

Determining Appropriateness of Total Joint Arthroplasty for Hip and Knee Osteoarthritis: multi-methods studies

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Dissertation Abstract

Background. Around 25-45% of elective total joint arthroplasty (TJA) for primary hip and knee osteoarthritis (OA) are of questionable appropriateness.

Objective. To examine how appropriateness of elective TJA for hip and knee OA is determined.

Methods and results. Multi-methods studies guided by the Knowledge-To-Action (KTA) framework and the six Hawker appropriateness criteria for TJA. Study 1 was an interpretive descriptive study exploring barriers and facilitators to using the Hawker appropriateness criteria for adults with knee OA. Nine semi-structured interviews with healthcare professionals and 14 with adults with a TKA revealed: a) 15 barriers (including difficulties in using criteria, lack of accessible conservative treatments, unreceptivity to practice change, clinical judgement limited to OA severity and age, patients receiving information after the decision is made); and b) one facilitator (providing research evidence to obtaining healthcare team buy-in). Study 2 was a systematic review identifying and appraising instruments to assess elective TJA appropriateness for adults with hip and knee OA. None of the 55 instruments met all the Hawker appropriateness criteria; the most included criteria were OA impact on quality of life and evidence of OA while the least included were trial of conservative treatments and elements of shared decision-making. There was limited evidence on psychometric properties. Study 3 was an environmental scan of online Canadian resources for adults with hip or knee OA considering TJA and healthcare professionals participating in the decision. The 73 patient resources were understandable for diverse health literacy levels, but only four were patient decisions aids. Thirteen healthcare professional resources typically recognized OA impact on quality of life, evidence of OA, trial of conservative treatments, and did not discuss elements of shared decision-making.

Conclusion. When determining appropriateness of elective TJA for primary hip and knee OA, clinical practice and instruments typically focus on OA symptoms negatively impacting quality of life and radiographic evidence of OA, while trial of conservative treatments is less reported. The appropriateness decision-making process poorly acknowledges or supports patient preferences (e.g., shared decision-making). Appropriateness of elective TJA needs to be reconsidered and conceptualized in a way that supports early conservative treatments and patient-centred care.

Preface

The doctoral student, LPB, was responsible for and participated in all aspects of this thesis including the conceptualization, design, data collection, data analysis and interpretation, and writing manuscripts and chapters. The first study of this thesis, Chapter 2, was approved by the University of Ottawa Research Ethics Board (H-04-22-7898) and the Montfort Hospital Research Ethics Board (22-23-05-005). Thesis Chapters 2, 3, and 4 are formatted following the guidelines of the peer-reviewed journal in which they are published or under review. Tables and Figures numbers were modified to respect the flow of this thesis.

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Abbreviations

AAOS	American Academy of Orthopedic Surgeons
ACR/AF	American College of Rheumatology and Arthritis Foundation
AUC	Area under the curve
BMI	Body mass index
CFIR	Consolidated Framework of Implementation Research
HCP	Healthcare professional
HOOS	Hip Disability and Osteoarthritis Outcome Score
HSS	Harris Hip Score
ICC	Intra-class correlation coefficient
ICOAP	Intermittent and Constant Osteoarthritis Pain score
IQR	Inter-quartile range
IPDAS	International Patient Decision Aids Standards
JA	Joint arthroplasty
JKOM	Japanese Knee Osteoarthritis Measure Score Threshold
KOOS	Knee Injury and Osteoarthritis Outcome Score
KSS	Knee Society Score
KTA	Knowledge-to-Action framework
MCID	Minimal clinically important difference
NICE	National Institute for Health Research and Care Excellence
NPV	Negative predictive value
NSAID	Nonsteroidal anti-inflammatory drugs and analgesic
OA	Osteoarthritis
OARSI	Osteoarthritis Research Society International

OHS	Oxford Hip Score
OKS	Oxford Knee Score
OMERACT	Outcome Measures in Rheumatology
PEMAT	Patient education material evaluation tool
PKA	Partial knee arthroplasty
PPV	Positive predictive value
PROM	Patient-reported outcome measures
PtDA	Patient decision aid
QoL	Quality of life
SENS	Sensitivity
SDM	Shared decision-making
SPEC	Specificity
SF-36	36-Item Short Form Survey
THA	Total hip arthroplasty
TJA	Total joint arthroplasty
TKA	Total knee arthroplasty
WOMAC	Western Ontario and McMaster Universities Arthritis Index

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Chapter 1. Introduction

1.1 Context and Statement of the Problem

Primary knee and hip osteoarthritis (OA) is a major cause of disability worldwide (1). A 2021 Canadian report revealed that more than 4 million of Canadians, around 1 out of 7 adults, have OA (2).

Clinical practice guidelines recommend the use of conservative treatments (e.g., exercise, weight control, pharmacological therapies) to manage OA symptoms such as pain and stiffness (3,4). When conservative treatments fail to alleviate OA symptoms, elective total joint arthroplasty (TJA) is recommended (5,6). For optimal care, a variety of healthcare professionals are involved in the management of hip and knee OA throughout the disease progression (5,7). However, the majority of OA clinical models of care are fragmented resulting in poor continuity of care between healthcare professionals and limiting timely access to appropriate care (7).

National TJA rates have been steadily increasing over the last several years (8) and this trend is not expected to plateau in the near future due to rising obesity rates, the aging population, inadequate physical activity, increasing TJA surgeries performed on younger individuals (<55 years), and increasing supply-induced demands (9–12). Yet, around 25 to 45% of elective TJA surgeries are of questionable appropriateness (13–17) (typically defined as maximizing benefits while minimizing risks (18,19)) and 10 to 34% of patients are dissatisfied with TJA results (13,20–23). This is concerning for the healthcare system because elective TJA is a burden on inpatient and outpatient resources (8,24). Hence, there is a need for appropriate TJA surgery to achieve Quintuple Aim of Healthcare (25): improve patient experience, decrease healthcare expenditure, advance population health, improve healthcare professional experience, and increase health equity (9,26,27).

There are four key factors contributing to lack of appropriateness and patient dissatisfaction. First, early and consistent evidence-based OA management is challenging because of the complexity of the healthcare systems and its structures (e.g., fragmented care, time, finance) (28–31). Second, most decisions to proceed with elective TJA are typically based on surgeons' judgment without necessarily considering patients' informed preferences, and there is poor association between patients' informed preference for TJA and surgeons' judgment (32–37). Third, there is a lack of standardized assessment criteria for healthcare professionals to determine elective TJA appropriateness leading to practice variations (10,13,27,38,39). Finally, patients are often given insufficient information about the TJA procedure, outcomes, and alternative OA treatment options which leads to unrealistic expectations and dissatisfaction with surgery results (23,32,37,40–45).

The challenges when determining elective TJA appropriateness is ensuring agreement between patient and healthcare professionals (e.g., surgeon, physiotherapist) that benefits outweigh harms, confirming patients are physically and mentally ready for surgery, and verifying that patients have realistic expectations of TJA outcomes (27,39,46). A group of OA Canadian experts (surgeons, rheumatologists, and health services researchers) and patients developed and validated (face/content, discriminant) six appropriateness criteria for TJA (9,10,27,32,46). According to the Hawker et al. appropriateness criteria for TJA (27), *“patients are appropriate for consideration for hip and knee replacement surgery when...:*

- 1) *the patient reports that OA symptoms are negatively impacting their overall quality of life (pain, function, quality of life),*
- 2) *the patient has evidence of OA on examination (clinical and radiographic),*
- 3) *the patient has had an adequate trial of conservative treatment,*

- 4) *the patients' expectations for TJA are achievable,*
- 5) *the patient and surgeon agree that potential benefits outweigh potential risks of surgery,*
- 6) *the patient is physically and mentally ready for surgery”*

Respectively, three criteria are on OA characteristics, two are relevant to shared decision-making (SDM), and one is about patient's readiness for surgery. The Hawker et al. appropriateness criteria for TJA support patient-centred care by including criteria relevant to SDM which is consistent with clinical practice guidelines (6,10,47,48). SDM is an approach by which healthcare decisions are made by the patient and healthcare professional using the best available evidence, and patients' informed preferences to support patients' realistic expectations and quality decisions (49,50). SDM was acknowledged as the crux of patient-centred care (51), and it is advocated by healthcare systems and recommended by TJA clinical practice guidelines (6,47,52). When patients are involved in making their healthcare decisions, they achieve better health outcomes, improve quality and safety of treatment, and reduce healthcare costs (53–56). Yet, studies have shown that many healthcare professionals do not know what SDM is and demonstrate poor level of SDM in clinical practice (57–62). There is currently limited knowledge about 1) how appropriateness of elective TJA for primary hip and knee OA is determined; 2) the extent to which patients are supported with resources about TJA decisions; and 3) the extent to which patient perspectives are incorporated into TJA decisions. The overarching aim was to examine how appropriateness of elective TJA for primary hip and knee OA is determined.

The purpose of this chapter is to summarize the current state of evidence related to the decision-making process to determine elective TJA appropriateness for primary hip and knee OA and identify gaps in knowledge providing the justification for this doctoral thesis. The guiding

theoretical frameworks and philosophical stance will then be presented. Finally, the statement of the problem and specific thesis objectives will be stated.

1.2 Literature Review

The following section will provide an overview of key findings revealed by a narrative literature review of the evidence on the decision-making process to determine elective TJA appropriateness for primary hip and knee OA. Articles were searched up to March 2023 in seven electronic databases using various combinations of key terms (e.g., “osteoarthritis”, “appropriateness”, “criteria”, “indication”, “joint replacement”, “joint arthroplasty”, “osteoarthritis”, “decision-making”, “guidelines”, “shared decision-making”, “decision aids”, “physiotherapy”, “physical therapy”). No time limit was applied.

1.2.1 Osteoarthritis

OA is a chronic and progressive condition characterized by changes in the cartilage, bones, and surrounding joint structures and predominantly affects women (63,64). Typical hip and knee OA symptoms include joint pain and aching, decrease range of motion, swelling, instability, and crepitus that may lead to decreased function (65). The first line of OA treatments involves a variety of conservative treatments (non-pharmacological and pharmacological) including education, physiotherapy (e.g., exercises, stretches, walking aids, thermotherapy, cryotherapy, braces), weight loss, and pharmacological therapies (topical and oral non-steroidal anti-inflammatory drugs) (5,47,48,66). Additional treatment options include intraarticular injections (e.g., corticosteroids), and opioids (weak recommendation for short-term weak opioids and conditional recommendation for non-tramadol opioids) (47,66). For moderate to severe OA, when

conservative treatment(s) fails to alleviate OA symptoms, clinical practice guidelines recommend TJA (5,67).

Many adults diagnosed with OA know little about the condition and are confused about the varying symptoms (68). Several adults with OA also believe the body is a machine that unavoidably wears down over time and that can only be repaired by an orthopaedic surgeon discouraging them to actively engage in their OA management and increasing their treatment dependence on healthcare professionals (69). Without appropriate OA education and guidance from healthcare professionals, adults with OA are usually unclear on how to manage the disease leading to activity avoidance and fear (68,70). Pain intensity, level of physical and functional limitation, and confidence in the joint are also factors influencing activity avoidance and fear (71,72).

1.2.2 OA clinical models of care

OA is typically diagnosed and managed by general practitioners in primary care settings and is reported as one of the most common reasons for consultation in adults (73). Clinical practice guidelines recommend using a combination of clinical symptoms and physical assessment to diagnose primary hip and knee OA and most do not recommend the use of radiographic evidence as a confident diagnosis can be made without this evidence (74–77). For best OA symptoms management, interprofessional teams are involved throughout the progression of OA (5,7). A scoping review revealed 30 studies reporting a variety of OA clinical models of care (e.g., in-person delivered programs, virtually delivered programs) including a variety of OA management treatments (e.g., exercise, self-management) provided by a range of healthcare professionals (78). However, in clinical practice, most OA clinics are discipline-specific and disconnected from other

healthcare professionals resulting in poor OA management, limited access to timely care, and inappropriate use of care (7,30,73).

In Canada, general practitioners are typically the first line of OA management and sometimes refer patients to other healthcare professionals (e.g., physiotherapists, dietician, orthopaedic surgeons) (79). However, some Canadian healthcare systems are trying different clinical models of care to support continuity and appropriateness of care. For example, the Ontario Ministry of Health and Long-Term Care, in collaboration with Health Quality Ontario, have implemented centralized referral intake and rapid access assessment clinics (80). This clinical model is intended to provide continuous access to high quality musculoskeletal care, to set clinical practice evaluation standards, and to accelerate clinical pathway implementation (80). Healthcare professionals other than physicians (e.g., physiotherapist, nurse) work in the centralized rapid access assessment clinic to assess and triage patients to surgical consultation or conservative treatments (80). There is a similar TJA process of care in Saskatchewan (81).

1.2.3 Total joint arthroplasty

TJA is the surgical procedure of replacing the surfaces of the bones of a joint with synthetic prosthesis (82). In Canada, most adults having elective hip or knee TJA are older than 65, women, and undergo the surgery because of primary OA (8). The most common age group is 65-74 years old for total knee replacement and 75 years and older for total hip replacement (8). This is consistent with the broader literature recognizing that TJA are mostly performed on adults between 60-79 years old, with surgery rates declining after 80 (38,83–85), but other countries report inconsistent sex characteristics (more men (38,83,86,87), more women (84,85,88), and similar rates (89,90)). Family physicians and orthopedic surgeons typically offer and recommend elective TJA more often to men (38,86) while Caucasian adults of higher socio-economic status and well-

educated are more likely to undergo elective TJA (38,84,88,89,91). Finally, adults living in rural area typically undergo TJA at a younger age (92).

1.2.4 Clinical practice guidelines and quality indicators for OA and TJA

There are 17 hip and knee OA clinical practice guidelines (6,47,48,66,67,74,75,77,93–101), two reviews of clinical practice guidelines (5,13), and two quality indicators guidelines (102,103). The guidelines were developed in the United States (n=7), international collaboration (n=7), United Kingdom (n=4), Canada (n=1), South America (n=1), and European collaboration (n=1). Of the 17 clinical practice guidelines and the two reviews, 14 include recommendations for elective TJA decision-making (5,6,13,48,66,67,74,75,77,96–100) and five are focused on nonsurgical OA management (47,93–95,101). Most decision criteria for elective TJA in guidelines consist of a combination of the following: OA symptoms (e.g., pain, functional limitations), radiographic evidence of OA, and failure of conservative treatments to control symptoms (5,6,13,47,48,66,67,74,75,77,96–100,102,103). The 2010 Osteoarthritis Research Society International (OARSI) guideline recommends consideration of traditional criteria (pain, disability, age, gender, comorbidities) and also suggests considering patients' willingness to undergo elective TJA (77). The American Academy of Orthopedic Surgeons (AAOS) evidence-based guidelines focus principally on traditional criteria including radiographic evidence, joint characteristics (range of motion, instability, alignment), and patient characteristics (e.g., age, comorbidities) (96,97,104,105). Interestingly, of the 17 guidelines, six (6,47,48,74,75,93) include recommendations emphasizing patient-centred care such as a) TJA consideration should include discussions between patients, referring healthcare professionals, and surgeons (6,47,74,75); b) patient characteristics should not be barriers to referral (e.g., age, sex, comorbidities) (48,74,75); c) discussion of benefits/harms, recovery, and perioperative care of TJA (6,47,74,75,93); and d)

use of SDM in TJA decision-making (6,47,48). Clinical guidelines consistent with patient-centred care were published after 2019 (6,47,48,74,93) except for one guideline in 2008 (75). None of the clinical practice guidelines provide clinical guidance to healthcare professionals on how to implement the recommendations, they do not specify cut-off values or ranges for criteria nor if all criteria should be present to recommend elective TJA. Only one guideline suggests a cut-off value for radiographic severity of the knee (Kellgren Lawrence grade $\geq$ III) (13).

In 2004, the American Arthritis Foundation developed quality indicators for the management of OA (102) with the purpose to evaluate OA quality of care (106). These quality indicators recommend that *“IF a patient with severe symptomatic osteoarthritis of the knee or hip has failed to respond to nonpharmacologic and pharmacologic therapy, THEN the patient should be offered referral to an orthopedic surgeon ...”* (102). However, “failure” of therapy is not defined (107). A Canadian set of quality indicators was developed for preoperative and postoperative TJA rehabilitation and includes recommendations for the assessment of patients already scheduled for TJA (103).

1.2.5 Appropriateness

A healthcare intervention is defined as appropriate when it provides net benefits to patients (9,10,18,32,108–112) that outweigh harms largely enough to make the intervention worth providing (10,108). A 2014 Canadian scoping review of 103 studies described appropriateness as *“...the right services being delivered to the right people, at the right time, by the right complement of healthcare providers and in the right healthcare setting.”* (109). Appropriateness of a healthcare intervention usually involves assessing the extent to which the intervention meets evidence-based criteria (e.g., eligibility) (113), has the potential to achieve relevant outcomes (e.g., risk, benefits)

considering all available options, and meets ethical principles (e.g., respect of patients autonomy and healthcare decisions are based on patients' preferences and willingness) (19).

Currently, there is no agreement on criteria to determine appropriateness of elective TJA for primary hip and knee OA (10,32,39,114,115). The most common criteria, developed based on experts, healthcare professionals, and empirical evidence, are: symptoms severity (e.g., pain, stiffness), physical and functional limitations, OA impact on activity of daily living, radiographic evidence of OA and its severity, failure of conservative treatments, characteristics of patients (e.g., age, comorbidities) (10,15,32,33,104,116–132). In contrast, factors influencing patient willingness to undergo elective TJA are: pain, OA symptoms severity and their impact on quality of life (functional limitations, restrictions of activities of daily living and social participation, psychological well-being), support and experience of social networks, treatment expectations, recommendations of healthcare professionals, and mental and physical readiness (27,32,35,36,38,42,43,133–146). Criteria deemed most important by healthcare professionals for recommending elective TJA are radiographic severity and pain (13,118,147–149) while most important factors influencing patients' preference for elective TJA are OA impact on quality of life and pain (13,32,136,137,139,141,143). Lately, there has been a shift in the literature from recommending TJA based on patient's characteristics, joint impairments (radiographic severity, range of motion), and prior surgery (15,104,116,117,127) to greater importance placed on patients lived experience (e.g., impact on quality of life, psychological factors, patients' readiness, social circumstances, expectations) (10,27,32,39,150).

In the previous decades, much research focused on developing instruments to determine elective TJA appropriateness for primary hip and knee OA. For the purpose of this thesis, instrument is defined as “a measuring device for assessing the present value of a quantity under

observation” (151), thus requiring to provide either a cut-off score, continuous score, probability of outcomes, eligible/ineligible, classification, and/or priority ranking. The most known instruments in the literature were published before 2000 or early 2000s including the Escobar Total Knee Arthroplasty Appropriateness Algorithm (15), Quintana Total Hip Arthroplasty Appropriateness Algorithm (127), the New Zealand Priority Score (152), the Catalonia Hip-Knee Priority Score (153), and the Western Canada Wait List Hip and Knee Prioritization Tool (154). However, there are concerns with the suitability of these instruments for current practice (10,18,27): 1) the evidence used to develop these instruments were published before 2000 (14); 2) there is a strong emphasis on radiographic evidence even if it was shown not to be associated with patient symptoms (155–157) or with TJA postoperative satisfaction (158); and 3) most instruments were developed based on experts’ opinions without including patients and their perspectives on the development team (18,26,159,160). The Escobar Total Knee Arthroplasty Appropriateness Algorithm (15) was updated in 2014 (14) and in 2020 (129), but the modified versions still rely heavily on traditional criteria (radiographic findings, age, pain) and overlook patients’ perspectives (10,129). Nonetheless, there is limited knowledge about the criteria included in published instruments to determine elective TJA appropriateness for primary hip and knee OA, instrument’s quality, and suggestions for clinical practice.

There is one set of appropriateness criteria for elective TJA that follows clinical practice guidelines recommending the use of SDM (6,47,52). This set, the Hawker et al. appropriateness criteria for TJA, conceptualized the elements that should be used when determining patient appropriateness for TJA, but it does not provide a score required of an instrument. The Hawker et al. appropriateness criteria has also been called by others as “a conceptualization” and “a system” (10,161).

1.2.6 Shared decision-making for hip and knee TJA

Elective TJA is considered as a “preference-sensitive” decision since it is one treatment option among many others with no single “best” choice (13,46,75,162). Yet, most patients who underwent TJA reported no meaningful discussion with orthopaedic surgeons of conservative treatment options (55). In Alberta (Canada), only 40% of patients scheduled for knee TJA have tried core nonsurgical treatments (pharmacotherapy, exercise or physiotherapy, weight loss) (163). In Ontario (Canada), only 5 to 35% of patients in a TJA appropriateness evaluation clinic had tried exercise, walking aid, weight loss, bracing, and physiotherapy while 41% used corticosteroids injections and 92% medications (164). Patients trial of nonsurgical treatments in Canada is consistent with other countries. In Sweden, only 47-62% scheduled for knee TJA have tried nonsurgical treatments (education, physiotherapy, walking aid, pharmacotherapy) (165) while in the Netherlands only 21-41% patients who received hip and knee TJA have tried lifestyle changes and pharmacotherapy, 34-81% exercises and weight loss, and 53% intra-articular joint injections (166). A meta-analysis examining quality indicators for OA management also revealed suboptimal trial of nonpharmacologic and pharmacologic treatments (167). A study in Sweden demonstrated that most patients with early to moderate OA that are informed about and use OA nonsurgical treatment options (e.g., physiotherapy) are no longer willing to undergo TJA (168).

Insufficient conversation with patients was identified as the most problematic issue for elective TJA decision-making (46). Many patients who underwent TJA decision-making process reported poor consideration of their preferences and values (43,137,139,141,163); while healthcare professionals report difficulties to adequately consider patients’ perspectives and values in consultations (27,169,170). Patients have reported receiving little information on TJA leading to ill-informed decision-making (37,43,44,137,139,141,163); while others search the Internet for

easily accessible healthcare information (171). However, an environmental scan of online educational resources on OA and TJA conducted in Australia, France, Germany, and Spain revealed the poor quality of online resources based on the Health on the Net tool endorsed by the World Health Organization (172). There is no evidence on the quality of Canadian online TJA resources for adults with primary OA considering the surgery. Patients who previously experienced TJA decision-making process have stressed the need to place a greater focus on preoperative counselling to promote more realistic expectations in patients considering elective TJA and to help them make a better informed decision (32,35,44). A systematic review of 36 studies demonstrated that many patients do not have accurate expectations of treatment outcomes and tended to overestimate the benefits and underestimate the harms (40). Fulfillment of patients' preoperative expectations is associated with increased satisfaction with hip and knee TJA (21–23,41,45,173–178). In a randomized controlled trial, patients receiving education on TJA outcomes achieved more realistic expectations, higher rate of postoperative expectations fulfilled, and in turn higher levels of satisfaction (179).

Healthcare professionals can support adults with primary hip and knee OA considering elective TJA by actively engaging them as collaborators in a SDM process. This would involve sharing evidence-based knowledge about OA, available treatment options and associated benefits and harms, setting realistic expectations, and clarifying patient's values for different outcomes of treatment options (e.g., describes what it is like to experience the treatment options) (46,53). Fostering participation in the decision-making process is especially important as most patients want to participate in healthcare decision-making processes (180,181) but typical education usually fails to engage patients in SDM (182). Also, healthcare professionals can support patients with a decision coach (50,53) and was found to result in better TJA health outcomes and

satisfaction with TJA results (46,55,56). When patients are engaged in the decision-making process of other elective surgeries, they also report higher decision quality (183,184) and health outcomes (55). There is limited evidence on the Canadian resources for healthcare professional participating in elective TJA decision-making process, and the extent to which they acknowledge and foster SDM.

1.2.7 Shared decision-making for hip and knee TJA in clinical practice

A decision-making model for total knee arthroplasty integrating SDM with orthopaedic surgeons was identified (39). The model, with the goal to define indication criteria, has a three-step process: 1) medical rational for TJA (patients are assessed against minimum requirement for TJA appropriateness); 2) medical indication (additional criteria, risk factors, contraindications, surgical success probability and risk assessment); and 3) SDM between surgeon and patients (39). This model was developed for the “average” patient (90% of patients with knee OA) (39). The model takes into consideration patients’ expectations, but SDM is not well described, and the model omits key SDM principles (e.g., value clarification) (50). Given the low uptake of SDM, there needs to be guidance on how to incorporate SDM in clinical practice (39,185).

SDM can be facilitated with use of patient decision aids (PtDAs). PtDAs are tools providing information on options, benefits and harms, and helping patients clarify their values for outcomes of options (53). Over 100 trials have demonstrated that PtDAs compared to usual practice are effective for enhancing patients’ knowledge, improving more realistic expectations, minimizing decisional conflict, and increasing participation in decision-making (53). A systematic review of 10 studies that I conducted demonstrated that, compared to usual care, PtDAs improve the quality of the decision and the decision-making process (increase knowledge, enhance informed decision congruent with values and preferences, and reduce decisional conflict) in adults

with primary hip and knee OA considering elective TJA (184). PtDAs give patients the chance to trade off benefits and harms of options and to clarify their values for outcomes of options (53,186). Hence, PtDAs are important for adults with OA considering elective TJA since there are many options for OA management (surgery and conservative) with varying health outcomes (75). Evidence suggests that the use of a PtDA does not lead to worse health outcomes (187,188) and a recent study demonstrated better TJA postoperative health outcomes for patients with knee OA that received a PtDA (189). PtDAs are also fundamental to achieve patient-centred care and to meet ethical obligations towards patients (e.g., respect of patient's autonomy) (188). Used in the context of elective TJA, they are suggested to support better patient-centred care (189) at a reduced cost while maintaining similar patient health outcomes (190). They also hold similar long-term cost and surgery rates compared to usual care (191,192) and hold short-term cost saving (190). However, they are associated with unclear long-term cost-effective properties (191,193,194). A systematic review of six studies involving SDM/PtDA interventions during the TJA encounter highlighted the need for further development and evaluation of SDM/PtDA for TJA encounter (195) while a scoping review of 17 studies on SDM for total knee arthroplasty emphasized the importance of carefully considering when and where SDM should take place in the total knee arthroplasty pathway (196).

Implementation of SDM and PtDAs in clinical practice remains low (55,185,197). A study examining the implementation of PtDAs in 11 worldwide countries (North America, Europe, Asia, Australia) reported that only 44% of PtDAs were implemented, disseminated, or passively diffused after trial termination (197). Most prevalent barriers reported were insufficient funding and support, outdated PtDAs, and healthcare professionals disagreement with PtDAs (197). To support PtDA implementation in clinical practice, multifaceted interventions tailored to healthcare

professionals perceived barriers and facilitators should be used (198–200) with a combination of training, education, and communication skills (201–204). For successful implementation strategy, current resources, workflows, clinical pathways, and time pressures need to be taken into consideration to minimize disruption (204).

1.2.8 Physiotherapy and shared decision-making

Interprofessional teams, including physiotherapists, are involved in OA management. In Ontario's centralized referral intake and rapid access assessment clinics, physiotherapists usually assess and triage patients to TJA surgical consultation or conservative treatments (80). However, the majority of studies have focused on strategies preparing physicians and patients in using SDM while few have focused on allied healthcare professionals such as physiotherapists (185). SDM has gained popularity within the physiotherapy discipline in the last decade and the necessity to include SDM in physiotherapy practice was emphasized in 2018 (205). SDM is judged suitable for the practice and called for by patients and physiotherapists (57,203,206–208) and physiotherapist are acknowledged as having a central role in implementing SDM for musculoskeletal conditions (182). However, there is currently limited research focusing on SDM and physiotherapy (57,208) and how physiotherapists can implement SDM in their practice (44,208,209).

The majority of physiotherapists are not familiar with SDM theoretical knowledge (57,203) and its implementation in clinical practice is low (58–60,201,203,208,210). In fact, 60.5% of physiotherapists in Germany did not know anything about SDM (57) while few physiotherapists in Australia reported discussing research evidence about the benefits and harms of options with patients (208). Studies investigating observed level of SDM in clinical practice in the United Kingdom, Belgium, Switzerland, Australia by physiotherapists using the OPTION instrument

(211) revealed low levels of SDM (mean SDM score of 5.2% to 31% (58,59,61); median score of 44.5% to 73% (60,62)) and poor information sharing about benefits and harms of options (58). Interestingly, a trial exposing Australian physiotherapists and physiotherapy students to a brief one-hour SDM knowledge and skill-based intervention demonstrated significant improvement in physiotherapists observed level of SDM post-intervention (61) while Australian healthcare professionals (including physiotherapists) demonstrated increased SDM knowledge and confidence in skills after completing a free 2-hour e-learning course (212). Scarcity of training opportunities, accessibility of adequate evidence synthesis and decision support tools, and time constraints were emphasized as barriers to physiotherapists implementing SDM in their practice (201,208).

Patient views and expectations are usually not adequately sought by physiotherapists, and they rarely inquire about patients' concerns (58,210). Patient preferred level of involvement in decision-making was also shown to not correspond with physiotherapists' assumptions of patients' preferences (62). This study conducted in Switzerland also revealed that half of patients wanted to be more involved in the decision-making process (62). Similar findings have been reported by various worldwide studies revealing that the majority of patients want to share their healthcare decisions with healthcare professionals (180,203,206,208,213).

Patients have emphasized the necessity to receive more information, discuss options, and be informed about their treatment preferences to facilitate their participation in decision-making processes with physiotherapists (180,203,206,210). Physiotherapists have raised concerns of overestimating patients' knowledge and ability to make informed decisions (208,214). Yet, physiotherapists recognize that patients should participate in decision-making but need to be well informed about their condition and available treatment options to be able to participate in decision-

making (208,214). Effective communication and individualized consultations were also stressed as key to facilitate decision-making centred on patients' preferences (205,213).

Studies conducted in the United Kingdom have investigated the use of a PtDA (Option Grid for Knee OA) for use within the physiotherapy consultation to foster collaborative conversations and have identified positive attitudes from physiotherapists (215–218). They did not find the tool to be disruptive as they had initially expected, recognized the tool to be implementable in clinical practice with minimal impact on consultation duration, and acknowledged that the tool empowered patients and stimulated discussion (217). A stepped wedge trial including patients with lower health literacy levels and physiotherapists also revealed that using the Option grid increased physiotherapists' level of SDM and did not lengthen consultation duration (215). Moreover, patients demonstrated increased knowledge and readiness to decide on a treatment option (215). Finally, a qualitative study exploring patients' view of the Option Grid used in consultation with physiotherapists in comparison to usual care demonstrated increased patient awareness and understanding of harms and benefits of treatment options and positive attitudes towards the PtDA (216). When the PtDA was not used by physiotherapists, discussions were more likely to focus on harms and benefits limited to the most probable treatment option rather than a discussion of all options (216).

Lastly, a theory analysis that I conducted identified one SDM conceptual model developed specifically for physiotherapists and designed to better acknowledge physiotherapists' role in SDM (209). This SDM model by Moore and Kaplan (219) details how SDM fits within physiotherapy practice. The theory analysis also revealed similar roles and contributions for healthcare professionals in other conceptual models, but that physiotherapists will better recognize their role in SDM models that explicitly identify them (209). Better recognizing SDM in physiotherapy

would help support targeted implementation strategies to increase SDM use in physiotherapy clinical practice and in turn leads to better patient-centred care.

In summary, 25 to 45% of elective TJA surgeries are of questionable appropriateness (13–17) and 10 to 34% of patients are dissatisfied with TJA results (13,20–23). This is concerning for the healthcare system because elective TJA is a burden on inpatient and outpatient resources (8,24). Hence, there is a need for appropriate TJA surgery to achieve Quintuple Aim of Healthcare (25): improve patient experience, decrease healthcare expenditure, advance population health, improve healthcare professional experience, and increase health equity (9,26,27). The literature review highlighted the variability of characteristics of adults undergoing elective TJA for primary hip and knee OA and the lack of expert consensus on how to determine elective TJA appropriateness. Many instruments have been published to determine TJA appropriateness, but there is limited knowledge about their quality. Furthermore, the literature review revealed the poor acknowledgement of patient perspectives and limited decisional support provided in TJA decision-making. There is also no evidence on the quality of easily accessible Canadian TJA resources to support healthcare professionals and patients with TJA decision-making.

1.3 Methodological Considerations

1.3.1 Guiding Theoretical Frameworks

Two theoretical frameworks guided this doctoral thesis. The Knowledge-To-Action framework (KTA) (220) guided the multi-methods studies. The Hawker et al. appropriateness criteria for TJA (27) was used as the guiding definition of elective TJA appropriateness for primary

hip and knee OA and used as the framework to appraise clinical practice (Chapter 2), instruments (Chapter 3), and resources (Chapter 4).

The KTA is a dynamic and iterative framework based on a review of over 30 planned action theories (220). This framework has been extensively used (221) and was adopted as the model for implementation research by the Canadian Institutes of Health Research (222). The KTA framework proposes knowledge translation requires two distinct but fluid concepts occurring in parallel or simultaneously: 1) *knowledge creation* represented by a funnel of knowledge synthesis; and 2) *knowledge application* represented by the action cycle of a process for implementing knowledge (220,222). The knowledge creation funnel includes three phases of knowledge: knowledge inquiry, knowledge synthesis, and knowledge tools/products. Knowledge tools and products include PtDAs that are based on a synthesis of evidence (223). The action cycle includes seven phases: 1) identifying the gap between clinical practice and current knowledge; 2) adapting knowledge to local context; 3) assessing of barriers/facilitators to knowledge use; 4) selecting, tailoring, and implementing interventions promoting knowledge use; 5) monitoring knowledge use; 6) evaluating outcomes; and 7) using strategies to ensure sustained knowledge use (220,222). The KTA framework was chosen from 49 healthcare implementation frameworks identified in a 2015 systematic review (224). The KTA was chosen to guide my proposed doctoral research because compared to the other frameworks: 1) it is the implementation framework recognized in Canada (225); 2) it proposes a comprehensive approach of knowledge creation that is paired with implementation; 3) the KTA acknowledges PtDAs as knowledge translation tools (knowledge creation); 4) it is widely used and tested (221); and 5) it is dynamic, iterative, and tailored to context use (220,222). Limitations of the KTA are the limited details provided on how to use the framework across multiple healthcare levels (supported by the two-dimensionality representation

of the model without relationship to different healthcare levels), and the limited instructions on the procedures to use for each phase (226).

The Hawker et al. appropriateness criteria for TJA, or also called the Canadian consensus criteria in Chapter 4, was designed to ultimately inform the future development and implementation of a set of TJA appropriateness criteria intended for clinical practice (27). See sections 1.1 and 1.3.6 for more details about the criteria. The Hawker et al. appropriateness criteria has been validated (face/content) (9,27,32,148) and demonstrated as discriminative (discriminant validity) of adults experiencing poor and good postoperative outcomes at one year (150,178,227). A study also confirmed multivariable relationships between the criteria and receiving a total knee arthroplasty (228) while another demonstrated that the criteria were predictors of experiencing net benefit from TKA (229). The Hawker et al. appropriateness criteria has been called a “contemporary” set of decision-making criteria to determine TJA appropriateness (10). The set of decision-making criteria has also been used in a randomized controlled trial as a one-page TJA appropriateness report for orthopaedic surgeon (230,231). In 2023, Hawker published an editorial calling for TJA decision-making process to move away from objective criteria (e.g., radiographic evidence, clinical examination, patients characteristics) and instead emphasized the importance of discussing with patients about their informed values and preferences to achieve good postoperative outcomes (46). The Hawker et al. appropriateness criteria for TJA was chosen as the TJA appropriateness framework of this thesis since: 1) it is the only set of appropriateness criteria for hip and knee TJA integrating elements of SDM as recommended in clinical practice guidelines, and 2) it was co-developed with patients (6,47,52). The main limitations of the Hawker et al. appropriateness criteria for TJA are the few details on how to operationalize criteria in clinical

practice and research, and that there is no evidence on the barriers and facilitators to using the Hawker et al. appropriateness criteria in clinical practice and research (27,46).

1.3.2 Philosophical Stance

This doctoral thesis recognizes that rehabilitation sciences, including physiotherapy, are characterized by a fusion of the biomedical ((post)positivism paradigm) and patient-centred care (constructivism paradigm) approaches to support a holistic and contextual approach to care (232,233). Similarly, this thesis acknowledges that rehabilitation sciences are bound to the social, historical, political, and healthcare system contexts (233). Accordingly, a pragmatic worldview oriented the decisions underlying this thesis to achieve meaningful and relevant findings to rehabilitation practices in various contexts (232,234). Pragmatism is concerned by practicality (“what works”; ontological grounds), action-based knowledge (reality discovered using objective and subjective approaches; epistemological beliefs), and explore action-oriented solutions to research problems (research purpose) (234,235). Under this philosophical stance, research methods were chosen based on the research problem and the methods best suited to meet the needs (232,234). Pragmatism encourages the use of multi-methods as it allows a more comprehensive and exhaustive picture of the problem with “real world” applications (232,234).

1.4 Knowledge Gaps and Thesis Objectives

This literature review identified several knowledge gaps. First, there is a lack of knowledge on the barriers and facilitators to using and implementing the Hawker et al. appropriateness criteria for total knee arthroplasty in clinical practice. Second, little is known about extent to which instruments to determine elective TJA appropriateness for primary hip and knee OA meet the

Hawker et al. appropriateness criteria for TJA and the psychometric properties of these instruments. Third, little is known about the available online Canadian resources supporting patients and healthcare professionals in elective TJA decision-making. The overarching aim was to examine how appropriateness of elective TJA for primary hip and knee OA is determined. Guided by the KTA framework, multi-methods studies were conducted to:

1. Explore the barriers and facilitators to using the Hawker et al. six appropriateness criteria for total knee arthroplasty in the decision-making process for adults with primary knee OA;
2. Evaluate instruments to assess appropriateness for elective joint arthroplasty for primary hip and knee OA according to the Hawker et al. appropriateness criteria for TJA and appraise the psychometric properties of these instruments;
3. Appraise the quality of publicly available online Canadian resources on TJA for patients with primary hip or knee OA and healthcare professionals participating in TJA decision-making processes.

1.5 Thesis Organization

This doctoral manuscript-based thesis was organized as multi-methods studies consisting of 6 chapters. Chapter 2 is the first study about exploring barriers and facilitators to using the Hawker et al. appropriateness criteria for total knee arthroplasty in clinical practice (assessing barriers/facilitators to knowledge use in the KTA framework). Chapter 3 is the second study about a systematic review on instruments to assess hip and knee arthroplasty appropriateness and their quality (synthesizing evidence to inform, tailor, and implement interventions in the KTA

framework). Chapter 4 is the third study about an environmental scan of hip and knee TJA Canadian online resources for patients and healthcare professionals (synthesizing evidence to inform, tailor, and implement interventions in the KTA framework). Chapter 5 is an integrated discussion of the knowledge gained from the multi-methods thesis, contributions to the broader literature, and discuss the implications for rehabilitation clinical practice, education, healthcare organization, and research. Chapter 6 presents collaborators of the three thesis studies and details contributions. Finally, appendices are presented.

Chapter 2. Exploring appropriateness criteria for informing the total knee arthroplasty decision-making process: an interpretive descriptive study

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Abstract

Rational: The Hawker appropriateness criteria for total knee arthroplasty (TKA) are: osteoarthritis symptoms impacting quality of life, evidence of osteoarthritis, trial of conservative treatments, patient's realistic expectations, patient/surgeon agree benefits outweigh risks, and readiness for surgery. Little is known about the barriers and facilitators of using the Hawker et al. appropriateness criteria for TKA in clinical practice. **Aims and objectives:** Explore the barriers and facilitators to using appropriateness criteria for TKA in making decisions for adults with knee osteoarthritis. **Methods:** Interpretive descriptive qualitative study at an academic hospital. Purposive sampling aimed to recruit: 1) healthcare team members at all levels influencing care delivery, and 2) adults with TKA assessed at the hospital clinic. Semi-structured interviews asked about the barriers/facilitators to using the Hawker appropriateness criteria. Data analysis consisted of inductive thematic analysis with themes mapped to the Consolidated Framework for Implementation Research domains. **Results:** Nine healthcare professionals and 14 adults with TKA participated and identified common barriers to using the Hawker appropriateness criteria: a) intervention characteristics domain: difficulty to assess criteria, patients expecting healthcare professionals to decide, limited accessibility to conservative treatments; b) individuals characteristics domain: no need to change current TKA process, clinical judgement limited to OA severity/age, implicit assessment of subjective criteria; c) inner setting domain: TKA information received after decision made; and d) outer setting domain: no timely access to TKA. A facilitator of use was evidence/buy-in fosters program changes. **Conclusion:** Barriers to using the criteria relevant to clinical practice and the healthcare system were identified while only one facilitator was revealed. Interventions tailored to these barriers are needed to support the use of the Hawker appropriateness criteria in TKA decision-making.

2.1 INTRODUCTION

Elective total knee arthroplasty (TKA) is a highly performed surgery worldwide and projected numbers consistently demonstrate an upward trend in the next decades.¹ Although TKA is considered effective when conservative treatments fail to manage moderate to severe osteoarthritis (OA) symptoms (e.g., pain, mobility, function)^{2,3}, not all candidates benefit from surgery. In fact, about 20% of patients reported persistent knee pain or disability following surgery.⁴

Hence, TKA is considered a “preference-sensitive” decision given it is one of several treatment options (e.g., physiotherapy, weight loss, pain medication, surgery) with different benefits and harms.^{5,6} Yet, many patients who received a TKA reported poor consideration of their preferences and values when making the decision to undergo TKA.⁷ Specifically, they report receiving little information on TKA procedures, potential outcomes, alternative treatment options, and benefits and risks leading to poor decision quality, unrealistic expectations, and dissatisfaction with surgery results.^{8–10}

To address these challenges, Hawker and colleagues together with OA experts (surgeons, rheumatologists, health services researchers) and patients developed and validated six appropriateness criteria for TKA.¹¹ According to the findings of Hawker et al. TKA appropriateness criteria, patients appropriate for surgery have: 1) OA symptoms that negatively impact their quality of life; 2) clinical and radiographic evidence of OA, 3) tried conservative treatments, 4) realistic expectations, 5) agreement with the surgeon that benefits outweigh risks, and 6) mental and physical readiness for surgery.¹¹ These criteria for TKA are unique as patients were involved in the development process and include criteria relevant to shared decision-making (patients have realistic expectations, patient/surgeon agree that benefits outweigh risks). Shared

decision-making is the process whereby patients and healthcare professionals discuss evidence-based information on the treatment options, benefits and harms, and clarify patient's preferences and values.¹² This approach fosters collaboration between patients and healthcare professionals when making healthcare decisions to achieve more realistic expectations and decisions based on patient's informed preferences.^{6,12,13} Shared decision-making is recommended by OA and TKA clinical practice guidelines^{2,3,14} and the Hawker et al. appropriateness criteria is the only set of criteria that integrates this approach.¹⁵ The Hawker et al. appropriateness criteria has been also called a "conceptualization" and a "system" as it conceptualizes the criteria that could be used when determining patient appropriateness for TKA.^{16,17}

For successful implementation of healthcare innovations in clinical practice, the first step is to assess the factors influencing use.¹⁸ Little is known about the barriers and facilitators of using the Hawker et al. appropriateness criteria for TKA in clinical practice. The objective is to explore the barriers and facilitators to using the Hawker et al. six appropriateness criteria for TKA in the decision-making process for adults with primary knee OA.

2.2 MATERIALS AND METHODS

2.2.1 Design

An interpretive descriptive study was conducted using an inductive analytic approach for describing findings relevant to clinical practice.¹⁹ This study was reported using the COREQ checklist²⁰. Ethics approval was obtained from the University of Ottawa (H-04-22-7898) and the Montfort Hospital (22-23-05-005) research ethics boards.

2.2.2 Setting

This study was conducted in a total joint arthroplasty (TJA) evaluation clinic of an academic hospital in Eastern Ontario (Ottawa, Canada). In Ontario, adults considering elective TKA typically proceed through the following TKA surgical pathway: 1) a physical assessment usually with a physiotherapist or nurse in a standardized TJA evaluation clinic who triages the patient to an orthopaedic surgeon or to conservative management; 2) for those triaged to the surgeon, a consultation with an orthopaedic surgeon to confirm TKA appropriateness and patient consent; 3) those who consent to surgery undergo a physical readiness assessment and participate in an education session at a preoperative clinic; and 4) TJA surgery. The TJA evaluation clinic uses standardized evaluation forms consisting of a medical history, knee history (pain, trial of conservative treatments, function, quality of life), and an objective assessment (functional performance-based test, knee clinical exam, evidence of OA on radiography). Eligibility to see an orthopaedic surgeon is determined based on the “knee assessment summary” including radiographic severity, pain intensity, and score on the functional performance-based test. At this academic hospital in 2022, patients waited, on average, 171 days before a consultation with an orthopaedic surgeon and 217 days from the surgeon consultation to surgery.²¹ The design and operationalization of the TJA care pathway is influenced by individuals at different levels: provincial decision-makers at the macro level (N=2), regional leaders at the meso level (N=3), and healthcare professional assessors (N=2) and orthopaedic surgeons (N=9) at the micro level.

2.2.3 Participants

Eligible participants were French and English-speaking: 1) healthcare team members influencing delivery of care of an academic hospital in Eastern Ontario (provincial level decision-makers, regional leaders, healthcare professional assessors, TKA orthopaedic surgeons); and 2)

adults at 6-week to 18-month post elective TKA surgery for primary knee OA and who were assessed at the evaluation clinic. Adults who underwent TKA revision or for any other reason than for primary OA were excluded.

2.2.4 Recruitment

Purposive sampling was used to recruit as many healthcare team members from the different groups.¹⁹ Purposive sampling allowed to select participants most directly involved in the situation and with different perspectives (different decision-making levels for healthcare team, sex/gender and ages for adults with TKA).²² For the healthcare team group, eligible provincial decision-makers and regional leaders were identified from the network of the research team and sent a personalized email. Head physiotherapist and orthopaedic surgeons of the hospital sent a recruitment email to all individuals within their teams.

Convenience sampling was used to recruit 10 to 15 adults with TKA.²³ Convenience sampling allowed to recruit adults with TKA readily available.²³ To identify adults who recently proceeded through the TKA surgical pathway, they were recruited using posters and in-person recruitment during postoperative ambulatory rehabilitation provided as part of the surgical pathway. Adults with TKA were given a gift card of 20\$ as compensation for their time.

2.2.5 Data collection

In-person, over the phone, and virtual semi-structured individual interviews were held at a convenient time and location for participants and conducted by the first author, who is a licensed physiotherapist and researcher (LPB). Verbal informed consent was obtained prior to initiating the interviews and collecting demographic information (e.g., sex and gender for adults with TKA,

years of experience in TKA decision-making for the healthcare team). Interviews were recorded and transcribed verbatim.

Interview guide

The interview guide was tailored to the two participant groups and informed by the Consolidated Framework for Implementation Research (CFIR).¹⁸ CFIR, based on 20 implementation theories, was used to systematically assess barriers and facilitators of using the innovation (e.g., Hawker et al. appropriateness criteria) in a multilevel context.¹⁸ CFIR has five domains: 1) intervention characteristics (e.g., the Hawker et al. appropriateness criteria); 2) outer setting (e.g., the economic, political, and social contexts influencing the TJA evaluation clinic); 3) inner setting (e.g., the TJA evaluation clinic); 4) characteristics of individuals (e.g., the assessors of the TJA evaluation clinic, orthopaedic surgeons, patients); and 5) process (e.g., mechanisms facilitating changes in the TJA evaluation clinic).¹⁸

Key questions in the interview guides asked participants about: a) criteria currently used to assess TKA eligibility; b) the extent to which the Hawker et al. appropriateness criteria are used within the current TJA surgical pathway; and c) barriers and facilitators to using the Hawker et al. appropriateness criteria. The main difference between the patient and provider interview guides was how the questions were framed (medical vs lay terminology, clinical practice vs lived experience). The interview guides were pilot tested with two co-authors and changes were made accordingly (e.g., clarifying some questions, changing flow, additions of question probes). Probes were also iteratively added throughout the interviews to explore new themes as they emerged.

2.2.6 Data analysis

Consistent with interpretive descriptive methods, analyses consisted of inductive thematic analysis for the set of healthcare professionals' transcribed interviews and the set of patients'

transcribed interviews.¹⁹ Findings were triangulated between groups. Two independent reviewers (two physiotherapist researchers and authors: LPB, MC) used NVivo software to facilitate the analysis consisting of six steps : 1) organizing and familiarizing with the data (reading transcripts in its entirety, uploading in NVivo); 2) developing initial codes (gathering together relevant data); 3) searching for themes (gathering codes into potential themes); 4) reviewing themes (checking logic of themes and making sense of patterns); 5) defining and naming themes (refining themes); and 6) developing the report (interpretation of data related to the study goal and literature).^{19,22} The two reviewers independently coded transcripts and wrote memos of their ideas, key concepts, and questions throughout the process.¹⁹ After discussion to compare data analysis findings, the codebook was iteratively developed and modified as new codes/themes emerged. Then, barriers and facilitators were mapped to the domains of CFIR.¹⁸ Findings were audited by senior authors (SP, DS) and confirmed by an interprofessional team of co-authors including physiotherapists (LPB, SP, MC, FD), a nurse (DS), and a health services researcher (SBA). An audit trail of the analysis was kept.

2.3 RESULTS

Between May and November 2022, interviews were conducted with 2 provincial decision-makers, 3 regional leaders, 2 physiotherapist assessors, and 2 TKA orthopaedic surgeons. The healthcare team had a range of 2 months to 40 years of experience in TKA care. Fourteen interviews were conducted with male and female adults with a TKA having a range of ages and living in urban or rural areas (Table 2.1).

Table 2.1 Characteristics of adults with TKA

Characteristics	Adults with TKA (n=14)
Mean age (range)	74 years (65 to 88)
Female/woman	8
Male/men	6
Living in urban area	13
Living in rural area	1
<i>Total knee arthroplasty (TKA)</i>	

2.3.1 Barriers to using the six Hawker et al. appropriateness criteria

We identified four barriers to using the Hawker et al. appropriateness criteria at the level of the CFIR domain **intervention** (see Table 2.2 for themes quotes). First, physiotherapist assessors and orthopaedic surgeons perceived ‘*[some] criteria unnecessary for decision-making*’. Although they agreed with assessing OA severity and impact on quality of life, they questioned the necessity of using the trial of conservative treatments, realistic expectations, patient/surgeon agree on benefits/risks, and readiness for surgery. Orthopaedic surgeons also questioned the criterion of clinical evidence of OA. Second, provincial decision-makers, physiotherapist assessors, and orthopaedic surgeons identified that it would be ‘*difficult to assess realistic expectations and benefits/risks*’ in routine clinical practice. Third, the healthcare team described ‘*patients often expecting healthcare professionals to decide*’, making it unnecessary to come to agreement with patients that the benefits outweighed the risks. This theme was supported by the adults with TKA who discussed relying on healthcare professional judgements and trusting their recommendations for TKA. Fourth, physiotherapist assessors and adults with TKA discussed ‘*limited accessibility to conservative treatments*’ influencing their decision (e.g., physiotherapy, bracing, medications, injections). They described these treatments as not funded by the Canadian healthcare system and many of these treatments were inaccessible in some rural communities.

We identified five barriers in the CFIR domain **characteristics of individuals** (Table 2.2). The first barrier was *'mental readiness beyond assessors' scope of practice'*. Although physiotherapist assessors working in the TJA evaluation clinics were described by the healthcare team as skilled and experienced professionals for adequately evaluating patients following standardized criteria, the criterion of mental readiness for surgery was described as not being one of their disciplinary competencies. Second, adults with TKA described *'patients already having made their decision before the TKA assessment'* making it difficult to use any criteria. They discussed how their decision to proceed with TKA was already made before the assessment at the TJA evaluation clinic predominantly because of decreased quality of life, pain, influence from their social support, and were expecting to be referred to an orthopaedic surgeon to proceed with surgery. Third, the healthcare team and adults with TKA indicated there was *'no need to change current TKA process'*. Provincial decision-makers, regional leaders, and orthopaedic surgeons were less receptive to change because they believed the current evaluation process to determine TKA appropriateness was comprehensive and exhaustive. Adults with TKA believed the current TJA decision-making process was generally fine. Fourth, the healthcare team described an *'implicit assessment of subjective criteria'* (e.g., realistic expectations, agreement benefits outweigh risks) by assuming them while explicitly assessing evidence of OA and trial of conservative treatments. Comments from adults supported this barrier by reporting they assumed physiotherapist assessors and orthopaedic surgeons already knew their situation. Fifth, the healthcare team described the decision-making process as being informed by standardized assessment forms using their *'clinical judgment limited to OA symptoms, OA evidence, and age'*. More specifically, they described their clinical judgment to determine appropriateness for TKA as limited to OA severity and age, while trial of conservative treatments being asked about but not

perceived as essential. Adults with TKA also described radiographic evidence and age as the main factors influencing the decision of healthcare professionals and influencing their decision.

We identified five barriers relevant to the CFIR domain **inner setting** (Table 2.2). First, provincial decision-makers, physiotherapist assessors and orthopaedic surgeons described *‘unclear roles for assessing some criteria’*. Some identified the assessors of the TJA evaluation clinic and others identified the orthopaedic surgeons as responsible. Furthermore, they described the anesthesiologist as responsible for physical readiness for surgery in the preoperative clinic scheduled within days of surgery. Consequently, some criteria are assessed both by physiotherapist assessors and orthopaedic surgeons in the TKA pathway (OA symptoms negatively impacting quality of life, radiographic evidence of OA) and other criteria (realistic expectations, agreement on benefits outweighing the risks) were rarely discussed. Second, physiotherapist assessors discussed their decision-making processes being influenced by knowledge about orthopaedic surgeons preferred TKA eligibility criteria, revealing the barrier *‘surgeons preferred criteria for decision-making’*. For example, patients with high body mass index would be referred to some orthopedic surgeons and not others. The third barrier was *‘limited patient involvement in decision-making’*. The healthcare team described making decisions in collaboration with patients. However, they also described clinic assessors as having the power to decline a consultation with an orthopaedic surgeon and orthopaedic surgeons a TKA surgery, complicating the use of some criteria (realistic expectations, agreement benefits outweigh risks, readiness for surgery). Fourth, the healthcare team described a *‘lack of resources for using the criteria’* given the time constraints and lack of personnel. Time constraints was mentioned to justify limited assessment of realistic expectations and agreement on benefits/risks. Lack of physiotherapist assessors and limited administrative support was seen as a barrier to assess realistic expectations and agreement on

benefits/risks because they were perceived as needing more consultation sessions and therefore increasing the administrative load. Fifth, the healthcare team discussed that *'patients receive some TKA information after the decision is made'*. Although the healthcare team spoke of three criteria (realistic expectations, agreement benefits/risks, readiness for surgery) as being discussed after patients are triaged to see an orthopaedic surgeon, but the discussion was not made in a timely manner to help patients trade off conservative treatments versus TKA. After triage, the healthcare team described patients being given education resources (verbal, paper, website), being matched with someone who experienced the TKA decision-making process, and offered the opportunity to schedule further appointments to allow time to think about options and discuss them with their social support. Adults with TKA also described support offered after the decision was made, and not receiving enough information on conservative treatments, rehabilitation, risks, benefits and expectations before making the decision. Adults described looking on the Internet for more information on the TKA benefits and risks before making the decision.

The healthcare team and adults with TKA described one barrier relevant to the **outer setting** (Table 2.2): *'no timely access to TKA surgery'*. The healthcare team discussed the long delay to see an orthopaedic surgeon and undergo TKA caused by the COVID-19 pandemic, leading to automatically refer patients to see an orthopaedic surgeon in anticipation of OA progression rather than using the standardized criteria. Adults with TKA confirmed the long wait times as precipitating their decision.

There were no barriers identified relevant to the **process**.

Table 2.2 Barriers to using the Hawker et al. appropriateness criteria for TKA

Themes	Healthcare team (x= mentioned)				Adult s with TKA (x= menti oned)	Hawker et al. appropriateness criteria (x= theme associated)						
	Provincial decision- makers	Regional leaders	Physiotherapists assessors	Orthopaedic surgeons		OA impact on QoL	OA evidence (clinical, radiographic)	Conservative treatments	Realistic expectations	Agreement benefits outweigh risks	Mental/physical readiness	Using the full set of criteria
Intervention characteristics												
[Some] criteria unnecessary for decision-making		X	X					X	X	X	X	
	At the arthroplasty evaluation stage, given that the objective is to determine whether the patient is a candidate for surgery or not, I believe it would be more or less relevant to have them fill out a document on their expectations, since it is not one of the most important factors in decision-making. Physiotherapist assessor											
	There's no real need for discussion [on readiness for TKA]. Generally, everyone agrees. Orthopaedic surgeon											
Difficult to assess realistic expectations and benefits/risks	X	X	X					X	X			
	We do have patients that are sort of old school, “No, no doctor, you tell me what I should have done”. Provincial decision-maker											
	Although very difficult to convey [expectations of TKA] to the patient... I think because outcomes are very variable... you don't want to paint a bleak picture in the beginning cause most people do well, but of course some people don't... Orthopaedic surgeon											
				X					X	X		
	They [expectations] were discussed, I just didn't hear them. Adult with TKA											
Patients often expecting healthcare professionals to decide	X	X	X						X	X	X	
	[Patients] often ask me “what would you do?”. Physiotherapist assessor											
	[It is difficult to use realistic expectations with] my older patients, who still want paternal medicine: “tell me what I need doctor”. Orthopaedic surgeon											
			X						X	X	X	
	The doctor say you need to get it done, so you get it done. Adult with TKA											
Limited accessibility to conservative treatments		X						X				
	It doesn't matter if you didn't do it [trial of conservative treatments] because it's not always possible for everyone to have access to everything (e.g., insurance, rural services). Physiotherapist assessor											
			X					X				
	Each series of injections cost 600\$ and that nor the province, nor the public servant's insurance cover. Adult with TKA											
Characteristics of individuals												

Themes	Healthcare team (x= mentioned)				Adults with TKA (x= mentioned)	Hawker et al. appropriateness criteria (x= theme associated)						
	Provincial decision-makers	Regional leaders	Physiotherapist assessors	Orthopaedic surgeons		OA impact on QoL	OA evidence (clinical, radiographic)	Conservative treatments	Realistic expectations	Agreement benefits outweigh risks	Mental/physical readiness	Using the full set of criteria
Mental readiness beyond assessors' scope of practice			X								X	
	<i>In the mental case [mental readiness for TKA], it becomes more medical. It's a bit more out of my area of expertise. Physiotherapist assessor</i>											
Patients already made their decision before the TKA assessment				X								X
	<i>[The decision] was made [before the TKA assessment]. It was a question of where this [TKA] was going to happen. Adult with TKA</i>											
	<i>The decision was already made in my head. Adult with TKA</i>											
No need to change current TKA process	X	X		X								X
	<i>The VIP treatment is through the rapid access clinic [TJA evaluation clinic; indicating the process is great and should not be changed]. Provincial decision-maker</i>											
	<i>I think our physiotherapists do a very good job. I think they're very, very thorough and the assessments are very good... almost all the information really is there and that is very useful. Orthopaedic surgeon</i>											
				X								X
	<i>[The TKA assessment] It was a great process, it was very fluid: information, discussion, decision-making... and in a timely manner too. [indicating no need for change] Adult with TKA</i>											
Implicit assessment of subjective criteria	X	X	X	X					X	X		
	<i>You also get a sense of mental readiness because you're discussing with the patient. You can immediately see; do they look scared? Do they ask you a lot of questions like they're fearful about it? Regional leader</i>											
	<i>[The assessment of expectations] is only discussion and education. [indicating no objective assessment] Physiotherapist assessor</i>											
				X					X	X	X	

Themes	Healthcare team (x= mentioned)				Adult s with TKA (x= menti oned)	Hawker et al. appropriateness criteria (x= theme associated)						
	Provincial decision- makers	Regional leaders	Physiotherapists assessors	Orthopaedic surgeons		OA impact on QoL	OA evidence (clinical, radiographic)	Conservative treatments	Realistic expectations	Agreement benefits outweigh risks	Mental/physical readiness	Using the full set of criteria
	<i>They didn't [ask about mental and physical readiness]... I think it was pretty obvious to them [that the adult was ready]. Adult with TKA</i>											
Clinical judgment limited to OA symptoms, OA evidence and age	X	X	X	X				X	X			
	<i>We assume that that somewhere on their X-Rays there's a reason for them to be here. Provincial decision-maker</i>											
	<i>It's a clinical judgment. Someone in their 50s, should have tried and failed all those conservative treatments. Someone who 75-80, I would probably just go ahead even if they hadn't tried everything conservative. Regional leader</i>											
				X				X	X	X		
	<i>[Cartilage] is 3/8 of an inch wide and depth, down to a 16th of an inch... that influenced my decision. Adult with TKA</i>											
	<i>[When asked about discussion of trial of conservative treatments] They suggested strongly that I have the surgery because of the results on the X-ray. Adult with TKA</i>											
Inner setting												
Unclear roles for assessing some criteria	X		X	X	X			X	X	X	X	
	<i>The advanced practice providers [clinic assessors] would have that conversation about the benefits and risks. But probably, we would leave more of the conversation to happen with the surgeon. Provincial decision-makers</i>											
	<i>Physical therapist can discuss how much their impairment is and how limited they [patients] are and how interested they like to have a treatment, but often patients want to know how [much] risks they are taking on. So, I find that's a fundamental role that we're taking in the evaluation. [indicating unclear roles between physiotherapist and orthopaedic surgeons] Orthopaedic surgeon</i>											
Surgeons have preferred criteria for decision-making	X	X	X	X							X	
	<i>With time, by being able to discuss with orthopaedic surgeons... I know a little more on what some prefer, their way of working, their openness for some cases... Knowing this, it is easier for me [to say to patients], "Look you don't qualify, but maybe this orthopedic surgeon will want [to do a TKA]". Physiotherapist assessor</i>											
	<i>As we work with our physios, they often ask us questions in our criteria, and they know what we're interested or how we make our decisions. Orthopaedic surgeon</i>											
	X	X	X	X				X	X	X	X	

Themes	Healthcare team (x= mentioned)				Adults with TKA (x= mentioned)	Hawker et al. appropriateness criteria (x= theme associated)						
	Provincial decision-makers	Regional leaders	Physiotherapist assessors	Orthopaedic surgeons		OA impact on QoL	OA evidence (clinical, radiographic)	Conservative treatments	Realistic expectations	Agreement benefits outweigh risks	Mental/physical readiness	Using the full set of criteria
Limited patient involvement in decision-making	<i>It's really a partnership. I tell them [patients] "We'll decide"... my role is to decide if patients are candidates [for TKA; indicating power to decline referral to orthopaedic surgeon]. Physiotherapist assessor</i>											
Lack of resources for using the criteria	X	X	X	X				X	X			
	<i>Because of turnover, we're not always the same therapists at the clinic... I think there's definitely a logistical, bureaucratic [barrier] there, it would be hard to manage [having a document supporting the use of the shared decision-making criteria]. Physiotherapist assessor</i>											
	<i>If we put stuff in for all of these [Hawker et al. appropriateness criteria], we wouldn't be able to get through the referral or the appointment. Regional leader</i>											
Patients receive some TKA information but after the decision is made	X	X	X	X			X	X	X	X	X	
	<i>They're allowed to make the decision whether that be that they want to wait and put it off, think about it, or go ahead and see a surgeon. Then, we give them... information. Regional leader</i>											
	<i>It [patient education] is given, but it is after the decision is made [to go with TKA] Physiotherapist assessor</i>											
				X			X	X	X	X	X	
	<i>My thought process is "give me some information so I can make a good decision". Adult with TKA</i>											
	<i>If I would have seen the videos they show us after the decision is made... I am not sure I would have said yes. Adult with TKA ID 3</i>											
	<i>I was given access to that [education] after my confirmation that I was going for surgery. Adult with TKA</i>											
	<i>[Expectations]I did my own research. Adult with TKA</i>											
Outer setting												
	X	X	X	X		X		X				X

Themes	Healthcare team (x= mentioned)	Adults with TKA (x= mentioned)	Hawker et al. appropriateness criteria (x= theme associated)
	Provincial decision-makers Regional leaders Physiotherapists assessors Orthopaedic surgeons	OA impact on QoL OA evidence (clinical, radiographic) Conservative treatments Realistic expectations	Agreement benefits outweigh risks Mental/physical readiness Using the full set of criteria
No timely access to TKA surgery	The challenge right now is patients are obviously aware of the wait. So, some of them are saying “Well, maybe I don't want surgery right now, but given the wait, I'd like to move forward with having sort of my name in the queue”. Regional leader		
	Because of the wait time, I prioritize my patients differently. So, a patient who is borderline, who, normally, I would have said to him “Well, come back to see us” ... I will say “No, I will put you on his waiting list right away” ... the pandemic has changed our decision-making. Physiotherapist assessor		
	X		X
	I heard there was long waiting lists, so I figured I don't want to prolong it...they said, it could be another year, but I don't know if I can take this another year. Adult with TKA		
Total knee arthroplasty (TKA), quality of life (QoL)			

2.3.2 Facilitators to using the Hawker et al. appropriateness criteria

One facilitator to using the Hawker et al. appropriateness criteria was identified at the level of the CFIR domain **intervention**, but it was not specific to individual criteria: ‘*changing practices requires evidence and buy-in*’. The healthcare team spoke of their practices as evidence-based and that any practice change must be informed by appropriate evidence, while provincial decision-makers emphasized the importance of marketing any changes to foster intervention uptake in practice.

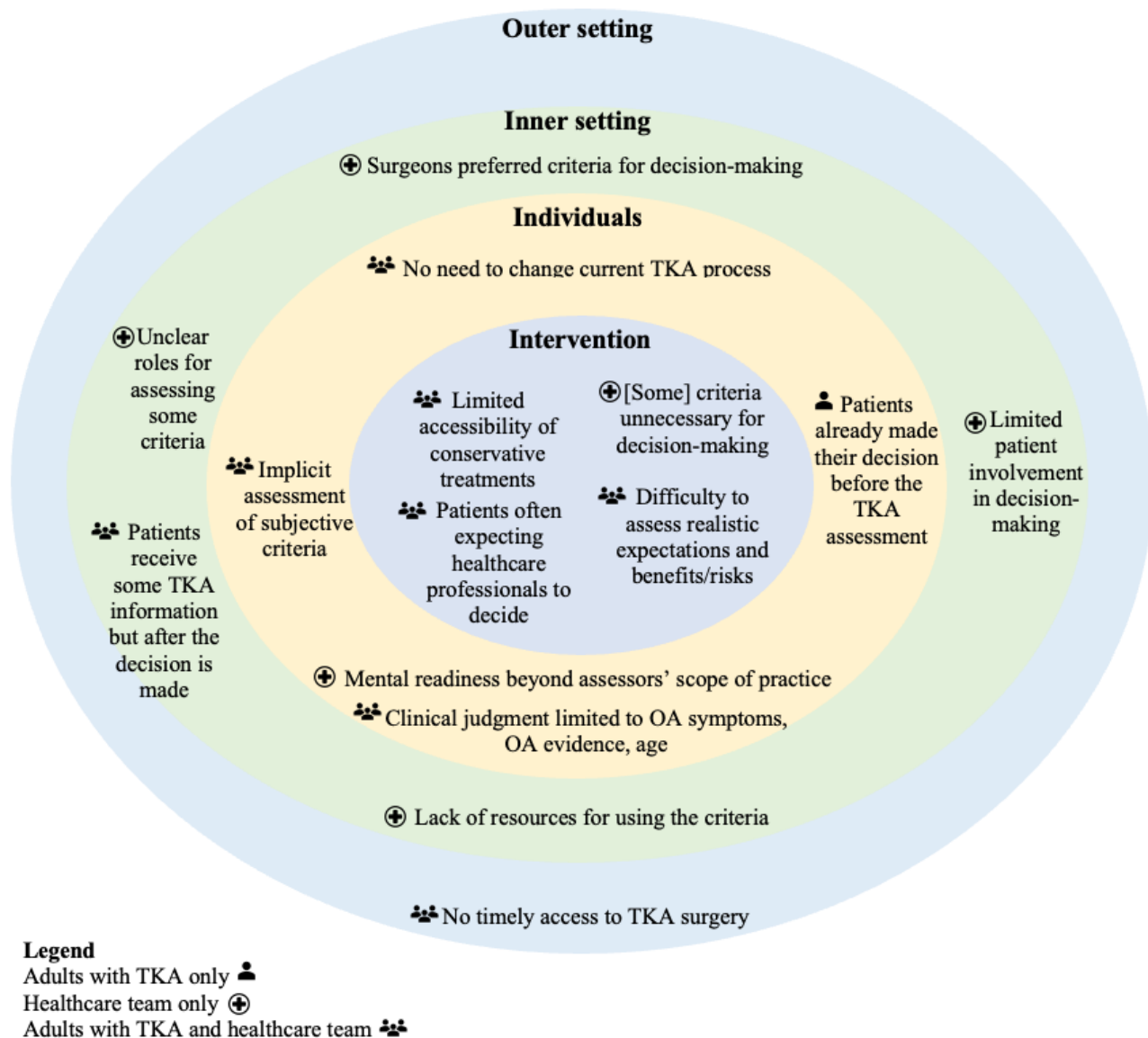
You're never finished marketing this kind of a model of care because the traditional route is so entrenched. Provincial decision-maker

If we feel that there's sufficient evidence to suggest that a change is needed, then we would take that to one of our committee levels... for final decision. Regional leader

2.4 DISCUSSION

This interpretive descriptive study enhanced our understanding of the factors influencing the use of the Hawker et al. appropriateness criteria for elective TKA decision-making in clinical practice from the perspectives of the healthcare team and adults who have undergone TKA (Figure 2.1). Common barriers identified, described by the healthcare team and adults with TKA, to using these criteria included: difficulty using some of them, lack of accessible conservative treatments, no need to change the current TKA process, clinical judgement limited to OA severity (symptoms, radiographic evidence) and age, implicit assessment of subjective criteria, patients receive some TKA information after the decision was made, and no timely access to TKA surgery. A facilitator to criteria use was the demonstration of evidence and buy-in supporting program changes. Themes were consistent between the healthcare team and adults with TKA. Our findings lead to the following discussion points.

Figure 2.1 Barriers to using the Hawker et al. appropriateness criteria



The healthcare team reported consistently using two criteria of the Hawker et al. appropriateness criteria to determine TKA appropriateness (OA negatively impacting quality of life, evidence of OA) and these criteria are on the standardized evaluation forms used at the TJA evaluation clinic. Use of these traditional criteria except trial of conservative treatments has been demonstrated in other studies to determine TKA appropriateness.^{5,14,24} Our findings revealed that

a trial of conservative treatment was not consistently used when determining eligibility for TKA. Another study in the Canadian province of Alberta reported only 40% of patients undergoing TKA had tried conservative treatments (pharmacotherapy, exercises or physiotherapy, weight loss)⁸ and other international studies reported similar results (47-62% in Sweden²⁵, 21-81% in the Netherlands²⁶). Some patients who use conservative treatments for OA no longer choose to undergo TKA.²⁷ In Canada, an important factor influencing choice is that surgery is fully paid by the publicly funded healthcare system whereas conservative treatments often require individuals to pay for these treatments (e.g., physiotherapy) or having personal insurance to cover portion of the costs (e.g., medication). Therefore, although weight loss and physiotherapy are reasonable options for decreasing pain and improving function^{28,29}, surgery is often the chosen option due to financial burden.³⁰ Other important factors to consider are the poor accessibility of conservative treatments for adults with OA living in rural areas compared to urban and the limited OA education provided to most adults.^{31,32} To increase appropriate OA management and decrease TKA demands, Canadian OA models of care need to improve access to early and timely conservative treatments and adequate education. A potential solution to consider is the use of telerehabilitation for OA management which has been shown to achieve, at a minimum, the same health outcomes compared to in-person treatment but can improve timely accessibility to conservative treatments and education for all.³³

Two criteria for shared decision-making (patient having realistic expectations, agreement on benefits outweighing risks) were not explicitly used to determine TKA appropriateness even if clinical practice guidelines recommend the use of shared decision-making when considering OA treatment options.^{3,14} In our study, adults with TKA reported limited knowledge about OA alternative treatment options, the TKA processes (e.g., recovery, rehabilitation) and postoperative

expectations but many adults revealed wanting to participate in the TKA decision. This is consistent with other studies reporting the desire of adults with OA to receive more information about OA, available treatment options, TKA processes (e.g., perioperative processes, recovery, rehabilitation) and implications and participate in decision-making.^{7,34} To support active patient involvement in decision-making, patients need education on alternative treatment options early in the OA disease process to support timely management.¹³ However, in the current TKA pathway, patients considering TKA were given education materials on TKA, or other alternative treatments when deemed not eligible for surgery, after the decision to refer to an orthopaedic surgeon is made. As a result, the timing of education does not allow patients to exchange evidence-based information on TKA and other alternative treatments options with healthcare professionals and actively participate in the decision-making process. Moreover, unidirectional education approaches are not as effective to improve patient's knowledge and increase participation in decision-making compared to more interactive education resources.³⁵ To facilitate the use of the shared decision-making criteria, models of care need to integrate earlier education on OA treatment options. Training should also be provided to the healthcare team members to increase their shared decision-making knowledge and skills. Studies have demonstrated that a short training session (one to two hours) are sufficient to increase knowledge, skills confidence, and observed level of shared decision-making in practice.^{36,37} To facilitate patient participation, patient decision aids should be provided before or during the TKA assessment.³⁸ Patient decision aids are booklets, videos, or interactive online tools and provide information on treatment options, benefits, and harms, and help patients clarify their values for outcomes of options.⁶ When provided to patients with OA considering elective TKA, they increase patient knowledge, improve decision quality (informed values-based choice), and decrease decisional conflict compared to usual care.¹³

Another challenging criterion to explicitly apply in clinical practice was assessment of physical/mental readiness for surgery to determine TKA appropriateness. Physical readiness is defined as being fit for surgery while mental readiness includes having the necessary information to be mentally prepared for the surgery (e.g., information on TKA perioperative processes) and deciding to have surgery.^{11,39} The healthcare team perceived that the criterion should be used after the decision was made to inform optimization of patients for the surgery (physical readiness) or has being out of their scope of practice (mental readiness). However, healthcare professionals should place more emphasis on physical/mental readiness since they are linked with postoperative satisfaction and outcomes.^{40–42}

It was difficult to explore the facilitators of using the Hawker et al. appropriateness criteria because the healthcare team perceived they were already using all the criteria in clinical practice as described by the theme ‘implicit assessment of subjective criteria’. Furthermore, there was unreceptivity to practice change as demonstrated by the theme ‘no need to change current TKA process’. These made it challenging to explicitly inquiry about the facilitators of using the criteria during the interviews and might explain why few facilitators to using the Hawker et al. appropriateness criteria were identified. According to CFIR, the degree individuals perceive the need to change their practice influences the implementation of innovations.¹⁸ Future studies are needed to further investigate the facilitators of using the Hawker et al. appropriateness criteria to support implementation in practice. Specifically, questions should only focus on facilitators of using the criteria in practice instead of first asking about the extent of use in practice.

According to CFIR, the barriers identified need to be addressed for the Hawker et al. appropriateness criteria to be implementing within the surgical TKA pathway.¹⁸ The facilitator of providing research evidence to obtaining healthcare team buy-in could support the use of the

Hawker et al. appropriateness criteria. For example, the following initiatives could be accomplished: emphasizing the potential benefits of using these criteria (e.g., can facilitate patient-centred care, improve timely access to surgery by triaging patients to appropriate treatment options), highlighting to the healthcare team areas of improvement in current TKA decision-making process (e.g., lack of shared decision-making, trial of conservative treatment and physical/mental readiness), and demonstrating how the Hawker et al. appropriateness criteria can address practice gaps.^{43,44} This could be done by providing continuing interactive education sessions on practice gaps to healthcare professionals involved in the TKA pathway.⁴³⁻⁴⁵ Additionally, to improve the integration of the Hawker et al. appropriateness criteria in current TKA pathway with minimal disruptions, the criteria could be incorporated in the standardized evaluation forms to remind healthcare professionals to use these criteria when determining patient appropriateness for TKA.^{46,47} Guidelines on how to operationalize the Hawker et al. appropriateness criteria in clinical practice also need to be elaborated (e.g., how to assess patient realistic expectations and physical/mental readiness). Finally, it is fundamental to clarify healthcare team members responsibilities and roles in using the Hawker et al. appropriateness criteria to enhance TKA pathway efficiency.^{48,49} To be consistent with patient-centred care and foster shared decision-making, it is fundamental to shift healthcare system views on decision-making for TKA and incorporate patients perspectives in the decision.⁵⁰

Several strategies were used to enhance trustworthiness of this study. This interpretive descriptive qualitative study included perspectives of all levels of individuals influencing delivery of care at the TJA evaluation clinic and adults with TKA were explored. In fact, all eligible provincial decision-makers, regional leaders, and physiotherapist assessors of the TJA evaluation clinic participated in this study. Credibility of finding of this study was further enhanced through

triangulation of findings.⁵¹ Transferability of findings was improved by providing a rich description of the setting and participants.⁵¹ Finally, confirmability of findings was increased through recording interviews and analyzing verbatim transcripts, analyses by two independent reviewers, comparison of reviewers' analyses until consensus, documenting decisions with an audit trail, and auditing of findings by an interprofessional team.⁵¹

2.5 CONCLUSION

This interpretive descriptive study revealed that appropriateness decisions for TKA was limited to OA impact on quality of life and OA severity. Identified barriers to using of the Hawker et al. appropriateness criteria were: difficulty in using some of them, lack of accessible conservative treatments, no need to change the current TKA process, clinical judgement limited to OA severity and age, implicit assessment of subjective criteria, patients receiving some TKA information after the decision is made, and no timely access to TKA surgery. Providing research evidence to obtaining healthcare team buy-in was the only facilitator identified to using the Hawker et al. appropriateness criteria. Interventions tailored to the identified barriers and healthcare system changes are needed to use the Hawker et al. appropriateness criteria in TKA decision-making. Further research is needed to evaluate interventions to overcome the identified barriers.

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Chapter 3. Instruments to assess appropriateness of hip and knee arthroplasty: A systematic review

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ABSTRACT

Objective: To assess criteria and psychometric properties of instruments for assessing appropriateness of elective joint arthroplasty (JA) for adults with primary hip and knee osteoarthritis (OA). **Methods:** A systematic review guided by Cochrane methods and PRISMA guidelines. Studies were searched in five databases. Eligible articles include all study designs developing, testing, and/or using an instrument to assess JA appropriateness. Two independent reviewers screened and extracted data. Instruments were compared with Hawker et al. JA consensus criteria. Psychometric properties of instruments were described and appraised guided by Fitzpatrick's and COSMIN approaches. **Results:** Of 55 instruments included, none met all Hawker et al. JA consensus criteria. Criteria the most met were pain (n=50), function (n=49), quality of life (n=33), and radiography (n=24). Criteria the least met were clinical evidence of OA (n=18), expectations (n=15), readiness for surgery (n=11), conservative treatments (n=8), and patient/surgeon agree benefits outweigh risks (n=0). The most tested psychometric properties were appropriateness (n=55), face/content validity (n=55), predictive validity (n=29), construct validity and feasibility (n=24). The least tested psychometric properties were intra-rater reliability (n=3), internal consistency (n=5), and inter-rater reliability (n=13). **Conclusion:** Most instruments included traditional criteria for assessing JA appropriateness but did not include a trial of conservative treatments or shared decision-making elements. There was limited evidence on psychometric properties.

3.1 INTRODUCTION

The number of hip and knee joint arthroplasties (JA) is steadily rising due to an aging population, obesity rates, and physical inactivity¹. This trend is concerning for healthcare systems as JA utilizes a significant amount of inpatient and outpatient resources² and appropriate patient selection for hip and knee JA is challenging^{3–7}.

Appropriateness of healthcare treatment is generally defined as providing net benefits to patients (maximizing benefits while minimizing risks)⁸. To achieve patient appropriateness for JA, timely access to JA and careful patient selection are essential to achieve best possible patient outcomes and maximize resources utilization³. However, there is no agreement on assessment criteria for healthcare professionals (HCP) to determine patient appropriateness for JA and this leads to practice variations^{3,9}. HCP judgment for hip and knee JA is principally based on radiographic severity and pain^{3,10}, whereas patient preferences for the surgery are driven by the impact of osteoarthritis (OA) on their quality of life and pain^{3,11}.

Lately, there has been a shift from recommending JA based on patient's joint impairments (radiographic severity, range of motion) to greater importance placed on patient perspectives (e.g., patients' readiness, expectations)^{12,13}. According to the 2017 Outcome Measures in Rheumatology (OMERACT) core domain set for hip and knee JA¹⁴, the 2020 National Institute for Health and Care Excellence evidence-based guideline for determining patient appropriateness for JA¹⁵, and the 2019 American College of Rheumatology and Arthritis Foundation (ACR/AF) OA management guideline¹⁶, patients are expected to participate in JA decision-making that includes a discussion between patients and HCPs on benefits, harms, and recovery following JA.

Specifically, OMERACT, NICE, and ACR/AF recommend the use of shared decision-making for hip and knee JA decisions. Shared decision-making is a process whereby patients and their HCP(s) make healthcare decisions together by discussing evidence-based information on their treatment options and guiding patients to clarify their values for outcomes of options¹⁷. When shared decision-making is used for elective hip and knee JA decision-making, there is: a) better decision quality, health outcomes, and patient satisfaction; b) improved quality and safety of treatment; and c) reduced healthcare costs^{18–21}.

There is currently only one set of appropriateness criteria for adults with hip and knee OA considering elective JA that integrates shared decision-making as recommended in clinical practice guidelines^{14–16}. The Hawker et al. consensus on six appropriateness criteria for JA⁹ was developed and validated (face/content) by a group of OA experts (surgeons, rheumatologists, and health services researchers) and patients^{9,12,22,23}, and has been used in multiple studies^{12,24–27}. It includes three criteria on OA characteristics (OA negatively impacting quality of life, clinical and radiographic evidence of OA, adequate trial of conservative treatments), two criteria on shared decision-making (patients have achievable expectations, patient/surgeon agree that benefits outweigh risks), and one criterion on patient's physical and mental readiness⁹. However, the Hawker et al. appropriateness criteria is a conceptualization of the criteria that could be used when determining patient appropriateness for the surgery, but it does not provide a score or result required of an instrument. The Hawker et al. appropriateness criteria has been referred to by other authors as “a conceptualization” and “a system”^{12,28}.

An instrument is defined as “a measuring device for determining the present value of a quantity under observation”²⁹ and thus providing a result (e.g., cut-off score, priority ranking). Many instruments have been created to help HCPs assess patient appropriateness for JA in clinical practice. However, little is known about the criteria used in instruments to determine patient appropriateness for JA and the psychometric properties of these instruments. The objectives of this systematic review are to 1) evaluate instruments to assess appropriateness for elective JA for primary hip and knee OA according to the Hawker et al. appropriateness criteria for JA, and 2) appraise the psychometric properties of these instruments.

3.2 METHODS

3.2.1 Design

The systematic review was guided by the Cochrane Handbook for Systematic Reviews ³⁰ and reported based on the PRISMA guidelines³¹. The protocol is registered on PROSPERO (CRD42021248611). According to the Tri-Council Policy Statement (TCPS 2) of ethical conduct for research involving humans, ethics approval was not required since this systematic review used publicly accessible literature as evidence³².

3.2.2 Eligibility

The SPIDER framework ³³ was used to outline eligibility for inclusion in the systematic review (Table 3.1).

Table 3.1 Eligibility criteria based on the SPIDER framework

Criteria	Inclusion	Exclusion
<u>Sample</u>	-Adults aged 16 years and older -Elective joint arthroplasty for primary hip and knee OA	-Other conditions than primary OA -Considering joint arthroplasty because of infection, replacement, fracture, dysplasia
<u>Phenomenon of interest (instruments)</u>	-Any instruments and set of instruments to assess patient appropriateness for elective hip and knee joint arthroplasty or to inform decision-making. For example: - o Patient-reported outcome measures - o Clinical measures - o Performance measures - o Subjective measures - o Others	-Not meeting the definition of instrument -Not explicitly stating to assess JA appropriateness -Used as an outcome measure -Used to assess appropriateness of same day surgery, outpatient surgery, bilateral surgery -To decide between partial or total knee arthroplasty -Only assessing risks of surgery (e.g., infection, readmission, mortality, fracture, dislocation) -One impairment (e.g., range of motion, imaging) -For optimization before surgery -Focused on hospital resources (e.g., length of stay) -Not available -COVID-based (prioritizing patients based on COVID risks)
<u>Design</u>	-Any study design involving developing, using, and/or testing psychometric properties of instrument(s) to assess patient appropriateness for elective joint arthroplasty -Studies testing and comparing different instruments -Studies involving hypothetical scenarios	-Reviews, editorials, commentaries, cost analysis
<u>Evaluation</u>	-Descriptive and psychometric data on instrument	
<u>Research type and other</u>	-Published in a peer-review journal -Grey literature (e.g., government report, clinical practice guideline) -Full text -French and English -No time limits	-Conference abstract -Book chapters -Thesis dissertation -Instruments and studies not publicly available

OA (osteoarthritis)

Sample

Eligible studies involved adults aged 16 years and older considering primary elective JA for primary hip or knee OA³⁴. Studies were excluded if they involved a majority of adults considering hip and knee JA for any other condition than primary OA (e.g., dysplasia, fracture), JA revision, and prosthesis replacement.

Phenomenon of interest

The phenomenon of interest was any available instrument explicitly developed to assess patient appropriateness or inform decision-making for elective JA for adults with primary hip and knee OA. Instruments needed to provide either a cut-off score, continuous score, probability of outcomes, eligible/ineligible, classification, and/or priority ranking²⁹.

Design

Any study design that involved developing, using, and/or testing psychometric properties of an instrument(s) to assess patient appropriateness for elective hip and knee JA. The following articles were excluded: reviews, editorials, commentaries, and cost analysis.

Evaluation

Any studies providing descriptive (e.g., description of an instrument, mean and SD of an instrument score) or data on psychometric properties.

Research type and others

Studies published in peer-reviewed journals or grey literature (e.g., governmental reports, clinical practice guidelines) in English or French and available in full text were included.

Conference abstract, thesis dissertations, and book chapters were excluded.

3.2.3 Data sources and search strategy

Studies were searched in Medline, Embase, CINAHL, Nursing and Allied Health, and Web of Science. The search strategy was created based on the PRESS guidelines³⁵ using SPIDER eligibility criteria. With the assistance of a medical librarian, the search strategy was created for Medline (supplementary material 3.1 in Appendix J) and adapted to the other databases (available upon request). Grey literature was captured in Web of Science. Databases were searched from inception to January 2022. Reference lists of included studies were manually screened by two independent reviewers.

3.2.4 Data management and selection process

All references were imported in Zotero reference management software for duplication removal and in Covidence web-based platform for systematic review for study selection. Four reviewers (LPB, ET, DL, AH) screened titles and abstracts independently in pairs using eligibility criteria. All studies appearing eligible or unsure passed to the next step for full text screening. Four reviewers (LPB, ET, DL, AH) screened full text articles independently in pairs to identify eligible studies. Corresponding authors were contacted when full texts were not available. Study selection process and reasons to exclude full text articles were recorded in Covidence. Disagreements between reviewers were discussed until consensus (LPB, CB) or by reaching out to a third party (SP, DS) to adjudicate disagreements when necessary.

3.2.5 Data collection and items

A pre-developed data extraction form was pilot tested by four independent extractors (LPB, ET, DL, AH) with three included studies. The data extraction form was modified accordingly through discussion. Data extraction was completed by the four independent extractors in pairs and included: a) general publication information (e.g., year of publication, journal, country, funding, conflict of interest) (completed by one extractor); b) study details (aim, design, sample size, setting); c) study population characteristics; d) characteristics of instruments (name, type, purpose, condition, number of criteria, criteria and responses for options, range of scores, material needed, mode of administration, assessor, assessment process, developed for what setting, and any other information deemed relevant); e) details on instrument development process, f) Fitzpatrick's psychometric properties (appropriateness, reliability, validity, feasibility, acceptability, interpretability)³⁶, and g) descriptive data on instrument (Table 3.2). Corresponding authors were contacted for further information when necessary. Inconsistencies in data extraction was discussed until consensus.

Table 3.2 Summary* of appraisal of psychometric properties

Psychometric properties	Definition based on Fitzpatrick³⁶	Rating guided by Fitzpatrick³⁶ and COSMIN^{37,38}
Appropriateness	The content fits the study purpose	Of Hawker et al. consensus on six criteria for TJA appropriateness (including 9 items): +: 7-9 items are included +/-: 4-6 items included -: ≤ 3 items included
Reliability	The measures of the instrument are reproducible, consistent between and within different raters, and internally consistent	+: Cronbach's alpha between 0.70-0.95 OR ICC/Cohen's kappa ≥ 0.80 +/-: ICC/Cohen's kappa 0.70-0.79 -: Cronbach's alpha < 0.70 or > 0.95 OR ICC/Cohen's kappa ≤ 0.69
Validity	<i>Predictive validity</i> : measure correlates with future values (e.g., diagnosis)	+: Correlation with other instruments ≥ 0.80 OR C statistics/AUC ≥ 0.75 OR SENS and SPEC ≥ 0.90 OR PPV and NPV ≥ 0.90 +/-: Correlation with other instruments 0.60-0.79 OR C statistics/AUC 0.60-0.74 OR SENS and SPEC 0.80-0.89 OR PPV and NPV 0.80-0.89 -: Correlation with other instruments ≤ 0.59 OR C statistics/AUC ≤ 0.59 OR SENS and SPEC ≤ 0.79 OR PPV and NPV ≤ 0.79
	<i>Face validity</i> : appears to measure what it is intended to measure	+: Instrument developed based on consultation with experts and patients +/-: Instrument developed based on experts AND clear description of the instrument aim, target population, concepts being measured, and item selection -: Patients not involved in development AND no clear description of the instrument aim, target population, concepts being measured, and item selection
	<i>Content validity</i> : covers important parts of the elements to be measured	
	<i>Construct validity</i> : cohesion between instrument measures and other similar measures and with theoretically derived hypotheses	+: ≥ 75% of the results are in agreement with theories/hypotheses +/-: 50-74% of the results are in agreement with theories/hypotheses -: < 50% of the results are in agreement with the theories/hypotheses
Feasibility	Facility of use	+, +/-, -: Reasonable time spent to use the instrument OR facility of use (e.g., training, scoring system) OR minimal missing response to items (≤ 15%)
Acceptability	Acceptable to patients and/or healthcare professionals	+, +/-, -: Clear language OR short instrument OR culturally applicable OR acceptable response rates (≥ 85%)

Interpretability	Interpretability and meaningfulness of measures/scores	+: One of the following: Mean and SD of general population presented OR MCID defined a priori +/-: Mean and SD of general population not presented AND MCID defined -: Mean and SD of general population not presented AND MCID not defined
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AUC (area under the curve), ICC (intra-class correlation coefficient), MCID (minimal clinically important difference), NPV (negative predictive value), PPV (positive predictive value), SENS (sensitivity), SPEC (specificity), TJA (total joint arthroplasty)

*See supplementary material 3.2 in Appendix K for detailed description of appraisal

3.2.6 Data analysis

Appropriateness criteria of instruments

The Hawker et al. appropriateness criteria for JA was chosen as the framework to appraise instruments because it is the only available set of appropriateness criteria for hip and knee JA incorporating elements of shared decision-making, and because it was co-developed with patients^{15,16}.

Instruments items were compared to the Hawker et al. appropriateness criteria for JA. To make it simpler for applying the six criteria, any multi-element criteria were broken down to individual components for a total of nine criteria: OA negatively impacting quality of life including 1) pain, 2) function, and 3) quality of life; 4) clinical and 5) radiographic evidence of OA; 6) adequate trial of conservative treatments; 7) patients have achievable expectations; 8) patient/surgeon agree that benefits outweigh risks, and 9) physical and mental readiness⁹. Any time trends in criteria (before and after 2010) were descriptively reported.

Psychometric properties of instruments

The following psychometric properties of instruments were appraised by one reviewer (LPB) and confirmed by another (SP) guided by Fitzpatrick's approach³⁶: appropriateness, reliability, validity, feasibility, acceptability, and interpretability (Table 3.2, supplementary material 3.2 in Appendix K for detailed psychometric properties appraisal guide). Fitzpatrick's appropriateness item was measured using Hawker et al. appropriateness criteria for JA⁹. Criterion validity was not assessed since there is no gold standard to assess patient appropriateness for JA.

Responsiveness was not assessed because these instruments are not used to assess change over

time. Precision was not assessed since it does not apply to dichotomous or categorical variables. COSMIN appraisal of psychometric properties was used: “+” defined as sufficient evidence, “+/-” defined as inconsistent evidence, “-” defined as insufficient evidence, “ ” defined as no evidence (Table 3.2)^{37,38}. Appraisal was based on the average of “+”, “+/-”, and “-” across studies. Justifications for ratings were documented (available upon request).

3.2.7 Data synthesis

Data was descriptively synthesized. Synthesis was grouped by objectives pursued by instruments: a) referral: to assess appropriate referral to orthopaedic surgeons; b) prediction: to estimate prediction of post-JA outcomes to inform JA decision-making; and c) selection: to assess indication for JA. Criteria and psychometric properties of instruments were synthesized in tables and reported descriptively.

3.3 RESULTS

3.3.1 Instruments selection and characteristics

Of 8,296 citations screened, 122 studies of 55 instruments were included (Figure 3.1). Instruments were published between 1987 and 2020: nine before or in 2000, 14 between 2001-2010, and 32 between 2011-2020 (Table 3.3). Instruments were developed in the United Kingdom (n=11), Canada (n=10), Spain (n=8), United States (n=6), Australia (n=4) France (n=3), Japan (n=2), New Zealand (n=2), and one each for France/Switzerland, United States/Belgium, China, Denmark, international collaboration, Ireland, Malaysia, Poland, and Singapore (Table 3.3). Of the 55 instruments, eight were referral instruments (ID 1-8), 16

prediction (ID 9-24), and 31 selection (ID 25-55). Of the 55 instruments, five were co-developed with patients (ID 1, 28, 32, 54, 55). The most tested instruments were ID 41 (n=14), IDs 34 and 52 (n=10), and IDs 32 and 51 (n=7). Table 3.4 describes characteristics of instruments.

Figure 3.1 PRISMA flow diagram of included studies

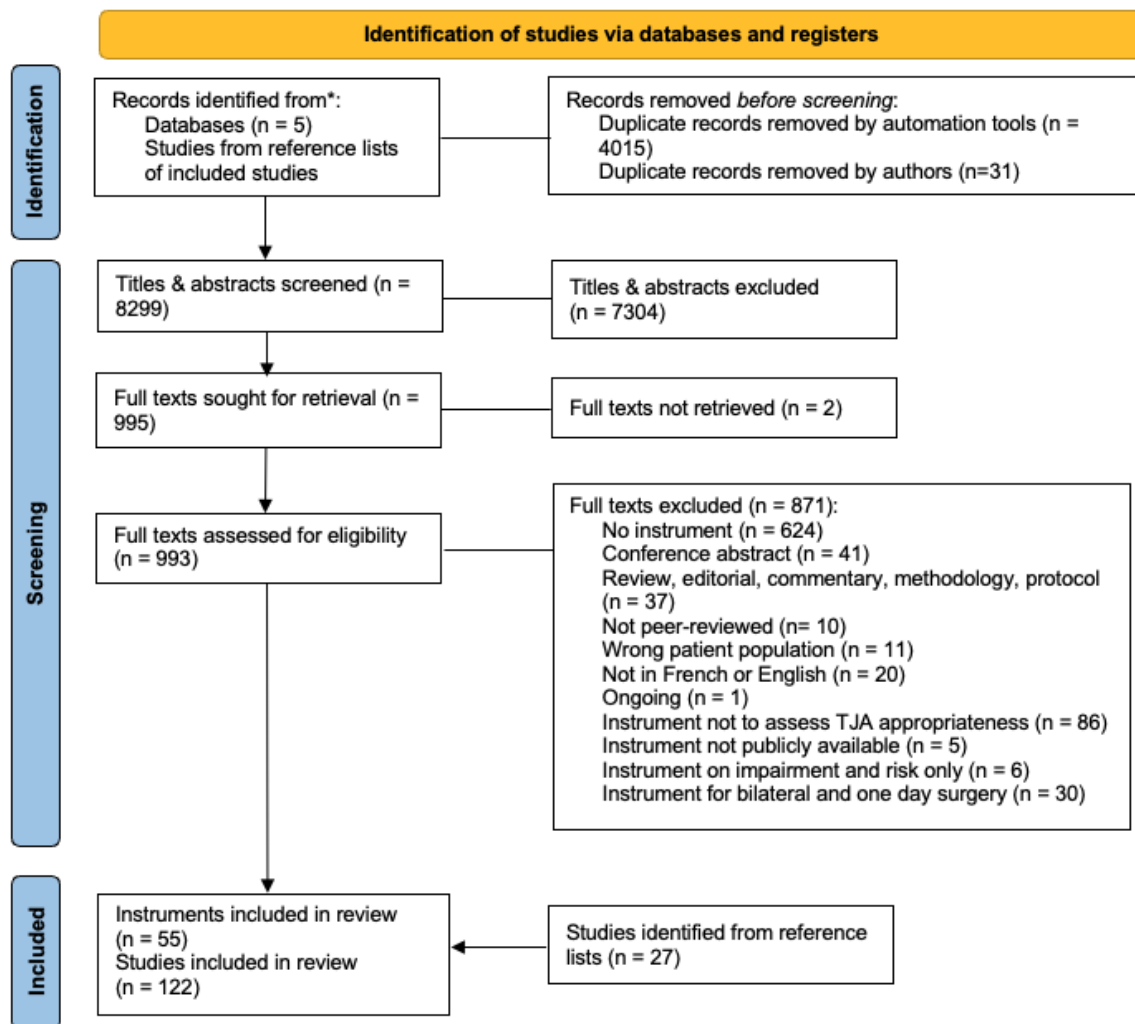


Table 3.3 Main characteristics of studies of instruments to assess elective hip and knee TJA appropriateness for OA

ID, instruments, studies references	Developer, year	Country
To assess appropriateness of JA referral		
1. The Arthroplasty Candidacy Help Engine Tool ^{53,73,74}	Price 2019 and 2020	United Kingdom
2. Screening Algorithm for TKA Referral ⁷⁵	Mikkelsen 2019	Denmark
3. Neufeld Oxfords Scores Thresholds ⁷⁶	Neufeld 2019	Canada
4. Simplified Algorithm for TKA Referral ⁷⁷	Churchill 2016	Canada
5. Definitive Referral Index for TKA ⁷⁸	Alcantara-Martos 2015	Spain
6. Criteria for Direct Listing on THA Surgical Waiting List ⁴⁰	Parfitt 2012	United Kingdom
7. Fast-track Clinic Selection Criteria for THA ⁷⁹	Johnson 2008	United Kingdom
8. Western Canada Wait List Priority Referral for Primary Care ⁴¹	De Coster 2007	Canada
Prediction of JA post-operative outcomes to inform decision-making		
9. Personalized Outcome Prediction Tool for Knee Arthroplasty ⁸⁰	Anis 2020	United States
10. Clinical Prediction Rule in Delay in QoL Recovery ⁴²	Tanaka 2020	Japan
11. Predictive Model For Satisfaction One Year Postoperatively ⁸¹	Kunze 2019	United States
12. PredicTKR ⁴³	Pua 2019	Singapore
13. Patient Reported Outcomes Measurement Information System ⁴⁴	Stiegel 2019	United States
14. Probabilistic Prediction Tool for 12-month Post-TKA Knee Pain ⁸²	Twiggs 2019	Australia
15. Clinical Risk Prediction Tool for 6-month Post-TKA ⁸³	Shim 2018	United Kingdom
16. Predictive Model of Poor Outcome Following TJA ³⁹	Arden 2017	United Kingdom
17. 6-month Postoperative Results Personalized Prediction Tool ⁵²	Gutacker 2017	United Kingdom
18. Predictive Model for TKA referral ⁷⁷	Churchill 2016	Canada
19. Prognostic Nomogram for TKA Nonresponse ^{45,84}	Dowsey 2016	Australia
20. Prediction Model for Patient Satisfaction after TKA ⁸⁵⁻⁸⁷	Van Onsem 2016	Belgium & United Kingdom
21. Rogers WOMAC Threshold for THA ⁸⁸	Rogers 2015	Canada
22. Preliminary Prediction Rule of Poor Outcomes 6-month Postoperatively ⁸⁹	Lungu 2014	Canada
23. Clinical Risk Prediction Tool for THA ⁹⁰	Judge 2012	United Kingdom
24. Judge Oxford Scores Thresholds ⁹¹	Judge 2011	United Kingdom
Selection of patients appropriate for JA		

ID, instruments, studies references	Developer, year	Country
Continuous score		
25. Ab Rahman WOMAC Threshold ⁹²	Ab Rahman 2020	Malaysia
26. Unicompartmental Indication Score ^{93,94}	Antoniadis 2019	France & Switzerland
27. Japanese Knee Osteoarthritis Measure Score Threshold ⁹⁵	Liu 2014	Japan
28. New Zealand Orthopaedic Association Prioritization Score ^{96–98}	Hansen 2012	New Zealand
29. OARSI-OMERACT Pain and Functional Impairment Thresholds ^{99,100}	Gossec 2011a and 2011b	International
30. Reflecting Formula for TKA ¹⁰¹	Chan 2010	China
31. MAPT Discrete Choice Experiment ¹⁰²	Witt 2009	Australia
32. Catalonia Hip-Knee Priority Score ^{46,103–108}	Sampietro-Colom 2008	Spain
33. Quintana WOMAC Threshold ^{109,110}	Quintana 2006 & Cobos 2010	Spain
34. Western Canada Wait List Hip and Knee Prioritization Tool ^{47,111–119}	Arnett 2003 & Noseworthy 2003	Canada
35. Waiting List Prediction Tool for THA ¹²⁰	Birrell 2003	United Kingdom
36. Composite Indexes for THA ⁴⁸	Maillefert 2002	France
37. Global Score for THA ¹²¹	Nakache 2001	France
38. Hawker WOMAC Threshold ^{49,68,122,123}	Hawker 2000	Canada
39. Harris Hip Score and Knee Society Score ¹²⁴	Kingston 2000	Ireland
40. Salisbury Priority Scoring System ^{125,126}	Lack 2000	United Kingdom
41. New Zealand Priority Score ^{50,127–139}	Hadorn 1997	New Zealand
42. Naylor Algorithm for Waiting List Priority ^{140,141}	Naylor 1996	Canada
43. Naylor Algorithm for Appropriateness ^{140,141}	Naylor 1996	Canada
44. Lequesne Indexes of Severity for Osteoarthritis ^{142–148}	Lequesne 1987 and 1990	France
Categorical score		
45. Escobar 2 nd Generation TKA Appropriateness Algorithm ^{54,149}	Escobar-Martinez 2020	Spain
46. Hip Replacement Clinical Decision Support System ¹⁵⁰	Fabisiak 2020	Poland
47. Appropriate Use Criteria for the Hip ^{151–153}	American Academy of Orthopaedic Surgeons 2017	United States

ID, instruments, studies references	Developer, year	Country
48. Surgical Management of Osteoarthritis of the Knee Appropriate Use Criteria for the Knee ^{154–156}	American Academy of Orthopaedic Surgeons 2016	United States
49. Modified Escobar 2003 Algorithm ^{4,157,158}	Riddle 2014	United States
50. Decision Tree for THA ¹⁵⁹	Quintana 2009	Spain
51. Escobar 2003 TKA Appropriateness Algorithm ^{5,68,110,160–163}	Escobar 2003	Spain
52. Quintana THA Appropriateness Algorithm ^{6,7,55,105,110,160–162,164,165}	Quintana 2000a	Spain
53. Imamura Indications for THA ¹⁶⁶	Imamura 1996	United Kingdom
Continuous & categorical score		
54. The Spanish Network on Health Outcomes and Health Services Research Priority Score Instrument ^{56,107,167,168}	Escobar 2007	Spain
55. Multi-Attribute Arthritis Prioritization Tool ^{51,169,170}	Osborne 2006	Australia

Total joint arthroplasty (TJA), total knee arthroplasty (TKA), total hip arthroplasty (THA)

3.3.2 Appropriateness criteria of instrument

None of 55 instruments met all of the Hawker et al. appropriateness criteria (Table 3.4). The mean number of Hawker criteria met was 3.8 out of 9 (SD 0.9). Criteria the most frequently met were pain (n=50, 90.9%), function (n=49, 89.1%), quality of life (n=33, 60.0%), and radiographic evidence of OA (n=24, 43.6%). Other criteria the most included in instruments were age (n=20, 36.4%), comorbidities (n=10, 18.2%), sex/gender (n=9, 16.4%), and Body Mass Index (BMI) (n=8, 14.5%). Criteria the least frequently met were clinical evidence of OA (n=18, 32.7%), patient's expectations (n=15, 27.3%), readiness for surgery (n=11, 20.0%), trial of conservative treatments (n=8, 14.5%), and patients and surgeons agree benefits outweigh risks (n=0, 0.0%). The following are the proportion of criteria present in instruments before 2010/after 2010 (n=55): pain 95.7%/87.5%; function: 95.7%/84.4%; quality of life: 73.9%/50.0%; imaging: 47.8%/40.6%; clinical evidence of OA: 39.1%/28.1%; trial of conservative treatments: 21.7%/9.4%; patient's expectations: 0.0%/46.9%; agreement benefits outweigh risks: 0%/0%; readiness for surgery 13.0%/25.0%. The instrument meeting most criteria was the prediction instrument ID 16 (6 of 9 criteria; Predictive Model of Poor Outcome Following Total Joint Arthroplasty)³⁹, followed by two referral instruments (IDs 6, 8)^{40,41}, four predictions instruments (IDs 10, 12, 13, 19)⁴²⁻⁴⁵, and five selection instruments (IDs 32, 34, 36, 38, 41)⁴⁶⁻⁵⁰, all meeting 5 of 9 criteria. The psychometric property of appropriateness, appraised using the Hawker et al. appropriateness criteria, was rated as inconsistent (+/-, 4 to 6 criteria met) in most instruments (n=34, 61.8%).

Table 3.4 Main Characteristics of instruments

ID	Condition	Assessor	Target domain	Hawker et al. appropriateness criteria									Appropriateness	Other criteria	Outcome
				Pain	Function	QoL	Radiography	Clinical evidence	Conservative treatments	Expectations	Patient & surgeon agree	Readiness			
To assess appropriateness of JA referral															
1	TKA, THA	Patient, system	Practice	X	X	X				X			+/-	Age, sex	Out of 48, severity
2	TKA	Patient	Practice	X	X		X						-	None	Categorical, severity and relevance
3	TKA, THA	Patient	Practice	X	X	X							-	None	Out of 48, severity
4	TKA	Patient	Practice	X	X							X	-	Age	Categorical, willingness and severity
5	TKA	HCP	Practice				X		X				-	Age, BMI	Out of 14, severity
6	THA	HCP, patient	Practice	X	X		X		X			X	+/-	Comorbidities, age, BMI	Categorical, severity
7	THA	HCP, patient	Practice	X	X	X	X						+/-	None	Categorical, severity
8	TKA, THA	HCP, patient	Practice	X	X	X		X	X				+/-	Walking aid, medication level, perceived urgency	Out of 100, severity and urgency
Prediction of JA post-operative outcomes to inform decision-making															
9	TKA, PKA	HCP, patient, system, laboratory	Practice	X	X	X						X	+/-	Age, sex, BMI, race, education, smoking status, comorbidities, cell count	Categorical and %, appropriateness and 1-year improvement
10	TKA	HCP, patient	Practice	X	X	X		X		X			+/-	None	Categorical, 1-month QoL

ID	Condition	Assessor	Target domain	Hawker et al. appropriateness criteria									Appropriateness	Other criteria	Outcome
				Pain	Function	QoL	Radiography	Clinical evidence	Conservative treatments	Expectations	Patient & surgeon agree	Readiness			
11	TKA	HCP, patient	Practice				X	X		X			-	BMI, drug allergies, opioid use, comorbidities, knee surgery history, smoking status, walking aid	Categorical and out of 110, 1-year satisfaction
12	TKA	HCP, patient	Practice	X	X			X		X		X	+/-	Age, gender, ethnicity, education, BMI, caregiver, comorbidities, walking aid	Continuous, 6-month outcomes (knee pain, range of motion, walking limitations)
13	TKA, THA	Patient	Practice	X	X	X				X		X	+/-	None	Out of 40 and 50, 6-week improvement (function, depression, pain)
14	TKA	Patient, system	Practice	X	X	X				X			+/-	Back and hip pain, age, gender	Out of 10 and color codes, 12-month knee pain
15	TKA	Patient	Practice	X	X	X				X			+/-	Coping skills, comorbidities	Out of 19, 6-month poor outcome

ID	Condition	Assessor	Target domain	Hawker et al. appropriateness criteria									Appropriateness	Other criteria	Outcome
				Pain	Function	QoL	Radiography	Clinical evidence	Conservative treatments	Expectations	Patient & surgeon agree	Readiness			
16	TKA, THA	HCP, patient, system	NR	X	X		X	X		X		X	+/-	Age, sex, BMI, education, surgical approach, femoral offset size, socioeconomic level, comorbidities, joint surgery history	Out of 48 and %, 1-year improvement
17	TKA, THA	HCP, patient, system	Practice	X	X	X				X			+/-	Age, gender	Categorical, 6-month improvement
18	TKA	Patient, system	Practice	X					X			X	-	Age, patient perception of current state	Infinitive number, referral to surgery
19	TKA	HCP, patient	Practice	X	X	X	X			X			+/-	BMI, mental state	Out of 220, 1-year surgery nonresponse
20	TKA	HCP, patient, system	Practice	X						X		X	-	Gender, age	Infinitive number, satisfaction
21	THA	Patient	Practice	X	X	X				X			+/-	None	Out of 100, 1-year satisfaction
22	TKA	Patient	Practice		X	X				X			-	None	Categorical, 6-month poor outcome
23	THA	HCP, patient	Practice	X	X		X			X			+/-	Sex, age, hip injury history	Out of -96, 8-year improvement

ID	Condition	Assessor	Target domain	Hawker et al. appropriateness criteria									Appropriateness	Other criteria	Outcome
				Pain	Function	QoL	Radiography	Clinical evidence	Conservative treatments	Expectations	Patient & surgeon agree	Readiness			
24	TKA, THA	Patient	Practice	X	X	X				X			+/-	None	Out of 48, 6-month satisfaction
Selection of patients appropriate for JA															
Continuous score															
25	TKA	Patient	Practice	X	X	X							-	None	Out of 100, severity
26	PKA	HCP	Practice				X	X					-	Age, cause of symptoms, BMI, knee history	Out of 30, surgery indication
27	TKA	Patient	Practice	X	X	X							-	None	Out of 100, severity
28	TKA, THA	HCP, patient	Practice	X	X	X							-	Potential benefits, consequences of delaying >6 months	Out of 100, severity
29	TKA, THA	Patient	Research	X	X	X							-	None	Out of 100, severity
30	TKA	HCP, system	Practice			X	X						-	Age, sex	Infinite number, surgery indication
31	TKA, THA	Patient, system	Practice	X	X	X						X	+/-	Economic impact	0 to 1, priority
32	TKA, THA	HCP, patient	Practice	X	X	X	X	X					+/-	Recovery probability, social support, caregiving	Out of 100, severity
33	TKA, THA	Patient	NR	X	X	X							-	None	Out of 100, appropriateness
34	TKA, THA	HCP, patient	Practice	X	X	X	X	X					+/-	Perceived urgency	Out of 100, priority and urgency

ID	Condition	Assessor	Target domain	Hawker et al. appropriateness criteria									Appropriateness	Other criteria	Outcome
				Pain	Function	QoL	Radiography	Clinical evidence	Conservative treatments	Expectations	Patient & surgeon agree	Readiness			
35	THA	HCP, patient	NR	X	X		X						-	Walking aid	Out of 6, waiting list
36	THA	HCP, patient	Practice, research	X	X	X	X		X				+/-	None	Out of 100, severity
37	THA	HCP, patient	Practice	X	X		X		X				+/-	None	Out of 100, severity
38	TKA, THA	Patient	NR	X	X	X	X	X					+/-	Comorbidities	Out of 100, appropriateness
39	TKA, THA	HCP, patient	Practice	X	X	X		X					-	None	Out of 100, priority
40	TKA, PKA, THA	HCP, patient, system	Practice	X	X	X		X					+/-	None	Out of 100, priority
41	TKA, THA	HCP, patient	Practice	X	X	X	X	X					+/-	Multiple joint disease	Out of 100, priority
42	TKA, THA	HCP, patient	Practice	X	X	X							-	None	Out of 7, priority
43	TKA, THA	HCP, patient	Practice	X	X								-	Osteotomy candidate, expected functional improvement	Out of 7, appropriateness
44	TKA, THA	Patient	Practice	X	X	X							-	None	Out of 24, severity
Categorical score															
45	TKA	HCP, patient	Practice	X	X		X					X	+/-	Age, comorbidities	Appropriateness

ID	Condition	Assessor	Target domain	Hawker et al. appropriateness criteria									Appropriateness	Other criteria	Outcome
				Pain	Function	QoL	Radiography	Clinical evidence	Conservative treatments	Expectations	Patient & surgeon agree	Readiness			
46	THA, others	HCP, patient, system	Practice	X	X		X	X					+/-	Other conditions	Treatment decision
47	THA, others	HCP, patient, system	Practice	X	X		X	X					+/-	Age, risk factors	Appropriateness
48	TKA, PKA, other	HCP, patient, system	Practice	X	X		X	X					+/-	Age	Appropriateness
49	TKA	HCP, patient	Practice	X	X		X	X					+/-	Age	Appropriateness
50	THA	HCP, patient	Practice, research	X	X	X			X				+/-	None	Appropriateness
51	TKA	HCP	Practice	X	X		X	X					+/-	Age, knee surgery history	Appropriateness
52	THA	HCP, patient	Administration	X	X		X		X				+/-	Age, risk factors	Appropriateness
53	THA	HCP	Practice	X	X								-	Weight, spine and knee disabilities, comorbidities	Appropriateness
Continuous & categorical score															
54	TKA, THA	HCP, patient	Practice	X	X	X		X					+/-	Comorbidities	Categorical and out of 100, priority
55	TKA, THA	Patient, system	Practice	X	X	X						X	+/-	Economic impact	Categorical and out of 100, severity

“X” present; “” not present. Acronyms: BMI (Body Mass Index); HCP (healthcare professional); HOOS (Hip Disability and Osteoarthritis Outcome Score); ICOAP (Intermittent and Constant Osteoarthritis Pain score); HSS (Harris Hip Score); JKOM (Japanese Knee Osteoarthritis

Measure Score Threshold); KOOS (Knee Injury and Osteoarthritis Outcome Score); KSS (Knee Society Score); NR (not reported), NSAID (Nonsteroidal anti-inflammatory drugs and analgesic); PKA (partial knee arthroplasty); QoL (quality of life); THA (total hip arthroplasty); TKA (total knee arthroplasty); % (percentage)

3.3.3 Psychometric properties of instruments

Of the 55 instruments, none were tested for all psychometric properties. The most tested psychometric properties were appropriateness (n=55, 100% of instruments) (Table 3.4), face/content validity (n=55, 100%), predictive validity (n=29, 52.7%), construct validity and feasibility (n=24, 43.6%) (Table 3.5). The least tested psychometric properties were intra-rater reliability (n=3, 5.5%), internal consistency (n=5, 9.1%), and inter-rater reliability (n=13, 23.6%).

Instruments with the most sufficient (+) ratings were the selection instruments IDs 17 and 55 (4 of 10 properties; 6-month Postoperative Results Personalized Prediction Tool, Multi-Attribute Arthritis Prioritization Tool)^{51,52}. Instruments with the most sufficient (+) and inconsistent (+/-) ratings was the selection instrument ID 34 (8 of 10 properties; Western Canada Wait List Hip and Knee Prioritization Tool)⁴⁷, followed by three selections instruments (IDs 32, 41, 55; 7 of 10 properties)^{46,50,51}, two referral instruments (IDs 1 and 8; 6 of 10 properties)^{41,53}, and one prediction and four selection instruments (IDs 17, 45, 51, 52, 54; 5 of 10 properties)^{5,52,54-56}.

Table 3.5 Psychometric properties appraisal

ID	Psychometric properties								
	Reliability			Validity					
	Inter-rater	Intra-rater	Internal	Face/content	Predictive	Construct			
To assess priority for JA									
1			+	+	-	-	+/-	+/-	+
2				-	-		+	+/-	
3				-	-	+/-			
4				-					
5	+	-	+	-					
6				-			+/-	+	
7				-	-				
8	+/-	+/-		+			+	+	
Prediction of JA post-operative outcomes									
9				-	+/-				
10				-	+				
11				-	+/-	-			+
12				-	+/-		+		
13				-	+/-				+/-
14				-			+		+/-
15				-	-				
16				-	+/-	-			
17				+			+	+	+
18				-	-				
19				-	+				
20				-	-			+/-	+
21				-	-	-			
22				-	-		+		
23				-	-		+/-		
24				-	-	-		+/-	
Selection of patients appropriate for JA									
Continuous score									
25				-	+		+		+
26	+	+		-	-	+/-			+
27				-	+/-				
28	+/-			+		+/-			+
29				-	+/-		-		
30				-	+/-		+		
31				-				+	

ID	Psychometric properties								
	Reliability			Validity					
	Inter-rater	Intra-rater	Internal	Face/content	Predictive	Construct			
32	+/-			+	+	+/-		+/-	+
33				-		+			+
34	+/-		+/-	+		+/-	+/-	+/-	+
35				-	-				
36				-	-		+		
37				-			+		
38				-		-		-	
39				+/-			+/-	+	+
40				-		+/-	+		+
41	-		+	+	+/-	-	+/-	+/-	+
42				-					+
43	-			-		-			+
44				-	+/-	+	+	+/-	
Categorical score									
45	+/-			-		+		+/-	+
46				-					
47				-		+	+		
48				-		+	+		
49				-		-			
50				-	-		+		+
51	+/-			-		+		+/-	+/-
52	+			+		+	+/-		
53				-					
Continuous & categorical scores									
54	-			+		+/-		+/-	+
55	+/-		+	+		+/-	+	-	+

“+” sufficient; “+/-” inconsistent; “-” insufficient; “ ” no evidence
 Appropriateness appraisal can be found in Table 3.2

3.4 DISCUSSION

Our systematic review identified 55 instruments to measure patient appropriateness for JA. Publications on standardized instruments to assess patient appropriateness for JA started in the nineties with a growing trend over the years. This review revealed variability in criteria used to measure patient appropriateness for JA and in the objectives pursued by instruments (referral, prediction, selection). Our findings lead to the following discussion points.

Most instruments met traditional criteria to measure patient appropriateness for JA (pain, function, quality of life, and imaging) but few considered trial of conservative treatments. In fact, the criterion of trial of conservative treatments was not included in many instruments published after 2010 compared to instruments published before 2010. This is consistent with studies showing that many patients scheduled for hip and knee JA have not tried common nonsurgical treatments (pharmacotherapy, exercise or physiotherapy, weight loss)^{57,58} and a meta-analysis that examined quality indicators for OA management also shown suboptimal trials of nonpharmacologic and pharmacologic treatments⁵⁹. Another study also revealed that patients with JA reported no meaningful discussion with surgeons of conservative treatment options²⁰. This is concerning given evidence-based practice guidelines consistently recommend JA when conservative treatment fails to alleviate OA symptoms^{3,60}. Although providing early OA management can be a challenge in current healthcare systems, studies of adults with end-stage OA have reported benefits from conservative treatments⁶¹.

Even though most instruments targeted HCPs and patients, none of the instruments met all criteria supporting elements essential for shared decision-making (patient's expectations; patient

and surgeon agree benefits outweigh)¹⁷. Assessment of expectations was included in few instruments, mostly published after 2010; while patient/surgeon agreeing that benefits outweigh risks was not considered in any instruments. These criteria are clearly challenging to operationalize. Other studies reported HCPs difficulties in implementing these criteria⁹, most patients report no significant discussion of potential negative outcomes of surgery²⁰, and patients report insufficient information on JA procedures and results²³. Many patients have unrealistic expectations of JA outcomes which leads to uninformed decisions¹⁹ and dissatisfaction with surgery results⁶². The Hawker et al. appropriateness criteria for JA does not suggest that patients with unrealistic expectations should be ineligible for surgery but rather suggests that realistic expectations should be addressed during JA decision-making. Since elective hip and knee JA is one of many treatment options, it is important to consider patient expectations and benefits/risks^{3,63,64}. Having conversations about expectations and benefits/risks are essential as patients and HCPs have different views on criteria deemed important for JA⁶⁵. Including the two shared decision-making criteria (patient having achievable expectations, patient and surgeon agree that benefits outweigh risks) in JA appropriateness instruments would likely prompt HCPs to have these conversations and assess these. In turn, this would lead to patients making informed quality decisions¹⁹.

Age, comorbidities, gender/sex, and BMI were often criteria within instruments. However, the utility of these criteria to assess patient appropriateness for elective JA is unclear since evidence is inconsistent on their relationship with adverse events and outcomes^{15,63}. Hence, restricting elective hip and knee JA based on these factors is inadequately justified and possibly limiting access to appropriate healthcare treatments⁶⁶.

Authors of identified instruments for assessing patient appropriateness for elective JA had tested few psychometric properties. Most authors tested validity to provide assurance that the instrument measured what it was supposed to measure and feasibility to demonstrate the ease of using the instrument^{36,38}. Both psychometric properties are fundamental for developing an adequate and implementable instrument for clinical practice. Moreover, authors did not typically include patients on the instrument development team; further questioning the instrument face/content validity³⁷. Patients are integral collaborators for co-developing instruments to ensure instruments are comprehensive³⁷. Nonetheless, there was sufficient evidence on predictive and construct validity of instruments. The psychometric property the least tested was reliability to ensure reproducibility/consistency of a measure between and within assessors^{36,38}. Since studies have demonstrated practice variations in recommending elective JA for OA^{10,12}, reliability is important to support similar practice within and between HCPs.

3.4.1 Implication for practice and future research

Developing instruments for use in clinical practice is time consuming. This systematic review identified 55 instruments with different objectives (to refer, predict, select patients). Rather than developing new instruments, the focus could be on addressing identified gaps in already developed instruments. Specifically, developers should consider existing instruments and, in collaboration with patients and clinical experts, modify the instrument to better operationalize innovative appropriateness criteria. To be consistent with patient-centred care and evidence-based practice guidelines, criteria specific to shared decision-making should be included in instruments as a reminder to engage in those conversations as part of the appropriateness

assessment (e.g., Did you and the patient discuss the potential benefits and risks of JA and agreed that benefits outweigh risks? Yes/No). To ensure instruments can be used in clinical practice, future studies should also investigate factors influencing their use in clinical practice (e.g., barriers, facilitators). For example, a study revealed that healthcare professionals did not use a mandatory instrument to prioritize patients on elective surgery waiting lists (general, orthopaedic, cardiac, vascular) because they believed their clinical judgement was sufficient to prioritize patients and had poor confidence in the quality of the instrument⁶⁷.

Current clinical practice for the assessment of patient appropriateness for elective hip and knee JA can be improved to achieve the Triple Aim of Healthcare: enhance quality of care, increase patient satisfaction, and decrease healthcare expenditures⁶⁹. The number of JA procedures performed each year is rapidly increasing⁷⁰, wait times for surgery are growing⁷¹, and there is large variability in the characteristics and symptom severity of patients waiting for JA¹⁰. Using instruments with criteria requiring engagement of patients in the decision-making process can help minimize practice variations across HCPs and settings^{3,9}. Assessing patient appropriateness for JA in a consistent approach can also support timely access to JA, help achieve best possible patient outcomes, and maximize inpatient and outpatient resources utilization³. Finally, instruments prompting HCPs to engage patients in the decision will support patients in making informed quality decisions and increase satisfaction¹⁹. Models of care will need to be improved to support earlier discussion with patients of OA and of evidence-based treatment options.

3.4.2 Strengths and limitations

A strength at the systematic review level is the exhaustive methodology used following the Cochrane Handbook: comprehensive search literature developed with an expert librarian, protocol registered in PROSPERO, and two independent reviewers screening articles, and extracting and analyzing data. Our systematic review used the SPIDER framework for describing eligibility and did not restrict eligibility based on study design.

There were five limitations to consider. First, there is no gold standard set of criteria to determine patient appropriateness for elective hip and knee JA for primary OA¹². Criteria to determine patient appropriateness for elective hip and knee JA for primary OA, including the assessment of patient expectations, is an evolving science⁷². We chose the Hawker et al. appropriateness criteria to appraise the instruments because it included criteria relevant to shared decision-making, but a limitation was the lack of information on how to operationalize some of the criteria in clinical practice. Second, although risk of bias of studies was not appraised, we conducted a comprehensive quality appraisal of the psychometric properties of the instruments and considered these results when discussing findings of our review. Yet, appraisal of psychometric properties was limited by the available literature testing included instruments and instruments with limited evidence on psychometric properties does not imply poor instrument quality. Third, some instruments and articles might have been missed since a forward search was not completed but reference lists of included studies were screened for eligible studies. Given the large number of included studies, it is unlikely that the instruments identified and appraised in this review would have been different if other studies were included. Fourth, referral forms were excluded since they were not publicly available. Finally, instruments were appraised based on

their content only, clinician likely also use other criteria and clinical judgement to determine TJA appropriateness.

3.5 CONCLUSION

We identified 55 instruments to assess patient appropriateness for JA. Instruments included traditional criteria to assess patient appropriateness for JA, but most did not have criteria focused on a trial of conservative treatment or shared decision-making. There was limited evidence on the psychometric properties of these instruments with most reporting validity and feasibility. Instruments developers could focus on improving current instruments and engage patients in the process.

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Chapter 4. Hip and Knee Total Joint Arthroplasty Online Resources for Patients and Health Care Professionals: A Canadian Environmental Scan

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Abstract

Purpose: To appraise the quality of publicly available online Canadian resources for patients with hip or knee osteoarthritis considering total joint arthroplasty (TJA) and health care professionals participating in TJA decision-making processes. **Method:** An environmental scan. Two independent authors appraised: a) patient resources against the International Patient Decision Aids Standards (IPDAS) criteria and the Patient Education Material Evaluation Tool (PEMAT); and b) health care professional resources against six appropriateness criteria for TJA and eight elements of shared decision-making. Analysis was descriptive. **Results:** Of 84 included resources, 71 were for patients, 11 for health care professionals, and 2 for both. For patient resources, the median number of IPDAS defining criteria met was 2 of 7, median PEMAT understandability score was 83%, and median PEMAT actionability score was 60%. For health care professional resources, the median number of appropriateness criteria was 3 of 6, and the median number of shared decision-making elements was 3 of 8. **Conclusions:** Only four of 73 patient resources were structured to help patients consider their options and reach a decision based on their preferences. Health care professional resources were limited to traditional criteria for determining TJA appropriateness (evidence of osteoarthritis, use of conservative treatments) and poorly met key elements of shared decision-making.

4.1 INTRODUCTION

Hip and knee total joint arthroplasty (TJA) is a frequently performed elective surgery in Canada with numbers steadily increasing each year.¹ This upward trend is concerning as Canadian health care services, including TJA, are publicly funded. Although TJA has been demonstrated as generally effective to manage hip and knee osteoarthritis (OA) symptoms and improve quality of life, not all patients benefit from these surgeries. Many experience postoperative pain² and report dissatisfaction with surgery results.³ The need to receive more information on TJA (e.g., procedure, outcomes, rehabilitation) and other available treatments during the decision-making process has been highlighted by patients to allow them to make a better-informed decision and to promote more realistic expectations.⁴⁻⁶ This is especially important as most patients want to participate in the decision-making process⁷ and frequently search the Internet for easily accessible health care information.⁸

Health care professionals, such as physiotherapists, play an important role in the TJA decision-making process by assessing patient appropriateness for surgery and by helping patients reach an informed decision. However, assessment of patient appropriateness for TJA is still mostly based on clinical criteria such as radiographic evidence of OA with less consideration of patient perspectives (e.g., impact of OA on quality of life and patient readiness).⁸⁻¹⁰ Consideration of patients' informed preferences is challenging for many health care professionals.^{11,12} Most decisions to proceed with elective TJA are based on surgeons' judgment without considering patients' informed preferences, and there is poor association between patients' informed preference for TJA and surgeons' judgment.^{4,13,14} This unilateral decision-

making process combined with lack of patient information results in approximately 25% to 45% of TJA being of questionable appropriateness.^{10,15–17}

Effective interventions to ensure patient involvement in decision-making are shared decision-making (SDM) and patient decision aids.¹⁸ SDM is an approach whereby patients and health care professionals make health care decisions together by exchanging evidence-based knowledge about harms and benefits of treatment options in order for patients to reach an informed healthcare decision that is congruent with their values and preferences.^{19,20} Patient decision aids are booklets, videos, or interactive online tools that provide information on available treatment options, benefits, and harms, and also help patients clarify their values for different outcomes of options.¹⁸ Patient decision aids are shown to increase patient knowledge, promote realistic expectations, decrease decision conflict, and increase participation in the decision-making process.¹⁸ When used in elective TJA decision-making processes, they result in higher-quality decisions and an improved decision-making process.²¹ The Canadian consensus on appropriateness criteria for TJA supports the shift from traditional criteria such as pain and radiographic evidence of OA to emphasizing patients' perspective in decision-making by including two SDM criteria (patient has achievable expectations, patient and health care professional agree that potential benefits outweigh potential risks of surgery)^{18,22} and supporting patient-centred care.²²

Despite hip and knee TJA being frequently performed surgeries in Canada, little is known about the available online Canadian resources supporting patients and health care professionals in TJA decision-making processes. The aim of this study is to appraise the quality of publicly available online Canadian resources on TJA for patients with hip or knee OA and health care professionals participating in TJA decision-making processes.

4.2 METHODS

4.2.1 Design

We conducted an environmental scan to provide evidence on current Canadian practices by gathering and interpreting information.²³ It was also used to identify practice gaps and opportunities for improvement.²⁴

4.2.2 Eligible resources

Eligible resources for patients were included if they met the following criteria: a) providing any education and information on TJA for hip or knee OA; b) targeting patients; and c) being publicly available on a Canadian Web site. Patient educational resources including information only on OA and not TJA were excluded.

Eligible resources for health care professionals were included if they met the following criteria: a) supporting health care professionals in determining appropriateness of TJA for patients with hip or knee OA; b) targeting health care professionals; c) being publicly available on a Canadian Web site. Health care professional resources were excluded if they included information only on OA and not TJA, or if they were focused on organization of care or outcomes.

4.2.3 Data sources and search strategy

The search focused on Canadian Web sites to provide a picture of current online resources publicly available to Canadian patients and health care professionals. We searched for TJA resources for patients and health care professionals in all 13 Canadian provincial and

territory governmental health care Web sites. Canadian health care associations relevant to OA and TJA were also searched if referenced in a province or territory Web site.

The search was conducted in English, except in Québec where it was conducted in French, by one author (LPB) between May and June 2021 as follows:²⁵⁻²⁷ 1) provincial/territorial health care government Web sites were identified from federal government Web sites and the federal government listing;²⁸ 2) each Web site was searched to identify resources related to hip and knee TJA; 3) key words related to TJA were used in Web site search engines if present (e.g., hip/knee/joint replacement AND (education OR decision OR decision aid OR decision support OR process OR pathway OR services OR program)); and 4) key words related to TJA were used in the Google search engine (province/territory name AND same key words as in step 3. If a province/territory government Web site referenced a Canadian health care association, it was searched using steps 2 and 3. Search engine results (Google and Web sites) were limited to the first fifty results or when all results of the next page were irrelevant. Google search engine cache was cleared between searches.^{26,29,30}

4.2.4 Data collection

One author collected data into a data extraction form piloted with one province/territory. The following were collected: a) resource name; b) targeted joint (hip, knee); c) type (e.g., decision aid, written education, video education, referral form, quality of care (e.g., guidelines for appropriate management of OA with TJA)); d) general description of included information; e) URL; f) key word used to identify resources (if any); g) pathway to the resources; h) province/territory/association; i) comments; j) date last updated; and k) date accessed.

4.2.5 Quality appraisal

Two authors (LPB, AK) conducted quality appraisal of patient educational resources and health care professional decision support resources independently. They compared quality appraisal results and differences were discussed until consensus or by consulting a third senior author (DS).

Patient resources

To determine if patient educational resources were decision aids, they were rated against the six defining criteria of the International Patient Decision Aids Standards (IPDAS): a) describes the health condition; b) explicitly states the decision to be considered; c) describes all options available; d) describes the positive features (benefits) of each option; e) describes the negative features (harms) of each option; f) helps clarify values for outcomes of options (e.g., describes what it is like to experience the options). A seventh recently proposed criterion was added: identifies the target population.^{31,32} When a patient decision aid was identified (meeting all seven defining criteria), six IPDAS certifying criteria were used to evaluate harmful decision bias (e.g., the decision aid shows the negative and positive features of the options with equal detail, the decision aid compares probabilities of options using the same denominator) and 23 quality criteria were used to evaluate the desirable quality characteristics (e.g., the decision aid describes what happens in the natural course of the condition if no action is taken, the decision aid compares probabilities of outcomes of option over the same period of time).³¹ IPDAS certifying and quality criteria specific to diagnostic testing or screening were excluded.

We assessed the health literacy of patient educational resources using the valid and reliable Patient Education Material Evaluation Tool for Printable Materials (PEMAT-P) or

Audiovisual Materials (PEMAT-A/V).^{33,34} This tool has been demonstrated to have face, content, and construct validity while being internally and externally consistent (interrater reliability).^{33,34} A strength of the PEMAT is that it offers an audiovisual version and actionability elements.³³ This tool assesses the health literacy over two domains: 1) understandability, defined as the ability of consumers of diverse backgrounds and levels of health literacy to process and explain key messages; and 2) actionability, defined as the ability to identify what consumers can do based on the information presented. PEMAT-P includes a total of 17 understandability and seven actionability items, while PEMAT-AV includes a total of 13 understandability and four actionability items. Items are rated as yes, no, or not applicable and converted to a percentage. Higher scores indicate better health literacy.³⁵ Good understandability and actionability were defined using a cutoff score of 70%.³⁶

Health care professional resources

Content of health care professional resources was compared to the Canadian consensus on six appropriateness criteria for TJA:¹¹ 1) OA symptoms negatively impact quality of life, 2) evidence of OA on examination (clinical and radiographic), 3) trial of conservative treatment, 4) achievable expectations, 5) patient and surgeon agree that potential benefits outweigh potential risks of surgery, and 6) patient is physically and mentally ready for TJA. Criteria were scored as being present or absent for a possible total score of six.

To evaluate the extent to which SDM is supported in TJA decision-making processes, content of health care professional resources was also evaluated against eight key elements of SDM: the resource a) encourages explicitly the use of SDM, b) defines/explains the problem, c) creates choice awareness (equipoise, explicitly states decision), d) encourages learning about the patient (e.g., patients' preferences and values, check/clarify understanding), e) encourages awareness of

health care professionals' knowledge/recommendations, f) encourages making the decision (document discussion about decision and the decision itself, make or explicitly defer decision, patients retain ultimate authority over decision, revisiting decision), g) encourages tailoring information (ascertain preferred format for information, flexibility and individualized approach, use clear language), and h) encourages deliberation (negotiation).^{37,38} Elements were scored as being present or absent in resources with a total possible score of eight.

4.2.6 Data analysis

Main characteristics of resources for patients and health care professionals were descriptively synthesized. Findings for patient resources (IPDAS, PEMAT-P and PEMAT-A/V) were analyzed using median, inter-quartile range (IQR), and range. Findings for health care professional resources (Canadian consensus on six appropriateness criteria for TJA, key elements of SDM) were analyzed using median, IQR, and range.

4.3 RESULTS

4.3.1 Characteristics of resources

Of a total of 184 Web sites and 1,647 Google results searched, 84 resources were included and analyzed (Figure 4.1). Of those, 71 resources were developed for patients, 11 for health care professionals, and 2 for both patients and health care professionals. Out of the 71 patient resources, four were patient decision aids (meeting all seven IPDAS defining criteria; IDs 1, 2, 3, 4), one a patient clinical practice guideline (ID 71), and 66 were patient information material (IDs 5–70). Out of the 11 health care professional resources, 1 was categorized as health care professional information material (ID 83), 1 an assessment form (ID 79), 4 referral forms

(IDs 75, 77, 78, 82), 1 a clinical practice recommendations document (ID 80), 1 a model of care document (ID 84), and 3 were quality of care materials (IDs 74, 76, 81). The two resources for both patients and health care professional (IDs 72, 73) were clinical practice guidelines. Most resources were written content in Web pages ($n = 37$), followed by videos ($n = 21$), and downloadable booklets ($n = 15$). Resources were last updated between 2011 and 2021 (Table 4.1).

Figure 4.1 PRISMA diagram of resources searches

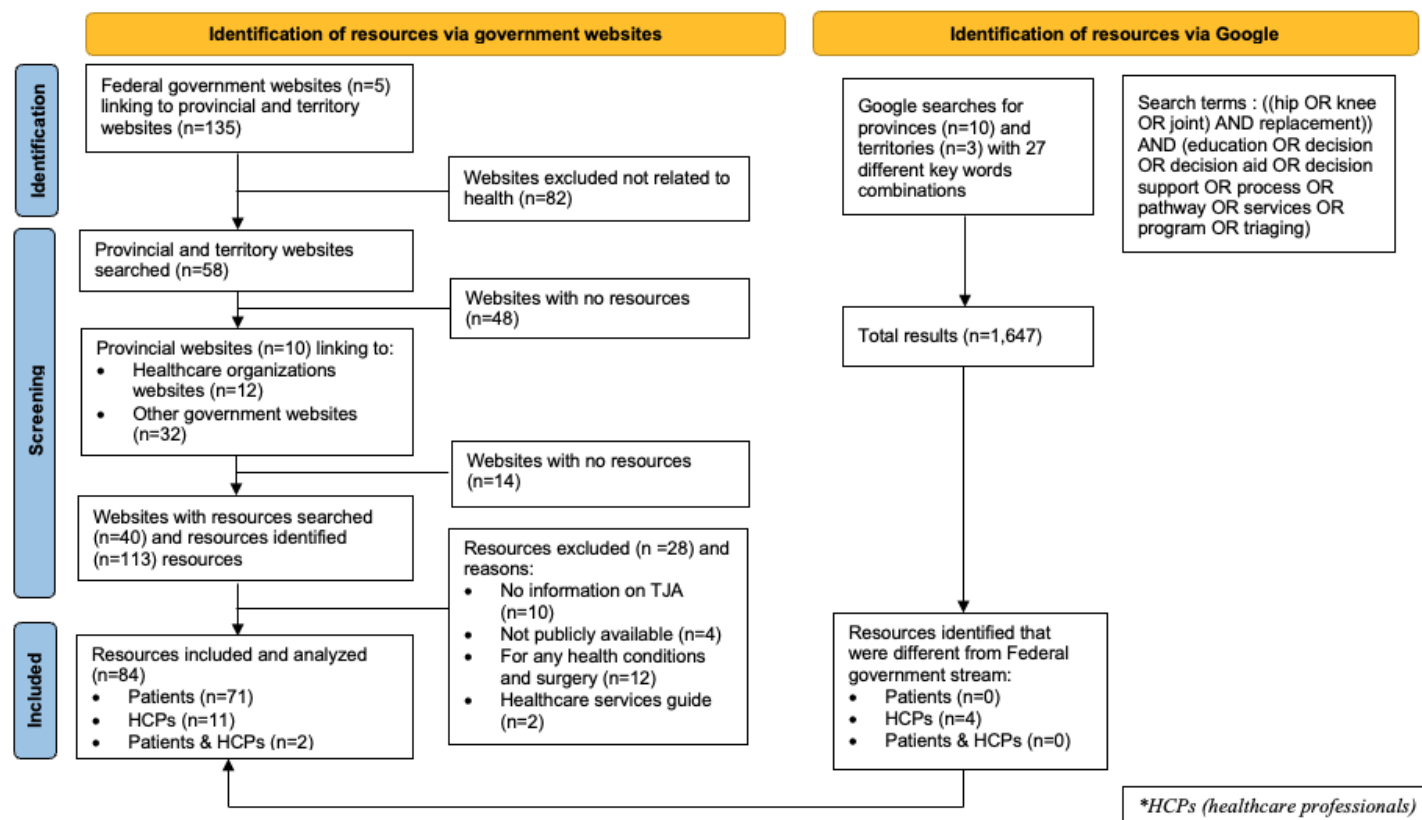


Table 4.1 Main characteristics of resources

ID	Resource name	Delivery	From	Developers	Last updated	Scores	
Patient decision aids						IPDAS (/7)	PEMAT U;A (%)
1	Arthritis: Should I have knee replacement surgery?	Interactive online	AB, BC, SK	Healthwise	2020	7	94;80
2	Arthritis: Should I have hip replacement surgery?	Interactive online	AB, BC, SK	Healthwise	2020	7	94;80
3	Deciding about hip replacement surgery	Video	AB	Healthwise	2020	7	90;100
4	Deciding about knee replacement surgery	Video	AB	Healthwise	2020	7	91;100
Patient information						IPDAS (/7)	PEMAT U;A (%)
5	The surgery journey	Webpage	AB, NB, NL, NS	Arthritis Society	2019	5	81;80
6	All about your hip- Preparation for surgery	Video	SK	Ministry of Health	2015	5	83;100
7	Osteoarthritis	Webpage	AB, BC, SK	Healthwise	2020	5	75;40
8	Osteoarthritis of the hip	Webpage	COA	OrthoGate	2015	5	87;20
9	Osteoarthritis of the knee	Webpage	COA	OrthoGate	2015	5	87;20
10	Hip replacement surgery: how others decided	Video	AB, SK	Healthwise	2020	4	56;0
11	Knee replacement surgery: how others decided	Video	AB, SK	Healthwise	2020	4	56;0
12	Osteoarthritis- Treating osteoarthritis of the knee	Webpage	NS	NS	2014	4	67;40
13	All about your knee- Preparation for surgery	Video	SK	Ministry of Health	2015	4	83;100
14	Artificial joint replacement of the hip	Webpage	COA	OrthoGate	2015	4	87;40
15	Artificial joint replacement of the knee	Webpage	COA	OrthoGate	2015	4	87;40
16	Knee replacement surgery: pros and cons	Video	AB	Healthwise	2020	3	56;0
17	Knee replacement surgery	Webpage	AB, BC, SK	Healthwise	2020	3	80;40
18	Total hip replacement surgery	Webpage	AB, BC, SK	Healthwise	2020	3	81;40
19	Deciding about total hip replacement	Webpage	AB	Healthwise	2020	3	86;40
20	Deciding about knee replacement surgery	Webpage	AB	Healthwise	2020	3	93;40

ID	Resource name	Delivery	From	Developers	Last updated	Scores	
21	Hip replacement (anterior) precautions: what to expect at home	Webpage	AB	Healthwise	2021	3	88;60
22	Knee replacement surgery	Webpage	AB, NB, NL, NS	Arthritis Society	2017	3	62;40
23	Hip and knee arthroplasty patient educational videos	Video	AB, NB, NS, COA	COF	2011	3	82;67
24	My guide to total knee replacement	Booklet	PE	Queen Elizabeth Hospital	2020	3	81;80
25	My guide to total hip replacement	Booklet	PE	Queen Elizabeth Hospital	2020	3	81;80
26	Knee replacement surgery	Booklet	NS	Health Authority	2018	3	88;100
27	My surgery- Orthopaedic surgery patient information: Before surgery	Webpage	NS	Health Authority	NR	3	94;83
28	Osteoarthritis	Webpage	NS	NS	2014	3	67;40
29	Treatment for osteoarthritis	Webpage	ON, COF, B&J Canada	GLA:D Canada	NR	3	73;0
30	Hip replacement surgery	Video	AB	Healthwise	2020	2	64;0
31	When you are having a knee replacement	Webpage	AB	B&J HSCN	2019	2	87;80
32	Knee replacement: recovery	Video	AB	Healthwise	2020	2	56;67
33	Hip replacement: before your surgery	Video	SK	Healthwise	2020	2	91;67
34	Having a hip replacement	Webpage	AB	B&J HSCN	2021	2	87;80
35	Learning about total knee replacement surgery	Webpage	AB	Healthwise	2020	2	93;40
36	Learning about total hip replacement surgery	Webpage	AB	Healthwise	2020	2	93;40
37	Total knee replacement rehabilitation	Webpage	AB	Healthwise	2020	2	81;60
38	Hip replacement (posterior) precautions: what to expect at home	Webpage	AB	Healthwise	2020	2	93;60
39	Hip replacement surgery: returning home	Video	AB	Healthwise	2020	2	73;100
40	Hip replacement: when can you be active again	Video	AB, SK	Healthwise	2020	2	91;100
41	Knee replacement surgery	Video	AB, SK	Healthwise	2020	2	60;0
42	Hip replacement surgery	Webpage	AB, NB, NL, NS	Arthritis Society	2017	2	54;40
43	Planning for maximal results: preparing for your surgery	Booklet	AB, NB, NS, COA	COF	NR	2	71;67

ID	Resource name	Delivery	From	Developers	Last updated	Scores	
44	Get moving: Maximizing your activity after a hip or knee Replacement	Booklet	AB, NB, NS, COA	COF	NR	2	65;83
45	Tips for recovery after hip replacement	Booklet	AB, NB, NS, COA	COF	NR	2	73;67
46	Hip and knee video by Dr. Mike Evans	Video	AB, NB, NS, COA	COF	2013	2	67;67
47	My surgery- Orthopaedic surgery patient information: In hospital	Webpage	NS	Health Authority	NR	2	93;80
48	NSHA patient education videos- Hip and knee surgery full video	Video	NS	Health Authority	2017	2	82;100
49	Patient and coach information total hip replacement	Booklet	SK	Health Authority	2018	2	88;83
50	Patient and coach information total knee replacement	Booklet	SK	Health Authority	2018	2	88;83
51	Osteoarthritis Treatments	Webpage	AB, NB, NL, NS	Arthritis Society	2021	2	53;40
52	Patient journey: Osteoarthritis	Webpage	AB, NB, NL, NS	Arthritis Society	2020	2	83;40
53	Total hip replacement	Webpage	AB, NB, NS, COA	COF	NR	2	46;0
54	What to expect before surgery	Webpage	AB, NB, NS, COA	COF	NR	2	64;40
55	What to expect during and after surgery	Webpage	AB, NB, NS, COA	COF	NR	2	62;40
56	Artificial hip dislocation precautions	Webpage	COA	OrthoGate	2015	2	87;40
57	Before your surgery: how to prepare	Video	AB	Healthwise	2020	1	91;100
58	Knee Arthritis: what is knee replacement surgery?	Video	AB	Healthwise	2020	1	83;0
59	Knee Replacement: when can you be active again?	Video	AB	Healthwise	2020	1	91;100
60	Knee replacement: learning about rehab	Video	AB, SK	Healthwise	2020	1	90;100
61	Learning about sex after hip replacement surgery	Webpage	AB	Healthwise	2020	1	93;60
62	Returning to sexual activity following joint replacement surgery	Booklet	AB, NB, NS, COA	COF	2017	1	93;60

ID	Resource name	Delivery	From	Developers	Last updated	Scores	
63	Total hip replacement patient care pathway	Booklet	PE	Queen Elizabeth Hospital	2018	1	57;20
64	My surgery- Orthopaedic surgery patient information: At home	Webpage	NS	Health Authority	NR	1	93;80
65	My surgery- Orthopaedic surgery patient information: Family and caregivers	Webpage	NS	Health Authority	NR	1	83;40
66	Elective hip replacement post operative exercises	Booklet	SK	Reginal Qu'appelle Health Region	NR	1	94;100
67	Elective knee replacement post operative exercises	Booklet	SK	Reginal Qu'appelle Health Region	NR	1	94;100
68	Do I need joint replacement surgery?	Webpage	AB, NB, NS, COA	COF	NR	1	78;60
69	Hip & knee replacement and you	Webpage	AB, COF	B&J Canada	NR	1	50;20
70	Joint replacement: Realistic expectations	Webpage	AB, BC	Healthwise	2020	0	67;0
Clinical practice guidelines for patients						IPDAS (/7)	PEMAT U;A (%)
71	Patient reference guide Osteoarthritis- Care for adults with osteoarthritis of the knee hip or hand	Booklet	ON	Health Quality ON	2018	3	69;40
72 *	Quality standards- Osteoarthritis: Care for adults with osteoarthritis of the knee, hip or hand	Booklet	ON	Health Quality ON	2018	3	69;0
73 *	Quality standard placemat for osteoarthritis	Booklet	ON	Health Quality ON	2020	2	60;20
Healthcare professionals						CAN criteria (/6)	SDM (/8)
74	Hip & knee replacement toolkit: a living document	Document	AB	B&J Canada	2011	5	4
75	Hip and knee replacement referral	Form	AB	Health Services	2017	4	1
76	Appropriateness of hip and knee replacement: A system based perspective	Document	AB	B&J Canada	NR	4	4

ID	Resource name	Delivery	From	Developers	Last updated	Scores	
77	WRHA central intake form for hip and knee joint replacement surgery	Form	MB	Winnipeg Regional Health Authority	2020	3	1
78	Orthopedic assessment clinic- Primary hip and knee arthroplasty referral form	Form	NS	Health Authority	2018	3	1
79	Osteoarthritis tool	Form	ON	Arthritis Alliance of Canada, Centre for Effective Practice, The College of Family Physicians of Canada	2017	3	3
80	Quality-based procedures clinical handbook for primary hip and knee replacement	Document	ON	Health Quality ON, Ministry of Health and Long-Term Care	2013	3	3
81	Healthcare professionals- When to get a consultation for hip or knee replacement surgery	Document	AB	B&J Canada	NR	3	2
82	Hip and knee multi-disciplinary clinics referral form	Form	SK	Government of SK	2017	2	0
83	Shared decision making- AB hip & knee osteoarthritis program	Video	AB	AB Bone and Joint Health Institute	2021	0	6
84	Healthcare professionals- Osteoarthritis	Webpage	AB	B&J Canada	NR	0	1
Healthcare professionals and patients							
72*	Quality standard- Osteoarthritis: Care for adults with osteoarthritis of the knee, hip or hand	Booklet	ON	Health Quality ON	2018	5	7
73*	Quality standard placemat for osteoarthritis	Booklet	ON	Ontario Health	2020	3	4

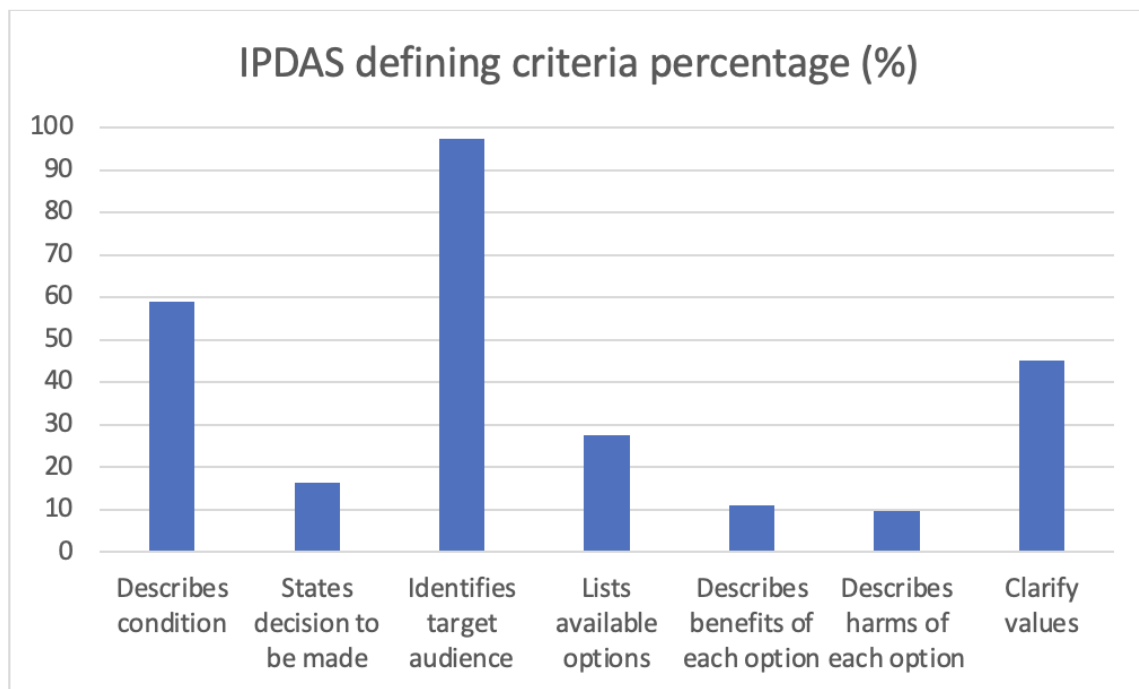
* ID 72 and 73 target patients and health care professionals and therefore are appraised under both types

A = Actionability; AB = Alberta, BC = British Columbia, B&J = Bone & Joint, CAN = Canadian, COA = Canadian Orthopaedic Association, COF = Canadian Orthopaedic Foundation, HSCN = Health Strategic Clinical Network, NB = New Brunswick, NL = Newfoundland and Labrador, NR = not reported, NS = Nova Scotia, ON = Ontario, PE = Prince Edward Island, U = Understandability, SK = Saskatchewan.

4.3.2 Quality appraisal of patient resources

The median number of IPDAS defining criteria met for the 73 patient resources was 2 out of 7 (IQR 1, min-max 0–7) (supplementary online material Table 4.2 in Appendix P). Criteria most met were identifying the target audience (97%), describing the health condition related to the decision (60%), and supporting values clarification for outcome of options (45%). Criteria least met were listing alternative options (27%), stating the decision to be made (16%), and providing benefits (11%) and harms (10%) of alternative options. Four patient resources met all IPDAS criteria to be defined as a patient decision aid (IDs 1, 2, 3, 4), and the median number of IPDAS criteria for bias minimization and quality was 5 out of 6 (IQR 1.3, min-max 4–6) and 12.5 out of 23 (IQR 15, min-max 5–20) respectively (Figure 4.2). Without the four decision aids, the 69 other resources met a median of 2 of 7 IPDAS criteria (IQR 1, min-max 0–5).

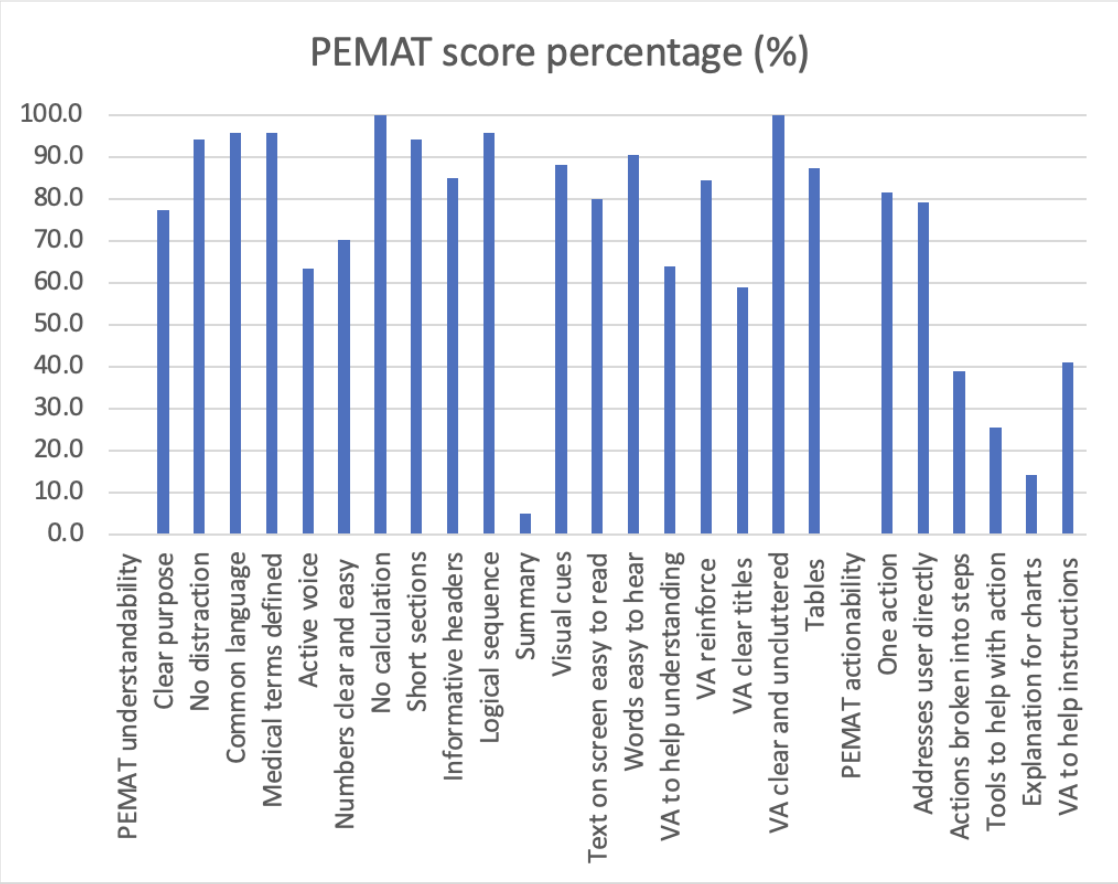
Figure 4.2 Patient resources compared to IPDAS defining criteria (N = 73)



Median PEMAT understandability score was 83% (IQR 23%, range 46–94%) (supplementary online material Table 4.3 in Appendix Q). Fifty-one resources (70%) achieved good understandability (defined as a score of $\geq 70\%$). Items most frequently met by the resources were: not asking users to perform calculations (100%), include clear visual aids (100%), use common language (96%), only use medical terms when needed and they are defined when used (96%), and present information in a logical sequence (96%). Items least frequently met by the resources were: provide a summary (5%), include visual aids with clear titles (59%), and use an active voice (63%). Median PEMAT understandability score for decision aids was 88% (IQR 13%, range 81–94%, all scored $\geq 70\%$) and 83% for other resources (IQR 23%, range 46–94%, 64% scored $\geq 70\%$).

Median PEMAT actionability score was 60% (IQR 40%, range 0–100%). Twenty-six resources (36%) achieved good actionability (defined as a score of $\geq 70\%$). Items most frequently met by the resources were: identify at least one action the user can take (82%), address the users directly (79%), and include visual aids to guide action (41%). Items least frequently met by the resources were: provide explanation on how to use tables and figures (14%), provide a tangible action tool (26%), and break down actions into steps (39%) (Figure 4.3). PEMAT actionability item “instruction for calculations” was not applicable for all resources. Median PEMAT actionability score for decision aids was 80% (IQR 0%, range 80–80%, all scored $\geq 70\%$) and 40% for other resources (IQR 40%, range 0–100%, 30% scored $\geq 70\%$).

Figure 4.3 PEMAT score of patient resources (N = 73)

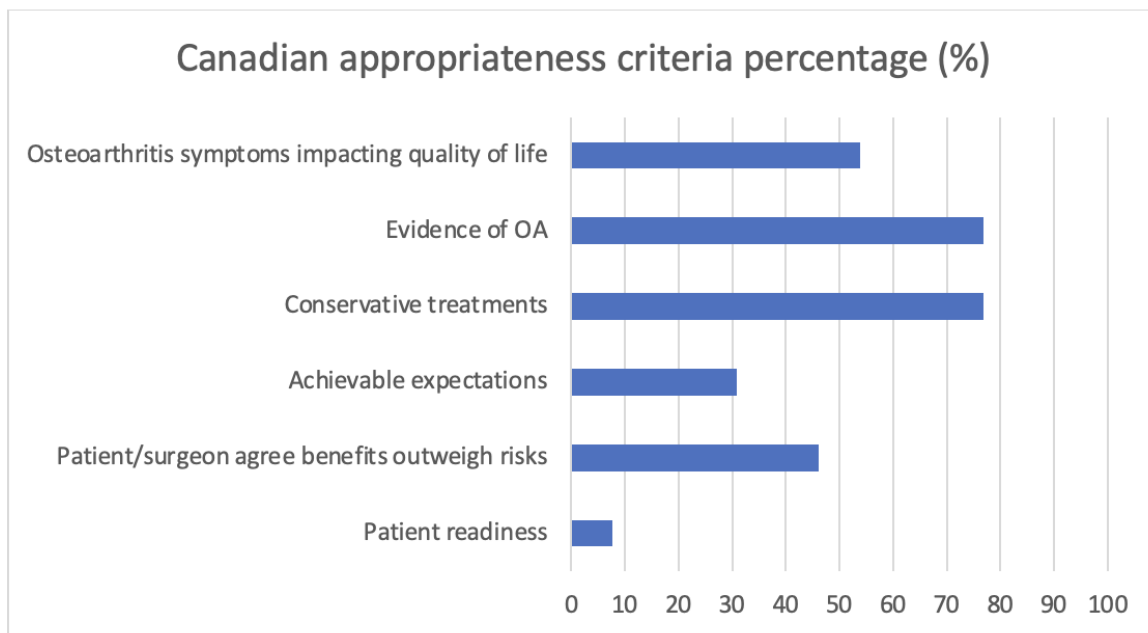


VA = visual aid

4.3.3 Quality appraisal of health care professional resources

The median number of Canadian consensus appropriateness criteria met by health care professional resources was 3 out of 6 (IQR 1, range 0–5) (supplementary online material Table 4.4 in Appendix R). Criteria most frequently met were: evidence of OA (77%), trial of conservative treatments (77%), and OA symptoms negatively impacting quality of life (54%). Criteria the least frequently met were: patients physically and mentally ready for surgery (8%), patients have achievable expectations (31%), and patients and surgeons agree that benefits outweigh risks (46%) (Figure 4.4).

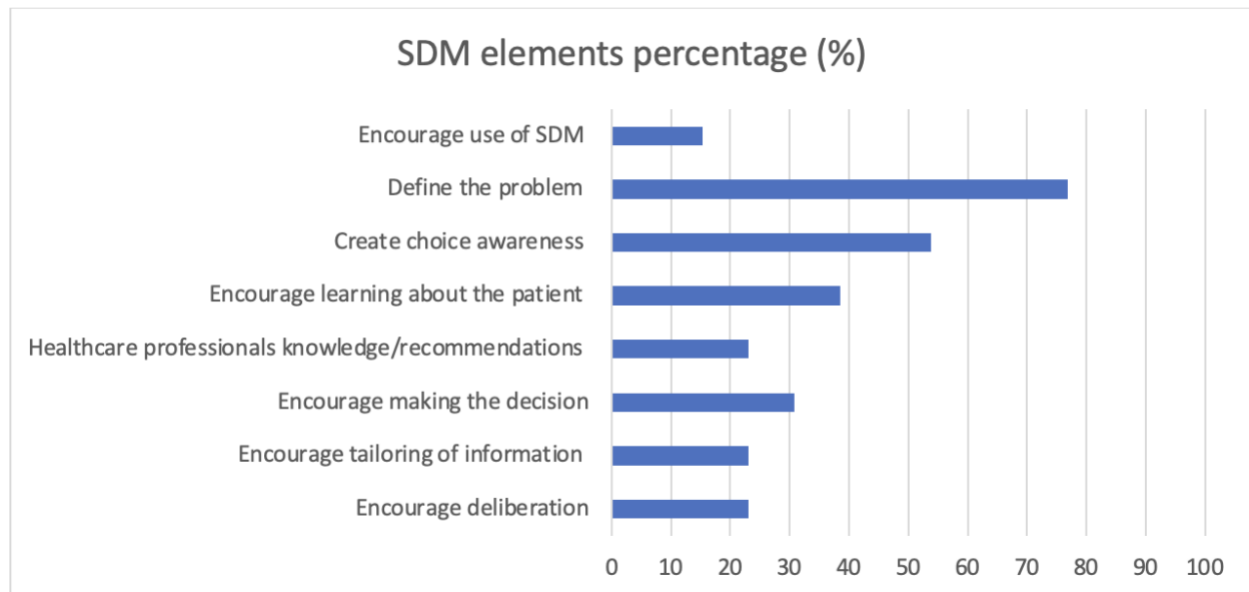
Figure 4.4 Health care professional resources compared to the six Canadian appropriateness criteria for TJA (N = 13)



OA = osteoarthritis

The median number of SDM key elements met was 3 out of 8 (IQR 3, range 0–7) (supplementary online material Table 4.5 in Appendix S). Key elements most frequently met were: define the problem (77%), create choice awareness (54%), and encourage learning about the patient (39%). Key elements least frequently met were: encourage SDM (15%), be aware of health care professional knowledge/recommendations (23%), encourage deliberation (23%), and tailoring of information (23%) (Figure 4.5).

Figure 4.5 Health care professional resources compared to SDM key definition elements (N = 13)



SDM = shared decision-making

4.4 DISCUSSION

This environmental scan of publicly available online TJA Canadian resources identified 73 resources for patients considering TJA, with only four meeting the definition of a patient decision aid. There were 13 resources for health care professionals, and none met all six Canadian consensus appropriateness criteria for TJA.

Of the numerous patient education materials on TJA, only four were structured in a way to help patients consider their options (benefits/harms) and reach a decision based on their preferences. These decision aids developed by Healthwise were used in three provinces (Alberta,³⁹⁻⁴² British Columbia,^{43,44} Saskatchewan^{45,46}), indicating a gap in available decision aids in other provinces. The other resources met few of the decision aid criteria. Previous

systematic reviews have reported that patients were more likely to have improved knowledge, reduced decisional conflict, and more likely to participate in decision-making with decision aids compared to usual care.¹⁸ However, these patient decision aids are available in only three provinces and not in French.²¹ Our findings highlight the need and opportunity for access to decision aids for all Canadians.

The other patient resources identified are focused on TJA surgery only and do not provide information on alternative options (e.g., pharmacotherapy, physiotherapy, weight loss) and their associated benefits and harms indicating a gap in information provided to patients. This is problematic because there are several treatment options for patients with OA and consent legislation requires that patients are aware of alternative options.²² This is particularly important given sub-optimal use of conservative treatments for OA prior to considering TJA.⁴⁷ Previous Canadian studies revealed 47% patients at TJA assessment clinics were referred to conservative treatments⁴⁸ and 40% of patients scheduled for knee TJA had not tried conservative treatments.⁴⁹ Patients require resources with full lists of alternative treatment options including benefits and harms to support their decision-making²¹ early in the disease process to support timely OA management. To support these conversations, models of care need to integrate these tools into practice.

Most included patient resources were understandable for diverse health literacy levels, but few provided a summary of key points or achieved high actionability scores. Consequently, patients with lower health literacy levels would most likely have difficulty transferring knowledge into meaningful actions or making an informed decision.^{50,51} Previous studies demonstrated that lower health literacy impacts quality of self-management,⁵² knowledge about surgery and perioperative care instructions,^{53,54} increases orthopaedic surgery disparities, and

influences overall quality and safety of care.⁵³ There is an opportunity to improve actionability of resources by identifying actions that patients can do based on the information presented, breaking actions into manageable steps, and providing tools to help with transferability of actions in patient life.

A recent clinical practice guideline recommends SDM with adults considering TJA.⁵⁵ TJA is a treatment option among many others, with no single best option.^{9,56} However, health care professional resources poorly met key elements of SDM. TJA decision-making resources for health care professionals were limited to traditional criteria for determining TJA appropriateness: evidence of OA and trial of conservative treatments.^{8–10} However, appropriateness also needs to include the patient's perspective (e.g., shared agreement that benefits outweigh harms, expectations, physically and mentally ready for surgery).⁵⁷ This is particularly important given that up to 34% of patients are dissatisfied after hip and knee TJA^{2,3,10,58} often because of unrealistic expectations.^{3,59,60} Most resources did not explicitly encourage health care professionals to learn about patient preferences in the TJA decision-making process nor encourage them to consider patient perspectives and expectations in determining TJA appropriateness indicating a gap in SDM. Given that none of the 13 identified resources for health care professionals met all 6 Canadian consensus appropriateness criteria for TJA, there is opportunity for creating resources that are more inclusive of these criteria. These online resources should be optimized to achieve the Triple Aim of Healthcare (increase patient satisfaction, enhance quality of care, and decrease health care expenditure).⁶¹

4.4.1 Strengths and limitations

This study has strengths and limitations to consider. The search strategy was exhaustive and completed systematically in all Canadian provincial/territorial health care Web sites and referred Canadian health care organizations. However, it is possible that some online resources were missed due to the changing nature of Web sites. Furthermore, resources appraised in this study are limited to publicly available online resources and do not include all resources used in clinical practice in Canada. Therefore, study results might not be representative of resources used in clinical practice. Quality appraisal was done by two independent authors with disagreements being resolved through consensus. Finally, the small number of health care professional resources identified is likely due to resources being available in private sections of Web sites available only to those with specific credentials. Therefore, results of health care professional resources appraisal are only representative of what is available publicly.

4.5 CONCLUSION

This environmental scan of publicly available online TJA Canadian resources for patients considering TJA and health care professionals participating in the decision-making process identified 84 resources with 4 considered patient decision aids. Most patient resources are understandable for different levels of health literacy but lack actionable strategies patients can take. The four decision aids identified are of good quality. However, the other patient resources are not designed to support patients in making quality decisions. Health care professional resources include traditional criteria to determine TJA appropriateness but poorly meet other

appropriateness criteria and key elements of SDM. There are opportunities for developers of patient resources to focus on designing resources that support informed decision-making of adults and actionable resources, while health care professional resources should consider patients' perspectives.

4.6 KEY MESSAGES

4.6.1 What is already known

Few patients with hip or knee OA considering TJA typically receive information on TJA (e.g., procedures, outcomes, rehabilitation) and other available treatments options, which can lead to uninformed decision-making and dissatisfaction with surgery results.

4.6.2 What this study adds

This study identified practice gaps and opportunities for improvement in publicly available online TJA Canadian resources for patients and health care professionals considering TJA. Most patient resources do not support a quality decision while health care professional resources suggest traditional criteria to determine TJA appropriateness and poorly support patients in making the decision.

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Chapter 5. Integrated discussion

I conducted multi-methods studies to examine how appropriateness for elective total joint arthroplasty (TJA) for primary hip and knee osteoarthritis (OA) is determined. In this chapter, I summarize the thesis findings to address the a priori knowledge gaps: a) factors influencing the use of the Hawker et al. appropriateness criteria for total knee arthroplasty in clinical practice; b) instruments to determine elective TJA appropriateness for primary hip and knee OA; and c) publicly available online Canadian TJA resources for patients and healthcare professionals participating in TJA decision-making. Then, I discuss the integrated findings and their contribution to the broader literature, and the implications for rehabilitation practice, education, healthcare organization, and research.

5.1 Summary of Studies

Following the Knowledge-To-Action (KTA) framework, I led a research team to conduct an interpretive descriptive qualitative study to explore the barriers and facilitators to using the Hawker et al. appropriateness criteria in the decision-making process for elective total knee arthroplasty for adults with primary OA (Chapter 2). This study corresponds to the barriers and facilitators of knowledge use in the KTA framework (220). I interviewed nine members the healthcare team at all levels of influence on the delivery of care at a TJA evaluation clinic of an academic hospital (provincial level decision-makers, regional leaders, healthcare professional assessors, TKA orthopaedic surgeons) and 14 adults with a TKA who were assessed at the hospital clinic. Identified barriers to using the Hawker et al. appropriateness criteria were: difficulty using some criteria, lack of accessible conservative treatments, no perceived need to change the current TKA process, clinical judgement limited to OA severity (symptoms, radiographic evidence) and

age, implicit assessment of subjective criteria, patients receive some TKA information after the decision was made, and no timely access to TKA surgery. A facilitator identified was providing research evidence to obtain healthcare team buy-in. Interventions tailored to the identified barriers are needed if the Hawker et al. appropriateness criteria are to be used for TKA decision-making. Having standardized instruments for healthcare professionals (Chapter 3) and publicly available TJA resources meeting the criteria could also facilitate the use of these in clinical practice (Chapter 4).

Then, I led a research team to conduct a systematic review, guided by the Cochrane methods, to appraise instruments assessing appropriateness of hip and knee joint arthroplasty (JA) for primary hip and knee OA according to the Hawker et al. appropriateness criteria for JA, and evaluate the psychometric properties of these instruments (Chapter 3) (236). This study corresponds to synthesizing evidence to inform, tailor, and implement interventions in the KTA framework (220). I found 55 instruments in 122 studies that developed, used and/or tested an instrument. This review revealed that no instruments met all the Hawker et al. appropriateness criteria for TJA. While most instruments included the criteria of pain, function, quality of life and radiographic evidence of OA, few included trial of conservative treatments, physical and mental readiness for TJA, or shared decision-making (SDM) elements (patient having realistic expectations, patient/surgeon agree benefits outweigh risks). There was also limited evidence on psychometric properties of instruments.

For the next study, I led a research team to conduct an environmental scan to appraise the quality of publicly available online TJA Canadian resources for patients with primary hip or knee OA considering elective TJA and healthcare professionals participating in the TJA decision-making process (Chapter 4) (237). This study corresponds to synthesizing evidence to inform,

tailor, and implement interventions in the KTA framework (220). The environmental scan identified 84 resources: 71 for patients, 11 for healthcare professionals, 2 for both. There were only four patient resources that were patient decision aids (PtDAs, structured in a way to help patients consider their options and reach a decision based on their informed preferences). The other patient resources did not inform about available OA treatment options beyond TJA. According to the Patient Education Material Evaluation Tool (238), most patient resources were understandable for diverse health literacy levels, but not actionable. None of the healthcare professional resources met all the Hawker et al. appropriateness criteria for TJA and were limited to OA symptoms negatively impacting quality of life, evidence of OA, and use of conservative treatments to determine TJA appropriateness. Healthcare professional resources also poorly acknowledged patients in the decision-making process (Hawker et al. appropriateness criteria of patient having realistic expectations, patient/surgeon agree benefits outweigh risks) and did not include the key elements of SDM (e.g., encourage the use of SDM, making the decision, tailoring information, deliberation).

Findings of my thesis revealed that the decision to undergo elective TJA is mostly based on OA symptoms negatively impacting quality of life and radiographic evidence of OA while the trial of conservative treatments and patient perspectives are poorly considered and not supported in the TJA decision-making process. These findings lead to the following discussion points.

5.2 Overcoming the Barriers to Implementing all the Hawker et al.

Appropriateness Criteria

My multi-methods studies revealed overarching barriers to using all of the Hawker et al. appropriateness criteria in clinical practice: a) poor criteria operationalization; b) unreceptivity to change how elective TJA appropriateness is determined; c) issues in accessing conservative treatments; d) no standardized instruments for healthcare professionals to use the appropriateness criteria; and e) no publicly available Canadian resources for healthcare professionals and patients to support TJA appropriateness decision-making. The following discusses each barrier with the broader literature.

Lack of criteria operationalization. It was challenging to appraise clinical practice (Chapter 2), instruments (Chapter 3), and resources (Chapter 4) to the Hawker et al. appropriateness criteria due to the lack of operationalization for some criteria (27). The criteria about OA symptoms negatively impact quality of life and evidence of OA were consistently used throughout my three thesis studies (Chapters 2, 3, 4), but not the other four criteria (trial of conservative treatments, achievable expectations, readiness for surgery, agreement benefits outweigh risks). To facilitate the use and implementation of the Hawker et al. appropriateness criteria for TJA, criteria need to be clearly defined and operationalized as it can negatively impact uptake in clinical practice, yield inconsistent interpretations, and lead to practice variations (239–242). A user manual guide, for example, could be developed to specify the theoretical justification, the actor, the action, the timing, the frequency, and the expected outcome for all the Hawker et al. appropriateness criteria (240,243,244). An umbrella review of 12 systematic reviews demonstrated that detailed guidelines with clear instructions leads to higher use and implementation in clinical practice (245).

Unreceptivity to change practice. Participants in the qualitative study (Chapter 2) revealed an unreceptivity to change clinical practice. To implement novelty in clinical practice, it is essential

to have a receptive climate to practice change (246). As revealed by the qualitative study (Chapter 2), providing research evidence to healthcare professionals is a facilitator to obtaining buy-in for practice change. A systematic review of 33 studies on implementation strategies for practice change suggest to focus on demonstrating the evidence of the Hawker et al. appropriateness criteria (e.g., robust development methods), the benefits of using them (e.g., patient-centred care, TJA outcomes), how they can address gaps in clinical practice (e.g., trial of conservative treatments), and how they can meet OA primary care needs (e.g., timely access to education on OA treatment options) (247). Another strategy to overcome unreceptivity to practice change is to have clinical champions (leadership) promoting the Hawker et al. appropriateness criteria for successful implementation by training staff, ongoing motivation and positive attitudes, and continuing monitoring and feedback (198,204). Clinical champions have been shown to positively influence the use and sustain use of an intervention, result in faster initiation of practice changes, and improved clinical team engagement, motivation, and skills (198,248).

Poor accessibility to conservative treatments. Clinical practice guidelines consistently identify a trial of conservative treatments as necessary before considering elective TJA for primary hip and knee OA (13,66,74). Yet, this criterion was seen in thesis study 1 (Chapter 2) as a barrier in clinical practice because of accessibility issues, it was rarely included in instruments to determine TJA appropriateness in thesis study 2 (Chapter 3), and few patient resources (e.g., four PtDAs) included conservative treatments (Chapter 4). Even if the trial of conservative treatment was discussed in most resources for healthcare professionals (Chapter 4), the thesis findings are not surprising since they are consistent with the literature demonstrating that most patients undergoing elective TJA for primary OA do not adequately use conservative treatments before TJA (e.g., weight loss, lifestyle changes, physiotherapy, pharmacotherapy) (163–165). Within the

Canadian healthcare systems, elective TJA costs are covered by the publicly funded healthcare system whereas costs for most conservative treatments (e.g., physiotherapy, lifestyle changes monitored by nutritionists, pharmacotherapy) require private insurance or personal financial resources. In Ontario, adults with primary hip and knee OA have access to some isolated publicly funded OA program (249,250). However, it is not clear to what extent they cover all needs, and they are not designed for chronic diseases (bundle of care for one episode of disease), potentially leading to fragmented care. Furthermore, access to conservative treatments, other than pharmacotherapy, is more difficult for remote communities and for individuals with disabilities (251,252). To use and implement the Hawker et al. appropriateness criteria in Canada, the healthcare system could be improved by funding OA as a chronic disease with better access to funded treatment across the trajectory. For example, Australia is publicly funding an OA chronic care program which has resulted in improved health outcomes (e.g., function, mobility), fewer comorbidities in adults with OA, and decreased number of patients on TJA waiting lists (30).

No standardized instruments for healthcare professionals. My systematic review (Chapter 3) did not identify any standardized instruments meeting all the Hawker et al. appropriateness criteria. While most instruments included the criteria of OA symptoms negatively impacting quality of life and evidence of OA, the two SDM criteria (realistic expectations, agreement benefits outweigh the risks) and readiness for surgery were not included. To help healthcare professionals be consistent with patient-centred care for TJA decision-making, they need to have access to instruments assisting them in using this approach in clinical practice (253). Therefore, the Hawker et al. appropriateness criteria could be incorporated in standardized instruments and these instruments embedded in TJA decision-making pathway to minimize workflow disruptions (198). A realist review including 35 studies implementing surgical safety

checklists highlighted poor implementation and sustain use of checklists when not embedded in clinical workflow (254). Having the criteria in standardized instruments will also act as reminders for healthcare professionals to use these criteria when determining patient appropriateness for TJA (253,255). Two overviews of reviews demonstrated that reminders, including instruments, checklist, and tools, result in positive healthcare professional behavior change (e.g., reducing unnecessary imaging for low back pain) (253,255).

Few publicly accessible resources for patients and healthcare professionals. My environmental scan (Chapter 4) demonstrated that online TJA resources for healthcare professional participating in the TJA decision-making process did not recognize SDM and readiness for surgery. Resources for healthcare professionals need to be improved if we want healthcare professionals to use the Hawker et al. appropriateness in clinical practice and make healthcare decisions, in collaboration with patients, that are respectful of and responsive to patient's needs and perspectives (253). A starting point would be for resources to explicitly instruct healthcare professionals to learn about patient perspectives and provide approaches to do so in clinical practice. A synthesis of 33 systematic reviews on clinical practice guidelines implementation strategies revealed a positive behavior change effect when healthcare professionals have access to explicit instructions in a guideline/instrument/tool (256). My environmental scan (Chapter 4) also identified a gap in information provided to patients since only four TJA patient resources were PtDAs which are only available to Canadians living in Alberta, British Columbia, and Saskatchewan. To support the use of the Hawker et al. appropriateness criteria in clinical practice and since most patients regularly look on the Internet for easily accessible healthcare information, resources are needed to help patients achieve realistic expectations and consider benefits outweighing the risks. To do so, TJA resources for patients

should provide information on OA treatment options, benefits and harms, and help patients make a preferences' informed decision (171,180). PtDAs can help providing this information and, when used in elective TJA for hip and knee OA, they result in improved patient knowledge, decision quality (informed values-based choice), decrease decisional conflict, and health outcomes (55,184). This information, or PtDAs, needs to be delivered in time for decision-making and not as currently described after decisions are made (Chapter 3).

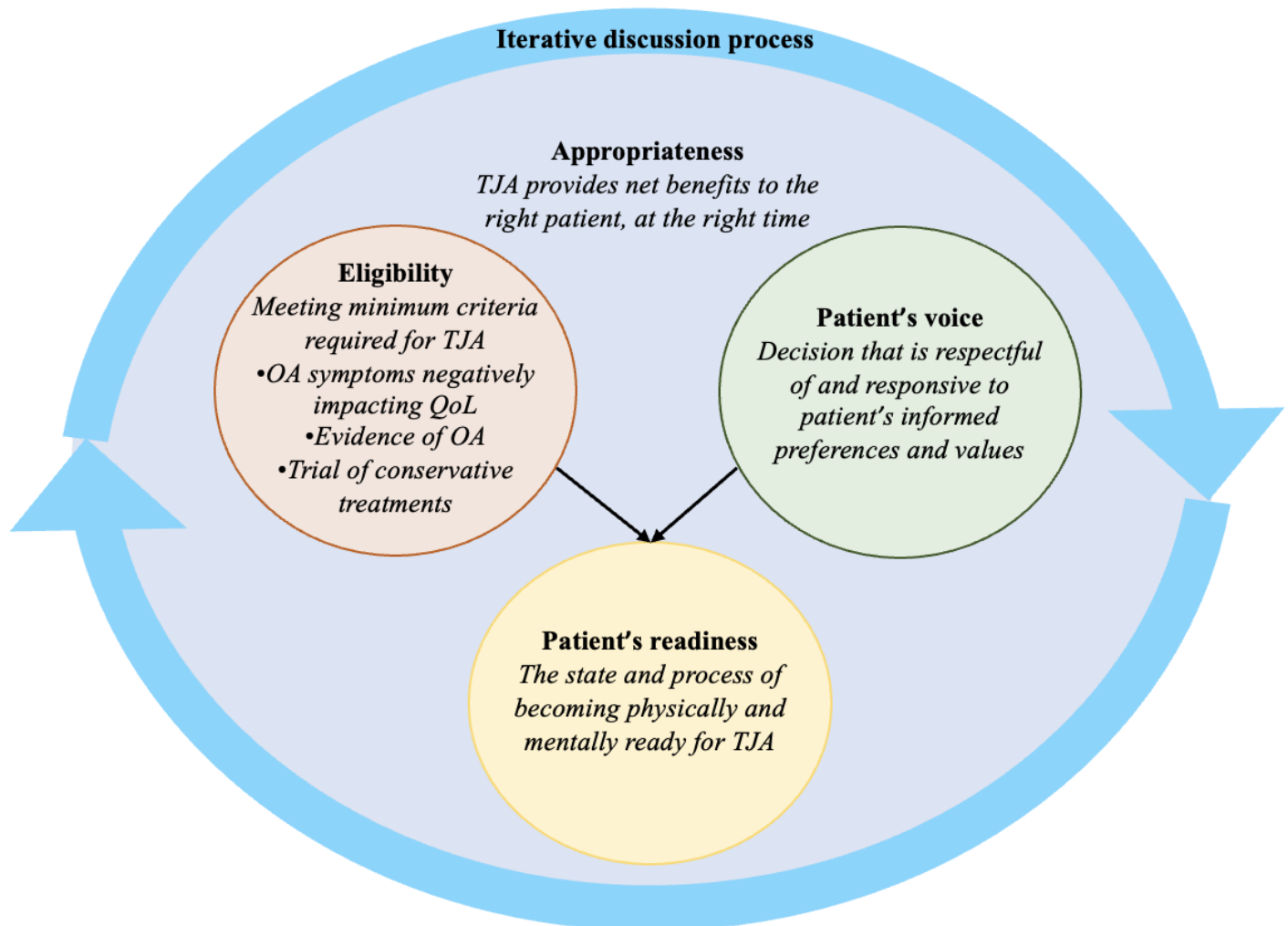
5.3 Rethinking TJA Appropriateness

TJA for primary hip and knee OA is an elective surgery recommended to improve quality of life and is one of many treatment options to manage OA symptoms (74,162). It is considered a preference-sensitive decision because adults need to trade off the benefits and risks of available OA treatments options when choosing treatments (53,257). However, the findings from my thesis revealed that the TJA decision-making process to determine appropriateness often does not sufficiently allow for a preference-informed decision. There is a need to reframe elective TJA decision-making process to raise patients to the centre of the decision to ensure that patients are at the core of the decision (46).

Based on my multi-methods thesis, I propose a patient-centred conceptualization for the decision-making process for elective TJA for primary hip and knee OA (Figure 5.1). The appropriateness decision-making process needs to embrace patient-centred care using four interconnected stages iteratively revisited through time with patients. To ensure elective TJA provides net benefits to the appropriate patients at the right time (appropriateness), the stages of the proposed patient-centred conceptualization for TJA appropriateness are to 1) determine if

patients meet the minimum eligibility criteria for TJA (e.g., clinical evidence of OA, OA symptoms impacting quality of life, conservative treatments); 2) acknowledge patient's voice and understand their perspectives to achieve patient-centred care and support preferences-informed decision; and 3) explore the state of readiness for surgery and support the process of becoming physically and mentally ready. OA is a chronic progressive illness and a patient's state can change over time, hence the decision-making process to determine elective TJA appropriateness for primary hip and knee OA needs to be understood and acknowledged as a process over time. The concepts of TJA appropriateness, eligibility, patient's voice, and patient's readiness are fundamental concepts to support the proposed patient-centred conceptualization of TJA appropriateness.

Figure 5.1. Patient-centred conceptualization of elective TJA appropriateness for primary hip and knee OA



Appropriateness is conceptualized as providing net benefits to patients implying that the benefits should exceed the risks largely enough to make the intervention worth providing (10,108) and as “...the right services being delivered to the right people, at the right time, by the right complement of healthcare providers and in the right healthcare setting.” (109). Based on Sharpe and Faden appropriateness model, appropriateness also needs to be understood as a spectrum influenced by clinical, patient, and societal perspectives (159). Therefore, under the proposed

patient-centred conceptualization of TJA appropriateness, TJA appropriateness is determined by the concepts of eligibility, patient's voice, and patient's readiness.

Eligibility is commonly defined as “satisfying the necessary conditions” (258), “qualified/permitted to do something” (259), and “meeting the stipulated requirements/fit to be chosen” (260). When translated to elective TJA decision-making process for primary hip and knee OA, eligibility means meeting the minimum required criteria for the surgery. The three thesis studies (Chapters 2, 3, 4) revealed consensus on eligibility (minimum) criteria for elective TJA for primary elective hip and knee OA: OA symptoms (pain, function) negatively impacting quality of life and evidence of OA. An international study conducted by OMERACT and OARSI suggested that pain, function, and radiographic severity could be included in a theoretical definition of TJA indication (122,261), but failed to agree on a final theoretical definition because of the range of other criteria influencing the decision in clinical practice (122,261). Similarly, many studies also reveal the influence of other criteria/factors on the decision (26,118,120,125,147). A study proposed to only use the more traditional criteria (pain, function, radiographic severity) as a way to raise awareness of the potential need for TKA instead of being used as a threshold for the surgery (26). Conversely, clinical practice guidelines do not recommend the use of radiographic severity of OA to determine TJA appropriateness since radiographic evidence is not linked to clinical symptoms and the lived experience (74–77,98). However, further research is needed on the role of radiographic evidence to determine TJA appropriateness. Surprisingly, there were inconsistent findings across my multi-methods thesis on the criterion of trial of conservative treatment even if elective TJA is recommended by clinical practice guidelines only after the failure of conservative treatments (13,66). Consequently, under the proposed patient-centred conceptualization of TJA appropriateness, the more traditional criteria (OA symptoms negatively impact quality of life,

clinical evidence of OA, conservative treatments) should be viewed as eligibility (minimum) criteria for elective TJA and that the “other criteria/variables” are instead related to the other concepts of the proposed patient-centred conceptualization of TJA appropriateness that needs to be acknowledged and considered in elective TJA decision-making process.

Listening to the *patient’s voice* is critical for ensuring that their perspectives are incorporated in TJA decision-making to achieve patient-centred care, which is recognized as a goal to improve quality of care, optimize management of healthcare resources, and support healthcare policies tailored to patients’ needs (113,262–264). The Institute of Medicine defines patient-centred care as “*providing care that is respectful of, and responsive to, individual patient preferences, needs and values, and ensuring that patient values guide all clinical decisions*” (p.40) (262). Yet, consistently across my three thesis studies (Chapters 2, 3, 4), patients’ perspectives were poorly considered and acknowledged in elective TJA decision-making. These findings are consistent with the literature demonstrating that “one size fits all” processes have typically been used for elective surgery ignoring patient uniqueness and resulting in decisions not concordant with patients’ informed preferences and values (265,266). To be consistent with patient-centred care, patients need to be engaged as collaborators in clinical encounters and throughout the decision-making process with appropriate education, counselling, discussion, and explicit invitation (46,113). Appropriate education, counselling, and discussion will also help patients achieve more realistic expectations and in turn better postoperative satisfaction and postoperative TJA health outcomes (22,23,45,173,176,177). The proposed patient-centred conceptualization of TJA appropriateness suggests to acknowledge patient’s voice as a fundamental concept in elective TJA decision-making to achieving a more inclusive concept of appropriateness for elective TJA (46,150).

Readiness is commonly defined as “a state of preparedness/receptivity to an experience” (267), “prepared mentally or physically for some experience” (268), and “willingness to do something” (269). Under the healthcare conceptual framework of Dalton and Gottlieb, readiness is described as a state and a process— the state of desiring to take action and the process of becoming ready to take action, with both being self-reported (270). For elective TJA decision-making, readiness has been described as “the time when no other alternatives would be viable” (42) while another study conceptualized readiness as a process with two overlapping steps: 1) the action of deciding if you will have surgery; and 2) the preparation needed to undergo surgery (137). The qualitative study I led (Chapter 2) revealed that healthcare professionals believed readiness for surgery was unnecessary when determining TJA appropriateness or that it should be assessed by the orthopaedic surgeon. Yet, orthopaedic surgeons believed readiness assessment (physical) was the responsibility of anesthesiologists. Moreover, the systematic review (Chapter 3) and environmental scan (Chapter 4) demonstrated that readiness for surgery was poorly considered in elective TJA decision-making. However, for TJA and other elective surgeries, patient’s readiness has been strongly associated with postoperative satisfaction, health outcomes, and quality of life (32,150,178,271). A systematic review of 30 studies and another of 10 studies also revealed that preoperative depression and anxiety (mental readiness) are predictors of poor TJA outcomes (e.g., persistent pain, poor functional scores, dissatisfaction, complications) (272,273). Studies have also demonstrated variability in patients’ readiness to undergo elective TJA and that patient’s readiness influenced when and if they perceived TJA as an appropriate treatment option (32,42,137). Consequently, the proposed patient-centred conceptualization of TJA appropriateness suggests acknowledging and understanding patient’s readiness as a continuum changing overtime including physical readiness (e.g., surgical optimization) and mental readiness (e.g., willingness to undergo

TJA). Furthermore, readiness also results from the concepts of eligibility (e.g., trial of conservative treatments) and patient's voice (e.g., psychological well-being, expectations). When patients are not physically or mentally ready, steps should be undertaken to support patients throughout the process of becoming physically and mentally ready (19,113). Even if patients are deemed eligible for TJA, they also need to be invited to reflect on their readiness for surgery (19,113).

5.4 Implications for Rehabilitation Clinical Practice, Education, Healthcare Organization, and Research

Table 5.1 summarizes the key points that are discussed in this section.

Table 5.1 Key implication points for rehabilitation clinical practice, education, healthcare organization and research

Implications	Key point 1	Key point 2
Rehabilitation clinical practice	To improve the delivery of care for OA management by supporting 1) earlier and easier access to OA conservative treatment, and 2) shifting clinical management practice from elective TJA to appropriate and timely OA conservative treatments	To foster patient-centred care by supporting the timely discussion of OA treatment options, patient's expectations, and benefits/harms using SDM
Education	To educate on the concepts of physical and mental readiness for TJA and how to translate these in clinical practice	To educate on the concept of SDM and how to implement the approach
Healthcare organization	To facilitate the use of OA conservative management by: 1) publicly funding treatments, and 2) improving accessibility throughout the OA journey	To support patient perspectives when determining TJA appropriateness by: 1) making mandatory to use SDM in clinical practice, and 2) providing countrywide access to OA PtDAs
Research	To evaluate the implementability of the proposed patient-centred conceptualization of TJA appropriateness (coherence, acceptability, feasibility, factors influencing implementation, resources to facilitate use)	To develop and test a SDM training for teams of healthcare professionals participating in TJA decision-making processes

5.4.1 Rehabilitation clinical practice

Findings from my multi-methods thesis (Chapters 2, 3, 4) highlighted the need to improve the delivery of care for OA and TJA: a) earlier and easier access to appropriate OA management (30,274), and b) shift the focus from elective TJA to appropriate and timely conservative OA management (30,275,276). Physiotherapists should have broader responsibilities including, amongst others, independent diagnosis and care management, ordering imaging and laboratory tests, and providing injections (277–281). When clinical models of care are led by physiotherapists, there is better access to quality care, greater focus on conservative management and education, higher patient satisfaction, and improved cost effectiveness while providing equal care than physicians (277–282). As physiotherapists usually have greater consultation duration than physicians (281), they should be considered key healthcare professionals for supporting OA management. Telerehabilitation is an approach that could also be incorporated to help earlier OA education, deliver timely access to adequate conservative treatments, and reach out individuals with limited access to care (e.g., living in rural communities, transportation issues) (283,284). The use of telerehabilitation compared to in-person care results in equal health outcomes while improving accessibility for all (285).

My multi-methods studies revealed the need to improve patient-centred care for OA management as demonstrated by the poor acknowledgment of OA treatment options, realistic expectations, and agreement that benefits outweigh risks (Chapters 2, 3, 4). SDM can help healthcare professionals and patients explicitly having these discussions. To facilitate the use of SDM in OA management and when determining TJA appropriateness, healthcare professionals should provide a PtDA to patients before or during their consultation to provide information on treatment options and their benefits and harms (53,184). Moreover, healthcare professionals

should document these discussions and their results to ensure continuity of treatment within and between healthcare professionals involved in the patient's OA journey (53,103).

5.4.2 Education

Based on the findings from the multi-methods studies, education is needed on physical and mental readiness for TJA and on SDM. First, healthcare professionals need to receive education on the concepts of physical and mental readiness for TJA. Since the qualitative study (Chapter 3) revealed physiotherapists did not believe it was in their scope of practice, it is important to educate and train them on how to assess and implement these concepts in practice, the link between the two concepts and postoperative TJA outcomes, and how they fit within their scope of practice. Providing education to healthcare professionals participating in OA management and TJA decision-making processes will help improve the use of these concepts when determining TJA appropriateness (286).

Second, it is important to educate and train healthcare professionals involved in OA management and TJA decision-making on SDM. Specifically, education should focus on what SDM is and how to implement the approach in clinical practice (e.g., PtDAs). Skills-building activities should also be incorporated in the education session(s). To embrace clinical practice that is patient-centred, entry-to-practice degrees should incorporate SDM training in their curriculum (287). A scoping review of 12 studies demonstrated that university degrees curriculum including SDM led to higher skills, and confidence while a systematic review of 18 studies suggested SDM training within university degrees resulted in improved SDM behaviour in clinical practice (288). Finally, specific to physiotherapists triaging patients in the Ontario TJA pathway, education on SDM could also consider the Moore and Kaplan SDM conceptual model that was specifically developed for physiotherapy clinical practice (289).

5.4.3 Healthcare organizations

Healthcare systems need to adequately cover the cost of OA conservative treatments and consultations with healthcare professionals for patients as my three thesis studies (Chapters 2, 3, 4) consistently demonstrated poor consideration of the trial of conservative treatments in TJA decision-making which seemed to be mostly linked to accessibility issues (30). The delivery of care needs to shift from a fragmented system to an integrated interdisciplinary model accountable for the complete OA journey. The aim of the Ontario TJA pathway should be expanded to provide care to all adults living with OA from the diagnosis to the last treatment option – elective TJA. Instead of focusing on determining patient appropriateness for elective TJA, Ontario TJA evaluation clinics should follow patients throughout their OA journey to provide free of charge appropriate quality OA management including OA education and early use of OA conservative treatments. To help achieve this, the Ontario TJA evaluation clinics could join force with the publicly funded OA treatment programs to promote unified and continuing care (249,250). Timely access to effective OA conservative treatments can ease the burden on healthcare systems and decrease healthcare costs (275).

For a real difference in clinical practice, Canadian legislations should make SDM mandatory for TJA decision-making process since it is an elective preferences-based surgery. My multi-methods studies has also demonstrated the poor support and recognition of patient perspectives when determining TJA appropriateness (Chapters 2, 3, 4). To be consistent with patient-centred care and clinical practice guidelines, the decision to undergo elective TJA for hip and knee primary OA should be driven by patients' preferences, values, and goals (6,93,262). Making SDM mandatory in clinical practice would further help achieved the informed consent

legislation requiring patients to be aware of available treatment options (290). This could be facilitated by providing countrywide access to OA PtDAs for patients.

5.4.4 Research

My doctoral thesis shed light on areas needing further investigation. Research should be conducted to evaluate the proposed patient-centred conceptualization of TJA appropriateness. The first step would be to explore the views of key users (e.g., adults with OA and TJA, physiotherapists, orthopaedic surgeons) on the proposed conceptualization using a qualitative study (291). Using focus groups and semi-structured interviews, the objectives would be to explore the coherence, acceptability, and feasibility of the proposed conceptualization for clinical practice. Then, another qualitative study should be conducted to explore barriers and facilitators of use with semi-structured individual interviews. Given that poor operationalization of some of the Hawker et al. appropriateness criteria was a barrier to implementation (Chapter 2), the third step should be to create a panel of key users (e.g., adults with OA and TJA, physiotherapists, orthopaedic surgeons) to select resources to facilitate the use of the proposed conceptualization in clinical practice.

Given the poor acknowledgement and use of the SDM elements (Chapter 2, 3, 4), a key research priority is to develop and test a SDM training for healthcare professionals participating in the TJA decision-making process with the goal to improve their knowledge, skills, and use in clinical practice. The SDM training should be co-designed with key users (e.g., physiotherapists, orthopaedic surgeons, SDM experts) based on other successful programs and tested using an experimental pre-post design study (292). A scoping review of 36 SDM training programs for healthcare professionals and students revealed post-training participants had better attitudes towards SDM, improved SDM knowledge, skills and confidence, and higher level of SDM in

clinical practice (292). Furthermore, to achieve successful post-training results, the SDM training should be delivered to the full healthcare team instead to individual healthcare professionals (198).

5.5 Limitations of Multi-Methods Thesis

One limitation to my multi-methods thesis was the absence of key knowledge users (e.g., healthcare professionals, patients) on my research teams. My thesis was conducted during COVID-19 and healthcare professionals were working in extremely stressful healthcare environments. Concurrently, I did not have the opportunity to build relationships with patient partners who could have been meaningfully involved throughout the research process (293). Previous research using an integrated KT approach with knowledge users on the research team has resulted in research more relevant to and useful for knowledge users (294).

5.6 Conclusion

Altogether, the findings of this multi-methods thesis highlighted that to implement the Hawker et al. appropriateness criteria in TJA decision-making process, strategies are needed to improve criteria operationalization, foster a climate of receptivity to practice change, enhance accessibility to conservative treatments, and to develop instruments/resources meeting the decision-making criteria. Elective TJA decision-making process demands to be reframed and conceptualized in a more inclusive way that support patient-centred care by incorporating the concepts of appropriateness, eligibility, patient's voice, and patient's readiness. Finally, the

findings of this thesis revealed broader implications for rehabilitation clinical practice, education, healthcare organization, and research to support timely access to OA education and conservative treatments and to foster preferences informed quality decisions.

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Chapter 6. Contribution of Collaborators

This chapter describes the involvement and contribution of collaborators of the doctoral process and dissertation including the primary research team and co-authors of dissertation manuscripts. Other individuals involved in the doctoral process are acknowledge. Authorship decisions were made according to the International Committee of Medical Journal Editors (1).

6.1 Primary research team

This doctoral dissertation was conceptualized and developed in collaboration with co-supervisors and thesis committee members. Lissa Pacheco-Brousseau (LPB) PT PhD (c), the primary researcher, was responsible for the conceptualization and conducting all research activities described in this dissertation. LPB accepts full responsibility for the manuscripts and dissertation. The primary research team includes LPB co-supervisors, Dr. Stéphane Poitras (SP) PT PhD and Dr. Dawn Stacey (DS) RN PhD, and thesis committee members, Dr. François Desmeules (FD) PT PhD OPPQ Fellow and Dr. Sarah Ben Amor (SBA) PhD. The primary research team participated in designing, developing, and approving the research plan and provided methodological and content expertise and support throughout the doctoral process (Table 6.1).

6.1.1 Primary researcher

LPB is a physiotherapist with expertise in rehabilitation sciences, SDM, and knowledge translation. In parallel of her doctoral studies, LPB was a clinical research assistant in the Division of Orthopaedic Surgery of the Ottawa Hospital and part-time contractual teacher in the Faculty of Rehabilitations Sciences of the University of Ottawa.

6.1.2 Thesis committee

SP and DS co-supervised LPB doctoral dissertation. SP is a Full Professor in the School of Rehabilitation Sciences at the University of Ottawa and collaborates with the Division of Orthopaedic Surgery of the Ottawa Hospital. SP has research expertise in investigating and

optimizing healthcare delivery, specifically hip and knee TJA in Ontario and Québec. DS is a Full Professor in the School of Nursing at the University of Ottawa, a Senior Scientist at the Ottawa Hospital Research Institute, and holds a university research chair in Knowledge Translation to Patients. DS is a well-recognized international leader in interventions to support patient engagement in making decisions with their clinician to meet their informed preferences. Supplementing co-supervisors is committee members FD and SBA. FD is an associate professor in the School of Rehabilitation at the Université de Montréal and has expertise on TJA decision pathways and support tools. SBA is an associate professor in Telfer School of Management at the University of Ottawa and has expertise in decision-making at the health system perspective.

6.2 Other collaborators and acknowledgements

Following are the detailed contributions of co-authors who collaborated significantly to studies manuscripts outlined in this dissertation and were not members of the thesis committee. Other individuals not members of the research team but contributed appreciably to the doctoral process are acknowledged.

6.2.1 Interpretive descriptive qualitative study (Chapter 2)

Marylène Charette (MC) PT PhD (c) contributed to this qualitative study by coding interviews, analysing and interpreting data, and reviewing and approving the final manuscript. LPB presents her appreciation to the provincial level decision-makers, regional leaders, healthcare professionals, and patients who participated in the interviews during the 7th wave of the COVID pandemic.

6.2.2 Systematic review (Chapter 3)

Erika Tangay (EK) MSc PT (c), Danika Lamber (DL) MSc PT (c), and Alyssa Hillaby (AH) MSc PT (c) contributed to this systematic review by screening titles/abstracts and full texts, and extracting data. Cédric Bechiau (CB) PT MDCM (c) and MC contributed to this systematic review by resolving screening conflicts with LPB. EK, DL, AH, CB, and MC reviewed and approved the final manuscript. LPB acknowledges the contribution of Marie-Cécile Domecq, a librarian in the School of Rehabilitation Sciences at the University of Ottawa, for her assistance with the development of the search strategy.

6.2.3 Environmental scan (Chapter 4)

Alda Kiss (AK) RN MScN contributed to this environmental scan by appraising resources identified and reviewing and approving the final manuscript.

6.2.4 Thesis proposal defense

LPB acknowledges Allyson Jones PT PhD. Dr. Jones was the external reader of the thesis proposal defense and provided feedback on the research plan. Dr. Jones is an Associate Professor in the School of Public Health at the University of Alberta.

Table 6.1 Summary of contribution of collaborators for thesis studies

Elements	Chapter 1. Introduction	Chapter 2. Interpretive descriptive	Chapter 3. Systematic review	Chapter 4. Environmental scan	Chapter 5. Integrated discussion
Conceptualization and design	LPB	LPB SP DS FD SBA	LPB SP DS FD SBA	LPB SP DS FD SBA	LPB
Data collection	LPB	LPB	LPB ET DL AH CB MC	LPB AK	LPB
Data analysis and interpretation	LPB	LPB MC SP DS	LPB ET DL AH SP DS	LPB AK SP DS	LPB
Drafts of chapters and manuscripts	LPB	LPB	LPB	LPB	LPB
Important revisions of chapters and manuscripts	LPB SP DS	LPB SP DS FD SBA MC	LPB SP DS FD SBA	LPB SP DS FD SBA	LPB SP DS
Approval of final version	LPB SP DS FD SBA	LPB SP DS FD SBA MC	LPB SP DS FD SBA ET DL AH CB MC	LPB SP DS FD SBA AK	LPB SP DS FD SBA

6.3 References

1. International Committee of Medical Journal Editors. Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly work in Medical Journals [Internet]. 2021 [cited 2022 Mar 21]. Available from: <http://www.icmje.org/recommendations/>

Chapter 7. Appendices

Appendix A – The Hôpital Montfort Research Ethics Board approval of the interpretive descriptive study (Chapter 2)



Affilié à l'Université d'Ottawa | Affiliated with the University of Ottawa

Certificate of Ethics Approval 745-A, chemin Montréal Road, Suite 204, Ottawa (Ontario) K1K 0T1

May 26, 2022

Principal investigator

Lissa Pacheco-Brousseau
University of Ottawa

Responsible site investigator

Stéphane Poitras
Hôpital Montfort & University of Ottawa

Co-Investigator

Dawn Stacey
University of Ottawa

Project title: « Exploring total knee arthroplasty decision-making process »

File number: 22-23-05-005

Start date: May 26, 2022

End date: May 25, 2023

In accordance with the latest edition of Tri-Council Policy Statement - Ethical Conduct for Research Involving Humans Subjects (TCPS 2), I confirm that the Hôpital Montfort Research Ethics Board (REB) has evaluated and **approved the research project** and the following documents for the start and end dates mentioned above:

- COREB Application Form, dated May 2, 2022
- UOttawa REB application approved_ April 2022
- Revised Study Proposal _ February 23, 2022
- Poster Patients (EN & FR)_version March 28, 2022
- E-mail DM (EN & FR)_version March 28, 2022
- E-Mail HCP (EN & FR)_version March 28, 2022
- Interview Guide (EN & FR)_version March 28, 2022
- Informed Consent form_HCPs & DM (EN & FR)_version May 19, 2022
- Informed Consent form _ Patients (EN & FR)_version May 19, 2022

713 Montréal, Ottawa, ON K1K 0T2
613-746-4621
613-748-4914
www.hopitalmontfort.com



The Hôpital Montfort REB is established and operates in compliance with the Clinical Practice Guidelines: Consolidated Guidelines of the International Council for the Harmonization of Technical Requirements for the Registration of Pharmaceuticals for Human Use (ICH-GCP E6), Part C, Title 5 of the Food and Drug Regulations, and The applicable regulations, Part 4 of the Natural Health Products Regulations; Part 3 of the Medical Devices Regulations, the "Code of Federal Regulations" of the United States, the Ontario Personal Health Information Protection Act, 2004, and the laws and regulations applicable in Ontario. Montfort's REB is registered with the U.S. Department of Health and Human Services (DHHS) and the Office for Human Research Protection (OHRP).

The protocol of the study cannot be amended without prior approval of the REB unless there is an immediate safety issue for the participants. You must notify the REB immediately of any changes, adverse event or new information that may increase the risk of the study, changing the course of the study or reach the safety of participants. The changes to the project and recruitment tools must be submitted to the REB.

Please send us **four weeks before the due date of the notice of approval**, a final report to close the file or to request the renewal of the certificate of ethical approval for the study.

If you have any questions, please do not hesitate to contact the Research Ethics Office by phone at 613-746-4621 extension 2221 or e-mail at ethique@montfort.on.ca.

Richard Carpentier, Ph. D.
Chair of the Research Ethics Board — Hôpital Montfort

Appendix B – The University of Ottawa Research Ethics Board approval of the interpretive descriptive study (Chapter 2)

Université d'Ottawa

Bureau d'éthique et d'intégrité de la recherche

University of Ottawa

Office of Research Ethics and Integrity

CERTIFICAT D'APPROBATION ÉTHIQUE | CERTIFICATE OF ETHICS APPROVAL

Numéro du dossier / Ethics File Number

H-04-22-7898

Titre du projet / Project Title

Exploring total knee arthroplasty
decision-making process

Type de projet / Project Type

Thèse de doctorat / Doctoral
thesis

Statut du projet / Project Status

Approuvé / Approved

Date d'approbation (jj/mm/aaaa) / Approval Date (dd/mm/yyyy)

22/04/2022

Date d'expiration (jj/mm/aaaa) / Expiry Date (dd/mm/yyyy)

21/04/2023

Équipe de recherche / Research Team

**Chercheur /
Researcher**

Affiliation

Role

Lissa
PACHECO-BROUSSEAU École des sciences de la réadaptation / School of
Rehabilitation Sciences

Chercheur Principal / Principal
Investigator

Stéphane POITRAS École des sciences de la réadaptation / School of
Rehabilitation Sciences

Superviseur / Supervisor

Dawn STACEY École des sciences infirmières / School of Nursing

Co-superviseur / Co-supervisor

Conditions spéciales ou commentaires / Special conditions or comments

Université d'Ottawa

Bureau d'éthique et d'intégrité de la recherche

Le Comité d'éthique de la recherche (CÉR) de l'Université d'Ottawa, opérant conformément à l'*Énoncé de politique des Trois conseils* (2014) et toutes autres lois et tous règlements applicables, a examiné et approuvé la demande d'éthique du projet de recherche ci-nommé.

L'approbation est valide pour la durée indiquée plus haut et est sujette aux conditions énumérées dans la section intitulée "Conditions Spéciales ou Commentaires". Le formulaire « Renouvellement ou Fermeture de Projet » doit être complété quatre semaines avant la date d'échéance indiquée ci-haut afin de demander un renouvellement de cette approbation éthique ou afin de fermer le dossier.

Toutes modifications apportées au projet doivent être approuvées par le CÉR avant leur mise en place, sauf si le participant doit être retiré en raison d'un danger immédiat ou s'il s'agit d'un changement ayant trait à des éléments administratifs ou logistiques du projet. Les chercheurs doivent aviser le CÉR dans les plus brefs délais de tout changement pouvant augmenter le niveau de risque aux participants ou pouvant affecter considérablement le déroulement du projet, rapporter tout événement imprévu ou indésirable et soumettre toute nouvelle information pouvant nuire à la conduite du projet ou à la sécurité des participants.

Riana MARCOTTE

Responsable d'éthique en recherche / Protocol Officer

Pour/For **Daniel LAGAREC** Président(e) du/ Chair of the **Comité d'éthique de la recherche en sciences de la santé et sciences / Health Sciences and Sciences Research Ethics Board**

University of Ottawa

Office of Research Ethics and Integrity

The University of Ottawa Research Ethics Board, which operates in accordance with the *Tri-Council Policy Statement* (2014) and other applicable laws and regulations, has examined and approved the ethics application for the above-named research project.

Ethics approval is valid for the period indicated above and is subject to the conditions listed in the section entitled "Special Conditions or Comments". The "Renewal/Project Closure" form must be completed four weeks before the above-referenced expiry date to request a renewal of this ethics approval or closure of the file.

Any changes made to the project must be approved by the REB before being implemented, except when necessary to remove participants from immediate endangerment or when the modification(s) only pertain to administrative or logistical components of the project. Investigators must also promptly alert the REB of any changes that increase the risk to participant(s), any changes that considerably affect the conduct of the project, all unanticipated and harmful events that occur, and new information that may negatively affect the conduct of the project or the safety of the participant(s).

Appendix C – Participant (healthcare team) informed consent form for interpretive descriptive study (Chapter 2)

Université d'Ottawa | University of Ottawa



Informed consent form for healthcare professionals & decision-makers

University of Ottawa REB file #: H-04-22-7898

Montfort Hospital REB file #: 22-23-05-005

1. GENERAL INFORMATION

Project Name: Exploring total knee arthroplasty decision-making process

Project conducted for a doctoral thesis project

Principal Researcher:

Lissa Pacheco-Brousseau PT, doctoral candidate
University of Ottawa, School of Rehabilitation Sciences

Thesis co-supervisors:

Dawn Stacey RN, PhD, FCAHS, FAAN, FCAN
University of Ottawa, School of Nursing

Stéphane Poitras PT, PhD

University of Ottawa, School of Rehabilitation Sciences

2. INTRODUCTION

You are being asked to participate in the above-named research project conducted by Lissa Pacheco-Brousseau of the University of Ottawa under the supervision of Professors Stacey and Poitras of the University of Ottawa.

You are invited to participate in this study because you are involved in total knee replacement decision-making processes for adults with knee osteoarthritis. This consent form provides you with information to help you make an informed choice. Please read this document carefully and ask any questions you may have. All your questions should be answered to your satisfaction before you decide whether to participate in this research study.

Taking part in this study is voluntary. You have the option to not participate at all or you may choose to leave the study at any time. Whatever you choose, it will not affect your current or future employment. Do not hesitate to ask the team all your questions.

3. IS THERE A CONFLICT OF INTEREST?

Researchers have no conflict of interest to disclose.

4. WHY IS THIS STUDY BEING DONE?

The purpose of the study is to explore the ways in which the decision is made about total knee replacement at the Montfort Hospital.

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451 Smyth
Ottawa ON K1H 8M5
Canada



Version Date: 19-May-22

5. HOW MANY PEOPLE WILL TAKE PART IN THIS STUDY?

It is anticipated that about 13 to 30 people will take part in this study, from research sites located in Ontario.

This study should take around 6 months to complete and the results should be known in about one year.

6. ELEGIBILITY CRITERIA

We are inviting French and English healthcare team members, regional representative, and provincial decision-makers of the Montfort Hospital pre-surgical assessment clinic.

You are eligible if you

- a) are a healthcare team member of the Montfort Hospital pre-surgical assessment clinic (e.g., physiotherapist, nurse) or is associated with the clinic (total knee replacement orthopaedic surgeon)
- b) are a regional representative of the Montfort Hospital pre-surgical assessment clinic
- c) are a provincial decision-maker for the total joint replacement processes of Ontario

7. WHAT WILL HAPPEN DURING THIS STUDY?

My participation will consist of the following:

Tasks	Details	Length	Location, time
One individual interview	You will be asked to discuss the decision-making process of having a total knee replacement at the Montfort Hospital pre-surgical assessment clinic with the PhD candidate. The discussion will be recorded for transcription and analysis. In-person interviews will be audio-recorded while virtual interviews will be video-recorded. The information you provide is for research purposes only. You can choose not to answer questions if you wish.	30-45 minutes	a) In-person at a convenient time and place or b) Virtual at a convenient time
OR One group discussion		OR 1 hour	
Review the results	At the end of the study, you will have the opportunity to review the results for the analysis.	15-20 minutes	On your computer or electronic device

8. WHAT ARE THE RESPONSIBILITIES OF STUDY PARTICIPANTS?

If you choose to participate in this study, you will be expected to:

- Participate in one individual interview or group discussion
- Review the results of the interviews and provide feedback (if needed)
- Not discuss any information you learn in the group discussion with others. This includes information about and opinions from other members.

9. HOW LONG WILL PARTICIPANTS BE IN THE STUDY?

Your participation on this study will last for about 1 hour to 1 hour ½.

10. CAN PARTICIPANTS CHOOSE TO LEAVE THE STUDY?

You can choose to end your participation in this research (called withdrawal) at any time without having to provide a reason. If you choose to withdraw from the study, you are encouraged to contact the study staff. Information that was collected before you withdrew will not be used by the researchers for the purposes of the study unless you give your permission, and no information will be collected after you withdraw your permission. If you participate in a group discussion and decide to withdraw from the study, the information that was collected will be used by the researchers because what is said during the discussion group will be connected to other participants and cannot be removed individually.

You may withdraw your permission to use information that was collected about you for this study at any time by letting the research team know. However, this would also mean that you withdraw from the study.

11. CAN MY PARTICIPATION IN THIS STUDY END EARLY?

Your participation on the study may be stopped early, and without your consent, for reasons such as:

- The research team decides to stop the study
- The University of Ottawa Research Ethics Board (REB) withdraws permission for this study to continue
- The Hôpital Montfort REB withdraws permission for this study to continue

12. WHAT ARE THE RISKS OR HARM OF PARTICIPATING IN THIS STUDY?

It is unlikely that any risks arise from participating in this study. You understand since your participation in this research requires you to attend an interview and answer questions, there is some possibility that it will result in emotional and psychological discomforts. You may choose not to answer questions at any time if you experience any discomfort.

13. WHAT ARE THE BENEFITS OF PARTICIPATING IN THIS STUDY?

You will not receive direct benefits from participating in this study. We hope the information learned from this study will help understand the current decision-making process for adults with knee osteoarthritis considering total knee replacement and healthcare professionals' role in the process.

14. HOW WILL PARTICIPANT INFORMATION BE KEPT CONFIDENTIAL?

If you decide to participate in this study, the research team will only collect the information they need for this study (profession, number of years of experience, gender, sex, contact information)

and will take the appropriate steps to protect their confidentiality. A master list will be created to separate your name from the answers you have shared and will replace it with a code. The key to the code linking your name to your research file will be kept by the PhD candidate in charge of this research project.

You have the researcher's assurance that any information you share with him/her will be kept strictly confidential. However, if you are a regional hospital representative or a provincial decision-maker, you may be identifiable by people in the field. You can expect that the content will be used only for the purposes described in this document and with respect for confidentiality. The only people who will have access to the research data are the research team. Authorized representatives of the following organizations may look at your original (identifiable) records at the site where these records are held, to check that the information collected for the study is correct and follows proper laws and guidelines.

- University of Ottawa REB will oversee the conduct of research
- Hôpital Montfort REB will oversee the conduct of research at this location

There is some possibility that research records identifying yourself will be examined in the presence of the researcher by the Research Ethics Board for research control purposes. However, you have been given assurances that no record identifying yourself, by name or initials, for example, will be permitted to leave the researcher's office. The records received by these organizations may contain your participant code.

You understand that if you chose to participate in a group discussion instead of an individual interview, there are limits to confidentiality related to participation in a group activity. Although the researchers will respect the confidentiality of the data, you understand that they cannot guarantee that other members of the group will respect the confidentiality of the information that you will share. However, researchers will remind participants of group discussion to preserve privacy of information discussed at the beginning of the group discussion. During the discussions, participants will be encouraged to refrain from using names. If names or other identifying information is shared during the discussion, it will not be included in the written records.

The data gathered (electronic and hard copy of audio recording of interviews, electronic and hard copy of the interview transcription) will be kept in a secure manner. Electronic copy of data gathered (including video/audio recording) will be stored in a password protected computer of the doctoral student with password protected documents and viewed only by members of the research team. The recordings will be kept until they have been transcribed (turned into written records), and then they will be destroyed. The researchers do not expect to produce hard copies of the data. If hard copies are produced, they will be scanned and stored as an electronic copy and hard copies will be automatically destroyed. The data will be kept for a period of 15 years at which time they will be destroyed.

It is expected that the information collected during this study will be published and presented to the scientific community at conferences and in journals. Anonymity is guaranteed as follows. If the results of this study are published, your identity will remain confidential. Personal information collected will not be directly linked to you. Your answers to questions may be used verbatim in

presentations and publications but you will not be identified. Even though the likelihood that someone may identify you from the study data is very small, it can never be completely eliminated.

Communication via e-mail is not absolutely secure. We do not recommend that you communicate sensitive personal information via e-mail.

15. VOLUNTARY PARTICIPATION

Your participation in the study is voluntary. You are free to withdraw at any time or to refuse to answer certain questions without exposing yourself to any negative consequences. Whatever you choose, it will not affect your employment now or in the future.

You will be informed at the appropriate time if any new information arises that might affect your interest in continuing to participate in the study.

16. WHAT IS THE COST TO PARTICIPANTS?

Participation in this study will not involve any additional costs to you or your private health care insurance.

17. ARE STUDY PARTICIPANTS PAID TO BE IN THIS STUDY?

You will not be receiving any compensation for participating in this study.

18. WHAT ARE THE RIGHTS OF PARTICIPANTS IN A RESEARCH STUDY?

You will be told, in a timely manner, about new information that may be relevant to your willingness to stay in this study.

You have the right to be informed of the results of this study once the entire study is complete. If you would like to be informed of the results of this study, please contact the research team. The research findings will be available in the published article.

19. CIVIL LIABILITY

Your rights to privacy are legally protected by federal and provincial laws that require safeguards to ensure that your privacy is respected. Your consent to participate in this study does not affect your right to seek legal recourse in any manner whatsoever. If your participation causes any prejudice to yourself, you reserve the right to take any available legal recourse against the various research partners.

20. CONSENT

I, (participant's name), agree to participate in this research project conducted by Lissa Pacheco-Brousseau under the supervision of Professors Stacey and Poitras. **Consent will be recorded at the beginning of your interview.**

For any further information concerning this study, please contact the researcher. If you have questions about your rights as a participant or about ethical issues related to this study, you can talk to someone who is not involved in the study at all.

If you have any questions regarding the ethical conduct of this study, you may contact the Office of Research Ethics and Integrity via email (ethics@uottawa.ca) or telephone (613-562-5387). You may also contact the Hôpital Montfort Research Ethics Board, 745-A Montreal Road, Ottawa, Ontario by telephone at 613-746-4621, extension 2221, or by email at ethique@montfort.on.ca.

Please keep this form for your records.

Thank you for your time and consideration.

Informed consent form for patients

University of Ottawa REB file #: H-04-22-7898

Hôpital Montfort REB file #: 22-23-05-005

1. GENERAL INFORMATION

Project Name: Exploring total knee arthroplasty decision-making process

Project conducted for a doctoral thesis project

Principal Researcher:

Lissa Pacheco-Brousseau PT, doctoral candidate
University of Ottawa, School of Rehabilitation Sciences

Thesis co-supervisors:

Dawn Stacey RN, PhD, FCAHS, FAAN, FCAN
University of Ottawa, School of Nursing

Stéphane Poitras PT, PhD

University of Ottawa, School of Rehabilitation Sciences

2. INTRODUCTION

You are being asked to participate in the above-named research project conducted by Lissa Pacheco-Brousseau of the University of Ottawa under the supervision of Professors Stacey and Poitras of the University of Ottawa.

You are invited to participate in this study because you received a total knee replacement because you have knee osteoarthritis. This consent form provides you with information to help you make an informed choice. Please read this document carefully and ask any questions you may have. All your questions should be answered to your satisfaction before you decide whether to participate in this research study.

Please take your time in making your decision. You may find it helpful to discuss it with your friends and family.

Taking part in this study is voluntary. You have the option to not participate at all or you may choose to leave the study at any time. Whatever you choose, it will not affect the current care you receive or future care. Do not hesitate to ask the team all your questions.

3. IS THERE A CONFLICT OF INTEREST?

Researchers have no conflict of interest to disclose.

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4. WHY IS THIS STUDY BEING DONE?

The purpose of the study is to explore the ways in which the decision is made about total knee replacement at the Montfort Hospital.

5. HOW MANY PEOPLE WILL TAKE PART IN THIS STUDY?

It is anticipated that about 13 to 30 people will take part in this study, from research sites located in Ontario.

This study should take around 6 months to complete and the results should be known in about one year.

6. ELEGIBILITY CRITERIA

You are eligible if you:

- a) were seen at the Montfort Hospital pre-surgical clinical
- b) had a total knee replacement 6 weeks to 18 months ago for osteoarthritis
- c) speak French or English

7. WHAT WILL HAPPEN DURING THIS STUDY?

My participation will consist of the following:

Tasks	Details	Length	Location, time
One individual interview	You will be asked to discuss the decision-making process of having a total knee replacement at the Montfort Hospital pre-surgical assessment clinic with the PhD candidate. The discussion will be recorded for transcription and analysis. In-person interviews will be audio-recorded while virtual interviews will be video-recorded. The information you provide is for research purposes only. You can choose not to answer questions if you wish.	30-45 minutes	a) In-person at a convenient time and place or b) Virtual at a convenient time
OR		OR	
One group discussion	If you prefer, you can also ask to participate in a group discussion. You will be ask the same questions as in the individual interview. If other participants are also interested, group discussion will be conducted with other adults who received a total knee replacement (minimum of 3 and maximum of 8 participants per group). The moderator will be the PhD candidate. In-person discussion groups will be audio-recorded while virtual discussion groups will be video-recorded. The information you provide is for research purposes only. You can choose not to answer questions if you wish.	1 hour	
Review the results	At the end of the study, you will have the opportunity to review the results for the analysis.	15-20 minutes	On your computer or electronic device

8. WHAT ARE THE RESPONSIBILITIES OF STUDY PARTICIPANTS?

If you choose to participate in this study, you will be expected to:

- Participate in one individual interview or group discussion
- Review the results of the interviews and provide feedback (if needed)
- Not discuss any information you learn in the group discussion with others. This includes information about and opinions from other members.

9. HOW LONG WILL PARTICIPANTS BE IN THE STUDY?

Your participation on this study will last for about 1 hour to 1 hour ½.

10. CAN PARTICIPANTS CHOOSE TO LEAVE THE STUDY?

You can choose to end your participation in this research (called withdrawal) at any time without having to provide a reason. If you choose to withdraw from the study, you are encouraged to contact the study staff. Information that was collected before you withdrew will not be used by the researchers for the purposes of the study unless you give your permission, and no information will be collected after you withdraw your permission. If you participate in a group discussion and decide to withdraw from the study, the information that was collected will be used by the researchers because what is said during the discussion group will be connected to other participants and cannot be removed individually.

You may withdraw your permission to use information that was collected about you for this study at any time by letting the research team know. However, this would also mean that you withdraw from the study.

11. CAN MY PARTICIPATION IN THIS STUDY END EARLY?

Your participation on the study may be stopped early, and without your consent, for reasons such as:

- The research team decides to stop the study
- The University of Ottawa Research Ethics Board (REB) withdraws permission for this study to continue
- The Hôpital Montfort REB withdraws permission for this study to continue

12. WHAT ARE THE RISKS OR HARMS OF PARTICIPATING IN THIS STUDY?

It is unlikely that any risks arise from participating in this study. You understand since your participation in this research requires you to attend an interview and answer questions, there is some possibility that it will result in emotional and psychological discomforts. You may choose not to answer questions at any time if you experience any discomfort.

13. WHAT ARE THE BENEFITS OF PARTICIPATING IN THIS STUDY?

We hope the information learned from this study will help understand the current decision-making process for adults with knee osteoarthritis considering total knee replacement and healthcare professionals' role in the process.

14. HOW WILL PARTICIPANT INFORMATION BE KEPT CONFIDENTIAL?

If you decide to participate in this study, the research team will only collect the information they need for this study (urban or rural living area, gender, sex, year of birth, contact information) and will take the appropriate steps to protect their confidentiality. A master list will be created to separate your name from the answers you have shared and will replace it with a code. The key to

the code linking your name to your research file will be kept by the PhD candidate in charge of this research project.

You have the researcher's assurance that any information you share with him/her will be kept strictly confidential. You can expect that the content will be used only for the purposes described in this document and with respect for confidentiality. The only people who will have access to the research data are the research team. Authorized representatives of the following organizations may look at your original (identifiable) records at the site where these records are held, to check that the information collected for the study is correct and follows proper laws and guidelines.

- University of Ottawa REB will oversee the conduct of research
- Hôpital Montfort REB will oversee the conduct of research at this location

There is some possibility that research records identifying yourself will be examined in the presence of the researcher by the Research Ethics Board for research control purposes. However, you have been given assurances that no record identifying yourself, by name or initials, for example, will be permitted to leave the researcher's office. The records received by these organizations may contain your participant code.

You understand that if you chose to participate in a group discussion instead of an individual interview, there is limits to confidentiality related to participation in a group activity. Although the researchers will respect the confidentiality of the data, you understand that they cannot guarantee that other members of the group will respect the confidentiality of the information that you will share. However, researchers will remind participants of group discussion to preserve privacy of information discussed at the beginning of the group discussion. During the discussions, participants will be encouraged to refrain from using names. If names or other identifying information is shared during the discussion, it will not be included in the written records.

The data gathered (electronic and hard copy of audio recording of interviews, electronic and hard copy of the interview transcription) will be kept in a secure manner. Electronic copy of data gathered (including video/audio recording) will be stored in a password protected computer of the doctoral student with password protected documents and viewed only by members of the research team. The recordings will be kept until they have been transcribed (turned into written records), and then they will be destroyed. The researchers do not expect to produce hard copies of the data. If hard copies are produced, they will be scanned and stored as an electronic copy and hard copies will be automatically destroyed. The data will be kept for a period of 15 years at which time they will be destroyed.

It is expected that the information collected during this study will be published and presented to the scientific community at conferences and in journals. Anonymity is guaranteed as follows. If the results of this study are published, your identity will remain confidential. Personal information collected will not be directly linked to you. Your answers to questions may be used verbatim in presentations and publications but you will not be identified. Even though the likelihood that someone may identify you from the study data is very small, it can never be completely eliminated.

Communication via e-mail is not absolutely secure. We do not recommend that you communicate sensitive personal information via e-mail.

15. VOLUNTARY PARTICIPATION

Your participation in the study is voluntary. You are free to withdraw at any time or to refuse to answer certain questions without exposing yourself to any negative consequences. Whatever you choose, it will not affect your employment now or in the future.

You will be informed at the appropriate time if any new information arises that might affect your interest in continuing to participate in the study.

16. WHAT IS THE COST TO PARTICIPANTS?

Participation in this study will not involve any additional costs to you or your private health care insurance

17. ARE STUDY PARTICIPANTS PAID TO BE IN THIS STUDY?

You will receive a 20\$ gift card to Tim Hortons for compensation of your time. The gift card will be in an electronic format and will be delivered to you using email. If you choose to withdraw from the study, you will still be entitled to receive the gift card.

18. WHAT ARE THE RIGHTS OF PARTICIPANTS IN A RESEARCH STUDY?

You will be told, in a timely manner, about new information that may be relevant to your willingness to stay in this study.

You have the right to be informed of the results of this study once the entire study is complete. If you would like to be informed of the results of this study, please contact the research team. The research findings will be available in the published article.

19. CIVIL LIABILITY

Your rights to privacy are legally protected by federal and provincial laws that require safeguards to ensure that your privacy is respected. Your consent to participate in this study does not affect your right to seek legal recourse in any manner whatsoever. If your participation causes any prejudice to yourself, you reserve the right to take any available legal recourse against the various research partners.

20. CONSENT

I, (participant's name), agree to participate in this research project conducted by Lissa Pacheco-Brousseau under the supervision of Professors Stacey and Poitras. **Consent will be recorded at the beginning of your interview.**

For any further information concerning this study, please contact the researcher. If you have questions about your rights as a participant or about ethical issues related to this study, you can talk to someone who is not involved in the study at all.

If you have any questions regarding the ethical conduct of this study, you may contact the Office of Research Ethics and Integrity via email (ethics@uottawa.ca) or telephone (613-562-5387). You

may also contact the Hôpital Montfort Research Ethics Board, 745-A Montreal Road, Ottawa, Ontario by telephone at 613-746-4621, extension 2221, or by email at ethique@montfort.on.ca.

Please keep this form for your records. Thank you for your time and consideration.

Appendix E – Recruitment poster for participant (adults with a TKA) for interpretive descriptive study (Chapter 2)



LA RECHERCHE DE VOLONTAIRES

Avez-vous reçu un remplacement total du genou?

Nous recherchons des volontaires pour participer à une étude dans le but de discuter comment la décision de recevoir un remplacement total du genou se fait à la clinique pré-chirurgicale de l'Hôpital Montfort.

Si vous décidez de participer, on vous demandera de participer à une entrevue individuelle (≈30-45 min) ou en groupe (≈1h, si d'autres choisissent la discussion en groupe)

Vous allez recevoir une carte cadeau de 20\$. Les volontaires seront acceptés selon le principe du premier arrivé, premier servi!

Critères de sélection :

- Adultes qui ont été vus à la clinique pré-chirurgicale de l'Hôpital Montfort
- Adultes qui parlent français ou anglais

Si vous êtes intéressé, communiquez avec :

Lissa Pacheco-Brousseau, candidate au doctorat

Ce projet a été approuvé par le comité d'éthique de la recherche de l'Hôpital Montfort.

LOOKING FOR VOLUNTEERS

Did you receive a total knee replacement?

We are looking for volunteers to take part in a study to discuss how the decision for a knee replacement is done at the pre-surgical assessment clinic of the Montfort Hospital.

If you choose to participate, you would be asked to participate in an individual interview (≈30-45 min) or group discussion (≈1h, if others also chose the group discussion).

You will receive a 20\$ gift card. Volunteers will be accepted on a first come first serve basis!

Selection criteria:

- Adults who were seen at the Montfort Hospital pre-surgical assessment clinic
- Adults who speak French or English

If you are interested, please contact:

Lissa Pacheco-Brousseau, doctoral candidate

This project has been approved by the Hôpital Montfort Research Ethics Board.

hopitalmontfort.com

Appendix F – Recruitment emails for interpretive descriptive study (Chapter 2)

Personalized introductory email for regional hospital representative, and decision-makers

Subject: Invitation for a study on total knee arthroplasty decision-making processes



Dear *<regional hospital representative, provincial decision-makers full name>*,

You are invited to participate in a study to explore the way decisions are made for total knee arthroplasty at the pre-surgical assessment clinic of the Montfort Hospital. The study is being led by Lissa Pacheco-Brousseau under the supervision of Professors Stéphane Poitras and Dawn Stacey from the University of Ottawa.

If you agree to participate, you would be asked to participate in an individual interview, or group interview (if others prefer a group discussion as well). Depending on your preference, the interview will be virtual or in-person and will last for about 30 to 45 minutes for an individual interview and about 1 hour for a group discussion.

For more information about the study, please see the attached consent form or contact us.

If you have any questions or comments, please let us know.

Thank you for considering participating in this study.

Lissa Pacheco-Brousseau PT, PhD (c)

University of Ottawa

Faculty of Health Sciences, School of Rehabilitation Sciences

Personalized introductory email for healthcare professionals

Subject: Invitation for a study on total knee arthroplasty decision-making processes



Dear <physiotherapist head of staff full name>,

You and your healthcare professional team are invited to participate in a study to explore the way decisions are made for total knee arthroplasty at the pre-surgical assessment clinic of the Montfort Hospital. The study is being led by Lissa Pacheco-Brousseau under the supervision of Professors Stéphane Poitras and Dawn Stacey from the University of Ottawa.

If you agree to participate, you would be asked to participate in an individual interview, or group interview (if others prefer a group discussion as well). Depending on your preference, the interview will be virtual or in-person and will last for about 30 to 45 minutes for an individual interview and about 1 hour for a group discussion.

Could you please forward this email to the healthcare professionals working in the pre-surgical assessment clinic of the Montfort Hospital? We can also present the study during a team meeting if you prefer.

For more information about the study, please see the attached consent form or contact us.

If you have any questions or comments, please let us know.

Thank you for considering participating in this study.

Lissa Pacheco-Brousseau PT, PhD (c)
University of Ottawa
Faculty of Health Sciences, School of Rehabilitation Sciences

Appendix G – Interview guides for interpretive descriptive study (Chapter 2)

Interview guide – provincial decision-makers, regional leaders, healthcare professionals

Date:

Participant ID:

Hello, my name is Lissa Pacheco-Brousseau. I am a physiotherapist and a doctoral student at the University of Ottawa. Our team has been looking at how decisions to have a total knee replacement for adults with osteoarthritis are made at the pre-surgical assessment clinic of the Montfort Hospital.

Before beginning, have you received the consent form?

- *If yes:* Do you have any questions for me before we begin? I want to confirm that you are consenting to this interview and being audio-recorded?
- *If no:* Go through the consent form. Do you have any questions for me before we begin? Confirm consent and audio-recording

If it is ok with you, I will start the questions. To help you follow them, you can look at the questions I sent you or I can post in the chat as we go.

Provincial, regional, and healthcare team
1. Tell me about the steps patients go through to have a joint replacement surgery.
2. Who among the healthcare professionals are involved in the process of making the decision to have a joint replacement?
3. What is your role in what is being done in the current decision-making process?
4. What criteria are used to assess patient eligibility for surgery? <i>(to check them out as they talk)</i> 4.1 Is a standardized form used to collect this information?
5. <i>You said X, Y, Z were used to assess patient eligibility for surgery. Next, I will ask about other criteria to assess eligibility of TKA that were identified by Canadian OA experts and that you did not talk about.</i> 5.1 When deciding if a patient should have a TKA, to what extent patient reporting that arthritis symptoms are negatively impacting their quality of life is considered? ○ <i>If considering: skip</i> ○ <i>If not considering:</i> ▪ Why is this criterion not considered?

- How easy would it be for you to use this criterion in the clinic?

5.2 When deciding if a patient should have a TKA, to what extent clinical and radiographic evidence of arthritis is considered?

- *If considering: skip*
- *If not considering:*
 - Why is this criterion not considered?
 - How easy would it be for you to use this criterion in the clinic?

5.3 When deciding if a patient should have a TKA, to what extent the trial of nonsurgical arthritis treatment is considered?

- *If considering: skip*
- *If not considering:*
 - Why is this criterion not considered?
 - How easy would it be for you to use this criterion in the clinic?

5.4 When deciding if a patient should have a TKA, to what extent the patient's expectations of the outcomes of joint replacement is considered?

- *If considering: skip*
- *If not considering:*
 - Why is this criterion not considered?
 - How easy would it be for you to use this criterion in the clinic?

5.5 When deciding if a patient should have a TKA, to what extent the physical and mental readiness of the patient to have surgery is considered?

- *If considering: skip*
- *If not considering:*
 - Why is this criterion not considered?
 - How easy would it be for you to use this criterion in the clinic?

5.6 When deciding if a patient should have a TKA, to what extent the patient and healthcare provider discuss and agree that the potential benefits of joint replacement outweigh the potential risks?

- *If considering: skip*
- *If not considering:*
 - Why is this criterion not considered?
 - How easy would it be for you to use this criterion in the clinic?

6. To what extent are patients currently involved in making the decision?

6.1 How are patients currently supported to be involved in making the decision?

7. Is there anything else you would like to share that was not discussed?

We are almost done! To finish, I will ask you few questions about you.

8. What is your profession?

9.

For province/regional: For how long have you been involved with TKA decision-making process?

For Montfort staff: For how long have you been working at the Montfort Hospital pre-surgical assessment clinic?

10. Do you describe yourself as a woman, man, gender fluid/non-binary, or prefer not to say?

11. Do you describe yourself as a female or male?

Thank you for your participation!

Interview guide – adults with a TKA

Date:

Participant ID:

Hello, my name is Lissa Pacheco-Brousseau. I am a physiotherapist and a doctoral student at the University of Ottawa. Our team has been looking at how decisions to have a total knee replacement for adults with osteoarthritis are made at the pre-surgical assessment clinic of the Montfort Hospital.

Before beginning, have you received the consent form?

- *If yes:* Do you have any questions for me before we begin? I want to confirm that you are consenting to this interview and being audio-recorded?
- *If no:* Go through the consent form. Do you have any questions for me before we begin? Confirm consent and audio-recording

If it is ok with you, I will start the questions. To help you follow them, you can look at the questions I sent you or I can post in the chat as we go.

Patients
1. Tell me about the steps you went through in getting your knee replacement surgery. <i>Prompts</i> Steps such as seeing your family physician, referral, consultation with surgeon
2. Thinking about the steps you just described, how was the decision made? 2.1 Who was involved?
3. How were you involved in making this decision? Please explain. <i>Prompt</i> Were you given any information – written or on a website to help you think about OA treatments
4. <i>Next, we will discuss how the decision was made for you to have a knee replacement.</i> 4.1 Did you discuss with an HCP the impact of your arthritis symptoms on your quality of life (everyday activities)? 4.2 Did an HCP confirm that you had arthritis after examining your knee and looking at x-rays? 4.3 Did you discuss with an HCP arthritis treatments you have tried (e.g., acetaminophen, physiotherapy, joint injections)?

4.4 Did you discuss with an HCP what you expect after having a knee replacement?

4.5 Did you discuss with an HCP how ready you felt for having surgery (physical, mental)?

4.6 Did you discuss with an HCP benefits of having the surgery and any risks or side effects of surgery?

5. If you had to go through this process again, are there things that could have been done differently?

6. Is there anything else you would like to share that was not discussed?

We are almost done! To finish, I will ask you few questions about you.

7. Do you live in an urban or rural area?

8. Do you describe yourself as a woman, man, other (gender fluid/non-binary), or prefer not to say?

9. What is your year of birth?

10. *Do not ask the following, assume by looking.*

Male:

Female:

Thank you for your participation!

Appendix H – Domains of the 2009 CFIR framework used to map themes in the interpretive descriptive study (Chapter 2)

From the CFIR public website: <https://cfirguide.org/constructs-old/>

Based on: Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. Implementation science. 2009 Dec;4(1):1-5.

Consolidated Framework for Implementation Research Constructs		
CFIR Website		
Construct		Short Description
I. INTERVENTION CHARACTERISTICS		
A	Intervention Source	Perception of key stakeholders about whether the intervention is externally or internally developed.
B	Evidence Strength & Quality	Stakeholders' perceptions of the quality and validity of evidence supporting the belief that the intervention will have desired outcomes.
C	Relative Advantage	Stakeholders' perception of the advantage of implementing the intervention versus an alternative solution.
D	Adaptability	The degree to which an intervention can be adapted, tailored, refined, or reinvented to meet local needs.
E	Trialability	The ability to test the intervention on a small scale in the organization, and to be able to reverse course (undo implementation) if warranted.
F	Complexity	Perceived difficulty of implementation, reflected by duration, scope, radicalness, disruptiveness, centrality, and intricacy and number of steps required to implement.
G	Design Quality & Packaging	Perceived excellence in how the intervention is bundled, presented, and assembled.
H	Cost	Costs of the intervention and costs associated with implementing the intervention including investment, supply, and opportunity costs.
II. OUTER SETTING		
A	Patient Needs & Resources	The extent to which patient needs, as well as barriers and facilitators to meet those needs, are accurately known and prioritized by the organization.

B	Cosmopolitanism	The degree to which an organization is networked with other external organizations.
C	Peer Pressure	Mimetic or competitive pressure to implement an intervention; typically because most or other key peer or competing organizations have already implemented or are in a bid for a competitive edge.
D	External Policy & Incentives	A broad construct that includes external strategies to spread interventions, including policy and regulations (governmental or other central entity), external mandates, recommendations and guidelines, pay-for-performance, collaboratives, and public or benchmark reporting.
III. INNER SETTING		
A	Structural Characteristics	The social architecture, age, maturity, and size of an organization.
B	Networks & Communications	The nature and quality of webs of social networks and the nature and quality of formal and informal communications within an organization.
C	Culture	Norms, values, and basic assumptions of a given organization.
D	Implementation Climate	The absorptive capacity for change, shared receptivity of involved individuals to an intervention, and the extent to which use of that intervention will be rewarded, supported, and expected within their organization.
1	Tension for Change	The degree to which stakeholders perceive the current situation as intolerable or needing change.
2	Compatibility	The degree of tangible fit between meaning and values attached to the intervention by involved individuals, how those align with individuals' own norms, values, and perceived risks and needs, and how the intervention fits with existing workflows and systems.
3	Relative Priority	Individuals' shared perception of the importance of the implementation within the organization.
4	Organizational Incentives & Rewards	Extrinsic incentives such as goal-sharing awards, performance reviews, promotions, and raises in salary,

		and less tangible incentives such as increased stature or respect.
5	Goals and Feedback	The degree to which goals are clearly communicated, acted upon, and fed back to staff, and alignment of that feedback with goals.
6	Learning Climate	A climate in which: a) leaders express their own fallibility and need for team members' assistance and input; b) team members feel that they are essential, valued, and knowledgeable partners in the change process; c) individuals feel psychologically safe to try new methods; and d) there is sufficient time and space for reflective thinking and evaluation.
E	Readiness for Implementation	Tangible and immediate indicators of organizational commitment to its decision to implement an intervention.
1	Leadership Engagement	Commitment, involvement, and accountability of leaders and managers with the implementation.
2	Available Resources	The level of resources dedicated for implementation and on-going operations, including money, training, education, physical space, and time.
3	Access to Knowledge & Information	Ease of access to digestible information and knowledge about the intervention and how to incorporate it into work tasks.
IV. CHARACTERISTICS OF INDIVIDUALS		
A	Knowledge & Beliefs about the Intervention	Individuals' attitudes toward and value placed on the intervention as well as familiarity with facts, truths, and principles related to the intervention.
B	Self-efficacy	Individual belief in their own capabilities to execute courses of action to achieve implementation goals.
C	Individual Stage of Change	Characterization of the phase an individual is in, as he or she progresses toward skilled, enthusiastic, and sustained use of the intervention.
D	Individual Identification with Organization	A broad construct related to how individuals perceive the organization, and their relationship and degree of

		commitment with that organization.
E	Other Personal Attributes	A broad construct to include other personal traits such as tolerance of ambiguity, intellectual ability, motivation, values, competence, capacity, and learning style.
V. PROCESS		
A	Planning	The degree to which a scheme or method of behavior and tasks for implementing an intervention are developed in advance, and the quality of those schemes or methods.
B	Engaging	Attracting and involving appropriate individuals in the implementation and use of the intervention through a combined strategy of social marketing, education, role modeling, training, and other similar activities.
1	Opinion Leaders	Individuals in an organization who have formal or informal influence on the attitudes and beliefs of their colleagues with respect to implementing the intervention.
2	Formally Appointed Internal Implementation Leaders	Individuals from within the organization who have been formally appointed with responsibility for implementing an intervention as coordinator, project manager, team leader, or other similar role.
3	Champions	"Individuals who dedicate themselves to supporting, marketing, and 'driving through' an [implementation]" [101] (p. 182), overcoming indifference or resistance that the intervention may provoke in an organization.
4	External Change Agents	Individuals who are affiliated with an outside entity who formally influence or facilitate intervention decisions in a desirable direction.
C	Executing	Carrying out or accomplishing the implementation according to plan.
D	Reflecting & Evaluating	Quantitative and qualitative feedback about the progress and quality of implementation accompanied with regular personal and team debriefing about progress and experience.

Appendix I – COREQ reporting checklist for interpretive descriptive study (Chapter 2)

Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

From: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care*. 2007;19(6):349-357.

No	Item	Guide questions/description	Page in manuscript
Domain 1: Research team and reflexivity			
Personal Characteristics			
1.	Interviewer/facilitator	Which author/s conducted the interview or focus group?	p.7
2.	Credentials	What were the researcher's credentials? <i>E.g. PhD, MD</i>	p.1, 7
3.	Occupation	What was their occupation at the time of the study?	p.1
4.	Gender	Was the researcher male or female?	p.1
5.	Experience and training	What experience or training did the researcher have?	p.1, 7
Relationship with participants			
6.	Relationship established	Was a relationship established prior to study commencement?	Not reported, upon request

No	Item	Guide questions/description	Page in manuscript
7.	Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. <i>personal goals, reasons for doing the research</i>	Not reported, upon request
8.	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g. <i>Bias, assumptions, reasons and interests in the research topic</i>	p.1, 7
Domain 2: study design			
Theoretical framework			
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. <i>grounded theory, discourse analysis, ethnography, phenomenology, content analysis</i>	p.4
Participant selection			
10.	Sampling	How were participants selected? e.g. <i>purposive, convenience, consecutive, snowball</i>	p.6
11.	Method of approach	How were participants approached? e.g. <i>face-to-face, telephone, mail, email</i>	p.6
12.	Sample size	How many participants were in the study?	p.8
13.	Non-participation	How many people refused to participate or dropped out? Reasons?	Not applicable
Setting			

No	Item	Guide questions/description	Page in manuscript
14.	Setting of data collection	Where was the data collected? <i>e.g. home, clinic, workplace</i>	p.6
15.	Presence of non-participants	Was anyone else present besides the participants and researchers?	Not applicable
16.	Description of sample	What are the important characteristics of the sample? <i>e.g. demographic data, date</i>	p.8 and Table 1
Data collection			
17.	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Upon request and p.7
18.	Repeat interviews	Were repeat interviews carried out? If yes, how many?	Not applicable
19.	Audio/visual recording	Did the research use audio or visual recording to collect the data?	p.7
20.	Field notes	Were field notes made during and/or after the interview or focus group?	p.8
21.	Duration	What was the duration of the interviews or focus group?	Not reported, upon request
22.	Data saturation	Was data saturation discussed?	Not applicable
23.	Transcripts returned	Were transcripts returned to participants for comment and/or correction?	Not applicable
Domain 3: analysis and findings			

No	Item	Guide questions/description	Page in manuscript
Data analysis			
24.	Number of data coders	How many data coders coded the data?	p.8
25.	Description of the coding tree	Did authors provide a description of the coding tree?	p.8
26.	Derivation of themes	Were themes identified in advance or derived from the data?	p.8
27.	Software	What software, if applicable, was used to manage the data?	p.8
28.	Participant checking	Did participants provide feedback on the findings?	NA
Reporting			
29.	Quotations presented	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. <i>participant number</i>	Table 2 and p.12
30.	Data and findings consistent	Was there consistency between the data presented and the findings?	Table 2, p.9-12
31.	Clarity of major themes	Were major themes clearly presented in the findings?	Table 2, p.9-12
32.	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	p.9-12

Appendix J – Supplementary material 3.1 of the systematic review (Chapter 3)

Medline search strategy

Database: Ovid MEDLINE(R) ALL <1946 to January 13, 2022>

Search Strategy:

-
- 1 Arthroplasty, Replacement, Hip/
 - 2 Arthroplasty, Replacement, Knee/
 - 3 Hip Prosthesis/
 - 4 Knee prosthesis/
 - 5 Orthopedic Procedures/ and (knee* or hip*).ti,ab,kw.
 - 6 Elective Surgical Procedures/ and (knee* or hip*).ti,ab,kw.
 - 7 (hip\$ adj2 (replac* or arthroplast* or prosth* or surger*)).ti,ab,kw.
 - 8 (knee\$ adj2 (replac* or arthroplast* or prosth* or surger*)).ti,ab,kw.
 - 9 or/1-8
 - 10 Decision trees/
 - 11 Health priorities/
 - 12 Health care rationing/
 - 13 "Referral and Consultation"/
 - 14 Needs assessment/
 - 15 exp Severity of illness index/
 - 16 Triage/
 - 17 Patient Selection/
 - 18 exp "Appointments and Schedules"/
 - 19 Critical Pathways/
 - 20 ((replac* or arthroplast* or prosth*) adj2 (appropriate* or inappropriate* or indicat* or criteri* or select* or triag*)).ti,ab,kw.
 - 21 ((tool\$ or instrument\$ or value\$ or model\$ or algorithm\$) adj2 (refer* or priori* or assess* or evaluat* or predict* or deci*) adj3 (osteoarthritis or replac* or arthroplast* or prothes* or surger*)).ti,ab,kw.
 - 22 (decision tree* or health priorit* or waiting list* or wait list* or disease sever*).ti,ab,kw.
 - 23 (patient adj2 select* adj2 (replacement\$ or arthroplast* or prosth* or surger*)).ti,ab,kw.
 - 24 or/10-23
 - 25 9 and 24

Appendix K – Supplementary material 3.2 of systematic review (Chapter 3)

Detailed psychometric properties appraisal guide

Detailed psychometric properties appraisal guide

Psychometric properties	Definition based on Fitzpatrick ¹	Rating guided by Fitzpatrick ¹ and COSMIN ^{2,3}
Appropriateness	The content of the instrument fits the research questions or purpose of the study Appropriateness in this study is defined by the Canadian consensus on six criteria for TJA: 1) OA negatively impacting quality of life, 2) evidence of OA, 3) adequate trial of conservative treatment, 4) patients' expectations are achievable, 5) patient and surgeon agree benefits outweigh risks, and 6) patients are physically and mentally ready for surgery ⁴	+: 7-9 items of the Canadian consensus on six criteria for TJA appropriateness are included in the instrument +/-: 4-6 items of the Canadian consensus on six criteria for TJA appropriateness are included in the instrument -: ≤ 3 items of the Canadian consensus on six criteria for TJA appropriateness are included in the instrument 1,4
Reliability	The measures of the instrument are reproducible, consistent between and within different raters, and internally consistent <i>Inter-rater reliability:</i> -Relates to the consistency and agreement between different observers/interviewers when using the instrument -Can be assessed with intra-class correlation coefficient (ICC) and Cohen's kappa <i>Intra-rater reliability:</i> -Relates to the consistency and agreement between the same observer/interviewer when using the instrument -Can be assessed with ICC and Cohen's kappa <i>Internal consistency:</i>	+: Cronbach's alpha between 0.70-0.95 OR ICC/Cohen's kappa ≥0.80 +/-: ICC/Cohen's kappa 0.70-0.79 -: Cronbach's alpha <0.70 or >0.95 OR ICC/Cohen's kappa ≤ 0.69 1,5
Validity	-Items in the instrument are homogeneous (they all measure elements of a single construct) -Usually assessed with Cronbach's alpha The instrument measures the domain(s) it is supposed to measure <i>Predictive validity:</i> the measure correlates with future values (e.g., diagnosis) -Can be determined with: o correlation between instrument results and future value or discrimination with the area under the curve (AUC) (C statistic or AUC) o sensitivity (SENS) and specificity (SPEC) o positive predictive value (PPV) and negative predictive value (NPV) <i>Face validity:</i> the instrument appears to measure what it is intended to measure based on its content -Determined by experts and patients <i>Content validity:</i> instrument covers important parts of the elements to be measured -Domain of interest is comprehensively evaluated by the items, or questions in the instrument -Determined by experts and patients <i>Construct validity:</i>	+: Correlation with other instruments ≥0.80 OR C statistics/AUC ≥ 0.75 OR SENS and SPEC ≥ 0.90 OR PPV and NPV ≥ 0.90 +/-: Correlation with other instruments between 0.60-0.79 OR C statistics/AUC between 0.60-0.74 OR SENS and SPEC between 0.80-0.89 OR PPV and NPV between 0.80-0.89 -: Correlation with other instruments ≤0.59 OR C statistics/AUC ≤0.59 OR SENS and SPEC ≤ 0.79 OR PPV and NPV ≤ 0.79 1,2,5-8 +: The instrument development is based on consultation with experts and target population (patients) +/-: The instrument development is based on experts AND clear description of the instrument aim, target population, concepts being measured, and item selection -: Target population (patients) not involved AND no clear description of the instrument aim, target population, concepts being measured, and item selection 1,2 +: ≥75% of the results are in agreement with theories/hypotheses such as:

	-The relationship of the measures of the instrument to other similar measures is coherent with other set of variables and are coherent with theoretically derived hypotheses -Can be assessed with: - o Convergent and discriminant validity - o correlations with other similar measures (Spearman, Pearson) - o Factor analysis when the instrument assesses more than one domain (e.g., function, psychological well-being) - o Results are consistent with theoretically derived hypotheses	- o factor analysis demonstrates instrument structure OR - o convergent/discriminant validity demonstrates instrument structure OR - o majority of correlation ≥ 0.80 +/-: 50-74% of the results are in agreement with theories/hypotheses such as: - o factor analysis demonstrates instrument structure OR - o convergent/discriminant validity demonstrates instrument structure OR - o majority of correlation between 0.50-0.79 -: < 50% of the results are in agreement with the theories/hypotheses such as: - o factor analysis does not demonstrate instrument structure OR - o convergent/discriminant validity does not demonstrate instrument structure OR - o majority of correlation < 0.50
		1,2,9
Feasibility	Facility of using the instrument Elective joint arthroplasty clinical context needs to be considered when appraising feasibility	+, +/-, -: Reasonable time spent to use the instrument OR facility of use (e.g., training, scoring system) OR minimal missing response to items ($\leq 15\%$)
		1
Acceptability	The instrument is acceptable to patients and/or healthcare professionals Can be determined with: -Completion rate	+, +/-, -: Clear language OR short instrument OR culturally applicable OR acceptable response rates ($\geq 85\%$)
		1
	-Target population views on the instrument	
Interpretability	Interpretability and meaningfulness of measures/scores <i>Minimal clinically important difference (MCID):</i> smallest change that a patient would identify as important indicating a change in the patient <i>Mean and standard deviation (SD):</i> mean and SD of the population (norm values) can help to interpret scores	+: One of the following: Mean and SD of general population presented OR MCID defined a priori +/-: Mean and SD of general population not presented AND MCID defined -: Mean and SD of general population not presented AND MCID not defined
		1,2

References

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Appendix L – Data extracted for each instrument/study included in the systematic review (Chapter 2)

Study details		
Publication date	Journal	Trial registration
Corresponding author information	Study country	Funding
Developing/using/testing instrument	Study aim	Study design
Recruitment methods	Study timeframe	Ethics approval
Declarations		
Study setting		
Location		
Instrument characteristics		
Name	Type	Instrument purpose
Condition	Number of items/criteria	Items/criteria
Responses for items/criteria	Ranges of scores	Material needed
Mode of administration	Assessor	Assessment process
Developed for whom	Other	
Instrument development methods		
Methods	Who developed the instrument	Process
Timing	Statistical plan	Results
Results divided by hip and knee		
Participants		
Eligibility criteria healthcare professionals	Eligibility criteria patients	Sample size healthcare professionals
Sample size patients		
Patients characteristics		
Diagnosis	Age	Sex
Education	Occupation	Socioeconomic details
Ethnicity	Other social details	Other details
Demographic group differences		
Experts/healthcare professionals characteristics		
Type	Age	Sex
Years practicing	Other details	
Instrument testing methods		
Methods	Statistical plan	
Psychometric property – appropriateness (present or absent)		
Pain	Functional limitations	Quality of life
Imaging	Physical evaluation	Conservative treatments

Expectations	Patient/surgeon agree benefits outweigh risks	Readiness
Other criteria		
Psychometric property – reliability		
Tested	Type	Methods
Timing	ICC	Cohen's kappa
Cronbach's alpha	Other	
Psychometric property – validity		
Tested	Type	Methods
Gold standard	Area under the curve	C statistics
Sensitivity	Specificity	Positive/negative predictive value
Developed based on experts/patients	Clear description of instrument aim	Clear description of target population
Clear description of concepts being measured	Clear description of item selection	Convergent/discriminant validity
Factor analysis	Results consistent with hypothesis	Other
Psychometric property – interpretability		
Tested	Methods	MCID
Mean, SD	Other	
Psychometric property – feasibility		
Tested	Methods	Time to use
Facility of use	Missing response to items	Other
Psychometric property – acceptability		
Tested	Methods	Clear language
Short/long instrument	Cultural applicability	Response rates
Other		
TJA appropriateness data		
Descriptive	Population	Sample size
Methods	Instrument used	Timing
Findings	Other	
Study conclusion		
Limitations	Conclusion	
Reference list screening		
Study that might be eligible for inclusion		

Appendix M – PRISMA reporting checklist for the systematic review (Chapter 3)



PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Title page
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	p.1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	p.3-4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	p.4
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	p.4-6 and Table 1
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	p.6
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Supplementary material 1
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	p. 6-7
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	p.7
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	p.7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	p.7
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	NA
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	p.7-8 , Table 2, supplementary material
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	p.7-9
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	p.7-9
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	p.7-9
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	p.7-9 Table 2
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	NA
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	NA



PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	NA
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	NA
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	p.9-10 and Figure 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Table 1 and Figure 1
Study characteristics	17	Cite each included study and present its characteristics.	p.9-10 and Table 3
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	NA
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	NA
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Table 3
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	p.9-11 and Tables 4-5
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	NA
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	NA
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	NA
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	NA
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	p.12-15
	23b	Discuss any limitations of the evidence included in the review.	p. 16
	23c	Discuss any limitations of the review processes used.	p. 16
	23d	Discuss implications of the results for practice, policy, and future research.	p.14-15
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Title page and p. 4
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	p.4
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	NA
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Title page
Competing interests	26	Declare any competing interests of review authors.	Title page



PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	p.17

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71
For more information, visit: <http://www.prisma-statement.org/>

Appendix N- PEMAT to evaluate health literacy levels of patient resources in environmental scan (Chapter 4)

Understandability

Item #	Item	Response Options	Rating
Topic: Content			
1	The material makes its purpose completely evident.	Disagree=0, Agree=1	
2	The material does not include information or content that distracts from its purpose.	Disagree=0, Agree=1	
Topic: Word Choice & Style			
3	The material uses common, everyday language.	Disagree=0, Agree=1	
4	Medical terms are used only to familiarize audience with the terms. When used, medical terms are defined.	Disagree=0, Agree=1	
5	The material uses the active voice.	Disagree=0, Agree=1	
Topic: Use of Numbers			
6	Numbers appearing in the material are clear and easy to understand.	Disagree=0, Agree=1, No numbers=N/A	
7	The material does not expect the user to perform calculations.	Disagree=0, Agree=1	
Topic: Organization			
8	The material breaks or "chunks" information into short sections.	Disagree=0, Agree=1, Very short material ⁱ =N/A	
9	The material's sections have informative headers.	Disagree=0, Agree=1, Very short material ⁱ =N/A	
10	The material presents information in a logical sequence.	Disagree=0, Agree=1	
11	The material provides a summary.	Disagree=0, Agree=1, Very short material ⁱ =N/A	
Topic: Layout & Design			
12	The material uses visual cues (e.g., arrows, boxes, bullets, bold, larger font, highlighting) to draw attention to key points.	Disagree=0, Agree=1, Video=N/A	
Topic: Use of Visual Aids			
15	The material uses visual aids whenever they could make content more easily understood (e.g., illustration of healthy portion size).	Disagree=0, Agree=1	
16	The material's visual aids reinforce rather than distract from the content.	Disagree=0, Agree=1, No visual aids=N/A	

17	The material's visual aids have clear titles or captions.	Disagree=0, Agree=1, No visual aids=N/A	
18	The material uses illustrations and photographs that are clear and uncluttered.	Disagree=0, Agree=1, No visual aids=N/A	
19	The material uses simple tables with short and clear row and column headings.	Disagree=0, Agree=1, No tables=N/A	

Total Points: _____

Total Possible Points: _____

Understandability Score (%): _____

(Total Points / Total Possible Points x 100)

Actionability

Item #	Item	Response Options	Rating
20	The material clearly identifies at least one action the user can take.	Disagree=0, Agree=1	
21	The material addresses the user directly when describing actions.	Disagree=0, Agree=1	
22	The material breaks down any action into manageable, explicit steps.	Disagree=0, Agree=1	
23	The material provides a tangible tool (e.g., menu planners, checklists) whenever it could help the user take action.	Disagree=0, Agree=1	
24	The material provides simple instructions or examples of how to perform calculations.	Disagree=0, Agree=1, No calculations=NA	
25	The material explains how to use the charts, graphs, tables, or diagrams to take actions.	Disagree=0, Agree=1, No charts, graphs, tables, or diagrams=N/A	
26	The material uses visual aids whenever they could make it easier to act on the instructions.	Disagree=0, Agree=1	

Total Points: _____

Total Possible Points: _____

Actionability Score (%): _____

(Total Points / Total Possible Points x 100)

Appendix O- IPDAS criteria used to evaluate patient resources in environmental scan (Chapter 4)

From:

Joseph-Williams N, Newcombe R, Politi M, Durand MA, Sivell S, Stacey D, O'Connor A, Volk RJ, Edwards A, Bennett C, Pignone M. Toward minimum standards for certifying patient decision aids: a modified Delphi consensus process. *Medical Decision Making*. 2014 Aug;34(6):699-710.

Martin RW, Brogård Andersen S, O'Brien MA, Bravo P, Hoffmann T, Olling K, Shepherd HL, Dankl K, Stacey D, Dahl Steffensen K. Providing balanced information about options in patient decision aids: an update from the International Patient Decision Aid Standards. *Medical Decision Making*. 2021 Oct;41(7):780-800.

Defining criteria
The patient decision aid describes the health condition or problem (treatment, procedure, or investigation) for which the index decision is required.
The patient decision aid explicitly states the decision that needs to be considered (index decision).
The decision aid identifies the target audience.
The patient decision aid describes the options available for the index decision.
The patient decision aid describes the positive features (benefits or advantages) of each option.
The patient decision aid describes the negative features (harms, side effects, or disadvantages) of each option.
The patient decision aid describes what it is like to experience the consequences of the options by: a) asking people to think about which positive and negative features of the options matter most to them AND/OR b) describing each option to help patients imagine the physical, social, and /or psychological effect.
Certification criteria
The patient decision aid shows the negative and positive features of options with equal detail (e.g., using similar fonts, sequence, presentation of statistical information).
The patient decision aid (or associated documentation) provides citations to the evidence selected.
The patient decision aid (or associated documentation) provides a production or publication date.
The patient decision aid (or associated documentation) provides information about the update policy.
The patient decision aid provides information about the levels of uncertainty around event or outcome probabilities (e.g., by giving a range or by using phases such as “our best estimate is . . .”).
The patient decision aid (or associated documentation) provides information about the funding source used for development.
Quality criteria

The patient decision aid describes the natural course of the health condition or problem, if no action is taken (when appropriate).
The patient decision aid makes it possible to compare the positive and negative features of the available options.
The patient decision aid provides information about outcome probabilities associated with the options (i.e., the likely consequences of decisions).
The patient decision aid specifies the defined group (reference class) of patients for whom the outcome probabilities apply.
The patient decision aid specifies the event rates for the outcome probabilities.
The patient decision aid allows the user to compare outcome probabilities across options using the same time period (when feasible).
The patient decision aid allows the user to compare outcome probabilities across options using the same denominator (when feasible).
The patient decision aid provides more than 1 way of viewing the probabilities (e.g., words, numbers, and diagrams).
The patient decision aid asks patients to think about which positive and negative features of the options matter most to them (implicitly or explicitly). (
The patient decision aid provides a step-by step way to make a decision.
The patient decision aid includes tools like worksheets or lists of questions to use when discussing options with a practitioner.
The development process included a needs assessment with clients or patients.
The development process included a needs assessment with health professionals.
The development process included review by clients/patients not involved in producing the decision support intervention.
The development process included review by professionals not involved in producing the decision support intervention.
The patient decision aid was field tested with patients who were facing the decision.
The patient decision aid was field tested with practitioners who counsel patients who face the decision.
The patient decision aid (or associated documentation) describes how research evidence was selected or synthesized.
The patient decision aid (or associated documentation) describes the quality of the research evidence used.
The patient decision aid includes authors'/developers' credentials or qualifications.
The patient decision aid (or associated documentation) reports readability levels (using 1 or more of the available scales).

There is evidence that the patient decision aid improves the match between the preferences of the informed patient and the option that is chosen.

There is evidence that the patient decision aid helps patients improve their knowledge about options' features.

Appendix P – Supplementary online material Table 4.2 of environmental scan (Chapter 4)

Detailed data on comparison of patient resources to IPDAS criteria

	Resources ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45		
Qualifying criteria to be defined as a patient decision aid	Describes health condition	•	•	•	•	•	•	•	•	•				•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	States decision to be made	•	•	•	•	•	•				•	•		•	•						•	•																								•	•	
	Target audience	•	•	•	•	•	•	•	•				•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	List all available options	•	•	•	•	•	•	•	•	•	•	•	•	•																•	•																	
	Benefits of each option	•	•	•	•			•	•	•			•																																			
	Harms of each option	•	•	•	•					•	•		•																																			
	Values clarification	•	•	•	•	•	•	•				•	•		•	•	•	•	•	•	•			•	•	•	•	•	•	•																		
	Total (/7)	7	7	7	7	5	5	5	5	5	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
Certification criteria	Total (/6)	6	6	4	4																																											
Quality criteria	Total (/23)	2	2	5	5																																											

	Resources ID	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	
Qualifying criteria to be defined as a patient decision aid	Describes health condition						•	•	•			•		•		•																•	•	
	States decision to be made																																	
	Target audience	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•			•	•	•	
	List all available options									•	•																				•	•	•	
	Benefits of each option																																	
	Harms of each option																																	
	Values clarification	•	•	•	•	•							•	•																				
	Total (/6)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	3	3
Certification criteria	Total (/6)																																	
Quality criteria	Total (/23)																																	

Legend: dots = present, "blank" = not present, shaded area = not applicable.

Appendix Q – Supplementary online material Table 4.3 in Appendix Q in environmental scan (Chapter 4)

Detailed data on comparison of patient resources to PEMAT

	Resource ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40					
Understandability	Clear purpose	•	•	•	•	•	•		•	•	•	•		•	•	•	•			•	•	•		•	•	•		•			•	•	•	•	•	•	•	•	•	•	•	•				
	No distraction	•	•			•			•	•			•		•	•		•	•	•	•	•	•		•	•	•	•	•	•		•			•	•	•	•	•	•	•					
	Common language	•	•	•	•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			
	Medical terms defined	•	•	•	•	•		•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			
	Active voice	•	•	•	•		•	•						•	•						•	•	•			•	•	•	•	•		•	3		•	•	•	•	•	•	•	•				
	Numbers clear and easy	•	•			•		•								•				•			•	•			•	•								•	•	•	•							
	No calculation	•	•			•		•	•	•			•		•	•	•		•	•	•	•	•	•		•	•	•	•	•	•		•			•	•	•	•	•	•					
	Short sections	•	•	•	•	•	•	•	•	•			•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•			
	Informative headers	•	•	•	•	•	•	•	•	•				•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•		
	Logical sequence	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	Summary	•	•																																											
	Visual cues	•	•			•		•	•	•						•	•	•	•	•	•	•	•			•	•	•	•	•		•		•				•	•	•	•	•	•			
	Text on screen easy to read			•	•		•								•									•								•			•							•	•			
	Words easy to hear			•	•		•					•	•		•			•							•							•		•	•							•	•			
	VA to help understanding					•				•	•					•	•		•	•	•	•	•			•	•	•	•		•		•				•	•	•	•	•	•				
	VA reinforce	•	•			•		•	•	•	•				•	•	•	•		•	•	•	•			•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•		
	VA clear titles	•	•					•	•	•	•				•	•	•		•	•						•	•	•	•	•		•					•	•	•	•	•	•	•	•		
	VA clear and uncluttered	•	•	•	•	•	•	•	•	•					•	•	•		•	•	•	•	•			•	•	•	•	•		•	•				•	•	•	•	•	•	•	•	•	•
	Tables	•	•				•								•															•																
Actionability	Total (%)		94	94	90	91	81	83	75	87	87	56	56	67	83	87	87	56	80	81	86	93	88	62	82	81	81	88	94	67	73	64	87	56	91	87	93	93	81	93	73	91				
	One action	•	•	•	•	•	•	•						•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•	•		
	Addresses user directly	•	•	•	•	•	•	•						•	•	•	•		•	•	•	•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•	•		
	Actions broke into steps	•	•	•	•	•	•								•						•	•				•	•	•	•						•				•			•	•			
	Tools to help with action	•	•			•															•	•						•	•				•													
	Instruction for calculations																																													
	Explanation for charts																																													
	VA to help instructions									•	•															•	•	•	•					•					•							
	Total (%)		80	80	100	100	80	100	40	20	20	0	0	40	100	40	40	0	40	40	40	40	60	40	67	80	80	100	83	40	0	0	80	67	67	80	40	40	60	60	100	100				

VA (visual aids)

Legend: dots = present, "blank" = not present, shaded area = not applicable

ID 72 and 73 target patients and healthcare professionals. Therefore, they are appraised under patient and healthcare professional resources.

	Resources ID	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73
Understandability	Clear purpose			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	No distraction	•	•			•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Common language	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	Medical terms defined	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Active voice			•	•	•	•	•	•	•	•	•	•		•	•		•	•	•	•	•	•		•	•	•	•	•					
	Numbers clear and easy	•		•																			•					•				•		•
	No calculation	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Short sections	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Actionability	Informative headers		•	•	•	•	•	•	•	•	•	•	•				•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Logical sequence	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Summary													•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Visual cues	•		•	•	•	•	•	•	•	•	•	•	•			•	•	•	•	•	•	•		•	•	•	•	•			•	•	•
	Text on screen easy to read	•							•								•		•	•														
	Words easy to hear	•							•									•	•	•	•													
	VA to help understanding	•				•	•	•	•	•	•					•		•	•	•		•	•	•	•	•	•							
	VA reinforce					•	•	•	•	•	•					•		•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•
	VA clear titles						•	•	•	•	•					•		•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•
	VA clear and uncluttered	•		•	•	•	•	•	•	•	•	•	•			•	•		•		•	•	•	•	•	•	•	•		•		•	•	•
	Tables	•		•	•	•																												
	Total (%)	60	54	71	65	73	67	93	82	88	88	53	83	46	64	62	87	91	83	91	90	93	93	57	93	83	94	94	78	50	67	69	69	
	One action		•	•	•	•	•	•	•	•	•	•	•		•	•	•	•		•	•	•	•		•	•	•	•	•			•		•
	Addresses user directly		•	•	•	•	•	•	•	•	•	•	•		•	•	•	•		•	•	•	•		•	•	•	•	•			•		
	Actions broke into steps			•	•			•	•	•	•	•					•			•	•			•		•	•	•						
Tools to help with action	•		•	•		•	•	•	•	•	•															•	•							
Instruction for calculations																																		
Explanation for charts				•																														
VA to help instructions				•	•	•	•	•	•	•		•										•	•	•	•	•	•	•	•	•				
Total (%)	0	40	67	83	60	67	80	100	83	83	40	40	0	40	40	40	100	0	100	100	60	60	20	80	40	100	100	60	20	0	40	0	20	

VA (visual aids)

ID 72 and 73 target patients and healthcare professionals. Therefore, they are appraised under patient and healthcare professional resources.

Legend: dots = present, "blank" = not present, shaded area = not applicable

Appendix R – Supplementary online material Table 4.4 in environmental scan (Chapter 4)

Detailed data on comparison of healthcare professional resources to the Hawker et al. appropriateness criteria

	Resources ID	74	75	76	77	78	79	80	81	82	83	84	72	73
Canadian Consensus Criteria	Osteoarthritis symptoms negatively impacting quality of life	•	•			•	•	•					•	•
	Evidence of osteoarthritis	•	•	•	•	•	•	•		•			•	•
	Trial of conservative treatments	•	•	•	•	•	•		•	•			•	•
	Achievable expectations	•		•					•				•	
	Patients and surgeons agree that benefits outweigh risks	•	•	•	•			•					•	
	Physically and mentally ready								•					
	Total (/6)	5	4	4	3	3	3	3	3	2	0	0	5	3

Legend: dots = present, "blank" = not present

ID 72 and 73 target patients and healthcare professionals. Therefore, they are appraised under patient and healthcare professional resources.

Appendix S – Supplementary online material Table 4.5 in environmental scan (Chapter 4)

Detailed data on comparison of healthcare professional resources to SDM key definition elements

Resources ID		74	75	76	77	78	79	80	81	82	83	84	72	73	Examples of quotes
SDM key definition elements	Explicitly encourage to use shared decision making										•		•		“The referral process should involve an integrated approach where there is collaboration, communication, and shared decision-making to promote patient-centred care.”
	Define the problem (e.g., osteoarthritis severity)	•	•	•		•	•	•	•			•	•	•	“Hip and knee replacement is an effective treatment for individuals who are experiencing the pain and disability of end stage arthritis in their knee or hip.”
	Create choice awareness (e.g., equipoise, describe treatment options)			•	•		•	•			•		•	•	“... the decision-making process for patients requires them to consider their options.”
	Encourage learning about the patient (e.g., preferences and values)	•		•			•				•		•		“Provide information about strategies and resources to help them develop an individualized plan that is responsive to their needs and preferences.”
	Be aware of healthcare professionals knowledge/recommendations										•		•	•	“... help them (patients) base their decision on what we've learn (healthcare professional) from patients we have cared for in the past...”
	Encourage making the decision (e.g., make or explicitly defer decision, patients retain authority)	•		•				•			•				“... the patient should be charged with asking the decision to: accept surgery, defer surgery, refuse surgery, access other treatment options, seek a second opinion.”
	Encourage tailoring of information (e.g., flexible and individualized approach)	•											•	•	“The information provided should be based on the individual needs of the person with osteoarthritis, their perception of their condition, their learning abilities, and their readiness to change.”
	Encourage deliberation								•		•		•		“... allowing space and time for information sharing and supporting patients to deliberate...”
Total (/8)		4	1	4	1	1	3	3	2	0	6	1	7	4	

Legend: dots = present, “blank” = not present, shaded area = not applicable

ID 72 and 73 target patients and healthcare professionals. Therefore, they are appraised under patient and healthcare professional resources.

Appendix T – Permissions from journals to use published Articles in PhD Thesis

Permission to use published qualitative study (Chapter 2) in thesis

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