Topic Brief: Optimizing Outcomes for Major Joint Replacement

Date: 08/26/19
Nomination Number: 0864

Purpose: This document summarizes the information addressing a nomination submitted on June 21, 2019 through the Effective Health Care Website. This information was used to inform the Evidence-based Practice Center (EPC) Program decisions about whether to produce an evidence report on the topic, and if so, what type of evidence report would be most suitable.

Issue: The nominator is interested in a systematic review which will inform decisions about implementing clinical interventions and strategies to deliver value and reduce costs in major joint replacement surgery.

Program Decision: The EPC Program will develop a new systematic review based on this nomination. The scope of this topic will be further developed in the refinement phase. When key questions have been drafted, they will be posted on the AHRQ Web site and open for public comment. To sign up for notification when this and other Effective Health Care (EHC) Program topics are posted for public comment, please go to https://effectivehealthcare.ahrq.gov/email-updates.

Key Findings

- Existing and in-process systematic reviews were identified for the nominator's questions around anti-coagulation for venous thromboembolism and care pathways for joint replacement surgery. While systematic reviews were identified that partially addressed the questions about the effectiveness of pre-habilitation and rehabilitation for major joint replacement surgery, these were not comprehensive.
- A new evidence review examining both the existing systematic reviews and primary studies of pre-habilitation and rehabilitation for major joint replacement is feasible. From our limited assessment of the size of the evidence base, we estimate that there would be approximately 51 primary studies reporting the impact of pre-habilitation and 187 reporting the impact of rehabilitation.
- We estimate the size of the proposed systematic review as large.
- Decision makers are unclear about which pre-habilitation and rehabilitation interventions provide the optimal patient outcomes with the most efficient use of resources. The settings where these interventions provide the most value is also unclear. Therefore, a new systematic review on the effects of pre-habilitation and rehabilitation for major joint replacement surgery may have a high impact.
- The value of a new evidence review on major joint replacement is potentially high. Members of the AHRQ Learning Health System panel could use the review to inform

their decisions about whether to implement pre-habilitation and rehabilitation interventions and the setting of care that provides the most value in terms of patient outcomes and costs.

Background

- In 2009, 438,000 hip and 686,000 knee arthroplasties were performed in the United States. A recent study predicted that by 2025, compared to 2014 numbers, total hip arthroplasties (THA) will increase by 75% and total knee arthroplasties (TKA) will increase by 110%.[1]
- In 2013, the Centers for Medicare and Medicaid Services (CMS) implemented the Bundled Payments for Care Improvement (BPCI) initiative to test whether linking payments for all providers that furnish Medicare-covered items and services during an episode of care could reduce Medicare payments while maintaining or improving the quality of care. Total joint arthroplasty of the lower extremity was the most prevalent clinical episode participating in the CMS bundled payment model[2] .
- As both bundled payment models and major joint replacement surgery become more prevalent, many organizations are working to improve efficiency and lower costs, while trying to improve health outcomes and patient experience.

Nomination Summary

- The submitted nomination covered the whole clinical pathway of major joint replacement from pre-habilitation to rehabilitation, except the specific surgical intervention itself. During discussion, we decided to focus on knee and hip replacement. Further, it was agreed that care transition was not a priority area and to focus on the four questions described below and in Table 1. Hospital interventions were specified as anticoagulation for prevention of venous thromboembolism (VTE).
- The nomination came from the AHRQ Learning Health System Panel (https://effectivehealthcare.ahrq.gov/products/learning-health-systems-panel/overview). An AHRQ evidence report would be used by the nominator to implement the most effective and high value patient pathways for major joint replacement.

Scope

1) Which pre-habilitation services are most effective in supporting optimum functional outcomes for patients undergoing knee or hip replacement surgery?
2) Is anticoagulation for prevention of venous thromboembolism effective in supporting optimum functional outcomes for patients undergoing knee or hip replacement surgery?
3) Which rehabilitation services are most effective in supporting optimum functional outcomes for patients undergoing knee or hip replacement surgery?
4) What care pathways are most effective for patients undergoing knee or hip replacement?

Table 1. Questions and PICOTS (population, intervention, comparator, outcome, timing and setting)

Questions	1) Pre-habilitation interventions	2) Anticoagulation	3) Rehabilitation	4) Care pathways
Population	People undergoing knee or hip replacement surgery	People undergoing knee or hip replacement surgery	People undergoing knee or hip replacement surgery	People undergoing knee or hip replacement surgery
Interventions	Pre-habilitation (e.g., physical therapy)	Post-operative anticoagulation – what and how long)	Rehabilitation (e.g. home physical therapy, outpatient physical therapy)	Care pathways (e.g. joint care, rapid recovery, enhanced recovery after surgery, fast track surgery, day care surgery, outpatient surgery)
Comparators	Pre-habilitation type No pre-habilitation	No intervention	Rehabilitation type No rehabilitation	Each other No care pathway
Outcomes	Patient-reported outcomes: - Functional outcomes - Pain - Satisfaction with care - HRQoL - Clinical outcomes: - Complications from surgery - Morbidity - Mortality - Healthcare utilization: - Length of stay - 30-day readmission rate	Patient-reported outcomes: - Functional outcomes - Pain - Satisfaction with care - HRQoL - Clinical outcomes: - Complications from surgery (including VTE) - Morbidity - Mortality - Healthcare utilization: - Length of stay - 30-day readmission rate	Patient-reported outcomes: - Functional outcomes - Pain - Satisfaction with care - HRQoL - Clinical outcomes: - Complications from surgery - Morbidity - Mortality - Healthcare utilization: - Length of stay - 30-day readmission rate	Patient-reported outcomes: - Functional outcomes - Pain - Satisfaction with care - HRQoL - Clinical outcomes: - Complications from surgery - Morbidity - Mortality - Healthcare utilization: - Length of stay - 30-day readmission rate
Timing	6-12 months post surgery	6-12 months post surgery	6-12 months post surgery	6-12 months post surgery
Setting	Hospital, home, ambulatory	Full-service hospital or ambulatory procedure hospital	Hospital, home, ambulatory	Hospital, home, ambulatory

Abbreviations: HRQoL=health-related quality of life; VTE=venous thromboembolism

Assessment Methods

See Appendix A.

Summary of Literature Findings

Existing systematic reviews were found which covered the scope of Questions 2 and 4. These questions were therefore not further assessed for an AHRQ evidence product. Systematic reviews were identified for Questions 1 and 3 but the reviews did not cover the full scope of the questions.

- Question 1: Two systematic reviews were identified for Question 1 but both only included studies of patients undergoing TKA. One of the reviews focused on pre-operative physiotherapy for TKA[3] and one review only included studies if they provided a full description of the physiological stress applied during the intervention[4]. A total of 7 primary studies were identified. The identified primary studies included three studies of patients receiving either hip or knee replacement who participated in muscle training[5], physiotherapy [6], or tele-pre-habilitation[7], respectively. The other four studies included only knee replacement patients and evaluated quadricep exercise [8], pre-habilitation influences on psychological well-being following surgery [9], a home exercise program [10], and strength training [11], respectively.
- Question 2: An AHRQ systematic review update on VTE prophylaxis was identified from 2017 that addressed Question 2[12]. The review focused on the comparative effectiveness of different thromboprophylaxis interventions for patients undergoing major orthopedic surgery.
- Question 3: One systematic review was identified for early (within 48 hours following surgery) rehabilitation, but only for TKA [13]. We identified a total of 16 primary studies. Three of these studies were conducted with hip replacement patients[14-16], one in both patients of hip and knee surgery [17], and the remainder in knee surgery patients [18-29]. The studies that included hip replacement patients evaluated arm exercise[15], comprehensive exercise[30], telerehabilitation[31], and a strength program [14].
- Question 4: Two systematic reviews were identified which looked at enhanced recovery for hip and knee arthroplasty[32, 33]. One systematic review protocol was found which explores the efficiency and safety of care pathways for knee and hip arthroplasty. The author of the review protocol confirmed that the review has been completed and will be published this year[34]. This review assessed clinical pathways including joint care, rapid recovery, enhanced recovery pathway, day care surgery, and outpatient surgery. Therefore, another systematic review of this question is not considered necessary.

Table 2. Literature identified for each Question

Question	Systematic reviews (8/2016-8/2019)	Primary studies (9/2014-9/2019)
Question 1: Pre-habilitation	Total: 2 • Other:2[3, 4]	Total: 16 • RCT: 4[7, 9-11] • Controlled pre-post: 0 • Observational: 1[6] Clinicaltrials.gov • Recruiting: [5, 8]
Question 2: Anticoagulation	Total: 1 • AHRQ:1[12]	N/A
Question 3: Rehabilitation	Total: 1 • Other: 1[13]	Total: 16 • RCT:10[22-27, 29-31, 35] • Controlled pre-post: 0

Question	Systematic reviews (8/2016-8/2019)	Primary studies (9/2014-9/2019)
		• Observational: 1[20] Clinicaltrials.gov • Recruiting: 5 [14, 15, 18, 19, 28]
Question 4: Care pathways	Total: 3 • Other:2[32, 33] • Protocol:1[34]	N/A

Abbreviations: AHRQ=Agency for Healthcare Research and Quality; N/A=not applicable; RCT=randomized controlled trial

See Appendix B for detailed assessments of all EPC selection criteria.

Summary of Selection Criteria Assessment

This nomination meets all selection criteria. A systematic review addressing Questions 1 and 3 would be impactful and valuable: the nominator could use the review to inform their decisions about whether to implement pre- and post – surgery interventions and the setting of care that provides the most value in terms of patient outcomes and costs.

Please see Appendix B for detailed assessments of individual EPC Program selection criteria.

Related Resources

The American Association of Orthopaedic Surgeons (AAOS) produced evidence-based guidelines for surgical management of osteoarthritis of the knee in 2015 and for management of osteoarthritis of the hip in 2017 (see http://www.orthoguidelines.org/guidelines). Both guidelines recommend preoperative and postoperative physical therapy but note that evidence was limited for preoperative physical therapy.

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Appendix A: Methods

We assessed nomination for priority for a systematic review or other AHRQ Effective Health Care report with a hierarchical process using established selection criteria. Assessment of each criteria determined the need to evaluate the next one. See Appendix B for detailed description of the criteria.

Appropriateness and Importance

We assessed the nomination for appropriateness and importance.

Desirability of New Review/Absence of Duplication

We searched for high-quality, completed or in-process evidence reviews published in the last three years August 2016 – August 2019 on the questions of the nomination from these sources:

- AHRQ: Evidence reports and technology assessments
  - AHRQ Evidence Reports https://www.ahrq.gov/research/findings/evidence-based-reports/index.html
  - EHC Program https://effectivehealthcare.ahrq.gov/
  - AHRQ Technology Assessment Program https://www.ahrq.gov/research/findings/ta/index.html
- US Department of Veterans Affairs Products publications
  - Evidence Synthesis Program https://www.hsrd.research.va.gov/publications/esp/
  - VA/Department of Defense Evidence-Based Clinical Practice Guideline Program https://www.healthquality.va.gov/
- Cochrane Systematic Reviews https://www.cochranelibrary.com/
- Cochrane Protocols
- PROSPERO Database (international prospective register of systematic reviews and protocols) http://www.crd.york.ac.uk/prospero/
- PubMed https://www.ncbi.nlm.nih.gov/pubmed/

Impact of a New Evidence Review

The impact of a new evidence review was qualitatively assessed by analyzing the current standard of care, the existence of potential knowledge gaps, and practice variation. We considered whether it was possible for this review to influence the current state of practice through various dissemination pathways (practice recommendation, clinical guidelines, etc.).

Feasibility of New Evidence Review

We conducted a limited literature search in PubMed, Ovid, PsycInfo, CINAHL from the last five years 9/7/2014-9/7/2019 on parts of the nomination scope not addressed by earlier identified systematic reviews. Because a large number of articles were identified, we reviewed a random sample of 200 titles and abstracts for each question for inclusion. We classified identified studies by question and study design, to assess the size and scope of a potential evidence review. We then calculated the projected total number of included studies based on the proportion of studies included from the random sample.

Search strategy

Current literature **Date Searched: 9/7/19**	
Sources:	**Strategy:**

MEDLINE via OVID	**KQ1** Database: Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily <1946 to September 06, 2019> Search Strategy: --- 1 (pre-hab$ or prehab$).ti,ab. (472) 2 ((presurg$ or preoperativ$ or pre-surg$ or pre-operativ$) adj3 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery)).ti,ab. (19445) 3 Preoperative Care/mt, rh (13914) 4 ((before or prior to) adj3 (arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery) adj12 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery)).ti,ab. (188) 5 (preoperative care/ or preoperative period/) and (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery).ti,ab. (22310) 6 or/1-5 (45647) 7 (arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery).ti,ab. (88696) 8 exp Arthroplasty, Replacement/ (51302) 9 7 or 8 (98008) 10 6 and 9 (2266) 11 limit 10 to yr="2014 -Current" (1137) 12 (systematic review.ti. or meta-analysis.pt. or meta-analysis.ti. or systematic literature review.ti. or this systematic review.tw. or pooling project.tw. or (systematic review.ti,ab. and review.pt.) or meta synthesis.ti. or meta-analy*.ti. or integrative review.tw. or integrative research review.tw. or rapid review.tw. or umbrella review.tw. or consensus development conference.pt. or practice guideline.pt. or drug class reviews.ti. or cochrane database syst rev.jn. or acp journal club.jn. or health technol assess.jn. or evid rep technol assess summ.jn. or jbi database system rev implement rep.jn. or (clinical guideline and management).tw. or ((evidence based.ti. or evidence-based medicine/ or best practice*.ti. or evidence synthesis.ti,ab.) and (((review.pt. or diseases category/ or behavior.mp.) and behavior mechanisms/) or therapeutics/ or evaluation studies.pt. or validation studies.pt. or guideline.pt. or pmcbook.mp.)) or (((systematic or systematically).tw. or critical.ti,ab. or study selection.tw. or ((predetermined or inclusion) and criteri*).tw. or exclusion criteri*.tw. or main outcome measures.tw. or standard of care.tw. or standards of care.tw.) and ((survey or surveys).ti,ab. or overview*.tw. or review.ti,ab. or reviews.ti,ab. or search*.tw. or handsearch.tw. or analysis.ti. or critique.ti,ab. or appraisal.tw. or (reduction.tw. and (risk/ or risk.tw.) and (death or recurrence).mp.)) and ((literature or articles or publications or publication or bibliography or bibliographies or published).ti,ab. or pooled data.tw. or unpublished.tw. or citation.tw. or citations.tw. or database.ti,ab. or internet.ti,ab. or textbooks.ti,ab. or references.tw. or scales.tw. or papers.tw. or datasets.tw. or trials.ti,ab. or meta-analy*.tw. or (clinical and studies).ti,ab. or treatment outcome/ or treatment outcome.tw. or pmcbook.mp.))) not (letter or newspaper article).pt. (363544) 13 11 and 12 (68)

14 ("clinical trial" or "clinical trial, phase i" or "clinical trial, phase ii" or clinical trial, phase iii or clinical trial, phase iv or controlled clinical trial or "multicenter study" or "randomized controlled trial").pt. or double-blind method/ or clinical trials as topic/ or clinical trials, phase i as topic/ or clinical trials, phase ii as topic/ or clinical trials, phase iii as topic/ or clinical trials, phase iv as topic/ or controlled clinical trials as topic/ or randomized controlled trials as topic/ or early termination of clinical trials as topic/ or multicenter studies as topic/ or ((randomi?ed adj7 trial*) or (controlled adj3 trial*) or (clinical adj2 trial*) or ((single or doubl* or tripl* or treb*) and (blind* or mask*))).ti,ab,kw. or ("4 arm" or "four arm").ti,ab,kw. (1558216)
15 11 and 14 (241)
16 cohort studies/ or longitudinal studies/ or follow-up studies/ or prospective studies/ or retrospective studies/ or cohort.ti,ab. or longitudinal.ti,ab. or prospective.ti,ab. or retrospective.ti,ab. (2484429)
17 11 and 16 (632)
18 Case-Control Studies/ or Control Groups/ or Matched-Pair Analysis/ or ((case* adj5 control*) or (case adj3 comparison*) or control group*).ti,ab. (740816)
19 11 and 18 (115)
20 11 not (13 or 15 or 17 or 19) (361)

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KQ3
Database: Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily <1946 to September 06, 2019>
Search Strategy:
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1 Postoperative Period/ and (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery).ti,ab. (16057)
2 ((postsurg$ or post-surg$ or postoperativ$ or post-operativ$) adj3 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery)).ti,ab. (36636)
3 ((after or post) adj3 (arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery) adj12 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery)).ti,ab. (1843)
4 or/1-3 (51984)
5 (arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery).ti,ab. (88696)
6 exp Arthroplasty, Replacement/ (51302)
7 5 or 6 (98008)
8 4 and 7 (4400)
9 limit 8 to yr="2014 -Current" (2234)
10 (systematic review.ti. or meta-analysis.pt. or meta-analysis.ti. or systematic literature review.ti. or this systematic review.tw. or pooling project.tw. or (systematic review.ti,ab. and review.pt.) or meta synthesis.ti. or meta-analy*.ti. or integrative review.tw. or integrative research review.tw. or rapid review.tw. or umbrella review.tw. or consensus development conference.pt. or practice guideline.pt. or drug class reviews.ti. or cochrane database syst rev.jn. or acp journal club.jn. or health technol assess.jn. or evid rep technol assess summ.jn. or

	jbi database system rev implement rep.jn. or (clinical guideline and management).tw. or ((evidence based.ti. or evidence-based medicine/ or best practice*.ti. or evidence synthesis.ti,ab.) and (((review.pt. or diseases category/ or behavior.mp.) and behavior mechanisms/) or therapeutics/ or evaluation studies.pt. or validation studies.pt. or guideline.pt. or pmcbook.mp.)) or (((systematic or systematically).tw. or critical.ti,ab. or study selection.tw. or ((predetermined or inclusion) and criteri*).tw. or exclusion criteri*.tw. or main outcome measures.tw. or standard of care.tw. or standards of care.tw.) and ((survey or surveys).ti,ab. or overview*.tw. or review.ti,ab. or reviews.ti,ab. or search*.tw. or handsearch.tw. or analysis.ti. or critique.ti,ab. or appraisal.tw. or (reduction.tw. and (risk/ or risk.tw.) and (death or recurrence).mp.)) and ((literature or articles or publications or publication or bibliography or bibliographies or published).ti,ab. or pooled data.tw. or unpublished.tw. or citation.tw. or citations.tw. or database.ti,ab. or internet.ti,ab. or textbooks.ti,ab. or references.tw. or scales.tw. or papers.tw. or datasets.tw. or trials.ti,ab. or meta-analy*.tw. or (clinical and studies).ti,ab. or treatment outcome/ or treatment outcome.tw. or pmcbook.mp.))) not (letter or newspaper article).pt. (363544) 11 9 and 10 (163) 12 ("clinical trial" or "clinical trial, phase i" or "clinical trial, phase ii" or clinical trial, phase iii or clinical trial, phase iv or controlled clinical trial or "multicenter study" or "randomized controlled trial").pt. or double-blind method/ or clinical trials as topic/ or clinical trials, phase i as topic/ or clinical trials, phase ii as topic/ or clinical trials, phase iii as topic/ or clinical trials, phase iv as topic/ or controlled clinical trials as topic/ or randomized controlled trials as topic/ or early termination of clinical trials as topic/ or multicenter studies as topic/ or ((randomi?ed adj7 trial*) or (controlled adj3 trial*) or (clinical adj2 trial*) or ((single or doubl* or tripl* or treb*) and (blind* or mask*))).ti,ab,kw. or ("4 arm" or "four arm").ti,ab,kw. (1558216) 13 9 and 12 (525) 14 cohort studies/ or longitudinal studies/ or follow-up studies/ or prospective studies/ or retrospective studies/ or cohort.ti,ab. or longitudinal.ti,ab. or prospective.ti,ab. or retrospective.ti,ab. (2484429) 15 9 and 14 (1131) 16 Case-Control Studies/ or Control Groups/ or Matched-Pair Analysis/ or ((case* adj5 control*) or (case adj3 comparison*) or control group*).ti,ab. (740816) 17 9 and 16 (245) 18 9 not (11 or 13 or 15 or 17) (708) **********
CCRCT via OVID	**KQ1** Database: EBM Reviews - Cochrane Central Register of Controlled Trials <August 2019> Search Strategy: --- 1 (pre-hab$ or prehab$).ti,ab. (259) 2 ((presurg$ or preoperativ$ or pre-surg$ or pre-operativ$) adj3 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery)).ti,ab. (3639) 3 Preoperative Care/mt, rh (0)

	4 ((before or prior to) adj3 (arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery) adj12 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery)).ti,ab. (28) 5 (preoperative care/ or preoperative period/) and (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery).ti,ab. (2054) 6 or/1-5 (5459) 7 (arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery).ti,ab. (15461) 8 exp Arthroplasty, Replacement/ (4038) 9 7 or 8 (15839) 10 6 and 9 (534) 11 limit 10 to yr="2014 -Current" (302) ********** **KQ3** Database: EBM Reviews - Cochrane Central Register of Controlled Trials <August 2019> Search Strategy: --- 1 Postoperative Period/ and (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery).ti,ab. (1778) 2 ((postsurg$ or post-surg$ or postoperativ$ or post-operativ$) adj3 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery)).ti,ab. (13366) 3 ((after or post) adj3 (arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery) adj12 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery)).ti,ab. (70) 4 or/1-3 (14763) 5 (arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery).ti,ab. (15461) 6 exp Arthroplasty, Replacement/ (4038) 7 5 or 6 (15839) 8 4 and 7 (1300) 9 limit 8 to yr="2014 -Current" (749) **********
PsycINFO via OVID	**KQ1** Database: PsycINFO <1806 to September Week 1 2019> Search Strategy: --- 1 (pre-hab$ or prehab$).ti,ab. (38) 2 ((presurg$ or preoperativ$ or pre-surg$ or pre-operativ$) adj3 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery)).ti,ab. (798) 3 Preoperative Care.ti,ab. (20)

	4 ((before or prior to) adj3 (arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery) adj12 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery)).ti,ab. (16) 5 ((preoperative care or preoperative period) and (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery)).ti,ab. (75) 6 or/1-5 (890) 7 (arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery).ti,ab. (1097) 8 Arthroplasty.ti,ab. (384) 9 7 or 8 (1097) 10 6 and 9 (73) 11 limit 10 to yr="2014 -Current" (36) 12 (systematic review.ti. or meta-analysis.pt. or meta-analysis.ti. or systematic literature review.ti. or this systematic review.tw. or pooling project.tw. or (systematic review.ti,ab. and review.pt.) or meta synthesis.ti. or meta-analy*.ti. or integrative review.tw. or integrative research review.tw. or rapid review.tw. or umbrella review.tw. or consensus development conference.pt. or practice guideline.pt. or drug class reviews.ti. or cochrane database syst rev.jn. or acp journal club.jn. or health technol assess.jn. or evid rep technol assess summ.jn. or jbi database system rev implement rep.jn. or (clinical guideline and management).tw. or ((evidence based.ti. or evidence-based medicine/ or best practice*.ti. or evidence synthesis.ti,ab.) and (((review.pt. or diseases category/ or behavior.mp.) and behavior mechanisms/) or therapeutics/ or evaluation studies.pt. or validation studies.pt. or guideline.pt. or pmcbook.mp.)) or (((systematic or systematically).tw. or critical.ti,ab. or study selection.tw. or ((predetermined or inclusion) and criteri*).tw. or exclusion criteri*.tw. or main outcome measures.tw. or standard of care.tw. or standards of care.tw.) and ((survey or surveys).ti,ab. or overview*.tw. or review.ti,ab. or reviews.ti,ab. or search*.tw. or handsearch.tw. or analysis.ti. or critique.ti,ab. or appraisal.tw. or (reduction.tw. and (risk/ or risk.tw.) and (death or recurrence).mp.)) and ((literature or articles or publications or publication or bibliography or bibliographies or published).ti,ab. or pooled data.tw. or unpublished.tw. or citation.tw. or citations.tw. or database.ti,ab. or internet.ti,ab. or textbooks.ti,ab. or references.tw. or scales.tw. or papers.tw. or datasets.tw. or trials.ti,ab. or meta-analy*.tw. or (clinical and studies).ti,ab. or treatment outcome/ or treatment outcome.tw. or pmcbook.mp.))) not (letter or newspaper article).pt. (123871) 13 11 and 12 (5) 14 clinical trials/ or "treatment outcome clinical trial".md. or ((randomi?ed adj7 trial*) or ((single or doubl* or tripl* or treb*) and (blind* or mask*)) or (controlled adj3 trial*) or (clinical adj2 trial*)).ti,ab,id. (97301) 15 11 and 14 (8) 16 cohort studies/ or longitudinal studies/ or follow-up studies/ or prospective studies/ or retrospective studies/ or cohort.ti,ab. or longitudinal.ti,ab. or prospective.ti,ab. or retrospective.ti,ab. (226380) 17 11 and 16 (14) 18 Case-Control Studies/ or Control Groups/ or Matched-Pair Analysis/ or ((case* adj5 control*) or (case adj3 comparison*) or control group*).ti,ab. (95560) 19 11 and 18 (3)

20 11 not (13 or 15 or 17 or 19) (14)

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KQ3
Database: PsycINFO <1806 to September Week 1 2019>
Search Strategy:
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1 ((postsurg$ or postoperativ$ or post-surg$ or post-operativ$) adj3 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery)).ti,ab. (1316)
2 Postoperative Care.ti,ab. (116)
3 ((after or post) adj3 (arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery) adj12 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery)).ti,ab. (96)
4 or/1-3 (1393)
5 (arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery).ti,ab. (1097)
6 Arthroplasty.ti,ab. (384)
7 5 or 6 (1097)
8 4 and 7 (161)
9 limit 8 to yr="2014 -Current" (76)
10 (systematic review.ti. or meta-analysis.pt. or meta-analysis.ti. or systematic literature review.ti. or this systematic review.tw. or pooling project.tw. or (systematic review.ti,ab. and review.pt.) or meta synthesis.ti. or meta-analy*.ti. or integrative review.tw. or integrative research review.tw. or rapid review.tw. or umbrella review.tw. or consensus development conference.pt. or practice guideline.pt. or drug class reviews.ti. or cochrane database syst rev.jn. or acp journal club.jn. or health technol assess.jn. or evid rep technol assess summ.jn. or jbi database system rev implement rep.jn. or (clinical guideline and management).tw. or ((evidence based.ti. or evidence-based medicine/ or best practice*.ti. or evidence synthesis.ti,ab.) and (((review.pt. or diseases category/ or behavior.mp.) and behavior mechanisms/) or therapeutics/ or evaluation studies.pt. or validation studies.pt. or guideline.pt. or pmcbook.mp.)) or (((systematic or systematically).tw. or critical.ti,ab. or study selection.tw. or ((predetermined or inclusion) and criteri*).tw. or exclusion criteri*.tw. or main outcome measures.tw. or standard of care.tw. or standards of care.tw.) and ((survey or surveys).ti,ab. or overview*.tw. or review.ti,ab. or reviews.ti,ab. or search*.tw. or handsearch.tw. or analysis.ti. or critique.ti,ab. or appraisal.tw. or (reduction.tw. and (risk/ or risk.tw.) and (death or recurrence).mp.)) and ((literature or articles or publications or publication or bibliography or bibliographies or published).ti,ab. or pooled data.tw. or unpublished.tw. or citation.tw. or citations.tw. or database.ti,ab. or internet.ti,ab. or textbooks.ti,ab. or references.tw. or scales.tw. or papers.tw. or datasets.tw. or trials.ti,ab. or meta-analy*.tw. or (clinical and studies).ti,ab. or treatment outcome/ or treatment outcome.tw. or pmcbook.mp.))) not (letter or newspaper article).pt. (123871)
11 9 and 10 (13)

	12 clinical trials/ or "treatment outcome clinical trial".md. or ((randomi?ed adj7 trial*) or ((single or doubl* or tripl* or treb*) and (blind* or mask*)) or (controlled adj3 trial*) or (clinical adj2 trial*)).ti,ab,id. (97301) 13 9 and 12 (18) 14 cohort studies/ or longitudinal studies/ or follow-up studies/ or prospective studies/ or retrospective studies/ or cohort.ti,ab. or longitudinal.ti,ab. or prospective.ti,ab. or retrospective.ti,ab. (226380) 15 9 and 14 (24) 16 Case-Control Studies/ or Control Groups/ or Matched-Pair Analysis/ or ((case* adj5 control*) or (case adj3 comparison*) or control group*).ti,ab. (95560) 17 9 and 16 (14) 18 9 not (11 or 13 or 15 or 17) (29) **********
CINAHL via EBSCOhost	**KQ1** Database: CINAHL Plus with Full Text- EBSCOhost Search Strategy: --- S1 TI ((pre-hab$ or prehab$)) OR AB ((pre-hab$ or prehab$)) (34) S2 TI (((presurg$ or preoperativ$ or pre-surg$ or pre-operativ$) N3 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery))) OR AB (((presurg$ or preoperativ$ or pre-surg$ or pre-operativ$) N3 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery))) (0) S3 (MH "Preoperative Education") OR (MH "Preoperative Period+") OR (MH "Preoperative Care+") (24898) S4 TI (((before or prior to) N3 (arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery) N12 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery))) OR AB (((before or prior to) N3 (arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery) N12 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery))) (36) S5 S1 OR S2 OR S3 OR S4 (24943) S6 TI ((arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery)) OR AB ((arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery)) (28923) S7 (MH "Arthroplasty, Replacement+") (31610) S8 S6 OR S7 (40658) S9 S5 AND S8 (1592) S10 S9 Limiters - Published Date: 20140101-20191231 (725) S11 S10 Source Types – Academic Journals (345) S12 (TI (systematic* n3 review*)) or (AB (systematic* n3 review*)) or (TI (systematic* n3 bibliographic*)) or (AB (systematic* n3 bibliographic*)) or (TI (systematic* n3 literature)) or (AB (systematic* n3 literature)) or (TI (comprehensive* n3 literature)) or (AB (comprehensive* n3 literature)) or (TI (comprehensive* n3 bibliographic*)) or (AB (comprehensive* n3 bibliographic*)) or (TI (integrative n3 review)) or (AB (integrative n3 review)) or (JN “Cochrane

	Database of Systematic Reviews") or (TI (information n2 synthesis)) or (TI (data n2 synthesis)) or (AB (information n2 synthesis)) or (AB (data n2 synthesis)) or (TI (data n2 extract*)) or (AB (data n2 extract*)) or (TI (medline or pubmed or psyclit or cinahl or (psycinfo not "psycinfo database") or "web of science" or scopus or embase)) or (AB (medline or pubmed or psyclit or cinahl or (psycinfo not "psycinfo database") or "web of science" or scopus or embase)) or (MH "Systematic Review") or (MH "Meta Analysis") or (TI (meta-analy* or metaanaly*)) or (AB (meta-analy* or metaanaly*)) (99784) S13 S11 AND S12 (40) S14 (MH (Randomized controlled trials)) or (MH (Double-blind studies)) or (MH (Single-blind studies)) or (MH (Random assignment)) or ((TI (comparative or comparison) AND AB (randomly))) or (PT (randomized controlled trial)) (75,221) S15 S11 AND S14 (77) S16 (TI (Cohort)) or (MH (Cohort Studies)) (40847) S17 S11 AND S16 (23) S18 (MH "Case Control Studies+") or (MH "Control Group") or (MH "Matched-Pair Analysis") or (TI (case or cases) n5 TI (control or controls)) OR (AB (case or cases) n5 AB (control or controls)) OR (TI (case or cases) n3 TI (matched)) OR (AB (case or cases) n3 AB (matched)) OR TI (control group*) (86409) S19 S11 AND S18 (24) S20 S11 NOT ((S13 or S15 or S17 or S19)) (263) ********** **KQ3** Database: CINAHL Plus with Full Text- EBSCOhost Search Strategy: --- S1 TI ((((postsurg$ or postoperativ$ or post-surg$ or post-operativ$) N3 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery)))) OR AB ((((postsurg$ or postoperativ$ or post-surg$ or post-operativ$) N3 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery))))) (0) S2 TI (Postoperative Care) OR AB (Postoperative Care) (1405) S3 TI ((after or post) N3 (arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery) N12 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery)) OR AB ((after or post) N3 (arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery) N12 (conditioning or optimis$ or optimiz$ or rehab$ or re-hab$ or care or assess$ or intervention$ or recovery)) (533) S4 S1 OR S2 OR S3 (1930) S5 TI ((arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery)) OR AB ((arthroplast$ or hip replacement$ or knee replacement$ or joint replacement$ or total hip or total knee or total joint$ or orthopedic surgery)) (28923) S6 (MH "Arthroplasty, Replacement+") (31610) S7 S6 OR S7 (40658) S8 S4 AND S7 (606) S9 S8 Limiters - Published Date: 20140101-20191231 (356)

	S10 S19 Source Types – Academic Journals (230) S11 (TI (systematic* n3 review*)) or (AB (systematic* n3 review*)) or (TI (systematic* n3 bibliographic*)) or (AB (systematic* n3 bibliographic*)) or (TI (systematic* n3 literature)) or (AB (systematic* n3 literature)) or (TI (comprehensive* n3 literature)) or (AB (comprehensive* n3 literature)) or (TI (comprehensive* n3 bibliographic*)) or (AB (comprehensive* n3 bibliographic*)) or (TI (integrative n3 review)) or (AB (integrative n3 review)) or (JN "Cochrane Database of Systematic Reviews") or (TI (information n2 synthesis)) or (TI (data n2 synthesis)) or (AB (information n2 synthesis)) or (AB (data n2 synthesis)) or (TI (data n2 extract*)) or (AB (data n2 extract*)) or (TI (medline or pubmed or psyclit or cinahl or (psycinfo not "psycinfo database") or "web of science" or scopus or embase)) or (AB (medline or pubmed or psyclit or cinahl or (psycinfo not "psycinfo database") or "web of science" or scopus or embase)) or (MH "Systematic Review") or (MH "Meta Analysis") or (TI (meta-analy* or metaanaly*)) or (AB (meta-analy* or metaanaly*)) (99784) S12 S10 AND S11 (35) S13 (MH (Randomized controlled trials)) or (MH (Double-blind studies)) or (MH (Single-blind studies)) or (MH (Random assignment)) or ((TI (comparative or comparison) AND AB (randomly))) or (PT (randomized controlled trial)) (75,221) S14 S10 AND S13 (63) S15 (TI (Cohort)) or (MH (Cohort Studies)) (40847) S16 S10 AND S15 (6) S17 (MH "Case Control Studies+") or (MH "Control Group") or (MH "Matched-Pair Analysis") or (TI (case or cases) n5 TI (control or controls)) OR (AB (case or cases) n5 AB (control or controls)) OR (TI (case or cases) n3 TI (matched)) OR (AB (case or cases) n3 AB (matched)) OR TI (control group*) (86409) S18 S10 AND S17 (6) S19 S10 NOT ((S12 or S14 or S16 or S18)) (247) **********

https://clinicaltrials.gov/ct2/results/details?cond=joint+replacement+surgery

Value

We assessed the nomination for value. We considered whether or not the clinical, consumer, or policymaking context had the potential to respond with evidence-based change; and if a partner organization would use this evidence review to influence practice.

Appendix B. Selection Criteria Assessment

Selection Criteria	Assessment
1. Appropriateness	
1a. Does the nomination represent a health care drug, intervention, device, technology, or health care system/setting available (or soon to be available) in the U.S.?	Yes, the nomination relates to the whole care pathway for knee or hip replacement in the U.S. healthcare setting.
1b. Is the nomination a request for an evidence report?	Yes, the nominator is requesting an evidence review to inform health systems about which interventions optimize outcomes for patients undergoing knee or hip replacement surgery.
1c. Is the focus on effectiveness or comparative effectiveness?	Yes, the nominator is interested in the comparative effectiveness of interventions and care pathways for joint replacement surgery.
1d. Is the nomination focus supported by a logic model or biologic plausibility? Is it consistent or coherent with what is known about the topic?	Yes, the nomination is consistent with previous literature which has assessed the effectiveness of interventions and settings for joint replacement surgery in improving outcomes and reducing costs.
2. Importance	
2a. Represents a significant disease burden; large proportion of the population	Yes, in 2009, 438,000 hip and 686,000 knee arthroplasties were performed in the U.S. This number is expected to increase.
2b. Is of high public interest; affects health care decision making, outcomes, or costs for a large proportion of the US population or for a vulnerable population	Yes, the high rate of joint replacement surgery in the U.S., especially in older people, represents a high cost to public and private payers.
2c. Incorporates issues around both clinical benefits and potential clinical harms	Yes, the topic covers the clinical harms and benefits of various care pathways and interventions for knee or hip replacement including patient reported outcomes, readmission rates, length of stay and complications from surgery
2d. Represents high costs due to common use, high unit costs, or high associated costs to consumers, to patients, to health care systems, or to payers	Yes, total joint arthroplasty of the lower extremity was the most prevalent clinical episode participating in the CMS bundled payment model, representing a high cost to public payers and health systems,
3. Desirability of a New Evidence Review/Absence of Duplication	
3. A recent high-quality systematic review or other evidence review is not available on this topic	Yes, seven existing SRs were identified[3, 4, 12, 13, 32-34]. A 2017 AHRQ review[12] on thromboprophylaxis was considered to be duplicative of question 2. Two published SRs[32, 33] and one SR due to be published[34] were considered to be duplicative of Question 4 relating to care pathways. Therefore Question 2 and 4 were not assessed for feasibility. The SRs found for Question 1 only related to knee arthroplasty[3, 4]. One SR[13] was found for Question 3 but only included studies of early rehabilitation (within 48 hours of surgery). Therefore, Questions 1 and 3 were assessed for feasibility of a new evidence product as no

	systematic reviews fully covered the scope of the questions.
4. Impact of a New Evidence Review	
4a. Is the standard of care unclear (guidelines not available or guidelines inconsistent, indicating an information gap that may be addressed by a new evidence review)?	Yes, we are unaware of any guidelines about whether, how and where to provide pre-habilitation or rehabilitation for joint replacement surgery. There are existing evidence-based guidelines from the American Academy of Orthopaedic Surgeons (AAOS) for surgical management of osteoarthritis of the knee (2016) and hip (2017). Both guidelines recommend post-operative rehabilitation and pre-habilitation but note the evidence on these topics is limited. These guidelines did not consider the setting of the intervention or the specific interventions which are most effective. These issues were important to the nominator and may also be of interest to the AAOS and the American Physical Therapy Association (APTA) who endorsed the guideline for osteoarthritis of the hip.
4b. Is there practice variation (guideline inconsistent with current practice, indicating a potential implementation gap and not best addressed by a new evidence review)?	Yes, according to the nominator, health systems vary with the extent to which they provide pre-habilitation and rehabilitation. There are wide differences in quality and cost among institutions and surgeons who perform these procedures. The setting for these processes also varies. For example, home, hospital or ambulatory setting. The effect of these variations on patient outcomes, health service use and cost is unknown.
5. Primary Research	
5. Effectively utilizes existing research and knowledge by considering: - Adequacy (type and volume) of research for conducting a systematic review - Newly available evidence (particularly for updates or new technologies)	For Question 1, we identified a total of 7 primary studies. The identified primary studies included three studies of patients receiving either hip or knee replacement who participated in muscle training[5], physiotherapy [6], or tele-pre-habilitation[7], respectively. The other four studies included only knee replacement patients and evaluated quadricep exercise [8], pre-habilitation influences on psychological well-being following surgery [9], a home exercise program [10], and strength training [11], respectively. For Question 3, We identified a total of 16 primary studies. Three of these studies were conducted with hip replacement patients[14-16], one in both patients of hip and knee surgery [17], and the remainder in knee surgery patients [18-29]. The studies that included hip replacement patients evaluated arm exercise[15], comprehensive exercise[30], telerehabilitation[31], and a strength program [14]. The estimated number of primary literature available for a systematic review of these two questions is 238. The size of the proposed review is large.

6. Value	
6a. The proposed topic exists within a clinical, consumer, or policy-making context that is amenable to evidence-based change	Yes, this topic will inform health systems on the optimal clinical pathways for knee or hip replacement surgery to achieve good patient outcomes and potentially reduce costs
6b. Identified partner who will use the systematic review to influence practice (such as a guideline or recommendation)	Yes, the nomination arose from the Learning Health System Panel. Health systems can use the findings of the review to implement or de-implement the interventions which provide the most value and benefit for patients undergoing major joint replacement. The review could also be used to decide on the most effective setting of care for pre-habilitation and rehabilitation.

Abbreviations: AHRQ=Agency for Healthcare Research and Quality; CMS=Centers for Medicare and Medicaid Services; SR=systematic review