

A scoping review of patient self-report measures of flare in knee and hip osteoarthritis (OA): A report from the OMERACT flares in OA working group

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ABSTRACT

Purpose: We aimed to analyze the content validity/domain match and feasibility of self-report instruments that could measure flare in osteoarthritis (OA), by extending our 2017 literature review on the definition of flare in knee and hip OA.

Method: We searched PubMed (Medline), Web of Science and PsycInfo (Ebsco Host) databases for original articles reporting research about flare (or synonyms) in humans with knee and hip OA, between 2017 and 2023. Four experts worked independently, checking the records, and assessing content validity and feasibility, writing justification for exclusion.

Results: At literature review phase, 575 papers were filtered. After experts' analysis, 59 studies were included, and 44 instruments associated with flare in OA were identified. Most were studies about pain in knee or hip OA (35%), cultural adaptation of a measure (33%) or studies investigating psychometric properties of full (16%) or short form (4%) instruments. The assessment of domain match and feasibility revealed that 15 instruments were assigned a label of 'yes' or 'uncertain' as to whether or not there was a good match with the domain concept or whether the instrument was considered feasible to use.

Discussion: Most identified instruments considered different aspects of pain and the associated discomfort in performing daily activities but did not include the central aspects of flare in OA, i.e. the change of state, nor the additional Outcome Measures in Rheumatology (OMERACT) endorsed domains for OA flare namely stiffness, swelling, psychological aspects, impact of symptoms including fatigue and sleep disturbance. Although it is possible that the period specified to conduct this literature review may have led to some recognized instruments being excluded, this review demonstrates the need for the research community to reach consensus on the best way to measure self-reported flares in future clinical trials and observational studies.

Introduction

Flare is important to osteoarthritis (OA) patients as a phenomenon that may occur throughout the life-course of this condition. Flare

occurrence is unique to each individual and often experienced as unpredictable episodes that can vary in frequency, intensity and duration [1] with their consequences lasting from minutes to hours to days [2–4]. Flares can result in both physical and mental discomfort that can

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interrupt long-term self-management behaviors [5] as well as impact job productivity and daily life in general. Usually, pain and its consequences are the dimensions favored when trying to understand the *change of state* associated with the flare phenomenon.

To provide support for the definition of flare in knee and hip OA, a previous review was conducted in 2017 with the goal of understanding how flare was assessed in OA studies [2]. This included 23 studies and revealed that the majority described flare as an increase in pain using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), a visual analog scale (VAS), or global assessment measures. One study reported the antecedents and consequences of pain flare (using qualitative methods) capturing data on the timing of increased pain, for example speed of onset and episode duration [6]. None incorporated the patient perspective. Based on the findings of this previous literature review, four components were identified that could inform a standardized definition: (a) Flare as a concept of pain (pain criteria); (b) Flare as factors other than pain (other criteria); (c) Flare as composite factors (composite criteria) and (d) Flare as a global evaluation (global assessment) [2].

To develop an evidence-based tool to measure flare in OA that integrates the patient perspective, an Outcome Measures in Rheumatology (OMERACT) Working Group has been established. This group proposed a definition of flare in OA as “a transient state, different from the usual state of the condition, with a duration of a few days, characterized by onset, worsening of pain, swelling, stiffness, impact on sleep, activity, functioning, and psychological aspects that can resolve spontaneously or lead to a need to adjust therapy” [3]. Then a decision-making process following OMERACT methodology [7] reached consensus agreement for the following patient-centered outcome domains for use across clinical trials and observational studies in rheumatology: Pain, Swelling, Stiffness, Psychological Aspects, Impact of Symptoms [4]. For each domain, a descriptive definition was also approved by patients, physicians, and health researchers (see Fig. 1). For these flare characteristics to represent a *change of state* different from usual, the increased impact should last a few days [3,4].

Building on the OMERACT work to establish a proposed definition and domains for flare in OA, the purpose of this literature review was to analyze the content validity of self-report instruments that could measure flare in OA from the patient’s perspective, by extending the Cross et al. [2] review. We proceeded in two steps: *literature review* for the identification of the instruments and *content validity analysis*, an assessment of domain match, where the identified instruments were analyzed considering the definition of Flare in OA and assessment of the feasibility of the instruments, according to the OMERACT instrument selection process [9,10].

Materials and methods

Literature review

We searched PubMed (Medline), Web of Science and PsycInfo (Ebsco Host) databases for original articles reporting research about flare (or synonyms such as exacerbation) in humans with knee and hip OA. There were no restrictions by language and all records between January 2017 and February 2023 were considered. The keywords used in the literature review conducted by Cross et al. [2] were considered for all three databases, with the addition of the following instrument-related terms: measure, measurement, reliability, validity, questionnaire and survey (search terms are displayed in Appendix 1).

This literature review followed the PRISMA 2020 statement [8]. After excluding duplicate records, initial *identification* involved reading article titles, a first phase in which each retained title was validated by two experts (FQ and FG). In the next phase, the *screening review* was conducted by reading the abstracts by three experts (FQ, FG and MC). Discrepancies in any step were resolved with discussion. In the last phase, *included review*, a fourth expert (JE) was added to confirm the records before assessing the full article. Consistent with the previous review by Cross et al., studies were included in which participants had confirmed OA. To avoid inclusion bias, the experts worked independently, checking the returned records, and writing comments to justify

Pain	<ul style="list-style-type: none"> • A distinct change in pain, that is more severe and lasts longer, that is particularly heightened with physical activity and persists with rest.
Swelling	<ul style="list-style-type: none"> • A new increase in size or feeling of fullness of the joint.
Stiffness	<ul style="list-style-type: none"> • Increased or prolonged stiffness of the joint that does not resolve with movement.
Psychological aspects	<ul style="list-style-type: none"> • Alterations in mood, including depressive symptoms, greater anxiety, greater irritability, and/or low morale that are consequences of the symptoms during flare.
Impact of symptoms	<ul style="list-style-type: none"> • A change in the ability to perform daily activities, requiring new adaptation and strategies due to the increase in pain, swelling, stiffness, fatigue and sleep disturbance related to the flare.

Fig. 1. Domains and respective descriptions endorsed by OMERACT Working Group in Flare in OA. Adapted from King et al. (p.5) [4].

exclusion.

Only papers that aimed to develop instruments for knee and/or hip OA were retained. As part of data extraction, we observed the number of items for each instrument and the definition of the construct being assessed, the target population and the validation sample size and demographics. To complete the screening task, we searched for the original version of instruments used in studies included in our literature review and we considered any disclosure information for each one. Specific characteristics of included studies were identified, including type of study design, type of joint (where applicable), description of construct measured and validation sample. Formal risk of bias assessment of included studies was not undertaken as the focus was on establishing how suitable the included self-report instruments are for capturing OA flares.

Domain match/Content validity analysis

We also examined to what extent the constructs captured by each instrument matched with the definition of flare in OA adopted for the present review (content validity, named as *domain match* or *truth* to facilitate communication with experts of different profiles [7,9]) and their feasibility. To complete both tasks (i.e. related to content validity and feasibility), four experts, including osteoarthritis clinicians and scientists [2], psychometrician [1] and methodologist [1], compared the concepts and judged each instrument according to the following scale.

The OMERACT Handbook [10] with its method for evaluating instruments, served as a guide for us to conduct the judgment of the instruments. However, throughout the evaluation process, we expanded the suggested scale from 3 to 4 categories to increase the variability in the characterization of the instruments. For domain match/truth (content validity), we considered how closely the definition presented in each retained article aligned with the definition of flare in OA as endorsed by OMERACT. For feasibility, judgements reflect an overall consideration of the following elements: how easy the instrument is for respondents to understand, time to complete the instrument, and the feasibility of administration methods in terms of costs and any copyright permissions. Instruments that received *positive evaluations* on both criteria were assigned a label “yes”. When an instrument obtained a combination of *poor feasibility* but *excellent/good domain match* or *truth*, it was assigned the label “uncertain”. Disagreements were resolved by consensus discussion.

Results

Literature review

The quantitative summary of records found in each database are presented in [Appendix 1](#). Due to the search specifics of each database, different concatenations were applied to obtain a reliable return of studies. We obtained 220 records in PubMed, 319 records for Web of Science and 36 records for PsycInfo ([Fig. 3](#)).

In addition to duplicate records, at the first level of identification, papers that did not provide information about knee and hip OA were eliminated ($n = 456$). At the screening phase, we retained only those papers which mentioned using measures related to knee and hip OA ($n = 21$ records excluded). Among the reports sought for retrieval, one measure focused on hand OA and was not retrieved [11]. In the eligibility step, papers were excluded if they did not use self-report measures ($n = 7$) or did not match with any domain of flare in OA ($n = 4$).

In total, 59 studies were included, and 44 instruments potentially associated with flare in OA were found. We observed 39 % of the instruments were reported only once, but some instruments (such as Knee Injury and Osteoarthritis Outcome Score – KOOS, Hip Injury and Osteoarthritis Outcome Score – HOOS and (WOMAC) were used in more than 10 studies. Considering the aim of the included studies, most were about global pain (but not *increase* pain) in knee or hip OA (35 %) or about cultural adaptation of a measurement instrument (33 %). Some studies reported their goal was to investigate psychometric properties of full instruments (16 %) or a short form version (4 %). Among them, we retained eight literature review papers about measures in knee and hip OA ($n = 4$) or that included concepts close to a definition of flare ($n = 4$).

Domain match/content validity analysis

Among the 44 instruments identified, 16 were outside the scope of our analysis. These were instruments related to movement performance-based measures or instruments related to others constructs, such as depression, anxiety, emotions, and self-efficacy without referring with neither flare nor knee or hip OA. Therefore, we had 28 screened instruments analyzed for their fit with the definition of flare [3] and their respective domains [4]. With regards to how closely instrument domains matched with the OMERACT-endorsed definition and domains, 15 were assigned ‘yes’ or ‘uncertain’ labels using the domains construct (truth). For the other 13 instruments, their constructs were too inconsistent with the flare in OA definition or did not include elements expected in flare domains. [Table 1](#) summarizes the principal characteristics of instruments we considered as potential candidates to measure self-reported flare.

When we compared the constructs definition presented in instruments, as well as the domains description, we observed some intersection with the OMERACT consensus definition of flare in OA [3, 4]. [Table 2](#) illustrates the flare domains identified in each instrument.

The *pain* domain was the aspect we most commonly found, even though the point of “change in pain” was not completely covered in the description of the instruments. The aspects presented in the domain *impact of symptoms* were also commonly covered in the instruments. Only the SF-MPQ-2 did not include elements of this dimension, and ICOAP and FreKAQ include a reference to daily activities in two items. The Flare-OA questionnaire is unique in that it includes all domains and also the aspect *due to the increase in pain*.

Elements described in the domain *psychological aspects* is well represented in candidate instruments. Sometimes these elements appeared in dimensions such as *mental health* (as in OAKHQOL and PROMIS), *anxiety/depression* (in EuroQoL), and *emotional* (in SF36). However, reference to the domains *swelling* and *stiffness* are only included in KOOS, HOOS, WOMAC and the Flare-OA questionnaire.

In terms of ease of completion for respondents, time taken for completion and the practicalities of administration, most instruments were deemed feasible. However, some original instruments that are popular in the literature, such as WOMAC, KOOS and HOOS, presented potential problems for feasibility due to their size. To solve this issue, it was common to find studies about short versions of the instruments [20, 35,40,67,68] or the use of isolated factors of the original instrument [13, 27,29,32,33,35,40,53,60]. Some reservations were also noted for PROMIS. The adaptive nature of this instrument means question items can change throughout completion, based on earlier responses. This gives flexibility in relation to specific conditions but also adds an extra layer of complexity to the application of OA flares. Finally, the feasibility

Table 1
Principal characteristics of candidate instruments to measure flare.

Instrument*/ Joint	Original Study/ number of items	Description of construct measured	Dimensions	Original Validation Sample	Study design
AAQ Knee/hip	Peter et al. [12] 17 activities and 68 videos	It was developed to assess activity limitations in people with Hip, Knee Osteoarthritis (HKOA). In a focus group, HKOA patients were asked to mention activities that they experienced limitations with, and how they performed these activities.	<i>Unidimensional:</i> level of difficulty in performing activities	1177 patients with HKOA visiting outpatient clinics and rehabilitation centers across six European countries: the Netherlands, UK, France, Denmark, Italy and Spain.	Longitudinal study
EQ-5D	EuroQoL Group [13] 6 items	Health states defined by the EuroQoL classification, and background information about the respondent.	<i>Multi-dimensional:</i> Mobility, Self-care, Usual activities, Pain/discomfort, and Anxiety/depression.	592 people from Sweden, U.K. and the Netherlands.	Cross sectional study
Flare-OA Knee/hip	Traore et al. [14] 19 items	This instrument was developed to measure flare in OA defined as a cluster of symptoms of sufficient duration and intensity to require initiation, change, or increase in therapy.	<i>Multi-dimensional:</i> Pain, Swelling, Stiffness, Psychology aspects and Impact of Symptoms	398 patients from Australia, France, and the United States with inclusion criteria of minimum age 45 years, physician-confirmed knee or hip OA, and ability to complete an online questionnaire.	Longitudinal study
FreKAQ-J Knee	Nishigami et al. [15] 9 items	The goal is to measure altered body-perception specific to the knee. The scores can provide a measure of perceptual impairment for patients suffering from knee OA.	<i>Unidimensional:</i> body-perception (knee)	65 people from Japan with knee OA were recruited consecutively from two orthopedic clinics and one Joint Surgery Center.	Cross sectional study
Health Survey SF36	Ware and Sherbourne [16] 36 items	Intended to measure general health concepts not specific to any age, disease, or treatment group.	<i>Multi-dimensional:</i> Physical functioning scale; General health; Mental health; Vitality; Role physical; Emotional; Bodily pain and Social functioning. The remaining item of the SF-36 is a health transition question that asks about a change in general health over the past 12 months	**	Theoretical study
HOOS hip	Nilsdotter et al. [17] 40 items	The measure intended to evaluate symptoms and functional limitations related to the hip.	<i>Multi-dimensional:</i> Pain; Symptoms (including stiffness and range of motion); Activity limitations-daily living; Sport and Recreation Function; and Hip-related Quality of Life	90 patients with primary hip OA assigned for total hip replacement for OA preoperatively. Prospective cohort study.	Longitudinal study
Impact Index	Valentine et al. [18] 4 items	It measures how much a health problem has a negative impact on a patient's quality of life	<i>Unidimensional:</i> Negative impact on a patient's quality of life	322 patients with hip or knee OA surveyed after visiting a surgeon at baseline. The study was a secondary analysis of data from a randomized controlled trial.	RCT
ICOAP Knee/hip	Hawker et al. [19] 11 items	The instrument measure pain intensity, affect on sleep, impact on quality of life, extent to which the pain 'frustrates or annoys', and the extent to	<i>Bi-dimensional:</i> Constant pain and Pain that comes and goes (in this case, two additional items asked respondents to report the frequency of pain and the degree to	100 participants aged plus 40 years with hip or knee OA.	Cross sectional study

(continued on next page)

Table 1 (continued)

Instrument*/ Joint	Original Study/ number of items	Description of construct measured	Dimensions	Original Validation Sample	Study design
IKDC Knee	Higgins et al. [20] 19 items	which it 'worries or upsets'. Knee evaluation form.	which the pain could be predicted. <i>Multi-dimensional:</i> current health assessment form, subjective knee evaluation form (which includes assessment of symptoms, sports activities, and function), knee history form, surgical documentation form, and knee examination form	1534 knee patients seen at a sports medicine clinic at a large medical center.	Cross sectional study
KOOS Knee	Roos et al. [21] 43 items	The measure intended to evaluate symptoms and functional limitations related to the knee.	<i>Multi-dimensional:</i> Pain; Symptoms (such as swelling and restricted range of motion); Activities of Daily Living; Sport and Recreation Function; and Knee- related Quality of Life.	75 individuals who had <i>meniscus</i> surgery 20 years previously.	Longitudinal study
OAKHQOL Knee/hip	Rat et al. [22] 43 items	It is an instrument that captures aspects specifically appropriate to knee and hip OA patients	<i>Multi-dimensional:</i> physical activities, mental health, social support, and social functioning.	263 patients recruited in outpatient clinics, where 139 were being treated medically, 97 were scheduled for surgery, and 27 had undergone total arthroplasty of hip or knee within the previous 2 years.	RCT
OXFORD Hip Score Hip	Dawson et al. [23] 12 items	A questionnaire about patients' perception of hip problems.	<i>Unidimensional:</i> Perception of hip problems	220 patients before operation and at follow- up six months late.	Longitudinal study
PROMIS	Cella et al. [24] Items are variable according the adaptative form	A family of instruments that can be used to measure different aspects of physical, mental, and social health. Measures are based on banks of items calibrated using the graded response model that estimates item location (severity) and discrimination (ability to distinguish among people with different levels of the pain outcome).	<i>Multi-dimensional:</i> Physical health (symptoms and function), Mental health (affect, behavior, cognition), and Social health (relationships, function).	Approximately 800 PROMIS bank items were tested alongside established ("legacy") questionnaires in a cross- country sample in excess of 11,000 individuals.	Cross sectional study
SF-MPQ-2	Dworkin et al. [25] 22 items	A comprehensive assessment and characterization of the symptoms of both neuropathic and non- neuropathic pain.	<i>Multi-dimensional:</i> Continuous pain, Intermittent pain, Neuropathic pain, Affective descriptors.	882 individuals with diverse chronic pain syndromes and in 226 patients with painful diabetic peripheral neuropathy who participated in a randomized clinical trial.	RCT
WOMAC Knee/hip	Bellamy et al. [26] 24 items	It a measure of health status in patients with OA of the hip or knee.	<i>Multi-dimensional:</i> Pain, Stiffness, and Physical Function	57 patients with symptomatic OA of the hip or knee requiring NSAID therapy. To be eligible patients had to be 55–85 years of age, have definitive radiographic evidence of primary OA in the hip or knee.	Longitudinal study

Notes: * Full instrument names are presented in Table 2.

** In the literature there are multiple validation studies of the SF-36 with different samples, but the original study included here is dedicated to content validity.
RCT: Randomized Controlled Trial; NSAID, Non-steroidal anti-inflammatory drug.

Table 2
Flare in OA domains identified in each instrument.

Instrument (study that applied the instrument)	Number of studies that assessed the instrument	Flare in OA domains
1. Animated Activity Questionnaire AAQ [27–30]	4	Impact of symptoms Pain
2. Health related quality of life measurement-Euro style EQ-5D [18,31,32]	3	Psychological aspects Impact of symptoms Pain
3. Flare-OA Questionnaire [14]	1	Swelling Stiffness Psychological aspects Impact of symptoms
4. Fremantle Knee Awareness Questionnaire FreKAQ-J [15,33]	2	Swelling Impact of symptoms
5. Health Survey (SF-36) [31,34–39]	7	Psychological aspects Impact of symptoms Pain
6. Hip Injury and Osteoarthritis Outcome Score HOOS [12,27–30,32,40–43]	10	Stiffness Impact of symptoms
7. Impact Index [18]	1	Impact of symptoms Pain
8. Intermittent and Constant Osteoarthritis Pain questionnaire (ICOAP) [38,42,44–50]	9	Impact of symptoms
9. International Knee Documentation Committee subjective knee evaluation form IKDC [48]	1	Impact of symptoms Pain
10. Knee Injury and Osteoarthritis Outcome Score (KOOS) [12,15,18,27,29,30,33,39–44,47–49,51–58]	24	Swelling Impact of symptoms
11. Osteoarthritis Knee and Hip Quality of Life (OAKHQOL) questionnaire [31,59–62]	5	Impact of symptoms Psychological aspects
12. OXFORD Hip Score (OHS) [32]	1	Impact of symptoms
13. PROMIS Pain Interference [42,43]	3	Psychological aspects Impact of symptoms
14. Short Form McGill Pain Questionnaire SF-MPQ-2 [46]		Pain Pain
15. Western Ontario & McMaster Universities Osteoarthritis Index (WOMAC) [35–38,42,49,60,63–66]	11	Stiffness Impact of symptoms

of the Impact Index was also deemed questionable. Even though it is a short measure, instructions require specific and restrictive logistics to collect data (self-report should be presented one week after the patient visit to the doctor and at follow-up).

The validation samples for these instruments generally included patients previously recognized as having knee and hip OA, but also instruments that used samples from the general population to assess general health status (as EQ-5D and PROMIS). Despite the sample characteristics shown in Table 1 (populated using the original validation studies), instruments such as WOMAC, KOOS, HOOS and SF 36 have also been further validated in multiple large and diverse study samples since their initial publication.

Table 3 summarizes the evaluation that was confirmed by two independent reviewers, considering “domain match” and “feasibility”.

Using the judgment criteria detailed in the method (see Fig. 2), each of the 15 instruments were evaluated. The individual assessments of the experts were discussed, and Table 3 presents the consensus among the experts regarding truth/domain match and feasibility. The decision column reflects a combined assessment of these two aspects, also agreed by the experts.

In general, the instruments disclose clear information on how to conduct the application, are low cost or free and freely accessible (the only exception is PROMIS that has copyright restrictions). Three

instruments we considered as *uncertain* (marked as U in the *decision* column of Table 3) to be a candidate to measure flare in OA: *SF-36*, because it has a poor alignment with flare definition; *Impact Index* and *PROMIS*, because of concerns regarding feasibility.

Discussion

From this search of the literature, we identified some candidate self-report instruments providing the patient perspective on OA pain, but most did not include all the central aspects of flare in OA that have been endorsed by OMERACT patients and other stakeholders. The instruments screened revealed that measures directed to patients with knee and hip OA usually consider different aspects of the pain dimension and the associated discomfort in performing daily activities [37,41, 69–71]. The psychological symptoms, frequently indicated by patients when they describe flare in knee and hip OA, are generally measured by mental health or emotional disturbance [37,60]. This observation was also found in a narrative review that points to pain and fatigue as the most present elements in knee and hip OA measurements [42]. Of note, the *change of state*, a typical characteristic of flare that was recently endorsed by international consensus for research purposes, was only covered by one instrument, the Flare-OA questionnaire [14]. We are convinced that, taking into account a theoretical definition that is

Table 3
Decision about candidate instruments considering domains match/truth (content validity) with flare domains and feasibility.

Candidate instruments	Original study	Truth/ Domain match	Feasibility	Decision*
1. Animated Activity Questionnaire (AAQ)	Peter et al. (2018)	+	+	Y
2. Health related quality of life measurement-Euro style (EQ-5D)	EuroQoL Group (1990)	+	++	Y
3. Flare-OA Questionnaire	Traore et al. (2022)	++	++	Y
4. Fremantle Knee Awareness Questionnaire (FreKAQ)	Nishigami et al. (2017)	+	++	Y
5. Health Survey (SF-36)	Ware and Sherbourne (1992)	-	+	U
6. Hip Injury and Osteoarthritis Outcome Score (HOOS)	Nilsdotter et al. (2003)	+	-	Y
7. Impact index	Valentine et al. (2021)	+	-	U
8. Intermittent and Constant Osteoarthritis Pain questionnaire (ICOAP)	Hawker et al. (2008)	+	++	Y
9. International Knee Documentation Committee subjective knee evaluation form (IKDC)	Higgins et al. (2000)	++	+	Y
10. Knee Injury and Osteoarthritis Outcome Score (KOOS)	Roos et al. (1998)	+	-	Y
11. Osteoarthritis Knee and Hip Quality of Life (OAKHQOL) questionnaire	Rat et al. (2005)	+	+	Y
12. Oxford Hip Score (OHS)	Dawson et al. (1996)	+	++	Y
13. PROMIS Pain Interference	Cella et al. (2007)	+	-	U
14. Short Form McGill Pain Questionnaire (SF-MPQ-2)	Dworkin et al. (2009)	+	+	Y
15. Western Ontario & McMaster Universities Osteoarthritis Index (WOMAC)	Bellamy et al. (1988)	+	+	Y

*Overall decision of whether candidate instrument meets truth/domain match and feasibility judgements.

Y = Yes, U = Uncertain.

++ = excellent truth/domain match | excellent feasibility.

+ = good truth/domain match | good feasibility.

- = poor truth/domain match | poor feasibility.

-- = very poor truth/domain match | very poor feasibility.

supported by an international consensus to evaluate instruments is an important contribution to the literature.

We recognize, however, some points of limitations in this study. First our starting point (i.e. 2017) may have prevented us from selecting studies using all recognized instruments in the field of knee and hip OA research. For example, our search identified studies adopting the Oxford Hip Score [32], but none with the Oxford Knee Score [72]. Furthermore, not all versions of the included instruments were identified over the study period. Second, our decision-making process for mapping flare domains identified in each instrument may vary if a different approach is taken. Here, we adopted terminology consistent with OMERACT filter 2.2 [9], which is comparable with the content validity evaluation procedures adopted in the COSMIN framework. Finally, our analysis applies the same flare definition to knee and hip OA. However, we still have no answer about the impact of the presence of this combination of both knee and hip flare in terms of measurement.

Significant pain variability affects up to a third of people with, or at high risk of, knee OA [73]. This illustrates that flares are likely to be common across the disease course for many people with OA. Establishing new ways to efficiently study flares will be important for patient care. To improve our understanding of flares, a first important step was to reach an agreed consensus about the definition and domains that compose flare in OA, which was previously accomplished by the OMERACT Working Group [3,4]. A second step to support future intervention research in patients with knee and hip OA is to provide a valid and reliable measure of flare occurrence and their consequences.

Given that flares commonly occur outside the clinical setting, we aimed to identify existing self-report measures that focused on the patient's perception and could potentially capture data on flares. In terms of being able to record flares, we found several instruments that appeared to be feasible for completion during a flare episode. For example, most instruments appeared to have short items with easy-to-understand content. However, we do not have sufficient information about whether instructions are deemed easy to understand for a self-report situation by patients nor whether they would provide any meaningful insights into flare episodes. Despite their frequency of use in the literature for the study of OA (HOOS and WOMAC, for example, are used at least in 10 studies), the use of these instruments for capturing useful data on transient flare episodes is unclear.

By assessing the domain match and feasibility of many candidate instruments identified in the scoping review, we have reduced the number of candidate instruments for the Flare in OA working group to consider moving forward into a full review of the measurement properties of an instrument. The next step will be for the Flare in OA working group to systematically survey all its members, with an emphasis on obtaining the views of patient research partners, on the domain match and feasibility of these candidate instruments. By doing this, we can identify one or more recommended instruments that can be taken forward for a full review of measurement properties and, for those that pass the OMERACT Filter 2.2, eventual use in clinical trials and observational studies. Above all, incorporating the patients' view will be crucial to obtain a decision on feasibility.

++	+	-	--
excellent truth/domain match excellent feasibility	good truth/domain match good feasibility	poor truth/domain match poor feasibility	very poor truth/domain match very poor feasibility

Fig. 2. Judgment scale for domain match/truth (content validity) and feasibility.

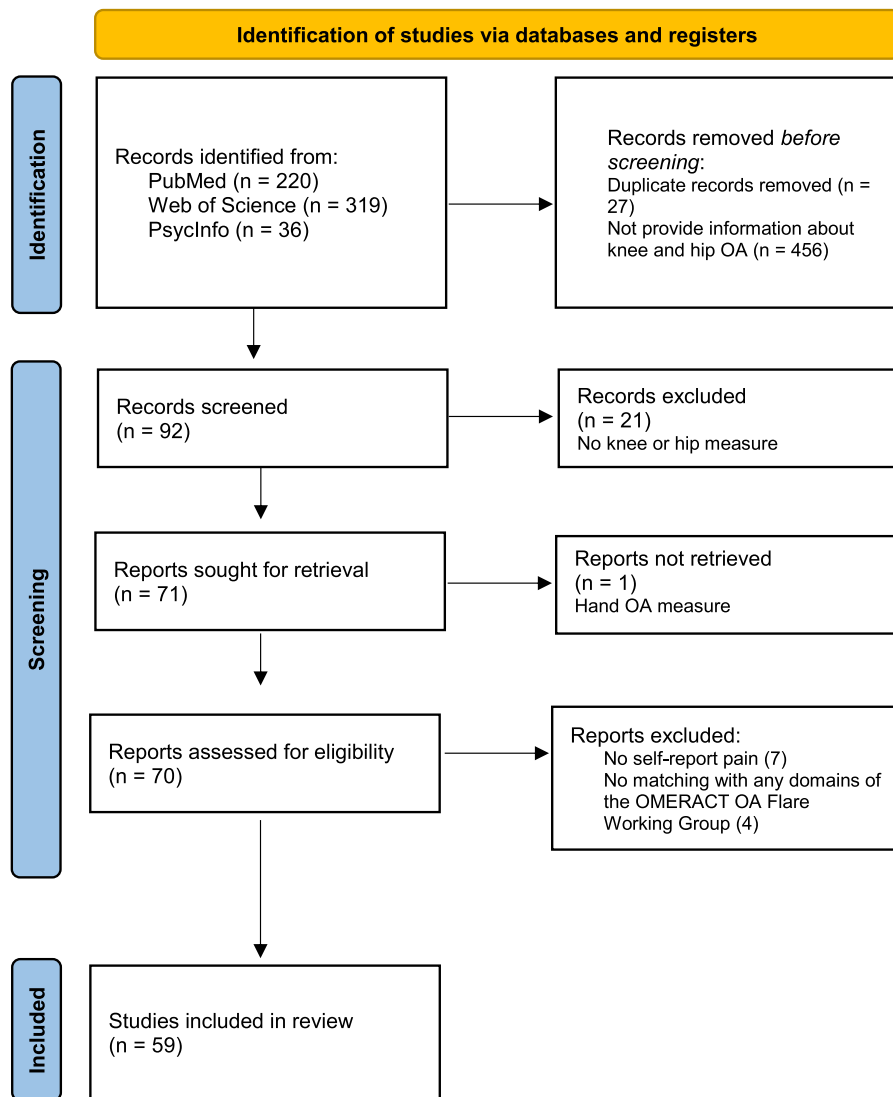


Fig. 3. PRISMA flowchart for systematic review for measurement of flare in knee and hip OA (N = 575).

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CRedit authorship contribution statement

Fabiana Queiroga: Writing – original draft, Writing – review &

editing, Conceptualization, Resources. **Marita Cross:** Writing – original draft, Writing – review & editing. **Martin J. Thomas:** Writing – original draft, Writing – review & editing. **Lyn March:** Conceptualization, Visualization. **Jonathan Epstein:** Conceptualization, Data curation, Formal analysis, Writing – review & editing. **Francis Guillemin:** Conceptualization, Writing – review & editing, Funding acquisition, Methodology, Investigation.

Declaration of Competing Interest

The authors declare that they have no conflict of interest.

Appendix 1. – Search terms applied in each database

Table A, Table B, Table C

Table A

Search terms for Medline.

Search terms	Records found
1. ((((((knee[MeSH Terms]) OR (knee [Title/Abstract]) OR (knees[Title/Abstract])) OR (hip[MeSH Terms])) OR (hip[Title/Abstract]) OR (hips[Title/Abstract])) OR ((((((osteoarthritis[MeSH Terms])) OR (arthrosis[MeSH Terms])) OR (osteoarthritis[Title/Abstract]) OR (osteoarthritides[Title/Abstract])) OR (arthrosis[Title/Abstract])) OR ("Degenerative joint disease"[Title/Abstract]) OR ("degenerative arthritis"[Title/Abstract]))	110,708
2. ((((((osteoarthritis[MeSH Terms])) OR (arthrosis[MeSH Terms])) OR (osteoarthritis[Title/Abstract]) OR (osteoarthritides[Title/Abstract])) OR (arthrosis[Title/Abstract])) OR ("Degenerative joint disease"[Title/Abstract]) OR ("degenerative arthritis"[Title/Abstract]))	103,458
3. 1 AND 2	32,924
4. (((((((flare[Title/Abstract]) OR (flares[Title/Abstract]) OR (exacerbation[Title/Abstract]) OR ("osteoarthritis pain"[Title/Abstract]) OR ("tender joint"[Title/Abstract]) OR ("swollen joint"[Title/Abstract]) OR ("morning stiffness"[Title/Abstract]) OR ("nocturnal awakenings"[Title/Abstract]) OR ("inflammatory status"[Title/Abstract]) OR ("knee effusion"[Title/Abstract]) OR ("acute inflammation"[Title/Abstract]))	30,379
5. 3 AND 4	3169
6. NOT(("arthritis, rheumatoid"[MeSH Terms]) NOT ("rheumatoid arthritis"[Title/Abstract]) NOT ("spondylitis, ankylosing"[MeSH Terms]) NOT ("spondylitis, ankylosing"[Title/Abstract]))	4225
7. AND ((measure[Title/Abstract]) OR (measurement[Title/Abstract]) OR (questionnaire[Title/Abstract]) OR (survey[Title/Abstract]) OR (reliability [Title/Abstract]) OR (validity [Title/Abstract]))	220

Notes: 1. Filters applied: from 2017 to 12/28/2021 | 1/1/2022.

2. Data of search: Feb, 28/2023.

Table B

Search terms for web of science – advance research.

Search terms	Records found
1. (TI=(knee OR knees OR hip OR hips)) AND (AB=(knee OR knees OR hip OR hips))	46,338
2. (TI=(osteoarthritis OR arthrosis OR osteoarthritides OR "Degenerative joint disease" OR "degenerative arthritis")) AND (AB=(osteoarthritis OR arthrosis OR osteoarthritides OR "Degenerative joint disease" OR "degenerative arthritis"))	15,095
3. 1 AND 2	6920
4. (TI=(flare OR flares OR exacerbation OR "osteoarthritis pain" OR "tender joint" OR "swollen joint" OR "morning stiffness" OR "nocturnal awakenings" OR "inflammatory status" OR "knee effusion" OR "acute inflammation")) AND (AB=(flare OR flares OR exacerbation OR "osteoarthritis pain" OR "tender joint" OR "swollen joint" OR "morning stiffness" OR "nocturnal awakenings" OR "inflammatory status" OR "knee effusion" OR "acute inflammation"))	7646
5. 3 AND 4	34
6. NOT (TI=("rheumatoid arthritis")) NOT (AB=("rheumatoid arthritis")) NOT (TI=("spondylitis, ankylosing")) NOT (AB=("spondylitis, ankylosing"))	34
7. AND TI=(measure OR measurement OR questionnaire OR survey) AND AB=(measure OR measurement OR questionnaire OR survey or validity OR reliability)	319

Notes:

1. Filters applied: from 2017 to 2/4/2023.

2. Data of search: Feb, 28/2023.

Table C

Search terms for PsychoINFO.

Search terms	Records FOUND
1. TI(knee OR knees OR hip OR hips) AND AB(knee OR knees OR hip OR hips)	899
2. TI(osteoarthritis OR arthrosis OR osteoarthritides OR "Degenerative joint disease" OR "degenerative arthritis") AND AB(osteoarthritis OR arthrosis OR osteoarthritides OR "Degenerative joint disease" OR "degenerative arthritis")	337
3. 1 AND 2	202
4. TI(flare OR flares OR exacerbation OR "osteoarthritis pain" OR "tender joint" OR "swollen joint" OR "morning stiffness" OR "nocturnal awakenings" OR "inflammatory status" OR "knee effusion" OR "acute inflammation") AND AB(flare OR flares OR exacerbation OR "osteoarthritis pain" OR "tender joint" OR "swollen joint" OR "morning stiffness" OR "nocturnal awakenings" OR "inflammatory status" OR "knee effusion" OR "acute inflammation")	107
5. 3 AND 4	1
6. NOT TI("rheumatoid arthritis" OR "spondylitis, ankylosing") NOT AB("rheumatoid arthritis" OR "spondylitis, ankylosing")	1
7. AND TI(measure OR measurement OR questionnaire OR survey) AND AB(measure OR measurement OR questionnaire OR survey OR validity OR reliability)	36

Notes:

1. Filters applied: from 2017 to 2/4/2023.

2. Data of search: Feb, 28/2023.

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