM) independently checked the deleted titles. Pairs of review authors independently screened abstracts of potential studies first, and then full text. Disagreements were discussed.

2.5. Data extraction

Data were extracted independently by pairs of review authors using a standardized, piloted form. Extracted data were compared, and disagreements were discussed. Extracted data included bibliographic details, study, and participants' characteristics, PROM characteristics, methods and results of measurement properties assessment, and interpretability and feasibility data [22]. Although interpretability and feasibility are not considered as measurement properties, they are relevant for the selection of the most suitable instrument. Study protocols and related studies (eg, Delphi study for PROM development) were consulted to extract information when necessary.

2.6. Methodological quality assessment

One reviewer (LAC) searched for previously published assessments of PROM development by searching the COSMIN Ratings for Development Studies of PROMs and no PROM included had a previous assessment available. Each study on development and/or measurement property was assessed using the COSMIN Risk of Bias checklist [25]. Checklist items were scored as "very good", "adequate", "doubtful",

"inadequate", or "not applicable". The overall score for each study was based on the worst score counts principle [25].

2.7. Measurement properties assessment

The measurement properties included validity (content validity, criterion validity, and construct validity aspects of structural validity, hypotheses testing, and cross-cultural validity), reliability (internal consistency, measurement error, and reliability), and responsiveness, following the COSMIN taxonomy [26]. Each measurement property study was classified as "+" (sufficient), "-" (insufficient), or "?" (indeterminate), according to Terwee et al [22,27]. An overall assessment and summary of measurement properties for each PROM was performed by pairs of reviewers and rated as "+" (sufficient), "-" (insufficient), "±" (inconsistent), or "?" (indeterminate), considering consistent results from at least 75% of the individual studies [22,27].

Content validity was rated considering the evidence provided from content validity studies included in our systematic review. We considered the long or original version of a shortened or revised PROM as the reference for criterion validity and criterion approach for responsiveness. Construct validity studies including comparison with other PROMs (eg, Numerical Pain Rating Scale) were considered as hypotheses testing [22]. To rate construct validity of included studies, we considered hypotheses as formulated by the authors of each individual study.

2.8. Quality of evidence

A modified Grading of Recommendations Assessment Development and Evaluation (GRADE) approach was used by pairs of reviewers to rate the quality of evidence as "high", "moderate", "low", or "very low" evidence. The criteria for downgrading the quality of evidence were based on risk of bias, inconsistency, imprecision, and indirectness [22,28]. Following the COSMIN recommendations, the starting point for determining the quality of evidence of internal consistency was the quality of evidence for structural validity.

2.9. Overall recommendations

An overall recommendation for each PROM was formulated based on the COSMIN guidelines [22]. PROMs were categorized as either: (A) *Suitable for use* (PROMs with evidence of sufficient content validity AND at least low-quality evidence for sufficient internal consistency); (B) *Potentially suitable for use* (PROMs not categorized in A or C); or (C) *Not recommended* (PROMs with high quality evidence of an insufficient measurement property).

2.10. Data synthesis and analysis

All data collected were electronically tabulated and study selection was summarized with a PRISMA flowchart (Fig 2). Data were described per musculoskeletal condition. We present numerical data as mean (standard deviation) for continuous variables, and as absolute values (percentage) for categorical variables. Measurement properties of included studies were analyzed using each criterion defined by the COSMIN group [22,27]. The measures of effect were those relevant to each investigated measurement property. Quantitative pooled result using meta-analysis of the parameters was not performed due to a lack of sufficient homogeneity among studies and measurement properties. All statistical analyses were performed using STATA, version 17 (Stata Corporation, College Station, TX, USA).

3. Results

3.1. Search and study selection

Electronic searches identified 12,982 records and 60 records were included, reporting on 25 PROMs. Based on COSMIN recommendations [22] that each PROM development and individual measurement property reported is considered a separate study, a total of 290 studies were included (Fig 2). Because the development study for the PROM "Osteoporosis and You" was not able to be retrieved [29], a report of the development from another study was used to obtain relevant information [30].

3.2. Characteristics of included records

Included records ($n = 60$) were published from 1991 to 2023 [30−87] and predominantly from Europe ($n = 23$) and Asia ($n = 15$) (Fig 3).

A total of 18/60 records used PROMs in English. Although an English translation was available for most of the PROMs, the English version did not have the measurement properties assessed in some included records [34,35,46,47,62,74,77,78]. Almost half of the records (28/60) had low back pain as their target condition, followed by rheumatoid arthritis (RA) (10/60). Each record comprised multiple studies, reporting between 2 and 7 measurement property studies per record. A summary of the characteristics of included records is presented in Table 1. A detailed description of each included record is reported in Appendix 2.

3.3. Characteristics of included PROMs

There were 25 different PROMs included. The Back Beliefs Questionnaire (BBQ) was the most frequently evaluated PROM ($n = 13$ records), followed by the Back Pain Attitudes Questionnaire (Back-PAQ) ($n = 9$ records). Details of the included PROMs are presented in Table 2. Reliability was assessed for 24 PROMs, validity was assessed for 23 PROMs, and responsiveness for 10 PROMs.
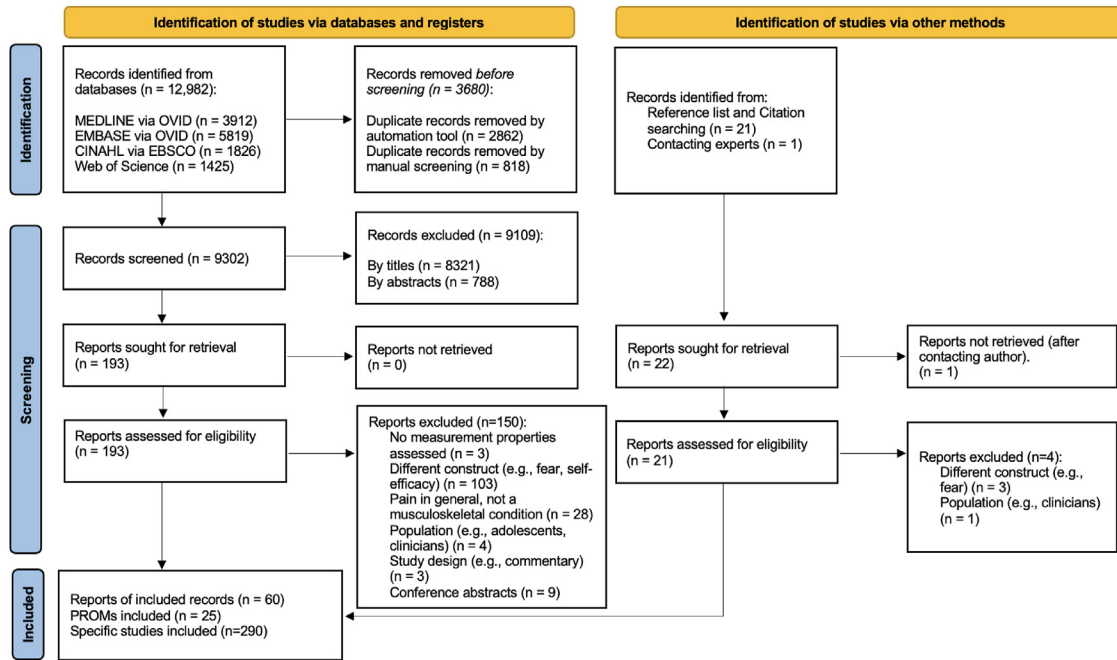
Figure 2. Flowchart of selection of studies based on PRISMA 2020 flow diagram. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

3.4. Methodological quality assessment

The overall methodological quality of PROM development was rated as "doubtful" for most of the PROMs (18/25) and "inadequate" for 7 PROMs (Appendix 3). All content validity studies ($n = 38$) had at least one section (ie, relevance, comprehensiveness, comprehensibility) rated as "doubtful" or "inadequate". Methodological quality for all content validity studies is reported in Appendix 4.

In addition to development ($n = 25$) and content validity ($n = 38$) studies, 227 studies reported on other measurement properties. Most studies were judged to have "adequate" (86/227, 37.9%) or "doubtful" (74/227, 32.6%) methodological quality. The measurement property that was most frequently scored as "inadequate" or "doubtful" was internal consistency ($n = 39$ studies). Structural validity was most frequently sored as "very good" or "adequate" ($n = 24$ studies). Methodological quality scores for each included study are detailed in Appendix 5.

3.5. Measurement properties

Table 3 shows the rating of overall measurement properties, quality of evidence, and overall recommendation for each PROM. Individual and pooled PROM scoring for all
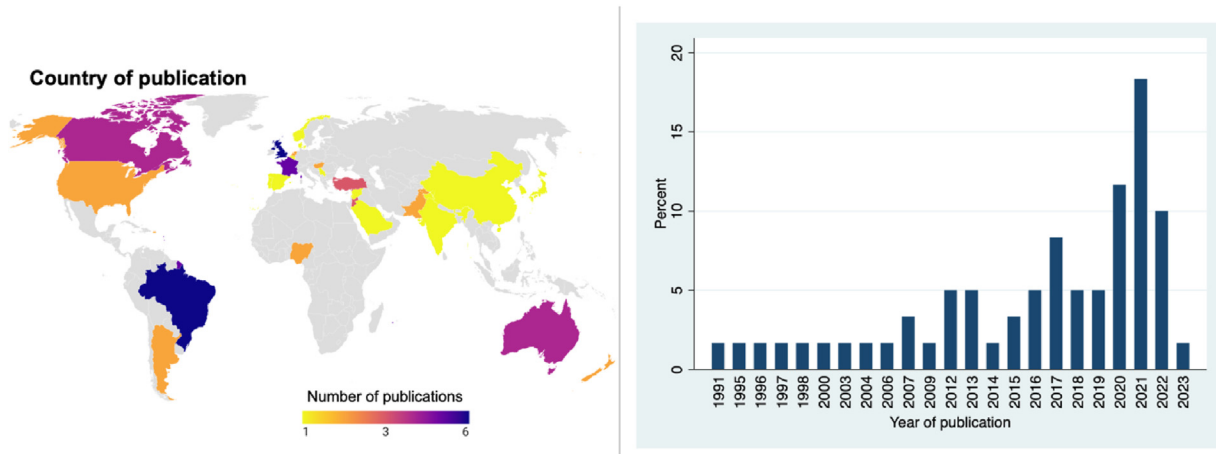
Figure 3. Publication distribution by country and year. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

Table 1. Summary of characteristics of included records ($n = 60$)

Characteristics	Total included ($n = 60$)
Region by geographic continents	
Africa	2 (3.3%)
Asia	15 (25.0%)
Europe	23 (38.3%)
North America	6 (10.0%)
Oceania	6 (10.0%)
South America	8 (13.3%)
Language of PROM included	
Arabic	7 (11.7%)
Dutch	2 (3.3%)
English	18 (30.0%)
French	6 (10.0%)
Hungarian	2 (3.3%)
Portuguese	7 (11.7%)
Spanish	3 (5.0%)
Turkish	3 (5.0%)
Urdu	2 (3.3%)
Other[a]	10 (16.7%)
Target musculoskeletal pain condition	
Ankylosing spondylitis	4 (6.7%)
Fibromyalgia	2 (3.3%)
Low back pain	28 (46.7%)
Osteoarthritis	5 (8.3%)
Osteoporosis	9 (15.0%)
Rheumatoid arthritis	10 (16.7%)
Shoulder pain	1 (1.7%)
Spondyloarthritis	1 (1.7%)
Types of studies reported[b]	
Development of a PROM	25 (41.7%)
Translation of a PROM	39 (65.0%)
Validity	55 (91.7%)
Reliability	58 (96.7%)
Responsiveness	13 (21.7%)

[a] "Other" includes 1 (1.7%) record for each of the following languages: Chinese, Danish, Hausa, Hindi, Japanese, Korean, Marathi, Norwegian, Serbian, and Yoruba.
[b] Each record comprised multiple studies. Measurement properties are grouped based on COSMIN taxonomy as validity (content validity, criterion validity, and construct validity aspects of structural validity, hypotheses testing, and cross-cultural validity), reliability (internal consistency, measurement error, and reliability), or responsiveness.

rating of measurement properties are detailed in Appendix 5, and summarized results per musculoskeletal condition are detailed in Appendix 6. All PROMs assessed were rated as having *indeterminate* content validity, with GRADE ranging from "very low" to "moderate" due to a lack of available studies, or a lack of details on methods for content validity assessment.

AS had one PROM included and the only measurement property considered to be sufficient was reliability. For fibromyalgia, the Fibromyalgia Knowledge Questionnaire was found to have sufficient reliability and responsiveness. All low back pain PROMs had sufficient reliability, and most of the measurement properties were rated as *inconsistent* or *indeterminate*. Osteoarthritis PROMs had no studies on criterion validity and responsiveness. Osteoporosis PROMs had no studies on measurement error and criterion validity, and a PROM named "Osteoporosis and You" was rated as having *insufficient* internal consistency, cross-cultural validity, and responsiveness. Rheumatoid arthritis PROMs had no studies on measurement error and most measurement properties rated as *indeterminate*. For shoulder pain, one included PROM was rated as having *very low* to *low* quality of evidence for measurement properties studies. For spondyloarthritis, one included PROM had *indeterminate* measurement properties.

No PROM was rated as "A: Suitable for use". A total of 24 (96.0%) PROMs were rated as COSMIN recommendation category "B: Potentially suitable for use", and 1 (4.0%) PROM was rated as "C: Not recommended for use".

3.6. Interpretability and feasibility

For all included PROMs, interpretability and feasibility assessment were poorly described or not reported. A summary of topics reported is presented in Table 4. All PROMs were self-reported questionnaires; however, few studies were performed using a rater-administration mode by telephone-based interviews [30,37,68] or in person-based interviews [47,52,62,68]. Participants' and clinicians' comprehensibility were poorly described as reported in content validity quality results (Table 3 and Appendix 4). PROMs ranged in length from 9 to 82 items (Table 2). Floor and ceiling effects were not assessed for most PROMs. No PROM had the Minimal Important Change (MIC) assessed. Reported completion time ranged from 3 to 25 minutes.

4. Discussion

We found 60 records reporting 290 studies on measurement properties for 25 PROMs. Five PROMs presented sufficient structural validity, three presented sufficient cross-cultural validity, ten presented sufficient reliability, three presented sufficient criterion validity, six presented sufficient hypothesis-testing, and four presented sufficient responsiveness. No PROM presented sufficient evidence for content validity, internal consistency, or measurement error. Based on the COSMIN criteria, no included PROM was classified as *suitable for use*. All included PROMs were classified as *potentially suitable for use*, except for "Osteoporosis and You", which was classified as *not recommended for use*.

Table 2. Characteristics of included PROMs (*n* = 25)

PROM	Number of studies (*n* = 60)	Countries included	Available translations	Measurement properties assessed[d]	Total items number/ response format	Scoring (range of scores)
Ankylosing spondylitis						
AS	4 (6.7%)	TR, PT, UK, BR	ENG[a], TUR, POR (PT), POR (BR)	Validity and reliability	14 MC questions	Sum of correct responses (0-39)
Fibromyalgia						
FKQ	2 (3.3%)	BR, ES	POR (BR)[a], SPA, ENG	Validity, reliability, and responsiveness	18 MC questions	Sum of correct responses (0-26)
Low back pain						
BBQ	13 (21.7%)	AU, BH, BR, CA, CN, UK, FR, JP, NG, NO, SA, TR	ENG[a], ARA, TUR, CHI, FRE, HAU, YOR, MAR, JPN, POR (BR), NOR	Validity, reliability, and responsiveness	14 items (5-point LS)	Sum of each LS score (9-45)
Back-PAQ	9 (15.0%)	NZ, BE, JO, BR, AR, DK, TR	ENG[a], FRE, ARA, POR (BR), SPA, DAN, TUR	Validity and reliability	34 items (FV), 20 items (AV), 10 items (SV), 5-point LS	Sum of each LS score (FV: −68 to +68; SV: −20 to +20), higher means positive results
LKQ	4 (6.7%)	JO, BR, HU, IN	POR (BR)[a], ARA, HUN, ENG, HIN	Validity, reliability, and responsiveness	16 (MC questions)	Sum of correct responses (0-24)
LBP-TBQ	2 (3.3%)	UK, JO	ENG[a], ARA	Validity and reliability	64 items (FV), 16 items (SV), 5-point LS	Sum of each LS score (64 to 320 - FV, 16 to 80 − SV)
Osteoarthritis						
KOFBeQ	1 (1.7%)	FR	FRE[a], ENG	Validity and reliability	11 items (10-point LS)	Sum of each LS score (0-99)
OAKS	1 (1.7%)	AU	ENG[a]	Validity and reliability	Hip version: 11 items (5-point LS) Knee version: 11 items (5-point LS)	Sum of each LS score (11-55), higher means greater knowledge
PKQ - OA	2 (3.3%)	UK, KR	ENG[a], KOR	Validity and reliability	16 MC questions	Sum of correct responses (0-30)
TOA	1 (1.7%)	NL	DUT[a], ENG	Validity and reliability	60 items (5-point LS)	Not reported
Osteoporosis						
LOKS	1 (1.7%)	LB	ARA[a], ENG	Validity and reliability	19 MC questions	Sum of correct responses (0-19)
O&Y[c]	2 (3.3%)	CA, US	ENG[a]	Validity, reliability, and responsiveness	20 items (5-point LS)	Proportion of correct responses (0%-100%)
OKAT	4 (6.7%)	AU, HU, RS, SY	ENG[a], ARA, HUN, SRP	Validity and reliability	20 items (FV) 9 items (SV) (T/F/N)	Sum of correct responses (0 to 20 - FV/0 to 9 SV)
OKT[b]	1 (1.7%)	US	ENG[a]	Reliability	32 MC questions	Proportion of correct responses (0%-100%)
OPQ	1 (1.7%)	UK	ENG[a]	Validity and reliability	20 MC questions	Sum of each item score (0-20)
Rheumatoid arthritis						
AKQ	1 (1.7%)	CA	ENG[a]	Validity, reliability, and responsiveness	82 MC questions	Sum of correct responses (0-82)
DataK-RA	1 (1.7%)	NL	DUT[a], ENG	Validity and reliability	42 MC questions	Not reported

(Continued)

Table 2. Continued

PROM	Number of studies (n = 60)	Countries included	Available translations	Measurement properties assessed[d]	Total items number/ response format	Scoring (range of scores)
PKQ - early RA	1 (1.7%)	UK	ENG[a]	Validity, reliability, and responsiveness	12 MC questions	Not reported
PKQ - RA	2 (3.3%)	UK, BR	ENG[a], POR (BR)	Validity and reliability	16 MC questions	Sum of correct responses (0-30)
QuAD	1 (1.7%)	FR	FRE[a], ENG	Validity	44 items (10-point LS)	Mean of item score (0-10), $\geq$7 means strong beliefs.
RAKE	1 (1.7%)	FR	FRE[a], ENG	Validity, reliability, and responsiveness	45 items (FV), 32 items (SV), (T/F/N)	Proportion of correct responses (0%-100%)
RAKAS	2 (3.3%)	PK	URD[a], ENG	Validity and reliability	13 MC questions	Sum of correct responses (0-14), higher means greater knowledge.
ACREU-RAKQ	1 (1.7%)	CA	ENG[a]	Validity, reliability, and responsiveness	31 items (5-point LS)	Sum of correct responses (0-31)
Shoulder pain						
PKQ-RCRSP	1 (1.7%)	AU	ENG[a]	Reliability and responsiveness	16 MC questions	Sum of correct responses (0-16)
Spondyloarthritis						
SPAKE	1 (1.7%)	FR	FRE[a], ENG	Validity, reliability, and responsiveness	42 items (T/F/N)	Proportion of correct responses (0%-100%)

PROM, Patient-Reported Outcome Measure; PROMs: AS, Ankylosing Spondylitis; FKQ, Fibromyalgia Knowledge Questionnaire; BBQ, Back Beliefs Questionnaire; Back-PAQ, Back Pain Attitudes Questionnaire; LKQ, Low back pain Knowledge Questionnaire; LBP-TBQ, Low Back Pain Treatment Beliefs Questionnaire; KOFBeQ, Knee Osteoarthritis Fears and Beliefs Questionnaire; OAKS, OsteoArthritis Knowledge Scale; PKQ, Patient Knowledge Questionnaire; OA, Osteoarthritis; TOA, Treatment beliefs in knee and hip OsteoArthritis; LOKS, Lebanese Osteoporosis Knowledge Scale; O&Y, Osteoporosis and You; OKAT, Osteoporosis Knowledge Assessment Tool; OKT, revised Osteoporosis Knowledge Test; OPQ, OsteoPorosis Questionnaire; AKQ, Arthritis Knowledge Questionnaire; DataK-RA, Disease and treatment associated Knowledge in Rheumatoid Arthritis item bank; RA, Rheumatoid Arthritis; QuAD, Questionnaire for Arthritis Dialogue; RAKE, Rheumatoid Arthritis Knowledge questionnairE; RAKAS, Rheumatoid Arthritis Knowledge Assessment Scale; ACREU-RAKQ, The ACREU Rheumatoid Arthritis Knowledge Questionnaire; PKQ-RCRSP, Patient Knowledge Questionnaire - Rotator Cuff Related Shoulder Pain; SPAKE, SPondyloArthritis Knowledge quEstionnaire; Countries: AR, Argentina; AU, Australia; BE, Belgium; BH, Bahrain; BR, Brazil; CA, Canada; CN, China; DK, Denmark; ES, Spain; FR, France; HU, Hungary; IN, India; JO, Jordan; JP, Japan; KR, South Korea; LB, Lebanon; NG, Nigeria; NL, Netherlands; NO, Norway; NZ, New Zealand; PK, Pakistan; PT, Portugal; RS, Serbia; SA, Saudi Arabia; SY, Syria; TR, Turkey; UK, United Kingdom; US, United States; Language: ARA, Arabic; CHI, Chinese; DAN, Danish; DUT, Dutch; ENG, English; FRE, French; HAU, Hausa; HIN, Hindi; HUN, Hungary; JPN, Japanese; KOR, Korean; MAR, Marathi; NOR, Norwegian; POR, Portuguese; SPA, Spanish; SRP, Serbian; TUR, Turkish; URD, Urdu; YOR, Yoruba; Response format: T/F/N, True/False/I don't know; LS, Likert-scale; MC, Multiple-choice; PROM versions: FV, full version; SV, short version; AV, adapted version.

[a] PROM original language.
[b] Original PROM from a thesis in 1991; however, first article published is a revised version in 2015.
[c] Report of the original article, as the original one is not available.
[d] Measurement properties are grouped based on COSMIN taxonomy as validity (content validity, criterion validity, and construct validity aspects of structural validity, hypotheses testing, and cross-cultural validity), reliability (internal consistency, measurement error, and reliability), or responsiveness.

To the best of our knowledge, this is the first systematic review assessing measurement properties of PROMs that aim to assess knowledge and/or beliefs about musculoskeletal conditions. When selecting a PROM for research or clinical practice, aspects of measurement properties, interpretability, and feasibility should be considered. This study provides an evidence-based recommendation on PROMs that can support their selection. This review also provides an overview about the lack of high-quality research in this field, guiding future research by highlighting information still needed for included PROMs and guidance about the development of new high-quality PROMs for conditions with limited or no available instrument (eg, neck pain). Our results suggest that clinicians and researchers should be aware of the limitations of these questionnaires and should use them with caution. Given that these questionnaires are already being used in many studies and clinical settings, this is particularly concerning.

Table 3. Pooled rating of measurement properties, quality of evidence, and overall recommendation for included PROMs

PROM	Content validity	Structural validity	Internal consistency	Cross-cultural validity	Reliability	Measurement error	Criterion validity	Hypotheses testing	Responsiveness	Overall recommendation
					Overall rating [quality of evidence]					
				Ankylosing spondylitis						
AS	? [Low]	? [Low]	? [Low]	NA	+ [Moderate]	NA	NA	? [Moderate]	NA	B: Potentially suitable for use
				Fibromyalgia						
FKQ	? [Low]	NA	? [Low]	NA	+ [Moderate]	NA	NA	? [Low]	? [Moderate]	B: Potentially suitable for use
				Low back pain						
BBQ	? [Low]	? [Low]	? [Very low]	? [Very low]	+ [Moderate]	? [Moderate]	NA	± [Moderate]	? [Moderate]	B: Potentially suitable for use
Back-PAQ	? [Moderate]	± [Moderate]	? [Very low]	+ [High]	+ [Moderate]	? [Moderate]	+ [High]	± [Moderate]	NA	B: Potentially suitable for use
LKQ	? [Low]	± [High]	? [Low]	NA	+ [Moderate]	? [High]	+ [High]	± [Moderate]	+ [High]	B: Potentially suitable for use
LBP-TBQ	? [Low]	± [Moderate]	± [Low]	- [Moderate]	+ [Moderate]	NA	NA	+ [Moderate]	NA	B: Potentially suitable for use
				Osteoarthritis						
KOFBeQ	? [Low]	? [Moderate]	? [Moderate]	NA	+ [Very low]	? [Low]	NA	+ [High]	NA	B: Potentially suitable for use
OAKS	? [Low]	? [Moderate]	? [Moderate]	+ [Moderate]	+ [Moderate]	? [Moderate]	NA	NA	NA	B: Potentially suitable for use
PKQ - OA	? [Low]	+ [High]	± [Low]	NA	± [Very low]	NA	NA	± [Moderate]	NA	B: Potentially suitable for use
TOA	? [Very low]	? [Moderate]	? [Moderate]	NA	+ [Low]	? [Low]	NA	NA	NA	B: Potentially suitable for use
				Osteoporosis						
LOKS	? [Low]	+ [High]	? [Very low]	NA	NA	NA	NA	? [Moderate]	NA	B: Potentially suitable for use
O&Y	? [Low]	+ [High]	- [High]	- [Low]	NA	NA	NA	+ [Moderate]	- [Moderate]	C: Not recommended
OKAT	? [Low]	? [Low]	? [Very low]	NA	? [Very low]	NA	NA	NA	NA	B: Potentially suitable for use
OKT	? [Very low]	NA	? [Low]	NA	? [Very low]	NA	NA	NA	NA	B: Potentially suitable for use
OPQ	? [Low]	NA	? [Very low]	NA	? [Very low]	NA	NA	NA	NA	B: Potentially suitable for use
				Rheumatoid arthritis						
AKQ	? [Low]	NA	? [Low]	NA	NA	NA	NA	+ [High]	? [Low]	B: Potentially suitable for use
DataK-RA	? [Low]	+ [High]	? [Low]	+ [Low]	NA	NA	NA	+ [High]	NA	B: Potentially suitable for use
PKQ - early RA	? [Moderate]	NA	? [Very low]	NA	+ [Very low]	NA	NA	? [Very low]	? [Very low]	B: Potentially suitable for use
PKQ - RA	? [Moderate]	NA	? [Very low]	NA	± [Very low]	NA	NA	? [Low]	NA	B: Potentially suitable for use
QuAD	? [Low]	NA	NA	NA	NA	NA	NA	? [Moderate]	NA	B: Potentially suitable for use
RAKE	? [Very low]	NA	? [Low]	NA	? [Very low]	NA	+ [High]	? [Low]	? [Low]	B: Potentially suitable for use
RAKAS	? [Low]	+ [High]	- [Low]	NA	± [Low]	NA	NA	± [Low]	NA	B: Potentially suitable for use
ACREU-RAKQ	? [Moderate]	? [Very low]	? [Very low]	NA	? [Very low]	NA	NA	+ [Moderate]	+ [High]	B: Potentially suitable for use

(*Continued*)

Table 3. Continued

PROM	Content validity	Structural validity	Internal consistency	Cross-cultural validity	Reliability	Measurement error	Criterion validity	Hypotheses testing	Responsiveness	Overall recommendation
Shoulder pain										
PKQ-RCRSP	? [Low]	NA	? [Very low]	NA	NA	NA	NA	NA	+ [Very low]	B: Potentially suitable for use
Spondyloarthritis										
SPAKE	? [Low]	NA	? [Low]	NA	? [Very low]	NA	NA	? [Moderate]	? [Low]	B: Potentially suitable for use

PROM, Patient-Reported Outcome Measure; NA, Not assessed; PROMs: AS, Ankylosing Spondylitis; FKQ, Fibromyalgia Knowledge Questionnaire; BBQ, Back Beliefs Questionnaire; BackPAQ, Back Pain Attitudes Questionnaire; LKQ, Low back pain Knowledge Questionnaire; LBP-TBQ, Low Back Pain Treatment Beliefs Questionnaire; KOFBeQ, Knee Osteoarthritis Fears and Beliefs Questionnaire; OAKS, OsteoArthritis Knowledge Scale; PKQ, Patient Knowledge Questionnaire; OA, Osteoarthritis; TOA, Treatment beliefs in knee and hip OsteoArthritis; LOKS, Lebanese Osteoporosis Knowledge Scale; O&Y, Osteoporosis and You; OKAT, Osteoporosis Knowledge Assessment Tool; OKT, revised Osteoporosis Knowledge Test; OPQ, OsteoPorosis Questionnaire; AKQ, Arthritis Knowledge Questionnaire; DataK-RA, Disease and treatment associated Knowledge in Rheumatoid Arthritis item bank; RA, Rheumatoid Arthritis; QuAD, Questionnaire for Arthritis Dialogue; RAKE, Rheumatoid Arthritis Knowledge questionnairE; RAKAS, Rheumatoid Arthritis Knowledge Assessment Scale; ACREU-RAKQ, The ACREU Rheumatoid Arthritis Knowledge Questionnaire; PKQ-RCRSP, Patient Knowledge Questionnaire - Rotator Cuff Related Shoulder Pain; SPAKE, SPondyloArthritis Knowledge quEstionnaire; Rating: +, sufficient; -, insufficient; ?, indeterminate; ±, inconsistent. Overall recommendation: (A) Suitable for use: PROMs with evidence of sufficient content validity AND at least low quality evidence for sufficient internal consistency; (B) Potentially suitable for use: PROMs not categorized in A or C; or (C) Not recommended: PROMs with high quality evidence of an insufficient measurement property.

Content validity is recommended to be the first measurement property to be evaluated when selecting a PROM. Content validity provides evidence of relevance, comprehensiveness, and comprehensibility of the items in relation to the construct and target population, considering both development studies and content validity studies [88]. In this systematic review, all included PROM development studies were rated as doubtful or inadequate methodological quality. Further, content validity studies did not cover all topics that are recommended to be assessed, leading to an indeterminate rating for all included PROMs, with very low to moderate quality of evidence. Previous systematic reviews on measurement properties for different constructs (eg, patellofemoral pain, medication adherence in cardiovascular disease) using COSMIN methods also rated content validity studies as indeterminate or inadequate, suggesting a general lack of quality of content validity studies [89,90]. Our review identified the lack of high-quality evidence on content validity of PROMs to measure knowledge and beliefs about musculoskeletal conditions. Additional content validity studies including patients and experts are required for existing PROMs.

Reliability was the most assessed group of measurement properties, including internal consistency, test-retest reliability, and measurement error. Internal consistency was the most assessed measurement property. Methodological guidelines highlight the need for internal consistency assessment for each factor found in a structural validity assessment of the PROM. Internal consistency studies in our review had the worst methodological quality ratings as structural validity was not determined for most included PROMs, and internal consistency was not usually reported for all factors, leading to doubtful overall internal consistency rating for most included PROMs. Overall ratings for test-retest reliability were scored as adequate in most of the included studies, with a common flaw being the lack of reporting of the ICC formula applied. No study reported the MIC value of the PROM and consequently, measurement error was rated as indeterminate for all included studies. Although reliability was widely assessed, this systematic review highlights the need for studies to report a greater level of methodological detail to achieve higher quality ratings.

The international consensus on taxonomy was reached by the COSMIN group in 2010, describing different aspects of validity [26]. However, many authors describe measurement properties using different criteria. In this systematic review, we applied the COSMIN taxonomy consistently across included studies and measurement properties were classified according to the international COSMIN consensus. Where authors described a measurement property using a different definition, we assessed the measurement property assessed based on the COSMIN taxonomy. For example, criterion validity assessment using a PROM version other than the original version was considered as hypothesis testing for construct validity.

Table 4. Summary of interpretability and feasibility data available for included PROMs (*n* = 25)

PROM	Interpretability			Feasibility	
	Floor and ceiling effects	Minimal important change (MIC)	Completion time (mean range across studies)	Ease of score calculation[a]	Cost of an instrument
Ankylosing spondylitis					
AS	Ceiling effect detected	NR	NR	Easy	Freely available in published article
Fibromyalgia					
FKQ	NR	NR	NR	Easy	Freely available in published article
Low back pain					
BBQ	Neither floor nor ceiling effect detected	NR	7 min	Easy	Freely available in published article
Back-PAQ	Neither floor nor ceiling effect detected		5 min	Easy	Freely available at www.otago.ac.nz/backpaq
LKQ	NR	NR	3 min	Easy	Freely available in published article
LBP-TBQ	Neither floor nor ceiling effect detected	NR	NR	Easy	Freely available in published article
Osteoarthritis					
KOFBeQ	Neither floor nor ceiling effect detected	NR	NR	Easy	Freely available in published article
OAKS	NR	NR	NR	Easy	Freely available at www.otago.ac.nz/oaks
PKQ - OA	NR	NR	5 to 20 min	Easy	NR
TOA	NR	NR	NR	NR	NR
Osteoporosis					
LOKS	NR	NR	15 min	Easy	Freely available in published article
O&Y	NR	NR	NR	Moderate	NR
OKAT	NR	NR	3 min	Easy	Freely available in published article
OKT	NR	NR	NR	Moderate	NR
OPQ	NR	NR	NR	Easy	Freely available in published article
Rheumatoid arthritis					
AKQ	NR	NR	NR	Easy	Freely available in published article
DataK-RA	Neither floor nor ceiling effect detected	NR	NR	NR	NR
PKQ-early RA	NR	NR	NR	NR	NR
PKQ-RA	NR	NR	10 min	Easy	Freely available in published article
QuAD	NR	NR	25 min	Moderate	NR
RAKE	NR	NR	NR	Moderate	Freely available in published article
RAKAS	NR	NR	4 min	Easy	Freely available in published article
ACREU-RAKQ	NR	NR	NR	Easy	Freely available in published article
Shoulder pain					
PKQ-RCRSP	Ceiling effect detected	NR	NR	Easy	Freely available in published article
Spondyloarthritis					
SPAKE	NR	NR	12 min	Moderate	Freely available in published article

PROM, Patient-Reported Outcome Measure; NR, Not Reported; PROMs: AS, Ankylosing Spondylitis; FKQ, Fibromyalgia Knowledge Questionnaire; BBQ, Back Beliefs Questionnaire; Back-PAQ, Back Pain Attitudes Questionnaire; LKQ, Low back pain Knowledge Questionnaire; LBP-TBQ, Low Back Pain Treatment Beliefs Questionnaire; KOFBeQ, Knee Osteoarthritis Fears and Beliefs Questionnaire; OAKS, OsteoArthritis Knowledge Scale; PKQ, Patient Knowledge Questionnaire; OA, Osteoarthritis; TOA, Treatment beliefs in knee and hip OsteoArthritis; LOKS, Lebanese Osteoporosis Knowledge Scale; O&Y, Osteoporosis and You; OKAT, Osteoporosis Knowledge Assessment Tool; OKT, revised Osteoporosis Knowledge Test; OPQ, OsteoPorosis Questionnaire; AKQ, Arthritis Knowledge Questionnaire; DataK-RA, Disease and treatment associated Knowledge in Rheumatoid Arthritis item bank; RA, Rheumatoid Arthritis; QuAD, Questionnaire for Arthritis Dialogue; RAKE, Rheumatoid Arthritis Knowledge questionnairE; RAKAS, Rheumatoid Arthritis Knowledge Assessment Scale; ACREU-RAKQ, The ACREU Rheumatoid Arthritis Knowledge Questionnaire; PKQ-RCRSP, Patient Knowledge Questionnaire - Rotator Cuff Related Shoulder Pain; SPAKE, SPondyloArthritis Knowledge questionnaire.

[a] Ease of score calculation was rated as easy or moderate. Easy requires sum of each item numerical score. Moderate requires sum of each item numerical score in addition to mathematical adjustments and/or calculations to obtain score.

Responsiveness was the least assessed group of measurement properties in this review (13/60). Responsiveness represents the ability of a PROM to detect change in the construct over time. Four included PROMs were rated as having adequate responsiveness. However, only two of the studies had high quality evidence (ACREU-RAKQ and LKQ). Responsiveness requires multiple timepoints and can be assessed by comparison with other instruments/reference, comparison between known groups, and/ or a comparison before and after an intervention. This systematic review highlights the need for further high-quality studies on responsiveness of PROMs aimed to assess knowledge and/or beliefs about musculoskeletal conditions.

This study has some limitations. Based on our inclusion criteria and the lack of widely accepted definitions for constructs like "knowledge", "beliefs", and "attitudes", we excluded PROMs that may provide knowledge and beliefs about a musculoskeletal condition when items were mostly related to a different concept (eg, catastrophizing, fear-avoidance) or pain in general, instead of a specific musculoskeletal condition (eg, Tampa Scale for Kinesiophobia, Pain Self-Efficacy Questionnaire). To avoid missing relevant PROMs that meet our inclusion criteria, investigators and experts met to discuss how to apply our eligibility criteria before screening the records. Also, the structural validity rating may have been impacted by the lack of sufficient evidence in the literature to formulate alternative criteria using EFA. In addition, this study was based on the current COSMIN guidelines [22] and some items for methodological quality assessment are subjective (eg, meaning of "other important flaws"). To avoid inconsistency, the investigators met to discuss how to achieve consensus on subjective questions, then one review author checked all ratings across studies.

5. Conclusion

There is no PROM to assess knowledge and beliefs about musculoskeletal conditions that meets the COSMIN criteria of *suitable for use*. Most PROMs identified in this systematic review are currently considered as *potentially suitable for use* and need further high-quality research to assess their measurement properties. PROMs commonly used in clinical practice and research lacked sufficient content validity.

CRediT authorship contribution statement

Leticia Amaral Corrêa: Writing − review & editing, Writing − original draft, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Stephanie Mathieson:** Writing − review & editing, Writing − original draft, Supervision, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Mark Hancock:** Writing − review & editing, Writing − original draft, Supervision, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Arianne Verhagen:** Writing − review & editing, Writing − original draft, Methodology, Formal analysis. **Leandro Alberto Calazans Nogueira:** Writing − review & editing, Writing − original draft, Methodology, Formal analysis. **Annie Young:** Writing − review & editing, Writing − original draft, Formal analysis. **Joshua W. Pate:** Writing − review & editing, Writing − original draft, Formal analysis. **Simon D. French:** Writing − review & editing, Writing − original draft, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Data availability

Data will be made available on request.

Declaration of competing interest

There are no competing interests for any author.

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Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jclinepi.2024.111398.

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