

Same-day joint replacement surgery

18 November 2021

Evidence check

Evidence check question

What is the evidence on outcomes, including associated factors, relating to same-day joint replacement surgery?

Summary

- Overall, same-day joint replacement surgery has similar or better outcomes in terms of reoperation rates, readmissions, transfusions, mortality, and patient-reported outcomes. However, there is evidence of higher complication rates.

In brief

- Ten systematic reviews were included. All these systematic reviews were published within the past five years, with seven being published in the past two years.
- Same-day joint replacement surgery was also referred to as outpatient surgery in the included studies.
- **Reoperation rate:** mixed findings across systematic reviews.
 - One systematic review concluded that the rates of reoperation were similar between same-day surgery and inpatient surgery.¹
 - One meta-analysis study found that the outpatient group had lower rates of revision compared to the inpatient group.²
 - In one systematic review, the reoperation rate was similar for total hip arthroplasty. However for total knee arthroplasty, it increased in the outpatient group compared to the inpatient group.³
 - Reasons for reoperation included fixation or revision of the implant.¹
- **Readmission rate:** most studies reported a similar readmission rate between the outpatient and inpatient joint-replacement pathways.²⁻⁹
- **Transfusion rate:** reduced rates of transfusion were associated with the outpatient procedure.³
- **Total complications:** mixed findings across systematic reviews.
 - A systematic review and meta-analysis reported that outpatient total knee arthroplasty led to a significantly higher overall complication rate than inpatient procedures (16.1% versus 10.5%).⁴
 - One recent systematic review found that there was no difference for the overall complication rates in the outpatient joint arthroplasty pathway compared to inpatient

- pathway. Total hip arthroplasty patients who were in the outpatient pathway showed significantly reduced adverse events.⁸
- One systematic review found that overall, the complication rates remained consistently low with the outpatient procedures; noting that the complication rates varied depending on the follow-up period.¹⁰ An earlier systematic review from 2016 reported that the complication rate ranged from 0% to 25.3% in the acute phase and 0% to 9.3% over the long term.⁷
 - **Major complications:** mixed findings across systematic reviews.
 - One systematic review and meta-analysis reported significantly higher rates of major complications associated with outpatient procedures versus inpatient (49% versus 33%).⁴
 - Another systematic review found that there were no significant differences in serious adverse events for the outpatient surgery group compared to inpatient.⁸
 - Most frequently reported major complications include heart attacks, infections, deep vein thrombosis, fractures and mobilisation of the prosthesis.¹
 - One meta-analysis found that inpatient procedures led to a significantly higher rate of deep vein thrombosis than outpatient procedures,² while the other found no difference.³ There was no difference in the rate of infection,^{2, 3} pneumonia,³ and wound complications.³
 - Another systematic review found that same-day discharge had a lower risk of infection, but a higher risk of deep vein thrombosis, renal insufficiency, and renal failure.⁹
 - **Mortality:** a significantly lower rate of mortality in the outpatient group compared to the inpatient group for total knee arthroplasty was reported in one systematic review based on data extracted from three individual studies.² In two of these included studies, outpatient patients were younger and/or with a lower rates of comorbidities.^{11, 12} Another systematic review found no significant difference between same-day discharge and inpatient pathways.⁹
 - **Patient reported outcomes:** favourable or similar outcomes for outpatient pathway compared to inpatient were reported across systematic reviews.⁸
 - Patient satisfaction was high among those who underwent same-day surgery (96%)⁵ and between 80% to 96% of patients reported they would choose outpatient procedures again.¹
 - Harris Hip Score (HHS): excellent or fair scores at follow-up and an improvement compared to inpatient procedure were reported across studies.^{6, 7}
 - Visual analogue pain scale (VAS) score: improved significantly for outpatient total hip arthroplasty.⁶
 - Numeric Rating Scale (NRS) at rest and during activity improved significantly for outpatient total hip arthroplasty.⁶
 - 12-Item Short Form Survey (SF-12): improved for both the physical and mental scores compared to inpatient.⁷
 - **Economic analysis:** reduced overall cost compared to inpatient procedure was reported.^{7, 8}

Limitations

Only systematic review studies relevant to hip or knee joint replacement were included.

Background

Same-day joint replacement surgery, also referred to as outpatient surgery, is becoming more common and feasible due to the advancement in the surgical and pain management techniques and enhanced pre-operative and postoperative care and planning.¹

Methods (Appendix)

Peer-reviewed articles were identified through PubMed. The search terms used are outlined in the Appendix. Grey literature search was conducted using Google.

Results

Table 1

Note some of the information has been copied directly from the source material.

Source	Summary
Peer reviewed sources	
<p>Safety and efficacy of outpatient hip and knee arthroplasty: a systematic review with meta-analysis</p> <p>Bemelmans, et al. 2021⁸</p>	<ul style="list-style-type: none"> • Study type: systematic review • Methods: <ul style="list-style-type: none"> ○ Review question/aim: assess the safety and efficacy of outpatient joint arthroplasty (OJA) pathways compared to inpatient pathways ○ Inclusion criteria: Randomised control trials and observational studies, studies comparing safety and/or efficacy outcomes, no date restrictions, English-language only ○ Exclusion criteria: studies reporting on patients undergoing revision surgery, bilateral arthroplasty, or arthroplasty due to traumatic conditions, strictly descriptive studies ○ Search date: December 2019 • Results: <ul style="list-style-type: none"> ○ 41 studies in two categories: outpatient surgery (OS) and semi-outpatient surgery (SOS) ○ Complications: <ul style="list-style-type: none"> ▪ no significant differences for overall complication rates in OJA pathways compared to inpatient pathways ▪ in the OS group, only total hip arthroplasties (THAs) showed significantly less adverse events in outpatient pathways compared to inpatient pathways; there were no significant differences in adverse events for SOS studies ▪ no significant differences in serious adverse events for both OS and SOS studies ○ Readmission rates: no significant differences for readmission rates in outpatient pathways (OS and SOS) compared to inpatient pathways ○ Same-day discharge (SDD) success rate: <ul style="list-style-type: none"> ▪ average 92% of outpatients in OS studies successfully discharged on day of surgery ▪ Total knee arthroplasties (TKAs) and unicompartmental knee arthroplasties (UKAs) average SDD success rate of 95% ▪ THAs 86% successfully discharge on day of surgery ○ PROMS: postoperative improvement was similar between outpatient pathways and inpatient pathways for all PROMs ○ Costs: a mean cost reduction was found in favour of outpatient pathways but with a large range

Source	Summary
Peer reviewed sources	
	<p>Conclusion: OJA pathways are safe and effective compared to inpatient pathways with a potential reduction of costs.</p>
<p>Same-day discharge arthroplasty has a higher overall complications rate than fast-track arthroplasty: a systematic review and meta-analysis</p> <p>Li, et al. 2021⁹</p>	<ul style="list-style-type: none"> • Study type: systematic review and meta-analysis • Methods: <ul style="list-style-type: none"> ○ Review question/aim: to compare mortality, readmission, and complications in same-day discharge for total joint arthroplasty (TJA) and inpatient TJA ○ Inclusion criteria: compared same-day discharge and inpatient TJA, primary TKA or THA, cohort design, appropriate matching method, data of complications, readmissions, reoperations etc., and ≥ 20 patients ○ Exclusion criteria: studies that presented duplicate data and outcomes, shoulder and ankle arthroplasty ○ Search date: June 2020 • Results: <ul style="list-style-type: none"> ○ 14 studies including 222,766 patients (10,062 same-day discharge TJAs and 212,704 inpatient TJAs) ○ Mortality: no significant difference between same-day discharge and inpatient TJA ○ Readmission: rates were similar across the two groups ○ Complications: <ul style="list-style-type: none"> ▪ in the traditional inpatient subgroup, there was a similar risk of overall complications in same-day discharge and inpatient TJA; however, in the fast-track subgroup, same-day discharge had a significantly higher risk compared to inpatient TJA ▪ same-day discharge group had lower risk of post-operative infection, but higher risk of deep vein thrombosis (DVT), renal insufficiency, and renal failure <p>Conclusion: Overall, same-day discharge TJA is safe, however more complications were detected in same-day discharge TJA compared to fast-track TJA.</p>
<p>Outpatient Total Knee Arthroplasty: A Meta-Analysis</p> <p>Migliorini, et al. 2021²</p>	<ul style="list-style-type: none"> • Study type: systematic review and meta-analysis • Methods: <ul style="list-style-type: none"> ○ Review question/aim: to compare patient reported outcome measures (PROMs), infection, readmission, revision, deep vein thrombosis (DVT), and mortality rates of outpatient versus inpatient TKA ○ Inclusion criteria: All the clinical trials comparing outpatient versus inpatient (>2 days) TKA were considered. Level I to IV of evidence were considered ○ Exclusion criteria: Reviews, opinions, letters, and editorials were not considered. Animals, in vitro, biomechanics,

Source	Summary
Peer reviewed sources	
	<p>computational, and cadaveric studies were also not eligible Studies which reported data on patients undergoing revision TKA were not included, nor were studies including patients discharged between one and two days</p> <ul style="list-style-type: none"> ○ Search date: August 2021 <ul style="list-style-type: none"> ● Results: <ul style="list-style-type: none"> ○ 10 studies with a total of 159,219 TKAs ○ The outpatient group evidenced a greater Oxford knee score ($p = 0.01$) ○ The inpatient group demonstrated a greater rate of revision ($p = 0.03$), mortality ($p = 0.003$), and DVT ($p = 0.005$) ○ No difference was found in the rate of readmission ($p = 0.3$) and infection ($p = 0.4$) <p>Conclusion: With regards to the endpoints evaluated in this meta-analysis, current evidence does not support outpatient TKA. However, given the limited data available for inclusion and the overall poor quality of the included articles, no reliable conclusion can be inferred. Further high-quality clinical trials with clear eligibility criteria are required.</p>
<p>Management of patients undergoing same-day discharge primary total hip and knee arthroplasty</p> <p>Bodrogi, et al. 2020¹</p>	<ul style="list-style-type: none"> ● Study type: review study with the systematic search strategy ● Methods: <ul style="list-style-type: none"> ○ Review question/aim: review observational and interventional research on the effectiveness of same-day discharge total hip and total knee arthroplasty ○ Inclusion criteria: written in English, clinical trials, meta-analyses, prognostic studies, observational studies and retrospective studies ○ Exclusion criteria: not mentioned ○ Same-day discharge arthroplasty refers to protocols that see patients discharged home on the same calendar day as the procedure, usually within four to eight hours after the end of the surgery ○ Search date: December 2018 ● Results: <ul style="list-style-type: none"> ○ Number of included studies: not mentioned ○ The rates for re-operation, hospital admissions, emergency department visits, acute office visits, serious adverse events, function scores after discharge including pain scores were similar between inpatient or same-day discharge procedures in the included studies ○ Patient satisfaction: between 80% and 96% of patients report that they would have outpatient arthroplasty again.

Source	Summary
Peer reviewed sources	
	<p>influential factors for patients favouring an outpatient procedure include:</p> <ul style="list-style-type: none"> ▪ previous negative experiences in the hospital ▪ fear of hospital-acquired illnesses ▪ a preference for recovering in the comfort and privacy <p>Conclusion: Through improvements in surgical technique and perioperative care, same-day discharge total joint arthroplasty has become a safe procedure for a subset of patients, with outcomes and patient satisfaction equivalent to standard inpatient protocols.</p>
<p>Outpatient total knee arthroplasty leads to a higher number of complications: a meta-analysis</p> <p>Bordoni, et al. 2020⁴</p>	<ul style="list-style-type: none"> • Study type: systematic review and meta-analysis • Methods: <ul style="list-style-type: none"> ○ Aim: to quantitatively evaluate and compare complication and readmission rates in outpatient (patient discharged on the same day of the intervention) and inpatient TKAs ○ Inclusion criteria: written in English and focused on the comparison between outpatient and inpatient TKAs in terms of complication and readmission rates ○ Exclusion criteria: Review articles, meta-analyses, case reports, surgical technique articles, editorials, letters to the editor, preclinical studies, and studies not available in English ○ Pathway element: not mentioned ○ Search date: July 2020 • Results: <ul style="list-style-type: none"> ○ Eight studies were included; A total of 212,632 patients were considered ○ Complications: all included articles except one reported complications. Overall complication rate was 10.7% <ul style="list-style-type: none"> ▪ Compared to inpatient procedures, outpatient procedures had a significantly higher complication rate (10.5% versus 16.1%) ▪ Two included studies distinguished complications as major or minor <ul style="list-style-type: none"> • Compared to inpatient procedures, outpatient procedures reported more major complications (33% versus 49%) • Most frequently reported major complications include heart attacks, infections requiring readmission, thrombosis, fractures, and mobilisation of the prosthesis ○ Readmission: the overall readmission rate was 5.6% <ul style="list-style-type: none"> ▪ The readmission rate for inpatient procedures is similar to outpatient procedures (5.9% versus 4.9%)

Source	Summary
Peer reviewed sources	
	<ul style="list-style-type: none"> ○ Death: Only three studies reported the number of deaths, which was 0 <p>Conclusion: outpatient TKAs lead to a slightly higher number of complications compared to inpatient TKAs. However, no difference was found in the readmission rate.</p>
<p>Is Outpatient Arthroplasty Safe? A Systematic Review</p> <p>Jaibaji, et al. 2020¹⁰</p>	<ul style="list-style-type: none"> ● Study type: systematic review ● Methods: <ul style="list-style-type: none"> ○ Review question/aim: to assess the complication and reoperation rates of outpatient arthroplasty. The secondary purpose is to examine the protocols of institutions with outpatient programs ○ Inclusion criteria: level I-IV evidence, cohort of a minimum of 50 patients, a minimum of 30-day follow-up, reporting on complications involving either THA, TKA, or UKA, same day defined as discharge on the same calendar day of the operation and published after January 1, 2009 ○ Exclusion criteria: studies which examined joint registries or other large databases ○ Search date: not mentioned ● Results: <ul style="list-style-type: none"> ○ Nineteen studies with a total of 6519 operations ○ Barriers to successful discharge: Nausea/dizziness was the most common reason ○ Complication rate: consistently low throughout all included studies ○ Reoperation rate within up to 90 days: mean 1.63% across studies who reported on it ○ Readmission rates within 90 days: mean 2.01% across studies who reported on it ○ Unplanned episode of care not resulting in readmission with 30 days: range 0.7% to 9.5% ○ Unplanned episode of care not resulting in readmission with 90 days: range 0.95% to 11.4% <p>Conclusion: The studies included demonstrate a consistently low readmission and reoperation rate. However, there are several confounding factors that make it difficult to draw firm conclusions from the data.</p>
<p>Outcomes of outpatient total hip arthroplasty: a systematic review</p> <p>Sharpia, et al. 2021⁶</p>	<ul style="list-style-type: none"> ● Study type: systematic review ● Methods: <ul style="list-style-type: none"> ○ Review question/aim: to analyse outcomes following outpatient THA ○ Inclusion criteria: included patient reported outcomes following outpatient THA

Source	Summary
Peer reviewed sources	
	<ul style="list-style-type: none"> ○ Exclusion criteria: studies which did not differentiate total hip arthroplasty (THA) and total knee arthroplasty (TKA) outcomes were excluded ○ Search date: April 2019 ● Results: <ul style="list-style-type: none"> ○ Nine studies with a total of 683 TKA ○ Patient reported outcomes: <ul style="list-style-type: none"> ▪ Harris Hip Score (HHS): three out of four studies reported excellent scores by six weeks postoperatively; one reported fair scores for both the inpatient and outpatient patients with no difference between groups; On average, at latest follow-up, all patients achieved the minimal clinically important difference (MCID) and patient acceptable symptomatic state (PASS) for Harris Hip Score ○ Pain following surgery: visual analogue pain scale (VAS) scores improved significantly in two studies; Numeric Rating Scale (NRS) at rest and during activity improved significantly in one study; and narrative analogue scale (NAS) pain decreased significantly in one study ○ Discharge details: 88.1% discharged on the same day of surgery ○ Readmissions: Out of the six studies reporting on readmissions rate, there were two (0.34%) readmissions within three months of surgery due to seroma and periprosthetic fracture that occurred because of a motorcycle accident. One study found no difference between outpatient and inpatient THA groups <p>Conclusion: In patients with no significant comorbidities, outpatient THA leads to favourable outcomes as well as low readmission rates in the short term.</p>
<p>Comparison of outpatient versus inpatient total hip and knee arthroplasty: A systematic review and meta-analysis of complications</p> <p>Xu, et al. 2019³</p>	<ul style="list-style-type: none"> ● Study type: systematic review and meta-analysis ● Methods: <ul style="list-style-type: none"> ○ Review question/aim: to compare the post-operative complication rates of outpatient and inpatient TJA with subgroup analysis of TKA and THA ○ Inclusion criteria: compared inpatient and outpatient cohorts receiving TKA and/or THA and reported post-operative complications at any follow-up length ○ Exclusion criteria: reported unicompartmental knee replacement or hip resurfacing outcomes ○ Search date: October 2018

Source	Summary
Peer reviewed sources	
	<ul style="list-style-type: none"> • Results: <ul style="list-style-type: none"> ○ Seven studies with a total of 176,179 inpatient patients and 1613 outpatient patients Total joint arthroplasty ○ Total complications: no difference between outpatient and inpatient groups <ul style="list-style-type: none"> ▪ DVT: no difference ▪ UTI: no difference ▪ pneumonia: no difference ▪ wound complications: no difference ○ Major complications: no difference ○ Readmission: no difference ○ Reoperation rate: an increase for outpatient (RR: 1.60, 95% CI: 1.08 to 2.36, p=0.02) ○ Transfusion rate: a reduction in transfusion rate for outpatient (RR: 0.61, 95% CI: 0.37 to 1.00, p=0.05) ○ Pathway elements: The definition of outpatient was same-day discharge in five studies and within 23 hours of the procedure in two studies Total knee arthroplasty <ul style="list-style-type: none"> ▪ Total complications: no difference between outpatient and inpatient groups ▪ UTI: no difference ▪ pneumonia: no difference ▪ wound complications: no difference ○ Major complications: no difference ○ Readmission: no difference ○ Reoperation rate: an increase for outpatient (RR: 1.76, 95% CI: 1.07 to 2.92, p=0.03) ○ Transfusion rate: a reduction in transfusion rate for outpatient (RR: 0.62, 95% CI: 0.46 to 0.84, p=0.002) Total hip arthroplasty ○ Total complications: no difference between outpatient and inpatient groups <ul style="list-style-type: none"> ▪ UTI: no difference ▪ pneumonia: no difference ▪ wound complications: no difference ○ Major complications: no difference ○ Readmission: no difference ○ Reoperation rate: no difference ○ Transfusion rate: no difference <p>Conclusion: Outpatient TJA had comparable total complication rates to inpatient TJA. Along with that outpatient TJA can significantly reduce costs to healthcare systems but careful pre-operative patient selection is required to optimise outcomes.</p>

Source	Summary
Peer reviewed sources	
<p>The Shift to Same-Day Outpatient Joint Arthroplasty: A Systematic Review</p> <p>Hoffmann, et al. 2018⁵</p>	<ul style="list-style-type: none"> • Study type: systematic review • Methods: <ul style="list-style-type: none"> ○ Review question/aim: to test hypothesis that outpatient arthroplasty would demonstrate higher readmission and complication rates than inpatient arthroplasty ○ Inclusion criteria: peer-reviewed clinical studies of level I-IV evidence, case series including at least 50 patients, involving patients undergoing total or partial hip or knee arthroplasty procedures, inclusion of an established institutional same-day or outpatient protocol, reporting the number of patients discharged same day by this protocol as well as perioperative complications and unplanned readmission ○ Exclusion criteria: literature review or expert opinion, publication in non-English language, published before the year 2000, reporting “outpatient” as a proxy for short hospital length of stay without planned same-day surgery, or subgroup analysis of a larger population isolating patients incidentally discharged home the same day ○ Search date: June 2016 • Results: <ul style="list-style-type: none"> ○ Ten studies with a total of 1009 patients. ○ Only one study reported one major complication (0.10%) ○ Reoperation: 20 patients (1.98%) required reoperation, nine (45%) of which required fixation or revision of implants ○ Minor complications: superficial infections or suture reactions, urinary tract infections, nonoperative hematoma, and in one case a peroneal nerve palsy which resolved with observation ○ Common reasons for failure to discharge pain, nausea, or hypotension ○ Readmission in the 90 days: nine patients were readmitted, eight occurred within the first 30 days ○ Functional assessment scores: mixed results, either no difference or significant improvement ○ Patient satisfaction: (citing an included study) majority (96%) satisfied with the decision to undergo same-day surgery and would choose it again; 87% felt they had more confidence and accelerated rehabilitation; 94% would recommend it to others <p>Conclusion: the hypothesis that outpatient arthroplasty would yield higher rates of readmission and complication did not materialise.</p>
<p>Outpatient total hip arthroplasty, total knee arthroplasty, and</p>	<ul style="list-style-type: none"> • Study type: systematic review • Methods:

Source	Summary
Peer reviewed sources	
<p>unicompartmental knee arthroplasty—a systematic review of the literature</p> <p>Pollock, et al. 2016⁷</p>	<ul style="list-style-type: none"> ○ Review question/aim: to examine the evidence regarding the safety and feasibility of performing THA, TKA, or UKA on an outpatient basis ○ Inclusion criteria: (1) a study population undergoing THA, TKA, or UKA, (2) discharge on the day of surgery, and (3) inclusion of at least 1 reported outcome ○ Exclusion criteria: no full text or not in English ○ Search date: November 2014 <ul style="list-style-type: none"> ● Results: <ul style="list-style-type: none"> ○ 17 studies with a total of 79,500 patients were included ○ Complication rate: low, ranging from 0% to 25.3% in the acute phase and 0% to 9.3% over the long term; comparative studies did not show a difference between outpatient and inpatient groups after surgery ○ Readmission rate: one study found no difference between outpatient and inpatient TKA groups at 90 days, one year, and two years; two studies found no difference for THA patients ○ HHS score: two studies found an improvement ○ SF-12: one study reported an improvement in both the physical and mental scores ○ Economic analysis: three studies found less overall cost and total average charge for the outpatient procedure compared to inpatient <p>Patient selection criteria: Most studies employed a selected population, with restrictions on age (65 years old), BMI, and the severity of comorbidities. Six studies involved an unselected population, with the inclusion of any patient undergoing a joint replacement who was discharged on the same day as the surgery.</p> <p>Conclusion: In selected patients, outpatient THA, TKA, and UKA can be performed safely and effectively.</p>

Appendix

PubMed search terms

Search terms

((("joint"[Title/Abstract] AND ("arthroplasty"[Title/Abstract] OR "replacement"[Title/Abstract])) OR ("hip"[Title/Abstract] AND ("arthroplasty"[Title/Abstract] OR "replacement"[Title/Abstract]))) OR

("knee"[Title/Abstract] AND ("arthroplasty"[Title/Abstract] OR "replacement"[Title/Abstract])) OR "arthroplasty"[MeSH Terms] AND (((("same-day"[Title/Abstract] OR "same-day"[Title/Abstract]) AND "discharge*"[Title/Abstract]) OR ("short-stay"[Title/Abstract] OR "short-stay"[Title/Abstract] OR "day-case"[Title/Abstract] OR "day-case"[Title/Abstract])) AND 2010/01/01:3000/12/31[Date - Publication] AND ("humans"[MeSH Terms] AND "english"[Language])) AND ((humans[Filter]) AND (english[Filter]))

170 hits on 22 October 2021

((("joint"[Title/Abstract] AND ("arthroplasty"[Title/Abstract] OR "replacement"[Title/Abstract])) OR ("hip"[Title/Abstract] AND ("arthroplasty"[Title/Abstract] OR "replacement"[Title/Abstract])) OR ("knee"[Title/Abstract] AND ("arthroplasty"[Title/Abstract] OR "replacement"[Title/Abstract])) OR "arthroplasty"[MeSH Terms] AND (((("same-day"[Title/Abstract] OR "same-day"[Title/Abstract]) AND "discharge*"[Title/Abstract]) OR ("short-stay"[Title/Abstract] OR "short-stay"[Title/Abstract] OR "day-case"[Title/Abstract] OR "day-case"[Title/Abstract] OR "out-patient"[Title/Abstract] OR "outpatient"[Title/Abstract])) AND 2010/01/01:3000/12/31[Date - Publication]) AND ((humans[Filter]) AND (english[Filter]))

833 hits on 22 October 2021

Google search terms

Same-day joint replacement, total knee/hip arthroplasty, review

Inclusion and exclusion criteria

Inclusion	Exclusion
<ul style="list-style-type: none"> Published in English Published since 2010 Population: patients undergoing joint replacement (all joints) Intervention: same-day treatment only (admitted and discharged within the 24-hour timeframe) Comparison: traditional protocols for joint replacement surgery Outcomes: re-operations, hospital readmissions, emergency department visits, rate or severity of adverse events, cost-effectiveness, patient-reported outcomes or any other relevant outcomes that are reported by the included studies Study types: <ul style="list-style-type: none"> Review studies with systematic search strategy and methods 	<ul style="list-style-type: none"> Not in English Published prior to 2010 Studies that do not meet PICOS criteria Letters, comments, editorials, study protocols, conference abstracts Resurfacing Risk assessment tools

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