Hip and Knee Replacements in Canada

CJRR Annual Report

2021–2022

Canadian Institute for Health Information
Institut canadien d'information sur la santé

Production of this document is made possible by financial contributions from Health Canada and provincial and territorial governments. The views expressed herein do not necessarily represent the views of Health Canada or any provincial or territorial government.

Unless otherwise indicated, this product uses data provided by Canada's provinces and territories.

Canadian Institute for Health Information
495 Richmond Road, Suite 600
Ottawa, Ontario K2A 4H6
Phone: 613-241-7860
Fax: 613-241-8120
cihi.ca
copyright@cihi.ca

ISBN 978-1-77479-222-3 (PDF)

How to cite this document:
Canadian Institute for Health Information. *Hip and Knee Replacements in Canada: CJRR Annual Report, 2021–2022*. Ottawa, ON: CIHI; 2023.

Cette publication est aussi disponible en français sous le titre *Arthroplasties de la hanche et du genou au Canada : rapport annuel du RCRA, 2021-2022*.
ISBN 978-1-77479-223-0 (PDF)

Table of contents

List of figures

List of tables

Overall key findings

- During the early stages of the COVID-19 pandemic, many planned surgeries were cancelled to free up beds for COVID-19 patients. This resulted in fewer hip and knee replacements being performed in Canada. In 2021–2022, 117,078 hip and knee replacements were performed in Canada, which was 5.9% more than the previous year but still fewer than before the pandemic.
- Most hip and knee replacements are performed in an inpatient setting; however, there has been a shift in recent years in Canada toward doing more of these surgeries in an outpatient setting (i.e., as day surgeries). In 2021–2022, 15.6% of hip and knee replacements done to treat osteoarthritis were performed as day surgeries, compared with 8.2% in 2020–2021, 1.9% in 2019–2020 and 0.7% in 2018–2019.
- Based on data from Ontario, Manitoba and Alberta, the vast majority of patients showed gains in their self-reported outcomes and responded that they felt satisfied 1 year after their hip or knee replacement, which shows the effectiveness of these surgeries at improving mobility and quality of life.

Introduction

Hip and knee replacements aim to improve mobility and quality of life for patients, particularly those who have spent years managing debilitating pain from osteoarthritis (OA). Even during the early stages of the COVID-19 pandemic — when many planned surgeries were cancelled to free up hospital beds for COVID-19 patients — hip and knee replacements remained among the highest-volume inpatient surgeries in Canada.[1]

This report from the Canadian Institute for Health Information (CIHI) provides the latest available statistics on hip and knee replacements performed in Canadian public hospitals in 2021–2022 for patients age 18 and older. Data at the national and jurisdictional levels is included, as are risk curves for revisions (repeat surgeries) based on factors such as age, type of procedure and prosthesis characteristics. Data sources include CIHI's Discharge Abstract Database–Hospital Morbidity Database (DAD-HMDB), National Ambulatory Care Reporting System (NACRS) and Canadian Joint Replacement Registry (CJRR). The report also includes patient-reported outcome measures (PROMs) based on data collected directly from patients who had hip or knee replacements in Ontario, Manitoba and Alberta.

Most hip and knee replacements are performed in an inpatient setting; however, there has been a shift in recent years toward doing more of these surgeries in an outpatient setting (i.e., as day surgeries). This year's report includes a section on hip and knee replacements performed as day surgeries and examines volume trends, patient characteristics and outcomes.

Annual statistics for hip and knee replacements, 2021–2022

- 58,635 hip and 58,443 knee replacements were performed in 2021–2022. These numbers are 6.0% and 5.7% higher, respectively, compared with 2020–2021 but still lower than before the COVID-19 pandemic. Using the average year-over-year increases in the pre-pandemic period,[i] we estimate that a total of 91,600 surgeries were not performed over the past 3 years, as would have been expected.
- As in previous years, a higher proportion of patients were female than were male, with 57% of hip replacements and 58% of knee replacements performed on female patients.[ii]
- Most patients were age 65 and older. Among hip replacement patients, the most common age group was age 75 and older (female patients, 44.0%; male patients, 31.6%). For knee replacements, the most common age group was 65 to 74 (female patients, 41.2%; male patients, 42.3%).
- The most common diagnosis for primary hip and knee replacement patients was OA, at 69.3% and 99.4%, respectively.
- There were 4.6% more hip and knee revisions performed compared with the previous year (8,942 in 2021–2022 versus 8,548 in 2020–2021).
- The top 3 reasons for hip and knee revisions combined were infection (32.5%), instability (14.3%) and aseptic loosening (14.0%).
- On average, patients undergoing inpatient revision surgery stayed in hospital more than twice as long as patients undergoing inpatient primary surgery (9.1 days versus 3.9 days, respectively).
- The average estimated hospital cost (including physician costs and excluding rehabilitation costs) for a hip or knee replacement in 2021–2022 was $11,979, which is similar to the cost in 2020–2021 ($11,945).
- The average estimated hospital cost (including physician costs and excluding rehabilitation) for an inpatient surgery was $12,402, which was 32.1% higher than the average estimated hospital cost for a day surgery ($9,387).

---

i. From 2016–2017 to 2018–2019, there was an average annual increase of 5.0% for hip replacements and 5.5% for knee replacements.

ii. CIHI uses the reporting categories *female* and *male* for both gender identity and sex at birth. This facilitates easier cross-tabulation to determine whether an individual's current gender identity does or does not match their assigned sex at birth (e.g., they may identify as transgender or gender non-conforming and experience inequalities in their health care and outcomes). CIHI believes the approach of using *female* and *male* as reporting categories is clearer than *man*/*woman*/*boy*/*girl* because it applies across all age groups and is supported in the literature. This approach aligns with Statistics Canada and the Treasury Board.

- The average estimated hospital cost (including physician costs and excluding rehabilitation) for a revision surgery was $19,830 — almost 73.0% higher than for a primary joint surgery ($11,464).
- Over $1.26 billion (including physician costs and excluding rehabilitation costs) was spent on hip and knee replacement surgeries in Canada in 2021–2022, compared with $1.20 billion the previous year.
- For results specific to hip or knee replacements, see Data tables.
- Patients treated with cemented hemiarthroplasty after hip fracture had a lower risk of revision than patients treated with hemiarthroplasty with cementless fixation. This finding holds true when controlling for age, sex and surgeon volume.[iii]
- For knee replacements, there was no difference in revision risk for total knee replacement regardless of the type of fixation used (cemented, hybrid, cementless).
- For all revision risk results, see Revision risk curves section.

Emergence of day surgery joint replacements

To explore characteristics and outcomes of patients who had a hip or knee replacement as a day surgery, we identified hip and knee replacements performed as day surgeries[iv] in Canadian public hospitals from April 1, 2015, to March 31, 2021. To determine the proportion of day surgeries performed out of all hip and knee replacements, we also identified those performed as inpatient surgeries during the same period. Since hip and knee replacements performed to treat OA are primarily planned while replacements done to treat hip fractures are urgent care, we limited this analysis on day surgeries to replacements with OA as the main diagnosis.[v]

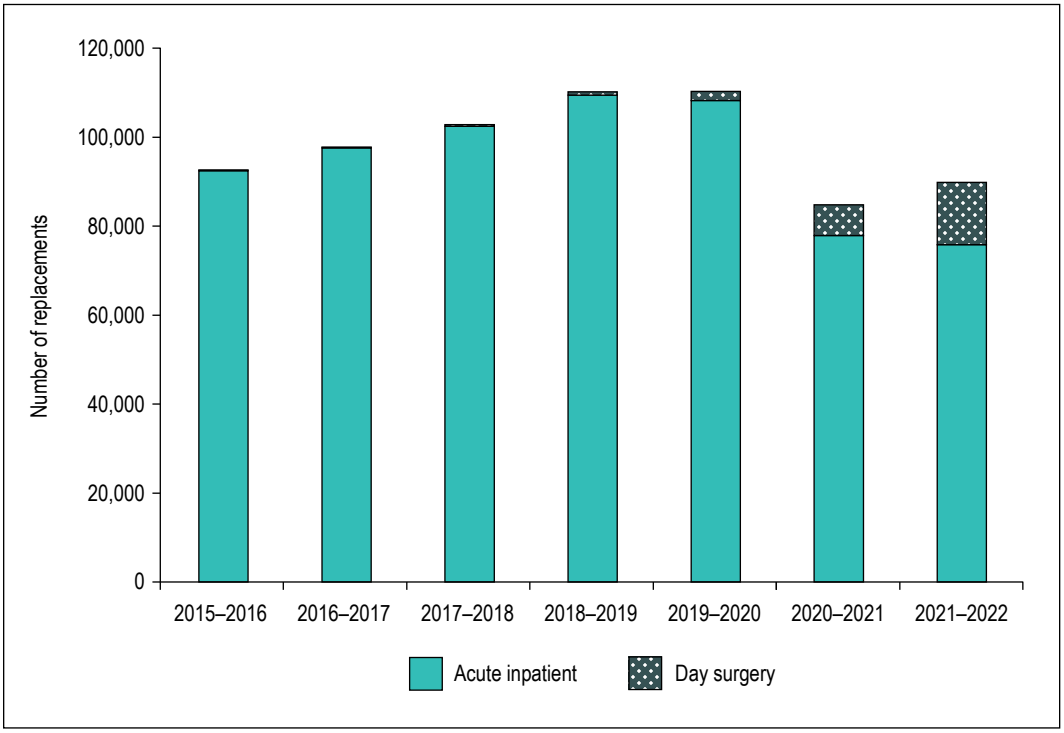
The majority of hip and knee replacements for OA are performed in an inpatient setting; however, in the past few years, a higher proportion have been done as day surgeries.

- From 2015–2016 to 2019–2020, there was a gradual increase in the overall number of hip and knee replacements for OA being performed; however, in 2020–2021 and 2021–2022, volumes decreased (Figure 1). In general, 2020–2021 included the first and second COVID-19 waves (Beta variant) and 2021–2022 included the third, fourth and fifth waves (Gamma, Delta and Omicron variants, respectively) in Canada.[2]

iii. Surgeon volume refers to the number of hip arthroplasties performed by the surgeon in a fiscal year.
iv. Day surgeries in the DAD-HMDB and NACRS are defined by the submitting jurisdiction. Variations exist but, in general, day surgeries are pre-booked, and patients are admitted to a formally organized unit of the health service organization that includes an operating or procedure room and a post-anesthetic recovery room. Since patients do not require admission to an inpatient bed, they are usually discharged within a few hours following surgery. A stay can exceed 24 hours but generally should not exceed 48 hours.
v. In 2021–2022, 90.9% of DAD records with a planned hip or knee replacement had OA as the most responsible diagnosis and 95.6% of NACRS records had OA as the main problem.

- Over these 7 years, the proportion of hip and knee replacements done as day surgeries increased to 15.6% of all replacements, up from 0.2% in 2015–2016.

Figure 1 Number of hip and knee replacements for osteoarthritis by type of care, Canada, 2015–2016 to 2021–2022



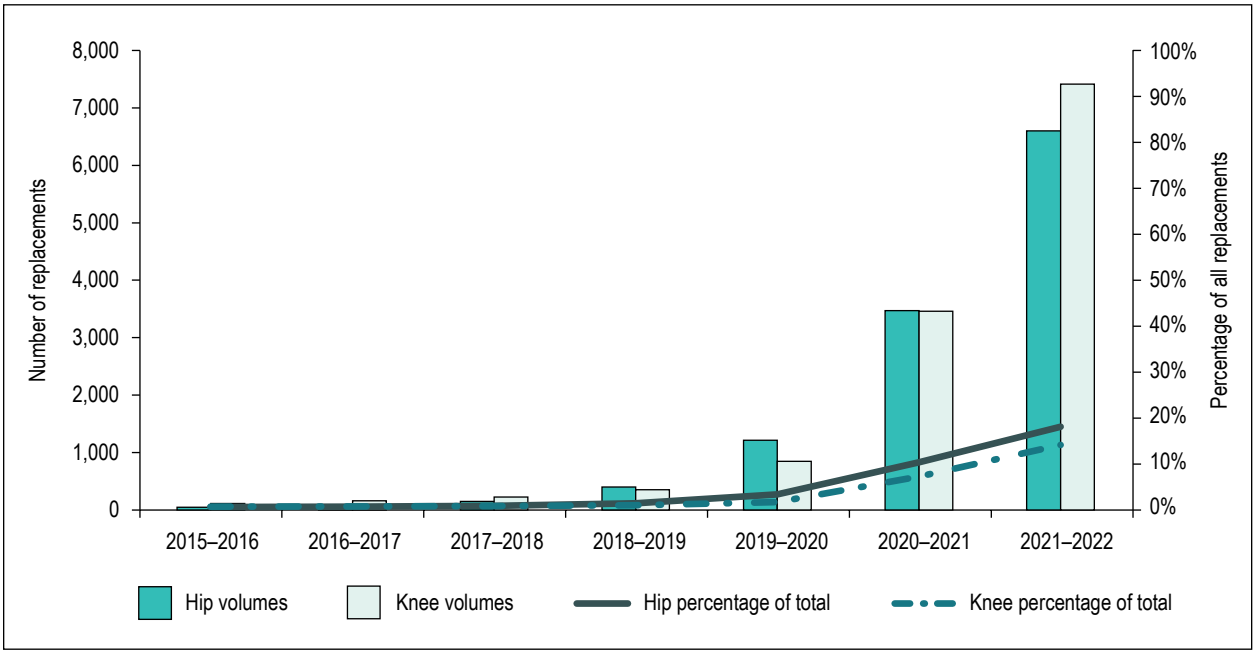
Note
Includes hip and knee replacements with osteoarthritis as the most responsible diagnosis or main diagnosis.
Sources
Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2015–2016 to 2021–2022, Canadian Institute for Health Information.

Over this period, the number of hip and knee replacements done as day surgeries increased significantly, with more jurisdictions performing this type of joint surgery. For hips, day surgery volumes increased 147-fold from 2015–2016 to 2021–2022. For knees, the increase was more than 66-fold during that period.

- In 2021–2022, 18.0% of hip replacements for OA were performed as day surgeries compared with 10.1% in 2020–2021 and 2.9% in 2019–2020. From 2015–2016 to 2018–2019, the annual proportion was below 1.0%. For knees, 14.0% of replacements for OA in 2021–2022 were performed as day surgeries compared with 6.9% in 2020–2021 and 1.2% in 2019–2020 (Figure 2). As with hip replacements, the annual proportion was below 1.0% from 2015–2016 to 2018–2019.

– Based on provisional data from April to December 2022, the proportion of hip and knee replacements being done as day surgeries continues to increase, with 48.4% and 58.0% more surgeries, respectively, compared with April to December 2021.

Figure 2 Number and percentage of hip and knee replacements for osteoarthritis performed as day surgeries, Canada, 2015–2016 to 2021–2022



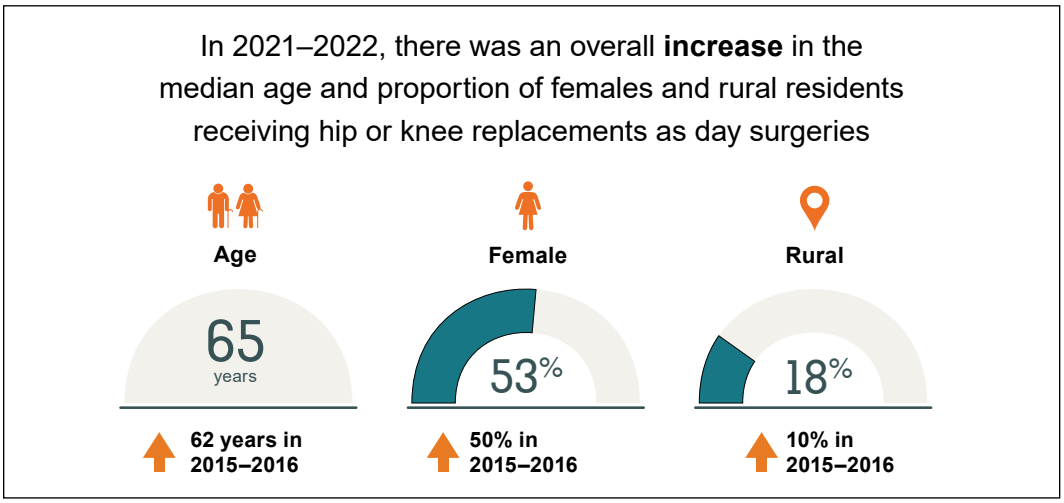
Note
Includes hip and knee replacements submitted as day surgeries and with osteoarthritis as the most responsible diagnosis or main diagnosis.
Sources
Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2015–2016 to 2021–2022, Canadian Institute for Health Information.

- In 2021–2022, 65.0% of all hip and knee replacements performed as day surgeries in Canada were performed in Ontario. However, looking at each province, Nova Scotia performed the highest percentage as day surgeries (31.4%), followed by Ontario (24.7%) and Quebec (15.8%).
- 7 jurisdictions performed more than 10 hip or knee replacements as day surgeries in 2021–2022 (Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Alberta and British Columbia). In 2015–2016, 1 province was doing hip replacements as day surgeries, while 4 were doing knee replacements as day surgeries.
- Throughout this entire period, more than 99% of day surgery joint replacements were performed in hospitals located in urban areas.

Compared with 7 years ago, the demographics of patients having day surgery hip or knee replacement appear to be changing: the average age is older, and proportions are higher for female patients and people living in rural areas (Figure 3).

- In 2021–2022, 50.0% of patients who had a hip replacement as day surgery were female, up from 48.9% in 2015–2016. Similarly, 56.2% of patients who had a knee replacement as day surgery were female, up from 50.9% in 2015–2016.
- The median age for day surgery hip replacement patients increased to 65 in 2021–2022, up from 63 in 2015–2016. There was a similar trend for patients having knee replacements as day surgery; the median age was 66 in 2021–2022 compared with 61.5 in 2015–2016.
- For hip replacements, the proportion of patients living in rural areas increased to 17.9% in 2021–2022 from 13.3% in 2015–2016. For knee replacements, the proportion of rural patients more than doubled to 17.3% in 2021–2022 from 8.2% in 2015–2016.

Figure 3 Selected demographic characteristics of patients having hip or knee replacements as day surgeries, 2021–2022 compared with 2015–2016



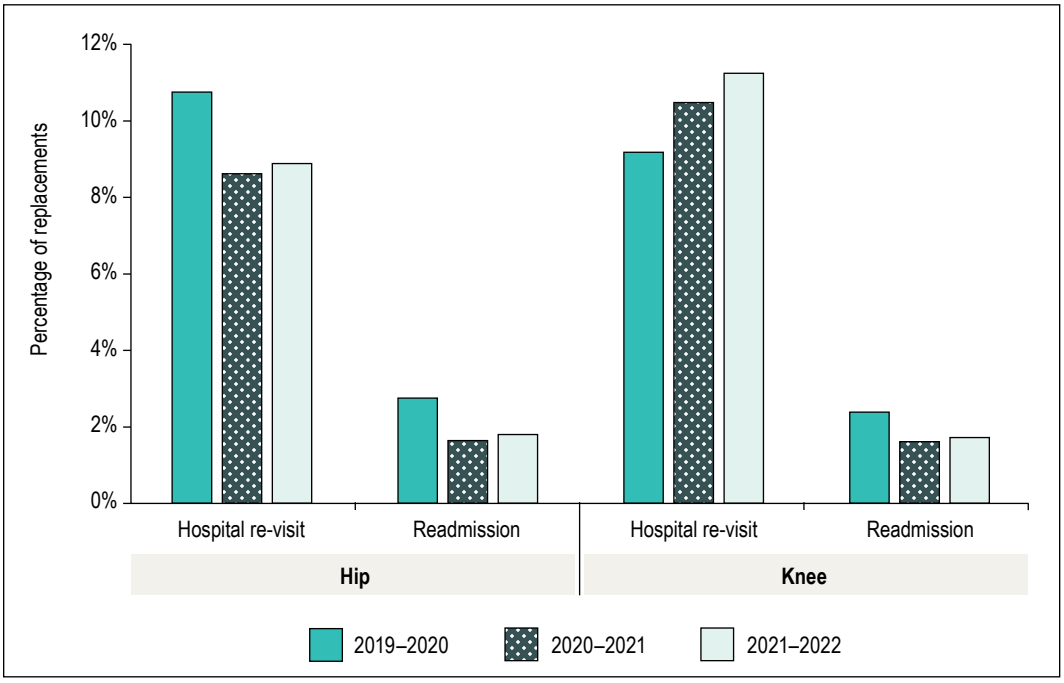
Note
Includes hip and knee replacements submitted as day surgeries and with osteoarthritis as the most responsible diagnosis or main diagnosis.
Sources
Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2015–2016 to 2021–2022, Canadian Institute for Health Information.

- The breakdown by income quintile was similar across all years, with the smallest group of patients being from the lowest income quintile for both joints. For hip replacements, the largest group of patients was in the highest income quintile. For knee replacements, the 3 highest income quintiles had the largest proportion of patients.
- The median length of stay in hours was 10.8 for hips and 9.8 for knees in 2021–2022 compared with 8.7 for hips and 7.8 for knees in 2015–2016.

Overall, a small number of day surgery patients returned to the hospital (re-visit[vi]) or required rehospitalization (readmission[vii]) within 30 days. In 2021–2022, a lower proportion of hip replacement patients who had day surgery returned to the hospital within 30 days, compared with 2019–2020; however, for knee replacements, a higher proportion of patients who had day surgery had re-visits within 30 days. Readmissions for both patient groups were lower in 2021–2022 compared with 2019–2020 (Figure 4).

- In 2021–2022, 8.8% of patients had a re-visit to the hospital within 30 days of their hip replacement surgery. This was higher compared with the 2020–2021 re-visit rate (8.6%) but lower than the re-visit rate in 2019–2020 (10.8%). For all 3 years combined, the most common main diagnoses recorded for hip re-visits were follow-up care related to dressings, sutures and casts (13.5%) and infection (7.9%).

Figure 4 30-day hospital re-visit and 30-day readmission rates for hip and knee replacements performed as day surgeries, Canada, 2019–2020 to 2021–2022



Notes
Includes hip and knee replacements submitted as day surgeries and with osteoarthritis as the most responsible diagnosis or main diagnosis.
Re-visits include inpatient hospitalizations, ambulatory care visits and emergency department visits where available.
Readmissions include inpatient hospitalizations only.
Sources
Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2019–2020 to 2021–2022, Canadian Institute for Health Information.

vi. Includes inpatient hospitalizations, ambulatory care visits and emergency department visits where available.
vii. Includes inpatient hospitalizations only.

- In 2021–2022, 11.2% of knee replacement patients returned to the hospital within 30 days. This hospital re-visit rate was higher than in previous years (9.2% in 2019–2020, 10.5% in 2020–2021). The most common main diagnoses for all 3 years combined were pain (13.9%) and hemorrhage and hematoma (9.5%).
- For hip replacements, 1.8% of patients were readmitted to the hospital within 30 days of their surgery in 2021–2022, which was slightly higher than the rate for 2020–2021 (1.6%) but lower than the rate in 2019–2020 (2.8%). For knee replacement patients, the 30-day readmission rate was 1.7% in 2021–2022 compared with 1.6% in 2020–2021 and 2.4% in 2019–2020.
- For all 3 years combined, the most common main diagnoses recorded for readmission within 30 days following a day surgery hip replacement were infection (21.1%) and fracture (17.1%). For 30-day readmission following a day surgery knee replacement, they were infection (14.4%) and pain (8.5%).
- A very small number of patients (7) who had a joint replacement as day surgery died in hospital within 30 days of their primary surgery (0.03%).

Patient-reported data

Patient-reported outcome measures (PROMs) are tools used to obtain information directly from patients on aspects of their physical, mental or social health. A key goal of hip and knee replacements is to improve a patient's pain, mobility and quality of life. When PROMs are administered before and after these interventions, they can provide a fuller picture of a patient's health gains, in addition to the monitoring of clinical outcomes. The Oxford Hip/Knee Score, EQ-5D-5L and satisfaction with surgical results are recommended PROMs for use in routine care in hip and knee replacements nationally.

This section is based on PROMs completed before (within 8 weeks) and after (9 to 15 months) surgeries performed in Ontario, Manitoba and Alberta between 2019–2020 and 2021–2022. PROMs were completed by 4,129 hip and 4,761 knee replacement patients. On average, patients were 66 and 68 years old, respectively. Refer to Appendix C for methodology details.

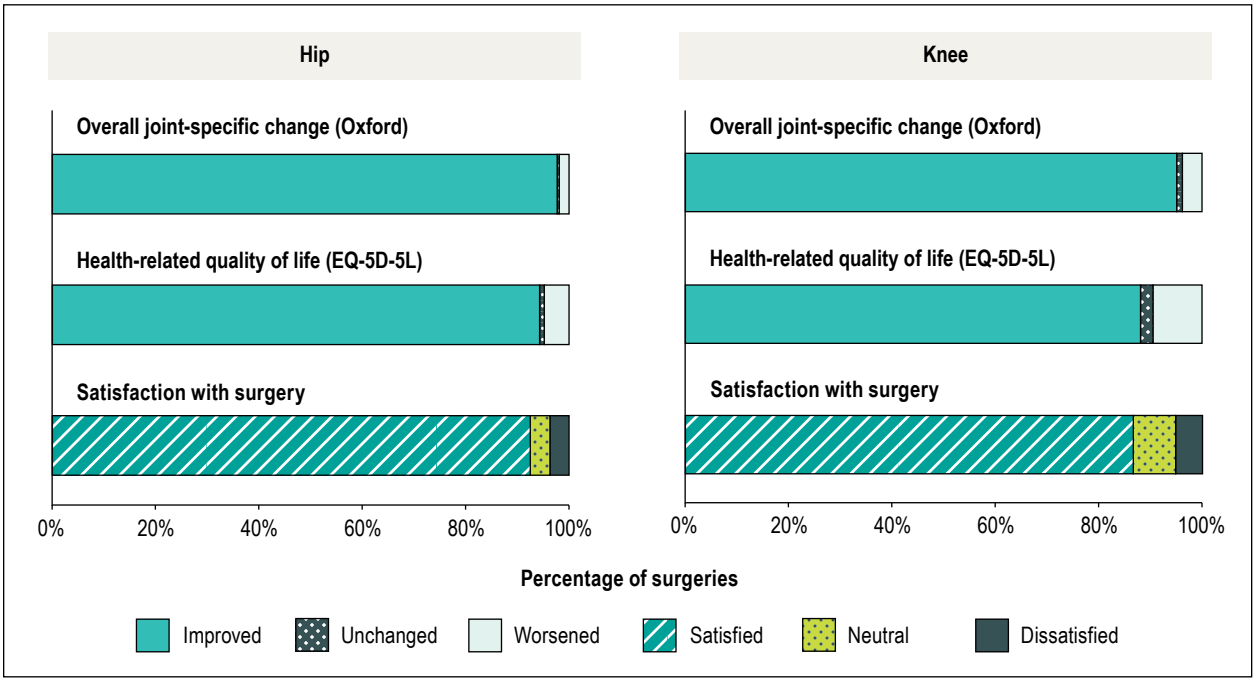
Figure 5 shows that a large proportion of patients improved their PROMs score and had high satisfaction with their outcome 1 year after a hip or knee replacement.

- More than 9 out of 10 patients reported a positive change in their Oxford Hip/Knee Score and EQ-5D-5L rating after hip or knee surgery. Most hip (93%) and knee (87%) replacement patients reported feeling satisfied with their surgical results.
- These findings support evidence[3, 4] suggesting that the vast majority of patients respond that they are satisfied with their hip or knee replacement; however, focusing on the small proportion of dissatisfied patients can help identify modifiable factors that can lead to better care.

Figure 6 highlights the patient characteristics and PROMs that contribute to a patient's satisfaction with the results of their surgery after 1 year.

- As expected, a larger proportion of hip and knee replacement patients were not satisfied when their standard PROMs result did not improve 1 year after surgery, particularly for functional status (Oxford Hip/Knee Score). A slight difference in the proportion of those not satisfied was also seen by age and type of care (day surgery or inpatient stay) for patients who had a hip replacement.
- Asking patients how satisfied they are with their surgery can provide opportunities to further understand the complex factors that contribute to a patient's perception of surgical success; these factors include judgments on the value of an intervention, patient–provider expectation setting and psychosocial experiences.[5] Exploring expectations around gains in functional status and quality of life resulting from a joint replacement or case selection for same-day surgery are potential factors that may influence patient satisfaction.

Figure 5 12-month change in patient-reported outcomes and satisfaction with surgery, 2019–2020 to 2021–2022



Note

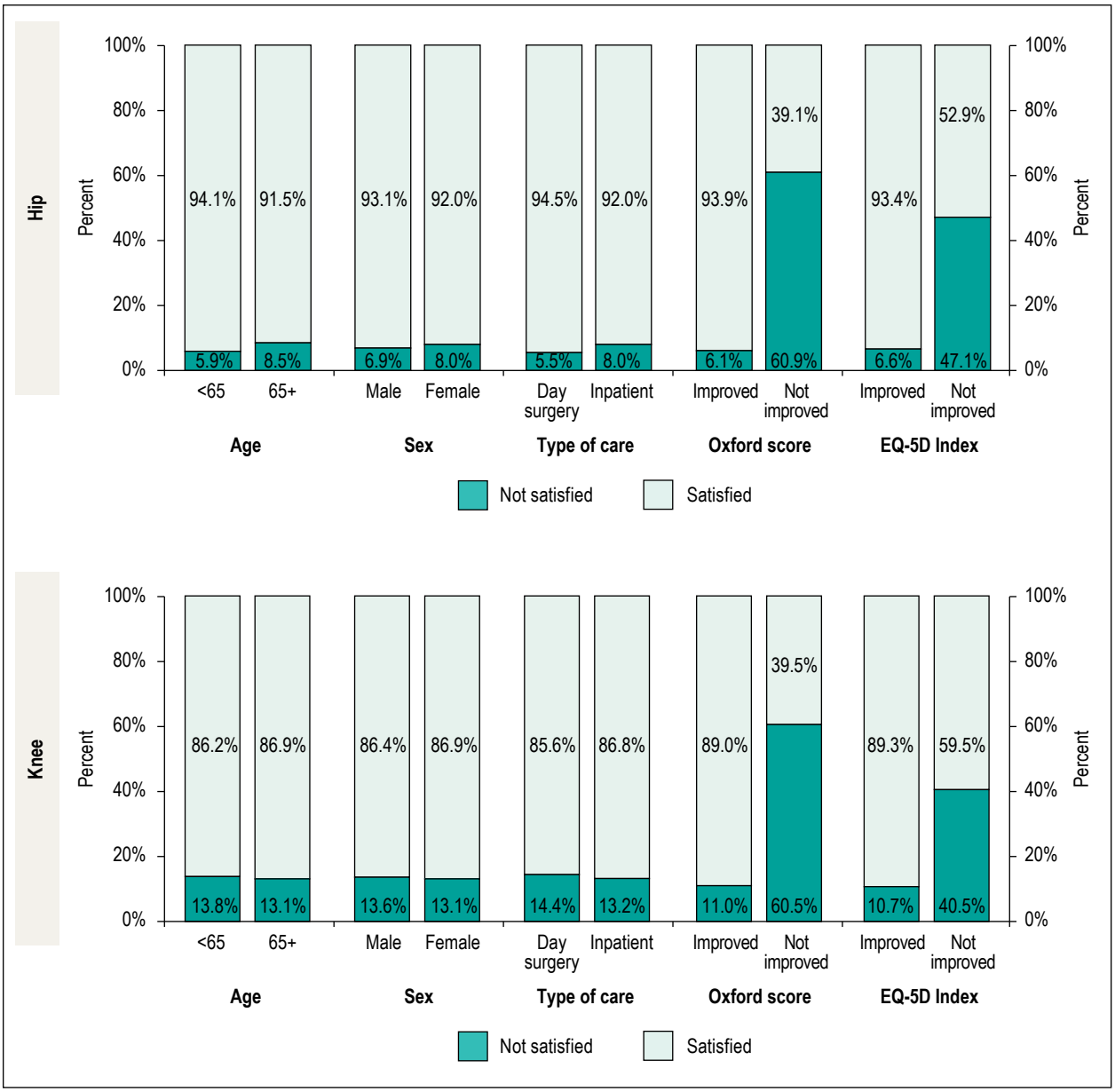
Improvement is based on the PROMs change score, which is the difference in score from pre-surgery to 1 year post-surgery. A change score greater than 0 indicates an improved outcome, a change score equal to 0 indicates an unchanged outcome and a change score less than 0 indicates a worsened outcome. Not all positive change scores indicate a meaningful improvement to the patient.

Sources

PROMs data: Alberta Bone and Joint Health Institute, 2018–2019 to 2022–2023; Winnipeg Regional Health Authority, 2018–2019 to 2022–2023; and Ontario PROMs Program co-executed by Ontario Ministry of Health, Ontario Health and Canadian Institute for Health Information, 2018–2019 to 2022–2023.

Surgical data: Discharge Abstract Database and National Ambulatory Care Reporting System, 2019–2020 to 2021–2022, Canadian Institute for Health Information.

Figure 6 12-month satisfaction rating of hip and knee replacement patients by characteristic and patient-reported outcome, 2019–2020 to 2021–2022



Notes

Improvement is based on the PROMs change score, which is the difference in score from pre-surgery to 1 year post-surgery. A change score greater than 0 indicates an outcome that has improved and a change score equal to or less than 0 indicates an outcome that has not improved. Not all positive change scores indicate a meaningful improvement to the patient.

The satisfaction rating was collapsed to 2 categories where the term “satisfied” refers to respondents who reported being “very satisfied” or “satisfied,” while the term “not satisfied” refers to those who reported feeling “neutral,” “dissatisfied” or “very dissatisfied.”

Sources

PROMs data: Winnipeg Regional Health Authority, 2018–2019 to 2022–2023; and Ontario PROMs Program co-executed by Ontario Ministry of Health, Ontario Health and Canadian Institute for Health Information, 2018–2019 to 2022–2023.

Surgical data: Discharge Abstract Database and National Ambulatory Care Reporting System, 2019–2020 to 2021–2022, Canadian Institute for Health Information.

Conclusion

Joint replacements are among the most performed surgeries in Canada, and ensuring optimal and consistent care across hospitals and jurisdictions is important. Regularly reporting data on hip and knee replacements and monitoring patient outcomes can help inform clinical best practices and resource allocation decisions. Patient-reported data can complement routinely collected clinical data to evaluate the quality of care. As population health needs evolve in a system where new care pathways are being implemented (such as day surgeries), it is vital that decision-makers consider tools that directly capture patients' views on the impact of these interventions on their health as they continue advancing a patient-centric approach to health system delivery.

In 2021–2022, more than 107,000 hip and knee replacements were performed in Canada, which represented over $1.26 billion in hospital costs (including physician costs and excluding rehabilitation costs). While the number of hip and knee replacements increased compared with the year before, the numbers have not yet returned to pre-pandemic levels. Over the past 3 years, approximately 91,600 fewer hip and knee replacements were performed than would be expected based on historical annual increases before the pandemic. As provincial and territorial health systems continue to work toward reducing surgical backlogs amid shortages of health care workers, long wait lists continue to be a challenge across the country. CIHI recently reported that 43% of hip replacement patients and 50% of knee replacement patients waited longer than the recommended 6 months for their surgery, compared with 25% and 30% of hip and knee replacements, respectively, before the pandemic.[6]

While most hip and knee replacements are still performed in an inpatient setting, the number of day surgery replacements performed in Canada has increased dramatically in the past few years, particularly since the pandemic began in March 2020. However, our analysis shows that the trend toward more day surgeries started before the pandemic and accelerated during it. Many hospitals — such as the Royal Jubilee Hospital in Victoria, Women's College Hospital in Toronto and Hamilton Health Sciences in Hamilton — had already developed same-day joint replacement programs before 2020.[7–9] As health systems struggled to address inpatient bed availability and surgical backlogs during the pandemic, more hospitals and jurisdictions, such as Eastern Health in Newfoundland and Labrador,[10] began developing day surgery joint replacement programs.

Having a joint replacement as day surgery is not appropriate for all patients; there are certain medical, physical function and social criteria that surgeons will consider before recommending this type of surgery.[11] Our findings suggest that the selection criteria for this type of surgery may be broadening, with more females, more rural patients and older patients having day surgery joint replacements compared with those who would have had day surgery in previous years.

In general, hospital re-visit rates within 30 days of the day surgery joint replacement are increasing compared with rates in previous years, but further investigation is needed to determine whether these return visits are preventable and what can be done outside of the hospital setting to lower these rates. Readmission rates following day surgery are decreasing, which could be the result of changing patient preferences, fewer beds being available, improved post-surgery processes and maturing day surgery programs. As more joint replacements are performed as day surgeries, it will be important to continue to monitor patient selection and outcomes, including PROMs (e.g., pain, function), to ensure the same standard of care and outcomes for patients whether they have their joint replacement as an inpatient or day surgery procedure.

Another area to monitor in future years will be hip and knee replacements being performed in private clinics. Several jurisdictions, such as Ontario and Alberta, have already committed to funding hip and knee replacements performed in private facilities.[12, 13] It will be important to be able to continue to identify and monitor these patients.

Data tables

Methodology details are available in Appendix A.

Hip replacement

Table 1 Number of hip replacements, by jurisdiction of surgery, 2017–2018 to 2021–2022

Jurisdiction	2017–2018	2018–2019	2019–2020	2020–2021	2021–2022	5-year percentage change
Newfoundland and Labrador	966	1,069	1,051	893	993	2.8%
Prince Edward Island	280	293	336	349	380	35.7%
Nova Scotia	2,056	2,073	2,220	1,882	1,758	-14.5%
New Brunswick	1,456	1,529	1,696	1,655	1,524	4.7%
Quebec	11,050	11,761	11,831	9,319	11,275	2.0%
Ontario	23,725	24,816	24,993	22,727	22,985	-3.1%
Manitoba	2,156	2,249	2,524	2,135	2,194	1.8%
Saskatchewan	2,021	2,100	2,286	1,676	2,044	1.1%
Alberta	6,163	6,240	6,562	5,728	6,084	-1.3%
British Columbia	8,593	9,851	9,945	8,892	9,322	8.5%
Yukon	0	0	11	8	40	—
Northwest Territories	26	35	41	36	36	38.5%
Canada	**58,492**	**62,016**	**63,496**	**55,300**	**58,635**	**0.2%**

Note

— The percentage change cannot be calculated as the denominator is 0.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2017–2018 to 2021–2022, Canadian Institute for Health Information.

Table 2 Number of hip replacements, by type of care, 2017–2018 to 2021–2022

Type of care	2017–2018	2018–2019	2019–2020	2020–2021	2021–2022	5-year percentage change
Acute	58,308	61,571	62,167	51,644	51,717	-11.3%
Day surgery	184	445	1,329	3,656	6,918	3,659.8%
Total	**58,492**	**62,016**	**63,496**	**55,300**	**58,635**	**0.2%**

Sources
Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2017–2018 to 2021–2022, Canadian Institute for Health Information.

Table 3 Age-standardized rate of hospitalizations for hip replacement, by jurisdiction of residence, 2017–2018 to 2021–2022

Jurisdiction	2017–2018	2018–2019	2019–2020	2020–2021	2021–2022	5-year percentage change
Newfoundland and Labrador	181	200	192	161	172	-5.0%
Prince Edward Island	198	197	221	224	227	14.6%
Nova Scotia	218	214	224	186	168	-22.9%
New Brunswick	183	184	203	194	175	-4.4%
Quebec	138	144	148	114	129	-6.5%
Ontario	189	194	189	167	164	-13.2%
Manitoba	197	204	225	184	188	-4.6%
Saskatchewan	216	218	232	163	199	-7.9%
Alberta	202	201	206	179	187	-7.4%
British Columbia	187	207	204	177	180	-3.7%
Yukon	229	223	267	151	277	21.0%
Northwest Territories	155	219	188	132	157	1.3%
Nunavut	258	198	n/r	95	138	-46.5%
Canada	**178**	**184**	**186**	**157**	**162**	**-9.0%**

Notes
n/r: Not reported due to small cell count (i.e., between 1 and 4) or incomplete data.
Rates are per 100,000 population, using the 2011 Canadian reference population age 18 and older.
Low volumes for the territories may result in more variability when looking at percentage change calculations over time.
Results are presented by patients' jurisdiction of residence, rather than by the province or territory of the facility where the treatment occurred.
Sources
Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2017–2018 to 2021–2022, Canadian Institute for Health Information.

Table 4 Number of hospitalizations for hip replacement and percentage by age group (years) for male patients, 2021–2022

Jurisdiction	Age 18–54 (%)	Age 55–64 (%)	Age 65–74 (%)	Age 75+ (%)	Total number of hospitalizations
Newfoundland and Labrador	11.8	22.5	36.5	29.2	414
Prince Edward Island	8.8	27.7	38.4	25.2	159
Nova Scotia	7.7	28.1	31.2	33.0	698
New Brunswick	10.7	24.2	31.2	34.0	645
Quebec	12.8	25.3	30.9	31.1	4,956
Ontario	11.2	25.6	30.6	32.7	9,704
Manitoba	13.1	22.8	32.9	31.1	944
Saskatchewan	12.9	25.6	31.7	29.8	829
Alberta	12.7	28.3	30.6	28.5	2,684
British Columbia	11.5	23.8	32.4	32.4	3,893
Yukon	n/r	n/r	33.3	33.3	15
Northwest Territories	n/r	36.8	26.3	n/r	19
Canada	**11.7**	**25.4**	**31.2**	**31.6**	**24,960**

Notes

n/r: Not reported due to small cell count (i.e., between 1 and 4) or due to residual disclosure.

Hospitalizations with unknown gender were excluded.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2021–2022, Canadian Institute for Health Information.

Table 5 Number of hospitalizations for hip replacement and percentage by age group (years) for female patients, 2021–2022

Jurisdiction	Age 18–54 (%)	Age 55–64 (%)	Age 65–74 (%)	Age 75+ (%)	Total number of hospitalizations
Newfoundland and Labrador	10.1	17.4	31.7	40.8	564
Prince Edward Island	6.9	17.4	39.7	36.1	219
Nova Scotia	8.3	17.5	32.2	42.1	1,053
New Brunswick	5.1	17.0	33.1	44.9	867
Quebec	6.1	16.5	30.6	46.8	6,234
Ontario	6.5	18.0	31.5	44.0	13,194
Manitoba	8.6	18.1	31.4	41.9	1,233
Saskatchewan	7.2	17.5	29.4	45.9	1,206
Alberta	7.4	20.3	31.0	41.4	3,341
British Columbia	6.7	18.1	32.1	43.1	5,387
Yukon	n/r	n/r	47.8	43.5	23
Northwest Territories	n/r	29.4	41.2	n/r	17
Canada	**6.7**	**17.9**	**31.4**	**44.0**	**33,338**

Notes

n/r: Not reported due to small cell count (i.e., between 1 and 4) or due to residual disclosure.

Hospitalizations with unknown gender were excluded.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2021–2022, Canadian Institute for Health Information.

Table 6 Number of hip replacements, by type of replacement and jurisdiction of surgery, 2021–2022

Jurisdiction	Number of primaries	Percentage of all replacements	Number of revisions	Percentage of all replacements
Newfoundland and Labrador	885	89.1%	108	10.9%
Prince Edward Island	355	93.4%	25	6.6%
Nova Scotia	1,598	90.9%	160	9.1%
New Brunswick	1,414	92.8%	110	7.2%
Quebec	10,455	92.6%	835	7.4%
Ontario	21,260	92.5%	1,734	7.5%
Manitoba	2,034	92.6%	163	7.4%
Saskatchewan	1,911	93.5%	134	6.6%
Alberta	5,569	91.5%	520	8.5%
British Columbia	8,664	92.9%	659	7.1%
Yukon	35	—	n/r	—
Northwest Territories	33	—	n/r	—
Canada	**54,213**	**92.4%**	**4,448**	**7.6%**

Notes

n/r: Not reported due to small cell count (i.e., between 1 and 4) or due to residual disclosure.

— The percentage cannot be calculated as either the denominator or the numerator is suppressed.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2021–2022, Canadian Institute for Health Information.

Table 7 Most responsible diagnosis for primary hip replacements, Canada, 2021–2022

Diagnosis groups*	Number of procedures	Percentage of total
Osteoarthritis	36,632	69.3%
Acute hip fracture	14,120	26.7%
Osteonecrosis (e.g., AVN)	1,164	2.2%
Tumour (primary and metastatic, including synovial)	411	0.8%
Old hip fracture (e.g., non-union, hardware failure)	389	0.7%
Inflammatory arthritis (e.g., RA, AS, SLE)	74	0.1%
Childhood hip problem (e.g., hip dysplasia)	40	0.1%
Infection (i.e., infectious arthritis)	20	0.0%
Total†	**52,850**	**100.0%**

Notes

* Determined using the most responsible diagnosis (MRDx) collected in the DAD-HMDB or the main problem collected in NACRS. Note that MRDx represents the clinical condition that consumes the most hospital resources during that hospitalization and may not necessarily be the main reason for having a primary hip replacement. For a list of ICD-10-CA codes used, email cjrr@cihi.ca.

† Total excludes hospitalizations that could not be assigned to any of these diagnosis groups.

AVN: Avascular necrosis.

RA: Rheumatoid arthritis.

AS: Ankylosing spondylitis.

SLE: Systemic lupus erythematosus.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2021–2022, Canadian Institute for Health Information.

Table 8 Type of primary hip replacement due to osteoarthritis, Canada, 2021–2022

Type of primary procedure*	Number of procedures	Percentage of total
Total hip arthroplasty	36,194	99.6%
Partial hip arthroplasty	161	0.4%
Total†	**36,355**	**100.0%**

Notes

* Determined using *Canadian Classification of Health Interventions* (CCI) codes and extent attribute codes. For more details, email cjrr@cihi.ca.

† Total excludes the procedures that could not be assigned to any of the groups listed above.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2021–2022, Canadian Institute for Health Information.

Table 9 Type of primary hip replacement due to hip fracture, Canada, 2021–2022

Type of primary procedure*	Number of procedures	Percentage of total
Bipolar hemiarthroplasty	7,347	53.4%
Modular monopolar hemiarthroplasty	3,707	27.0%
Total hip arthroplasty	2,429	17.7%
Monoblock monopolar hemiarthroplasty	144	1.0%
Hemiarthroplasty unspecified	125	0.9%
Total†	**13,752**	**100.0%**

Notes

* Determined using *Canadian Classification of Health Interventions* (CCI) codes and extent attribute codes. For more details, email cjrr@cihi.ca.

† Total excludes the procedures that could not be assigned to any of the groups listed above.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2021–2022, Canadian Institute for Health Information.

Table 10 Type of fixation* for primary hip replacement due to hip fracture, Canada, 2021–2022

Jurisdiction	Number of procedures using cement fixation	Percentage of procedures using cement fixation	Number of procedures using cementless fixation	Percentage of procedures using cementless fixation
Newfoundland and Labrador	249	86.2%	40	13.8%
Prince Edward Island	76	n/r	n/r	n/r
Nova Scotia	386	83.7%	75	16.3%
New Brunswick	157	35.3%	288	64.7%
Quebec	1,923	66.7%	961	33.3%
Ontario	3,071	56.5%	2,366	43.5%
Manitoba	188	35.2%	346	64.8%
Saskatchewan	252	52.8%	225	47.2%
Alberta	707	48.3%	758	51.7%
British Columbia	1,272	62.8%	753	37.2%
Yukon	8	50%	8	50%
Northwest Territories	7	n/r	n/r	n/r
Canada	**8,296**	**58.8%**	**5,824**	**41.2%**

Notes

* Type of fixation is determined using *Canadian Classification of Health Interventions* (CCI) codes and extent attribute codes. For more details, email cjrr@cihi.ca.

n/r: Not reported due to small cell count (i.e., between 1 and 4) or due to residual disclosure.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2021–2022, Canadian Institute for Health Information.

Table 11 Reasons for hip revision, Canada, 2021–2022

Reason for revision*	Number of procedures	Percentage of total
Infection	1,277	28.6%
Instability	714	16.0%
Aseptic loosening	550	12.3%
Periprosthetic fracture	538	12.1%
Implant fracture and dissociation	171	3.8%
Bearing wear (e.g., poly wear)	164	3.7%
Pain and other complications	148	3.3%
Osteolysis	83	1.9%
Acetabular erosion	46	1.0%
Leg length discrepancy	14	0.3%
Remaining reasons†	755	16.9%
Total	**4,460**	**100.0%**

Notes

* Determined using revision reason (from CJRR or DAD Group 20), most responsible diagnosis (DAD-HMDB) or main diagnosis (NACRS). For more details, refer to Appendix A.

† Includes most responsible diagnosis codes not generally related to hip replacement revision surgery (e.g., cancer) and groups with small cell counts such as stiffness.

Note that the total number of revisions in this table differs slightly from the total in other tables because bilateral revisions collected in CJRR are 2 separate records (i.e., left and right side).

Sources

Discharge Abstract Database–Hospital Morbidity Database, National Ambulatory Care Reporting System and Canadian Joint Replacement Registry, 2021–2022, Canadian Institute for Health Information.

Table 12 Primary hip replacements due to osteoarthritis:* Acute care length of stay for hospitalization (in days), by jurisdiction of surgery, 2021–2022

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	3.3	3.0	2.0	3.0
Prince Edward Island	2.7	2.0	1.0	3.0
Nova Scotia	1.6	1.0	1.0	1.0
New Brunswick	2.5	2.0	1.0	3.0
Quebec	3.2	2.0	1.0	3.0
Ontario	1.9	1.0	1.0	2.0
Manitoba	2.7	2.0	1.0	3.0
Saskatchewan	3.4	3.0	2.0	4.0
Alberta	1.9	1.0	1.0	2.0
British Columbia	2.1	1.0	1.0	2.0
Yukon	1.9	2.0	1.0	2.0
Northwest Territories	4.1	3.0	3.0	5.0
Canada	**2.3**	**2.0**	**1.0**	**3.0**

Notes

* Identified using the most responsible diagnosis for the hospitalization. For a list of ICD-10-CA codes used, email cjrr@cihi.ca. This table presents only the acute portion of the hospital stay. Due to a difference in collection of acute and alternate level of care (ALC) data, caution should be used when comparing Quebec length of stay results with results for other jurisdictions.

Source

Hospital Morbidity Database, 2021–2022, Canadian Institute for Health Information.

Table 13 Primary hip replacements following acute hip fracture:* Acute care length of stay for hospitalization (in days), by jurisdiction of surgery, 2021–2022

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	11.1	8.0	5.0	15.0
Prince Edward Island	9.2	5.0	4.0	9.0
Nova Scotia	12.5	7.0	5.0	13.0
New Brunswick	10.3	7.0	4.0	13.0
Quebec	13.8	10.0	5.0	17.0
Ontario	9.3	7.0	5.0	11.0
Manitoba	11.2	7.0	4.0	13.0
Saskatchewan	8.4	7.0	5.0	10.0
Alberta	9.9	7.0	5.0	12.0
British Columbia	11.1	8.0	5.0	13.0
Yukon	11.9	8.0	5.0	13.0
Northwest Territories	12.1	9.5	6.0	13.0
Canada	**10.8**	**7.0**	**5.0**	**13.0**

Notes

* Identified using the most responsible diagnosis for the hospitalization. For a list of ICD-10-CA codes used, email cjrr@cihi.ca. This table presents only the acute portion of the hospital stay. Due to a difference in collection of acute and alternate level of care (ALC) data, caution should be used when comparing Quebec length of stay results with results for other jurisdictions.

Source

Hospital Morbidity Database, 2021–2022, Canadian Institute for Health Information.

Table 14 Revisions of hip replacements (any diagnosis): Acute care length of stay for hospitalization (in days), by jurisdiction of surgery, 2021–2022

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	11.4	5.0	3.0	12.0
Prince Edward Island	15.7	6.0	3.0	13.0
Nova Scotia	14.1	8.0	4.0	14.0
New Brunswick	10.8	7.0	3.0	11.0
Quebec	11.1	7.0	3.0	13.0
Ontario	9.1	6.0	3.0	10.0
Manitoba	12.7	7.0	3.0	12.0
Saskatchewan	13.4	7.0	5.0	12.0
Alberta	12.5	7.0	3.0	14.0
British Columbia	9.7	5.0	2.0	11.0
Yukon	n/r	n/r	n/r	n/r
Canada	**10.5**	**6.0**	**3.0**	**12.0**

Notes

n/r: Not reported due to small cell count (i.e., between 1 and 4).

This table presents only the acute portion of the hospital stay. Due to a difference in collection of acute and alternate level of care (ALC) data, caution should be used when comparing Quebec length of stay results with results for other jurisdictions.

Source

Hospital Morbidity Database, 2021–2022, Canadian Institute for Health Information.

Table 15 Primary hip replacements for osteoarthritis:* Estimated inpatient costs, by jurisdiction, 2021–2022

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	$8,481	$8,371	$8,371	$8,371
Prince Edward Island	$8,981	$8,960	$8,960	$8,960
Nova Scotia	$8,312	$8,208	$8,208	$8,208
New Brunswick	$8,260	$8,150	$8,150	$8,150
Quebec	$10,257	$9,804	$9,804	$9,804
Ontario	$7,706	$7,520	$7,520	$7,520
Manitoba	$9,891	$9,724	$9,724	$9,724
Saskatchewan	$10,143	$10,007	$10,007	$10,007
Alberta	$10,737	$10,474	$10,474	$10,474
British Columbia	$9,360	$9,205	$9,205	$9,205
Yukon	$11,071	$11,071	$11,071	$11,071
Northwest Territories	$15,503	$15,503	$15,503	$15,503
Canada (excluding physician costs)†	**$9,052**	**$9,205**	**$7,520**	**$9,804**
Estimated physician cost based on 7 provinces‡	**$2,007**	**$1,908**	**$1,647**	**$2,256**
Canada total (including physician costs)	**$11,059**	**$11,113**	**$9,167**	**$12,060**

Notes

* Identified using the most responsible diagnosis for the hospitalization. For a list of ICD-10-CA codes used, email cjrr@cihi.ca.

† Only typical cases are included. Estimates do not include payments made to physicians, rehabilitation or amortization expenses on land, buildings and building service equipment.

‡ Estimated inpatient physician cost is based on physician billing data per primary hip replacement hospitalization from 7 provinces (Newfoundland and Labrador, Nova Scotia, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia). Only typical cases are included.

Sources

Hospital Morbidity Database, Canadian Management Information System Database and Patient-Level Physician Billing Data Repository, 2021–2022, Canadian Institute for Health Information.

Table 16 Primary hip replacements for acute hip fracture:* Estimated inpatient costs, by jurisdiction, 2021–2022

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	$14,668	$12,152	$12,152	$14,384
Prince Edward Island	$14,244	$13,006	$13,006	$15,395
Nova Scotia	$14,335	$11,915	$11,915	$14,103
New Brunswick	$13,929	$11,831	$11,831	$14,004
Quebec	$19,096	$14,232	$14,232	$20,156
Ontario	$14,074	$10,917	$10,917	$15,462
Manitoba	$16,313	$14,116	$14,116	$16,709
Saskatchewan	$16,415	$14,527	$14,527	$14,527
Alberta	$18,137	$15,205	$15,205	$17,997
British Columbia	$16,862	$13,363	$13,363	$18,925
Yukon	$18,302	$16,072	$16,072	$22,763
Northwest Territories	$26,032	$26,639	$22,505	$26,639
Canada (excluding physician costs)†	**$16,010**	**$14,232**	**$11,915**	**$16,846**
Estimated physician cost based on 7 provinces‡	**$3,598**	**$3,371**	**$2,640**	**$4,247**
Canada total (including physician costs)	**$19,608**	**$17,602**	**$14,554**	**$21,120**

Notes

* Identified using the most responsible diagnosis for the hospitalization. For a list of ICD-10-CA codes used, email cjrr@cihi.ca.

† Only typical cases are included. Estimates do not include payments made to physicians, rehabilitation or amortization expenses on land, buildings and building service equipment.

‡ Estimated inpatient physician cost is based on physician billing data per primary hip replacement hospitalization from 7 provinces (Newfoundland and Labrador, Nova Scotia, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia). Only typical cases are included.

Sources

Hospital Morbidity Database, Canadian Management Information System Database and Patient-Level Physician Billing Data Repository, 2021–2022, Canadian Institute for Health Information.

Table 17 Revisions of hip replacements (all diagnoses): Estimated inpatient costs, by jurisdiction, 2021–2022

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	$18,305	$16,533	$12,062	$18,201
Prince Edward Island	$20,239	$17,695	$12,909	$19,481
Nova Scotia	$18,686	$16,210	$11,826	$17,846
New Brunswick	$15,420	$11,742	$11,742	$17,720
Quebec	$21,908	$14,126	$14,126	$21,316
Ontario	$15,672	$10,836	$10,836	$16,351
Manitoba	$18,591	$14,011	$14,011	$21,143
Saskatchewan	$17,722	$14,419	$14,419	$19,764
Alberta	$21,849	$15,091	$15,091	$22,773
British Columbia	$17,738	$13,263	$13,263	$18,180
Canada (excluding physician costs)*	**$18,169**	**$14,419**	**$11,742**	**$19,362**
Estimated physician cost based on 7 provinces†	**$4,274**	**$3,661**	**$2,681**	**$5,113**
Canada total (including physician costs)	**$22,442**	**$18,080**	**$14,423**	**$24,475**

Notes

* Only typical cases are included. Estimates do not include payments made to physicians, rehabilitation or amortization expenses on land, buildings and building service equipment.

† Estimated inpatient physician cost is based on physician billing data per primary hip replacement hospitalization from 7 provinces (Newfoundland and Labrador, Nova Scotia, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia). Only typical cases are included.

Sources

Hospital Morbidity Database, Canadian Management Information System Database and Patient-Level Physician Billing Data Repository, 2021–2022, Canadian Institute for Health Information.

Knee replacement

Table 18 Number of knee replacements, by jurisdiction of surgery, 2017–2018 to 2021–2022

Jurisdiction	2017–2018	2018–2019	2019–2020	2020–2021	2021–2022	5-year percentage change
Newfoundland and Labrador	1,173	1,231	1,174	741	959	-18.2%
Prince Edward Island	330	360	373	462	505	53.0%
Nova Scotia	2,337	2,553	2,700	1,934	1,690	-27.7%
New Brunswick	1,906	2,017	1,891	1,801	1,545	-18.9%
Quebec	12,810	13,227	13,144	7,940	10,832	-15.4%
Ontario	30,692	32,136	31,971	24,105	24,376	-20.6%
Manitoba	2,423	2,745	2,904	2,164	2,125	-12.3%
Saskatchewan	2,601	2,655	2,933	1,671	1,930	-25.8%
Alberta	6,624	6,795	6,409	5,260	5,398	-18.5%
British Columbia	9,553	11,541	11,469	9,093	8,970	-6.1%
Yukon	30	45	57	81	83	176.7%
Northwest Territories	23	40	48	33	30	30.4%
Canada	**70,502**	**75,345**	**75,073**	**55,285**	**58,443**	**-17.1%**

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2017–2018 to 2021–2022, Canadian Institute for Health Information.

Table 19 Number of knee replacements, by type of care, 2017–2018 to 2021–2022

Type of care	2017–2018	2018–2019	2019–2020	2020–2021	2021–2022	5-year percentage change
Acute	70,201	74,882	74,113	51,591	50,643	-27.9%
Day surgery	298	463	960	3,694	7,800	2,517.4%
Total	**70,499**	**75,345**	**75,073**	**55,285**	**58,443**	**-17.1%**

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2017–2018 to 2021–2022, Canadian Institute for Health Information.

Table 20 Age-standardized rate of hospitalization for knee replacement, by jurisdiction of residence, 2017–2018 to 2021–2022

Jurisdiction	2017–2018	2018–2019	2019–2020	2020–2021	2021–2022	5-year percentage change
Newfoundland and Labrador	207	216	201	125	157	-24.2%
Prince Edward Island	227	236	243	286	313	37.9%
Nova Scotia	245	256	263	183	158	-35.5%
New Brunswick	232	237	219	205	170	-26.7%
Quebec	157	160	165	97	123	-21.7%
Ontario	245	251	242	178	175	-28.6%
Manitoba	221	251	259	187	181	-18.1%
Saskatchewan	281	281	296	158	183	-34.9%
Alberta	215	216	198	159	159	-26.0%
British Columbia	209	241	232	178	171	-18.2%
Yukon	183	200	226	246	231	26.2%
Northwest Territories	103	143	171	105	101	-1.9%
Nunavut	320	469	n/r	238	182	-43.1%
Canada	**214**	**222**	**217**	**155**	**160**	**-25.2%**

Notes

n/r: Not reported due to small cell count or incomplete data.

Rates are per 100,000 population, using the 2011 Canadian reference population age 18 and older.

Low volumes within the territories may result in more variability when looking at percentage change calculations over time.

Results are presented by patients' jurisdiction of residence, rather than by the province or territory of the facility where the treatment occurred.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2017–2018 to 2021–2022, Canadian Institute for Health Information.

Table 21 Number of hospitalizations for knee replacement and percentage by age group (years) for male patients, 2021–2022

Jurisdiction	Age 18–54 (%)	Age 55–64 (%)	Age 65–74 (%)	Age 75+ (%)	Total number of hospitalizations
Newfoundland and Labrador	6.0	28.7	42.4	22.9	432
Prince Edward Island	5.0	30.1	43.8	21.0	219
Nova Scotia	4.7	28.7	45.8	20.9	705
New Brunswick	4.4	27.2	44.9	23.5	633
Quebec	5.7	27.7	42.7	23.9	4,700
Ontario	5.4	29.4	41.0	24.2	9,822
Manitoba	6.1	29.6	43.5	20.8	899
Saskatchewan	5.2	28.9	44.8	21.1	788
Alberta	5.4	29.4	42.0	23.3	2,198
British Columbia	5.0	27.2	43.1	24.8	3,836
Yukon	n/r	22.0	53.7	n/r	41
Northwest Territories	n/r	50.0	38.9	n/r	18
Canada	**5.4**	**28.6**	**42.3**	**23.7**	**24,291**

Note

n/r: Not reported due to small cell count (i.e., between 1 and 4) or due to residual disclosure.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2021–2022, Canadian Institute for Health Information.

Table 22 Number of hospitalizations for knee replacement and percentage by age group (years) for female patients, 2021–2022

Jurisdiction	Age 18–54 (%)	Age 55–64 (%)	Age 65–74 (%)	Age 75+ (%)	Total number of hospitalizations
Newfoundland and Labrador	11.1	27.2	42.1	19.6	525
Prince Edward Island	13.3	30.4	38.5	17.8	286
Nova Scotia	9.1	27.5	42.1	21.4	983
New Brunswick	7.7	30.5	39.3	22.5	908
Quebec	6.9	26.5	40.8	25.9	6,108
Ontario	6.7	27.1	41.0	25.1	14,524
Manitoba	7.6	28.6	40.7	23.2	1,225
Saskatchewan	8.1	30.8	35.9	25.2	1,138
Alberta	5.7	27.7	42.9	23.7	3,186
British Columbia	5.6	25.2	42.4	26.7	5,120
Yukon	n/r	40.5	38.1	n/r	42
Northwest Territories	n/r	n/r	58.3	n/r	12
Canada	**6.8**	**27.1**	**41.2**	**25.0**	**34,057**

Note

n/r: Not reported due to small cell count (i.e., between 1 and 4) or due to residual disclosure.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2021–2022, Canadian Institute for Health Information.

Table 23 Number of knee replacements, by type of replacement and jurisdiction of surgery, 2021–2022

Jurisdiction	Number of primaries	Percentage of all replacements	Number of revisions	Percentage of all replacements
Newfoundland and Labrador	888	92.5%	72	7.5%
Prince Edward Island	462	91.3%	44	8.7%
Nova Scotia	1,550	91.6%	143	8.5%
New Brunswick	1,445	93.3%	104	6.7%
Quebec	10,034	92.4%	825	7.6%
Ontario	22,494	92.1%	1,930	7.9%
Manitoba	1,986	92.6%	158	7.4%
Saskatchewan	1,725	88.7%	219	11.3%
Alberta	5,013	92.6%	402	7.4%
British Columbia	8,416	93.7%	564	6.3%
Yukon	81	—	n/r	—
Northwest Territories	30	—	n/r	—
Canada	**54,124**	**92.4%**	**4,461**	**7.6%**

Notes

n/r: Not reported due to small cell count (i.e., between 1 and 4) or due to residual disclosure.

— The percentage change cannot be calculated as the numerator is suppressed.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2021–2022, Canadian Institute for Health Information.

Table 24 Most responsible diagnosis for primary knee replacements, Canada, 2021–2022

Diagnosis grouping*	Number of procedures	Percentage of total
Osteoarthritis	53,058	99.4%
Inflammatory arthritis (e.g., RA, AS, SLE)	179	0.3%
Osteonecrosis (e.g., AVN)	63	0.1%
Fracture (femur or tibia)	46	0.1%
Tumour (primary and metastatic, including synovial)	32	0.1%
Infection (i.e., infectious arthritis)	8	0.0%
Total†	**53,386**	**100.0%**

Notes

* Determined using the most responsible diagnosis (MRDx) collected in the DAD-HMDB or the main problem collected in NACRS. Note that MRDx represents the clinical condition that consumes the most hospital resources during that hospitalization and may not necessarily be the main reason for having a primary knee replacement. For a list of ICD-10-CA codes used, email cjrr@cihi.ca.

† Total excludes hospitalizations that could not be assigned to any of these diagnosis groups.

RA: Rheumatoid arthritis.

AS: Ankylosing spondylitis.

SLE: Systemic lupus erythematosus.

AVN: Avascular necrosis.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2021–2022, Canadian Institute for Health Information.

Table 25 Type of primary knee replacement, Canada, 2021–2022

Type of primary procedure*	Number of procedures	Percentage of total
Total knee arthroplasty, including patella	22,650	45.2%
Total knee arthroplasty, excluding patella	22,394	44.7%
Unicompartmental arthroplasty, medial	4,064	8.1%
Unicompartmental arthroplasty, unspecified	694	1.4%
Unicompartmental arthroplasty, lateral	201	0.4%
Patellofemoral arthroplasty (PFA)	130	0.3%
Total†	**50,133**	**100.0%**

Notes

* Determined using *Canadian Classification of Health Interventions* (CCI) codes and extent attribute codes. For more details, email cjrr@cihi.ca.

† Total excludes the procedures that could not be assigned to any of the groups listed above.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2021–2022, Canadian Institute for Health Information.

Table 26 Reasons for knee revision, Canada, 2021–2022

Reason for revision*	Number of procedures	Percentage of total
Infection	1,632	36.4%
Aseptic loosening	698	15.6%
Instability	561	12.5%
Pain and other complications	345	7.7%
Periprosthetic fracture	181	4.0%
Bearing wear (e.g., poly wear)	111	2.5%
Implant fracture and dissociation	98	2.2%
Arthritis in previously unresurfaced compartment	86	1.9%
Stiffness	76	1.7%
Patella maltracking or instability	59	1.3%
Osteolysis	22	0.5%
Remaining reasons†	613	13.7%
Total	**4,482**	**100.0%**

Notes

* Determined using revision reason (from CJRR or DAD Group 20), most responsible diagnosis (DAD-HMDB) or main diagnosis (NACRS). For more details, refer to Appendix A.

† Includes most responsible diagnosis codes not generally related to knee replacement revision surgery (e.g., cancer).

Note that the total number of revisions in this table differs slightly from the total in other tables because bilateral revisions collected in CJRR are 2 separate records (i.e., left and right side).

Sources

Discharge Abstract Database–Hospital Morbidity Database, National Ambulatory Care Reporting System and Canadian Joint Replacement Registry, 2021–2022, Canadian Institute for Health Information.

Table 27 Primary knee replacements: Acute care length of stay for hospitalization (in days), by jurisdiction of surgery, 2021–2022

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	3.1	3.0	2.0	3.0
Prince Edward Island	2.8	2.0	2.0	3.0
Nova Scotia	1.6	1.0	1.0	1.0
New Brunswick	2.4	2.0	1.0	3.0
Quebec	3.2	2.0	1.0	4.0
Ontario	1.8	1.0	1.0	2.0
Manitoba	3.0	2.0	2.0	3.0
Saskatchewan	3.8	3.0	3.0	4.0
Alberta	2.1	1.0	1.0	2.0
British Columbia	2.1	2.0	1.0	2.0
Yukon	2.7	2.0	2.0	3.0
Northwest Territories	3.1	3.0	3.0	3.0
Canada	**2.3**	**2.0**	**1.0**	**3.0**

Note
This table presents only the acute portion of the hospital stay. Due to a difference in collection of acute and alternate level of care (ALC) data, caution should be used when comparing Quebec length of stay results with results for other jurisdictions.
Source
Hospital Morbidity Database, 2021–2022, Canadian Institute for Health Information.

Table 28 Revisions of knee replacements: Acute care length of stay for hospitalization (in days), by jurisdiction of surgery, 2021–2022

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	7.8	4.0	2.0	8.0
Prince Edward Island	5.1	3.0	2.0	4.0
Nova Scotia	6.1	4.0	1.0	7.0
New Brunswick	11.9	5.0	3.0	10.0
Quebec	8.2	4.0	2.0	9.0
Ontario	6.7	3.0	1.0	7.0
Manitoba	9.8	7.0	3.0	12.0
Saskatchewan	8.6	5.0	3.0	8.0
Alberta	8.2	4.0	2.0	8.0
British Columbia	8.0	3.0	2.0	8.0
Yukon	n/r	n/r	n/r	n/r
Canada	**7.6**	**4.0**	**2.0**	**8.0**

Notes

n/r: Not reported due to small cell count (i.e., between 1 and 4) or due to residual disclosure.

This table presents only the acute portion of the hospital stay. Due to a difference in collection of acute and alternate level of care (ALC) data, caution should be used when comparing Quebec length of stay results with results for other jurisdictions.

Source

Hospital Morbidity Database, 2021–2022, Canadian Institute for Health Information.

Table 29 Primary knee replacements: Estimated inpatient costs, by jurisdiction, 2021–2022

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	$7,872	$7,639	$7,639	$7,639
Prince Edward Island	$8,366	$8,176	$8,176	$8,176
Nova Scotia	$7,655	$7,489	$7,489	$7,489
New Brunswick	$7,673	$7,437	$7,437	$7,437
Quebec	$9,367	$8,946	$8,946	$8,946
Ontario	$7,054	$6,862	$6,862	$6,862
Manitoba	$9,158	$8,873	$8,873	$8,873
Saskatchewan	$9,577	$9,131	$9,131	$9,131
Alberta	$9,885	$9,557	$9,557	$9,557
British Columbia	$8,600	$8,400	$8,400	$8,400
Yukon	$10,201	$10,103	$10,103	$10,103
Northwest Territories	$14,146	$14,146	$14,146	$14,146
Canada (excluding physician costs)*	**$8,290**	**$8,400**	**$6,862**	**$8,946**
Estimated physician cost based on 7 provinces†	**$1,934**	**$1,864**	**$1,582**	**$2,180**
Canada total (including physician costs)	**$10,224**	**$10,264**	**$8,444**	**$11,126**

Notes

* Only typical cases are included. Estimates do not include payments made to physicians, rehabilitation or amortization expenses on land, buildings and building service equipment.

† Estimated inpatient physician cost is based on physician billing data per primary knee replacement hospitalization from 7 provinces (Newfoundland and Labrador, Nova Scotia, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia). Only typical cases are included.

Sources

Hospital Morbidity Database, Canadian Management Information System Database and Patient-Level Physician Billing Data Repository, 2021–2022, Canadian Institute for Health Information.

Table 30 Revisions of knee replacements: Estimated inpatient costs, by jurisdiction, 2021–2022

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	$12,168	$10,357	$10,357	$14,808
Prince Edward Island	$11,984	$11,085	$11,085	$11,085
Nova Scotia	$13,554	$13,819	$10,155	$14,519
New Brunswick	$14,066	$14,306	$10,083	$14,416
Quebec	$17,431	$12,129	$12,129	$17,342
Ontario	$12,911	$9,304	$9,304	$13,303
Manitoba	$15,767	$17,070	$12,031	$17,201
Saskatchewan	$15,083	$12,381	$12,381	$17,702
Alberta	$18,992	$12,959	$12,959	$18,528
British Columbia	$17,927	$11,389	$11,389	$16,283
Yukon	n/r	n/r	n/r	n/r
Northwest Territories	n/r	n/r	n/r	n/r
Canada (excluding physician costs)*	**$15,123**	**$12,381**	**$10,083**	**$16,283**
Estimated physician cost based on 7 provinces†	**$3,336**	**$2,946**	**$2,374**	**$3,741**
Canada total (including physician costs)	**$18,459**	**$15,327**	**$12,457**	**$20,024**

Notes

* Only typical cases are included. Estimates do not include payments made to physicians, rehabilitation or amortization expenses on land, buildings and building service equipment.

† Estimated inpatient physician cost is based on physician billing data per primary knee replacement hospitalization from 7 provinces (Newfoundland and Labrador, Nova Scotia, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia). Only typical cases are included.

n/r: Not reported due to small cell count (i.e., between 1 and 4) or due to residual disclosure.

Sources

Hospital Morbidity Database, Canadian Management Information System Database and Patient-Level Physician Billing Data Repository, 2021–2022, Canadian Institute for Health Information.

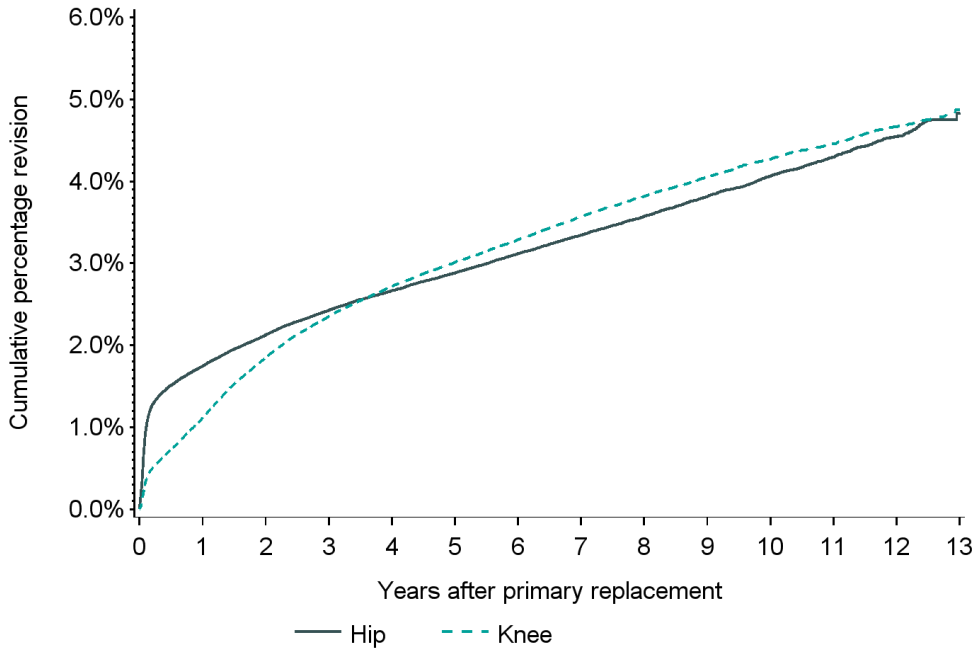
Revision risk curves

Revision risk curves show the cumulative percentage risk of a patient having a revision surgery after a joint replacement, from the time of the primary surgery to revision within a specific period. Methodology details can be found in Appendix B.

Revision risk curves based on hospitalization data

The following revision risk curves are based on hospitalization and day surgery data in Canada, sourced from CIHI's Discharge Abstract Database–Hospital Morbidity Database (DAD-HMDB) and the National Ambulatory Care Reporting System (NACRS). Figure 7 shows the cumulative percentage revision for all primary hip and knee replacements performed in all Canadian jurisdictions with a main diagnosis of osteoarthritis (OA). From 2009–2010 to 2021–2022, 431,468 primary hip replacements and 739,264 primary knee replacements were performed due to OA with up to 13 years of follow-up.[viii]

Figure 7 Cumulative percentage revision for primary hip and knee replacement due to osteoarthritis, Canada, 2009–2010 to 2021–2022



Sources
Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2009–2010 to 2021–2022, Canadian Institute for Health Information.

viii. OA is the most common primary diagnosis for both hip and knee replacements in Canada (about 69% of primary hip replacements and over 98% of primary knee replacements).

Joint	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Hip	1	1.75	1.71–1.79	385,840
	2	2.13	2.08–2.17	348,160
	3	2.43	2.38–2.47	304,913
	4	2.67	2.61–2.72	262,350
	5	2.88	2.83–2.93	223,460
	6	3.12	3.06–3.17	187,000
	7	3.35	3.28–3.41	153,652
	8	3.57	3.51–3.64	122,234
	9	3.81	3.74–3.89	92,988
	10	4.06	3.98–4.14	66,791
	11	4.29	4.21–4.38	42,485
	12	4.54	4.44–4.65	20,528
	13	4.83	4.63–5.02	499
Knee	1	1.12	1.09–1.14	675,490
	2	1.85	1.82–1.88	616,863
	3	2.35	2.31–2.39	542,701
	4	2.72	2.68–2.76	469,095
	5	3.01	2.97–3.05	402,201
	6	3.29	3.24–3.33	339,123
	7	3.57	3.52–3.62	280,065
	8	3.82	3.77–3.87	224,432
	9	4.05	4.00–4.11	171,393
	10	4.27	4.21–4.33	122,800
	11	4.46	4.39–4.52	77,911
	12	4.66	4.59–4.74	37,602
	13	4.87	4.75–4.99	889

Note

* At the end of each time period. The cumulative percentage revision is not included if the number at risk for the group is less than 40.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2009–2010 to 2021–2022, Canadian Institute for Health Information.

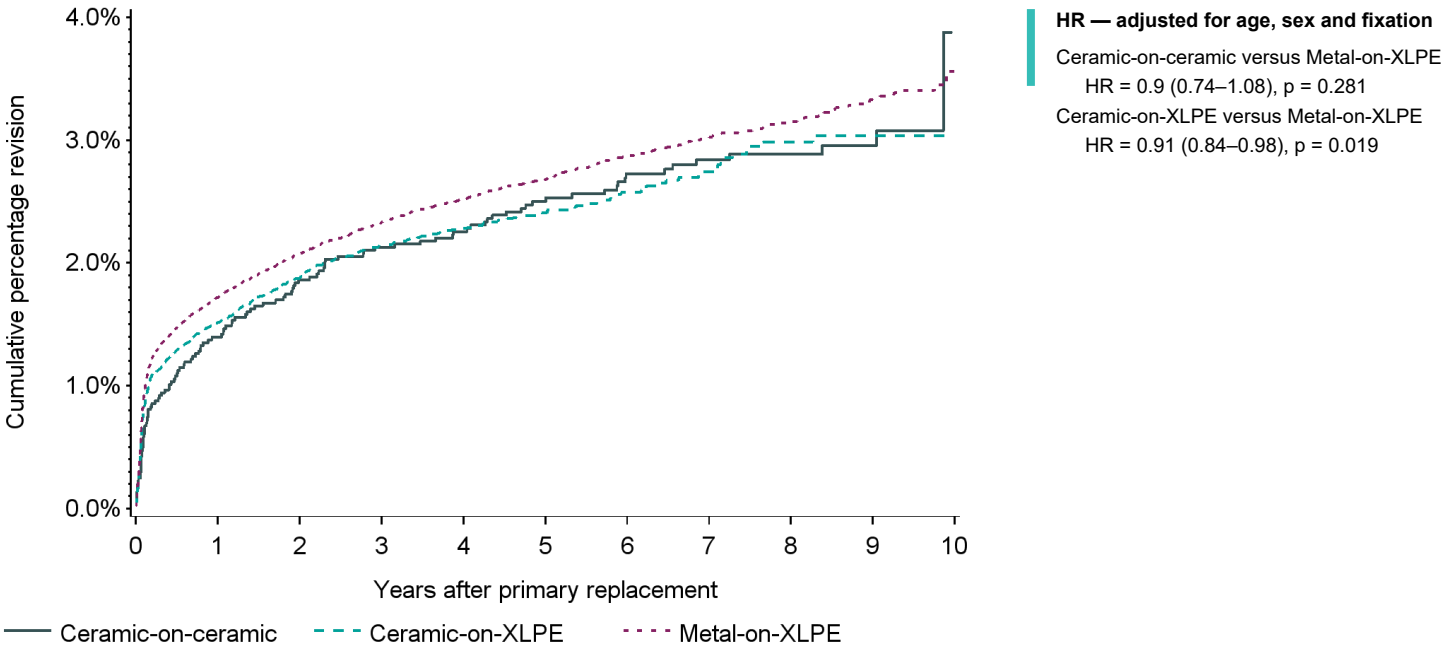
Revision risk curves based on CJRR data

The following revision curves are based on primary replacements found in the Canadian Joint Replacement Registry (CJRR). Registry data contains more detailed information on these joint replacements, including prosthesis characteristics such as bearing surface, which allows for comparison of findings with other international arthroplasty registries. These cumulative revision risk curves are presented based on a large Canadian cohort of over 626,094 primary hip and knee surgeries from 3 provinces (Ontario, Manitoba and British Columbia) that have more than 90% coverage of CJRR prosthesis data.

Details on the methodology and subgroups examined can be found in Appendix B.

Hip replacement

Figure 8 Cumulative percentage revision for primary total hip replacement, by bearing surface (primary diagnosis of osteoarthritis), 2012–2013 to 2021–2022



Notes
XLPE: Cross-linked polyethylene.
HR: Hazard ratio.
p: P-value.
The risk of revision for ceramic-on-ceramic around year 10 may be overestimated due to revisions occurring among a small number of patients at risk. Please interpret with caution.
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Bearing surface of primary replacement	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Ceramic-on-ceramic	1	1.40	1.05–1.74	4,301
	2	1.86	1.46–2.26	4,152
	3	2.13	1.7–2.56	3,961
	4	2.26	1.81–2.70	3,720
	5	2.50	2.03–2.97	3,346
	6	2.73	2.23–3.22	2,887
	7	2.84	2.33–3.35	2,368
	8	2.88	2.36–3.40	1,648
	9	2.96	2.42–3.49	853
Ceramic-on-XLPE	1	1.52	1.39–1.64	34,577
	2	1.88	1.74–2.01	28,146
	3	2.14	1.99–2.29	20,771
	4	2.28	2.12–2.44	14,190
	5	2.41	2.24–2.58	9,189
	6	2.57	2.38–2.77	5,739
	7	2.74	2.51–2.97	3,674
	8	2.99	2.70–3.27	2,269
	9	3.04	2.74–3.34	1,017
Metal-on-XLPE	1	1.72	1.65–1.79	118,233
	2	2.08	2.00–2.16	107,368
	3	2.33	2.24–2.41	92,987
	4	2.52	2.43–2.61	77,684
	5	2.68	2.59–2.77	63,616
	6	2.87	2.77–2.97	48,957
	7	3.02	2.91–3.13	34,750
	8	3.15	3.03–3.26	21,354
	9	3.34	3.21–3.47	9,635

Notes

* At the end of each time period. The cumulative percentage revision is not included if the number at risk for the group is less than 40.

XLPE: Cross-linked polyethylene.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Table 31 Top reasons for revision of total hip replacement for osteoarthritis, by bearing surface, 2012–2013 to 2021–2022

Bearing surface	Aseptic loosening	Infection	Instability	Periprosthetic fracture
Ceramic-on-ceramic	21 (31.8%)	26 (39.4%)	12 (18.2%)	7 (10.6%)
Ceramic-on-XLPE	84 (22.2%)	131 (34.6%)	106 (28.0%)	58 (15.3%)
Metal-on-XLPE	406 (22.7%)	573 (32.0%)	377 (21.1%)	433 (24.2%)

Notes

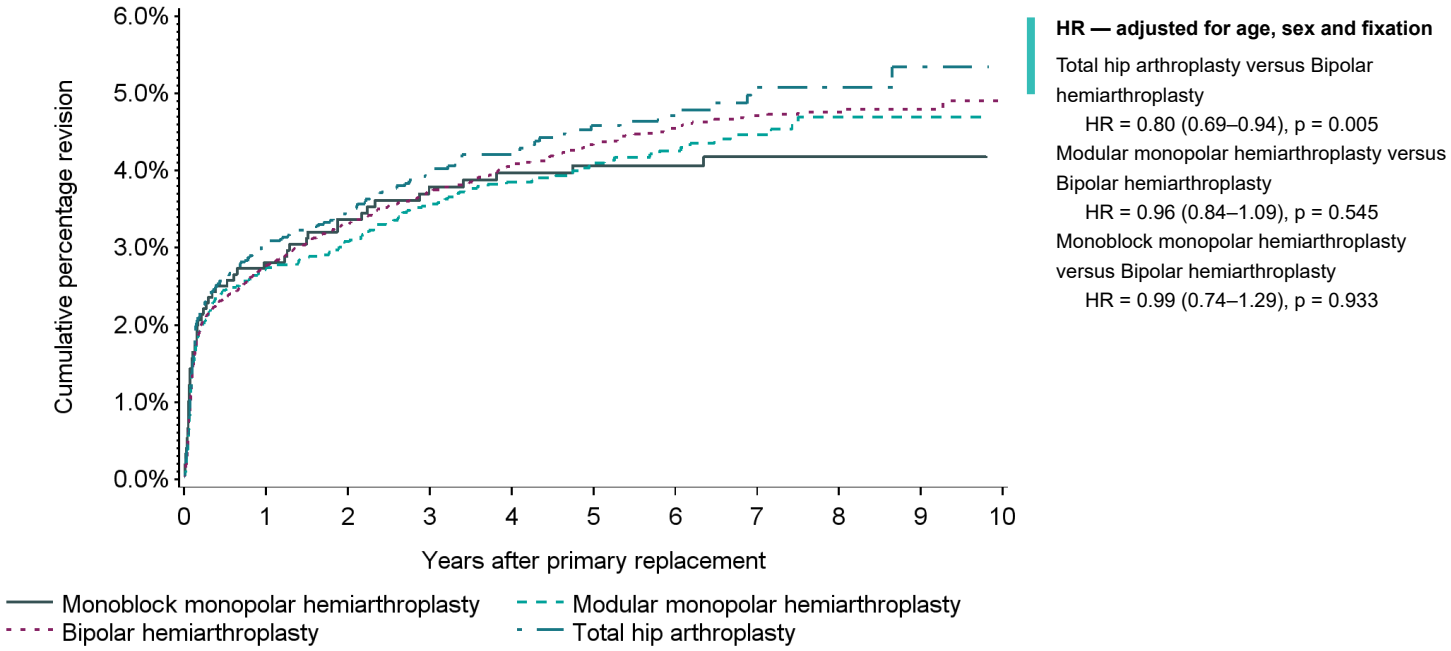
XLPE: Cross-linked polyethylene.

Only revision records with a specific revision reason were included. Revisions with a reason listed as "other" and ones in the DAD and NACRS that could not be linked to a CJRR reason for revision were excluded. Remaining reasons for revision are not shown in table due to small cell counts and include bearing wear, osteolysis, pain of unknown origin, implant fracture, implant dissociation, leg length discrepancy and stiffness.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Figure 9 Cumulative percentage revision for primary hip replacement, by type of procedure (primary diagnosis of acute hip fracture), 2012–2013 to 2021–2022



Notes

HR: Hazard ratio.

p: P-value.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Type of hip arthroplasty	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Total hip arthroplasty	1	3.05	2.59–3.50	4,412
	2	3.46	2.96–3.96	3,610
	3	3.96	3.41–4.51	2,911
	4	4.20	3.63–4.78	2,278
	5	4.58	3.95–5.21	1,757
	6	4.71	4.06–5.37	1,251
	7	5.08	4.33–5.83	898
	8	5.08	4.33–5.83	566
	9	5.34	4.44–6.25	250
Modular monopolar hemiarthroplasty	1	2.73	2.37–3.09	6,530
	2	3.08	2.69–3.47	5,440
	3	3.57	3.14–4.00	4,488
	4	3.85	3.39–4.30	3,579
	5	4.10	3.61–4.59	2,804
	6	4.26	3.75–4.77	2,072
	7	4.46	3.91–5.01	1,453
	8	4.70	4.09–5.31	848
	9	4.70	4.09–5.31	339
Bipolar hemiarthroplasty	1	2.77	2.57–2.98	20,214
	2	3.30	3.07–3.53	16,520
	3	3.73	3.48–3.98	13,219
	4	4.07	3.80–4.34	10,388
	5	4.35	4.06–4.64	8,108
	6	4.55	4.24–4.86	6,058
	7	4.71	4.38–5.03	4,286
	8	4.76	4.43–5.09	2,631
	9	4.80	4.46–5.14	1,251
Monoblock monopolar hemiarthroplasty	1	2.81	1.95–3.67	1,256
	2	3.37	2.42–4.32	1,184
	3	3.79	2.77–4.80	1,108
	4	3.97	2.93–5.01	1,030
	5	4.07	3.01–5.12	964
	6	4.07	3.01–5.12	897
	7	4.18	3.10–5.26	766
	8	4.18	3.10–5.26	572
	9	4.18	3.10–5.26	295

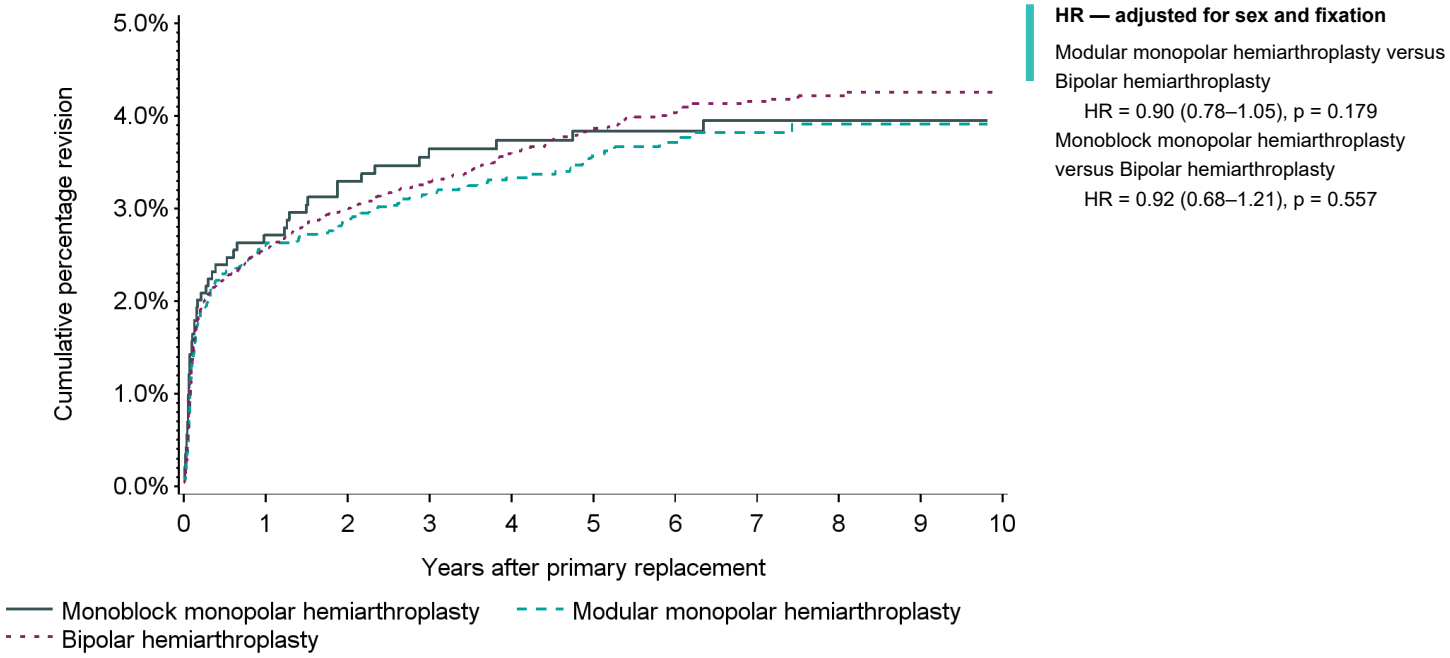
Note

* At the end of each time period. The cumulative percentage revision is not included if the number at risk for the group is less than 40.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Figure 10 Cumulative percentage revision for primary partial hip replacement, by type of procedure (primary diagnosis of acute hip fracture, patients age 70 and older), 2012–2013 to 2021–2022



Notes

HR: Hazard ratio.

p: P-value.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Type of hip arthroplasty	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Bipolar hemiarthroplasty	1	2.57	2.36–2.78	17,808
	2	2.99	2.76–3.23	14,527
	3	3.29	3.04–3.54	11,623
	4	3.60	3.33–3.87	9,111
	5	3.85	3.56–4.14	7,097
	6	4.04	3.73–4.35	5,289
	7	4.16	3.83–4.48	3,737
	8	4.22	3.88–4.55	2,264
	9	4.26	3.92–4.60	1,058
Modular monopolar hemiarthroplasty	1	2.61	2.24–2.98	5,900
	2	2.89	2.50–3.29	4,911
	3	3.17	2.75–3.60	4,054
	4	3.33	2.89–3.78	3,234
	5	3.59	3.11–4.06	2,519
	6	3.71	3.22–4.21	1,865
	7	3.82	3.30–4.34	1,300
	8	3.91	3.36–4.46	748
	9	3.91	3.36–4.46	301
Monoblock monopolar hemiarthroplasty	1	2.71	1.85–3.57	1,206
	2	3.29	2.33–4.25	1,139
	3	3.64	2.63–4.66	1,073
	4	3.74	2.71–4.77	1,001
	5	3.84	2.79–4.89	936
	6	3.84	2.79–4.89	874
	7	3.95	2.88–5.02	749
	8	3.95	2.88–5.02	559
	9	3.95	2.88–5.02	290

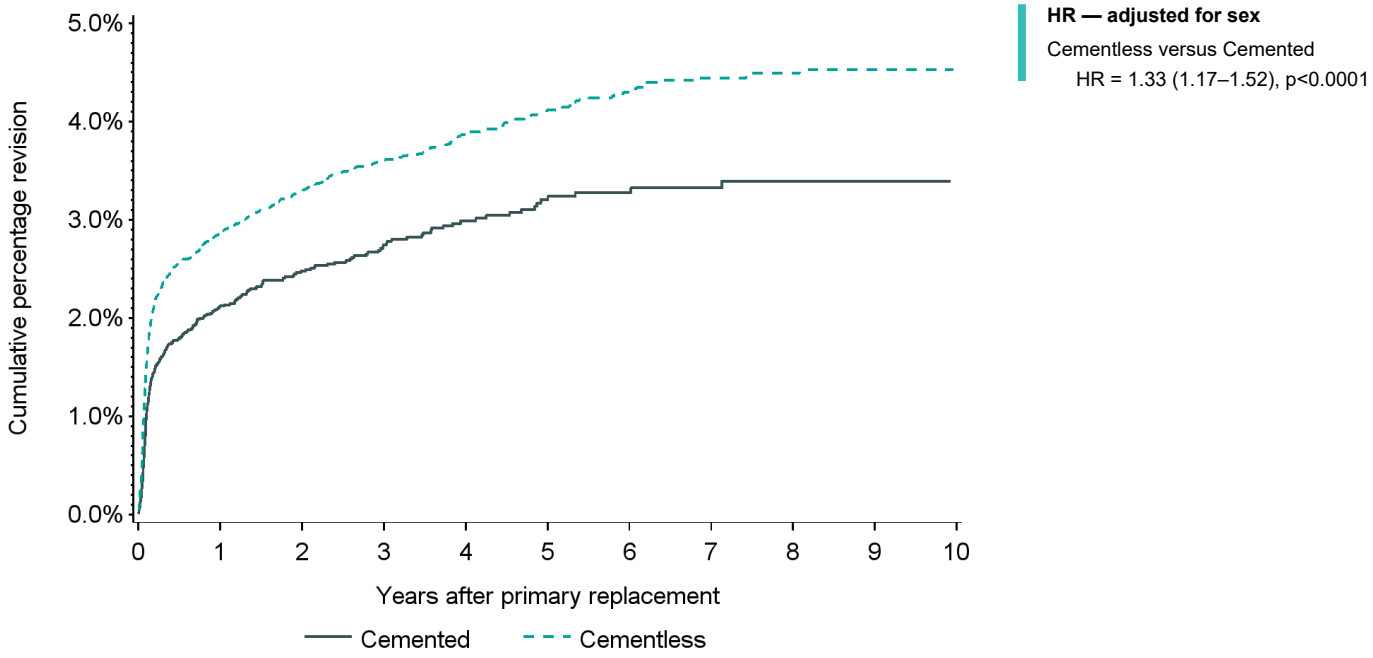
Note

* At the end of each time period. The cumulative percentage revision is not included if the number at risk for the group is less than 40.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Figure 11 Cumulative percentage revision for primary partial hip replacement, by femoral fixation (primary diagnosis of acute hip fracture, patients age 70 and older), 2012–2013 to 2021–2022



Notes

HR: Hazard ratio.

p: P-value.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Femoral fixation	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Cemented	1	2.12	1.86–2.39	9,048
	2	2.48	2.18–2.77	6,876
	3	2.74	2.42–3.07	5,124
	4	2.99	2.64–3.34	3,744
	5	3.20	2.82–3.59	2,813
	6	3.28	2.88–3.67	2,056
	7	3.32	2.92–3.73	1,460
	8	3.39	2.96–3.82	879
	9	3.39	2.96–3.82	442
Cementless	1	2.88	2.64–3.12	15,866
	2	3.30	3.04–3.56	13,701
	3	3.61	3.33–3.88	11,626
	4	3.87	3.58–4.16	9,602
	5	4.12	3.81–4.43	7,739
	6	4.30	3.98–4.62	5,972
	7	4.44	4.10–4.78	4,326
	8	4.49	4.15–4.84	2,692
	9	4.53	4.18–4.88	1,207

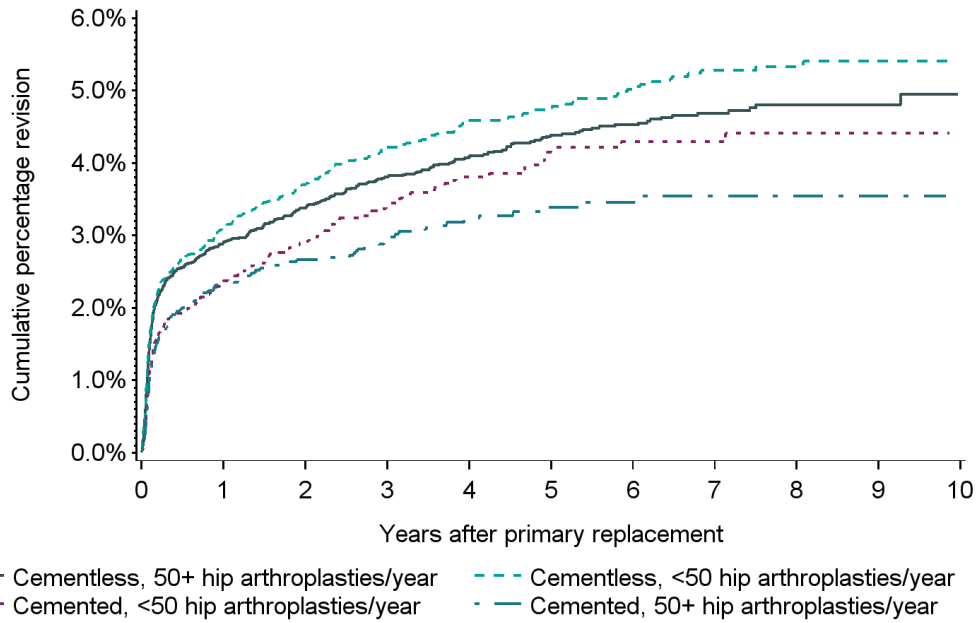
Note

* At the end of each time period. The cumulative percentage revision is not included if the number at risk for the group is less than 40.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Figure 12 Cumulative percentage revision for primary partial hip replacement, by femoral fixation and surgeon hip arthroplasty volume (primary diagnosis of acute hip fracture), 2012–2013 to 2021–2022



HR — adjusted for age and sex

Cementless, <50 hip arthroplasties/year versus Cementless, 50+ hip arthroplasties/year
HR = 1.08 (0.95–1.24), p = 0.239

Cemented, <50 hip arthroplasties/year versus Cemented, 50+ hip arthroplasties/year
HR = 1.13 (0.92–1.38), p = 0.247

Cementless, <50 hip arthroplasties/year versus Cemented, <50 hip arthroplasties/year
HR = 1.20 (1.01–1.42), p = 0.040

Cementless, 50+ hip arthroplasties/year versus Cemented, 50+ hip arthroplasties/year
HR = 1.24 (1.05–1.48), p = 0.012

Notes

HR: Hazard ratio.

p: P-value.

Surgeon volume refers to the number of hip arthroplasties performed by the surgeon in a fiscal year.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Femoral fixation	Surgeon volume	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Cementless	50 or more procedures a year	1	2.91	2.61–3.21	10,519
		2	3.38	3.06–3.71	9,164
		3	3.81	3.46–4.16	7,748
		4	4.09	3.72–4.46	6,462
		5	4.39	3.99–4.78	5,189
		6	4.53	4.12–4.94	4,011
		7	4.69	4.26–5.12	2,890
		8	4.80	4.36–5.25	1,818
		9	4.80	4.36–5.25	875
	Fewer than 50 procedures a year	1	3.12	2.75–3.48	7,397
		2	3.70	3.30–4.11	6,382
		3	4.22	3.78–4.66	5,465
		4	4.57	4.10–5.04	4,515
		5	4.76	4.28–5.24	3,698
		6	5.02	4.51–5.53	2,865
		7	5.28	4.74–5.83	2,123
		8	5.34	4.78–5.89	1,361
		9	5.41	4.83–5.98	615
Cemented	50 or more procedures a year	1	2.34	1.96–2.71	4,987
		2	2.67	2.26–3.07	3,813
		3	2.91	2.47–3.36	2,785
		4	3.23	2.73–3.72	2,058
		5	3.39	2.86–3.91	1,546
		6	3.46	2.92–4.00	1,093
		7	3.55	2.98–4.12	732
		8	3.55	2.98–4.12	420
		9	3.55	2.98–4.12	217
	Fewer than 50 procedures a year	1	2.38	1.99–2.77	4,635
		2	2.93	2.48–3.37	3,552
		3	3.44	2.93–3.95	2,756
		4	3.81	3.25–4.37	2,051
		5	4.15	3.53–4.78	1,549
		6	4.29	3.64–4.95	1,163
		7	4.29	3.64–4.95	862
		8	4.41	3.72–5.10	552
		9	4.41	3.72–5.10	277

Notes

* At the end of each time period. The cumulative percentage revision is not included if the number at risk for the group is less than 40.

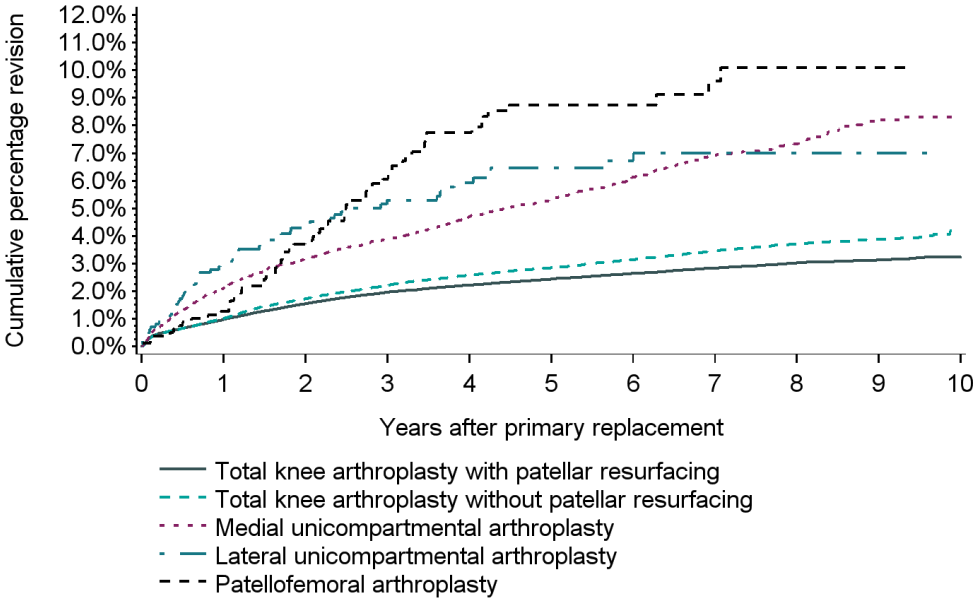
Surgeon volume refers to the number of hip arthroplasties performed by the surgeon in a fiscal year.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information

Knee replacement

Figure 13 Cumulative percentage revision for primary total and partial knee replacement, by type of procedure (primary diagnosis of osteoarthritis), 2012–2013 to 2021–2022



HR — adjusted for age and sex

Total knee arthroplasty without patellar resurfacing versus Total knee arthroplasty with patellar resurfacing
HR = 1.15 (1.10–1.21), p<0.0001

Medial unicompartmental arthroplasty versus Total knee arthroplasty with patellar resurfacing
HR = 1.99 (1.84–2.14), p<0.0001

Lateral unicompartmental arthroplasty versus Total knee arthroplasty with patellar resurfacing
HR = 2.18 (1.66–2.8), p<0.0001

Patellofemoral arthroplasty versus Total knee arthroplasty with patellar resurfacing
0–1 year: HR = 1.10 (0.55–1.94), p = 0.756
1 year+: HR = 3.18 (2.38–4.15), p<0.0001

Notes

HR: Hazard ratio.

p: P-value.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Type of knee arthroplasty	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Total knee arthroplasty with patellar resurfacing	1	0.98	0.93–1.02	179,108
	2	1.54	1.49–1.60	163,659
	3	1.96	1.89–2.02	143,874
	4	2.22	2.15–2.29	121,941
	5	2.43	2.36–2.51	100,249
	6	2.64	2.56–2.72	78,381
	7	2.83	2.74–2.92	56,989
	8	3.02	2.93–3.12	36,587
	9	3.13	3.02–3.23	17,452
	10	3.23	3.11–3.35	66
Total knee arthroplasty without patellar resurfacing	1	1.02	0.96–1.07	112,634
	2	1.72	1.65–1.80	96,922
	3	2.21	2.12–2.29	76,678
	4	2.57	2.48–2.67	58,107
	5	2.84	2.74–2.95	44,336
	6	3.14	3.02–3.26	32,847
	7	3.45	3.31–3.59	23,211
	8	3.69	3.54–3.84	14,483
	9	3.88	3.71–4.05	6,602
Medial unicompartmental arthroplasty	1	2.12	1.88–2.35	13,990
	2	3.17	2.89–3.46	12,260
	3	3.89	3.57–4.21	10,256
	4	4.69	4.33–5.06	8,308
	5	5.33	4.92–5.73	6,708
	6	6.14	5.68–6.60	5,271
	7	6.92	6.40–7.43	3,883
	8	7.33	6.77–7.89	2,537
	9	8.21	7.53–8.90	1,314
Lateral unicompartmental arthroplasty	1	2.99	1.92–4.06	919
	2	4.41	3.11–5.72	842
	3	5.29	3.84–6.73	683
	4	5.93	4.36–7.50	539
	5	6.47	4.80–8.15	445
	6	6.72	4.98–8.46	335
	7	7.00	5.18–8.82	263
	8	7.00	5.18–8.82	174
	9	7.00	5.18–8.82	100

Type of knee arthroplasty	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Patellofemoral arthroplasty	1	1.27	0.49–2.05	764
	2	3.84	2.47–5.21	689
	3	6.06	4.32–7.80	588
	4	7.75	5.75–9.76	487
	5	8.75	6.59–10.92	363
	6	8.75	6.59–10.92	269
	7	9.60	7.16–12.05	187
	8	10.1	7.48–12.73	122
	9	10.1	7.48–12.73	57

Note

* At the end of each time period. The cumulative percentage revision is not included if the number at risk for the group is less than 40.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Table 32 Reasons for revision of total knee replacement for osteoarthritis, by type of procedure, 2012–2013 to 2021–2022

Primary procedure type	Infection	Instability	Aseptic loosening	Remaining reasons
Total knee arthroplasty with patellar resurfacing	970 (34.8%)	612 (22.0%)	543 (19.5%)	660 (23.7%)
Total knee arthroplasty without patellar resurfacing	540 (28.4%)	358 (18.8%)	322 (16.9%)	682 (35.9%)

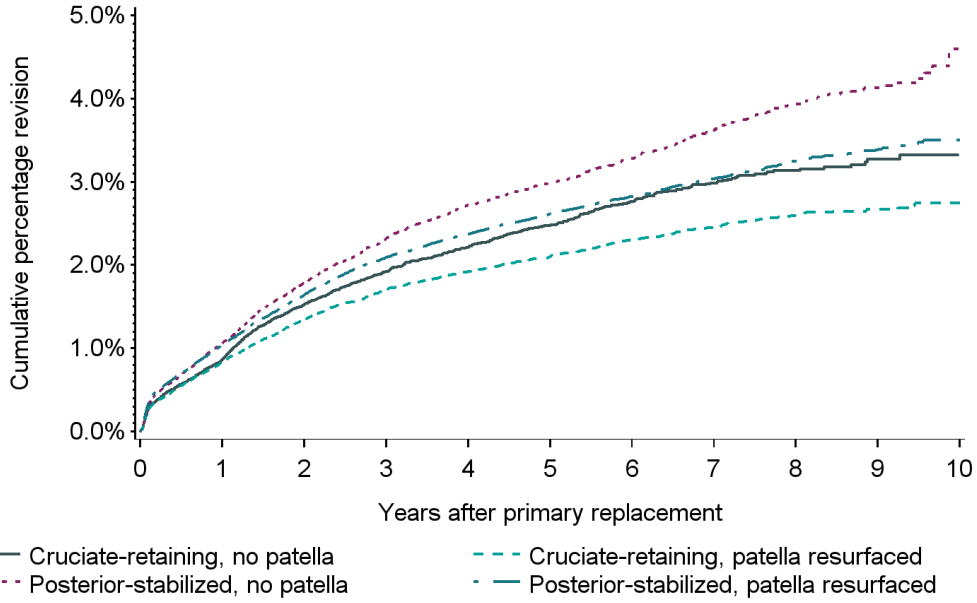
Note

Only revision records with a specific revision reason were included. Revisions with a reason listed as “other” and ones in the DAD and NACRS that could not be linked to a CJRR reason for revision were excluded. Remaining reasons included pain of unknown origin, patella maltracking or instability, periprosthetic fracture (femur or tibia), bearing wear, implant dissociation, implant fracture, osteolysis and stiffness.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Figure 14 Cumulative percentage revision for primary total knee replacement, by stability and patella resurfacing (primary diagnosis of osteoarthritis), 2012–2013 to 2021–2022



HR — adjusted for age and sex

Cruciate-retaining, no patella versus Cruciate-retaining, patella resurfaced
0–1 year: HR = 1.01 (0.89–1.13), p = 0.933
1 year+: HR = 1.23 (1.11–1.36), p<0.0001

Posterior-stabilized, no patella versus Posterior-stabilized, patella resurfaced
HR = 1.14 (1.08–1.21), p<0.0001

Cruciate-retaining, no patella versus Posterior-stabilized, no patella
HR = 0.81 (0.76–0.88), p <0.0001

Cruciate-retaining, patella resurfaced versus Posterior-stabilized, patella resurfaced
HR = 0.82 (0.77–0.88), p<0.0001

Notes

HR: Hazard ratio.

p: P-value.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Stability and patella resurfacing	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Cruciate-retaining, no patella	1	0.87	0.80–0.95	50,535
	2	1.52	1.42–1.63	41,866
	3	1.92	1.80–2.04	31,584
	4	2.21	2.07–2.35	23,301
	5	2.48	2.32–2.63	17,464
	6	2.77	2.59–2.94	12,747
	7	2.99	2.79–3.18	8,959
	8	3.14	2.92–3.35	5,453
	9	3.27	3.03–3.52	2,523
Cruciate-retaining, patella resurfaced	1	0.84	0.77–0.91	66,032
	2	1.34	1.26–1.43	59,394
	3	1.69	1.59–1.79	51,557
	4	1.92	1.81–2.03	43,370
	5	2.10	1.98–2.21	35,861
	6	2.31	2.18–2.43	28,383
	7	2.46	2.32–2.59	21,043
	8	2.60	2.46–2.75	13,808
	9	2.67	2.52–2.82	6,691
Posterior-stabilized, no patella	1	1.06	0.98–1.15	56,774
	2	1.78	1.68–1.89	50,767
	3	2.32	2.19–2.44	42,121
	4	2.72	2.58–2.86	32,759
	5	2.98	2.83–3.13	25,393
	6	3.28	3.12–3.45	19,191
	7	3.62	3.43–3.81	13,633
	8	3.93	3.72–4.15	8,704
	9	4.13	3.89–4.37	3,942
Posterior-stabilized, patella resurfaced	1	1.04	0.98–1.10	109,352
	2	1.64	1.57–1.72	100,803
	3	2.09	2.01–2.18	89,359
	4	2.37	2.28–2.47	76,107
	5	2.61	2.51–2.71	62,411
	6	2.82	2.72–2.93	48,483
	7	3.03	2.92–3.15	35,011
	8	3.25	3.12–3.38	22,339
	9	3.38	3.24–3.52	10,585
	10	3.50	3.34–3.66	42

Note

* At the end of each time period. The cumulative percentage revision is not included if the number at risk for the group is less than 40.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Table 33 Reasons for revision of total knee replacement for osteoarthritis, by stability and patella resurfacing, 2012–2013 to 2021–2022

Stability and patella resurfacing	Infection	Instability	Aseptic loosening	Remaining reasons
Cruciate-retaining, no patella	189 (27.0%)	136 (19.4%)	118 (16.8%)	258 (36.8%)
Cruciate-retaining, patella resurfaced	303 (33.9%)	216 (24.2%)	155 (17.3%)	220 (24.6%)
Posterior-stabilized, no patella	319 (30.6%)	181 (17.4%)	179 (17.2%)	364 (34.9%)
Posterior-stabilized, patella resurfaced	631 (34.7%)	383 (21.1%)	381 (21.0%)	424 (23.3%)

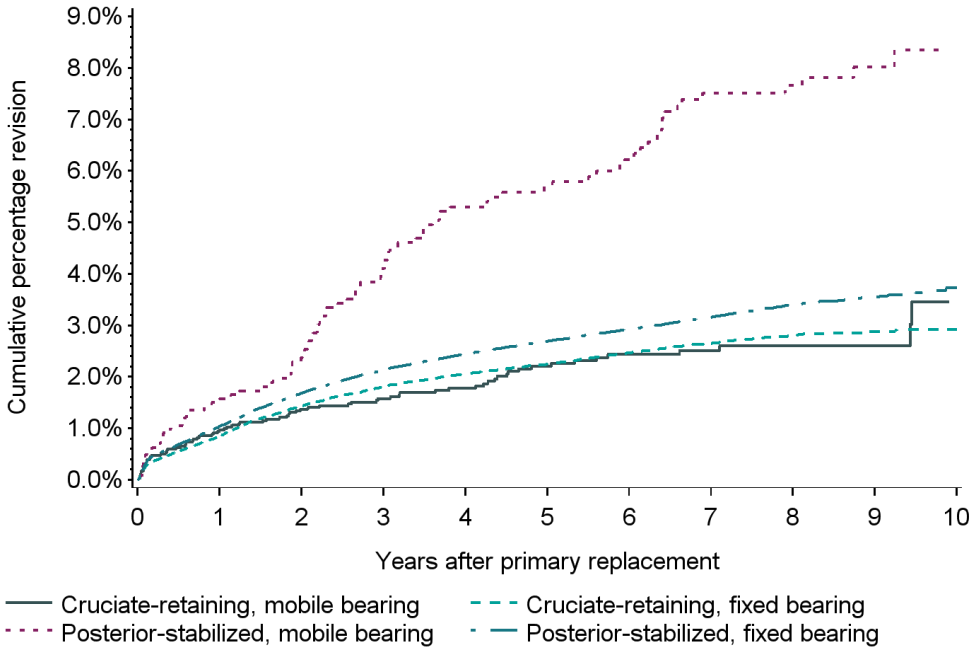
Note

Only revision records with a specific revision reason were included. Revisions with a reason listed as "other" and ones in the DAD and NACRS that could not be linked to a CJRR reason for revision were excluded. Remaining reasons for revision included bearing wear, osteolysis, pain of unknown origin, patellar maltracking, periprosthetic fracture, implant fracture, implant dissociation and stiffness.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Figure 15 Cumulative percentage revision for primary total knee replacement, by stability and mobility (primary diagnosis of osteoarthritis), 2012–2013 to 2021–2022



HR — adjusted for age and sex

Cruciate-retaining, fixed bearing versus Cruciate-retaining, mobile bearing
HR = 1.05 (0.84–1.33), p = 0.663

Posterior-stabilized, fixed bearing versus Posterior-stabilized, mobile bearing
HR = 0.52 (0.42–0.64), p<0.0001

Cruciate-retaining, fixed bearing versus Posterior-stabilized, fixed bearing
HR = 0.84 (0.80–0.88), p<0.0001

Cruciate-retaining, mobile bearing versus Posterior-stabilized, mobile bearing
HR = 0.41 (0.30–0.56), p<0.0001

Notes

HR: Hazard ratio.

p: P-value.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Stability and mobility	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Cruciate-retaining, fixed bearing	1	0.85	0.80–0.91	96,799
	2	1.43	1.35–1.50	86,826
	3	1.80	1.72–1.89	72,912
	4	2.05	1.96–2.15	60,068
	5	2.25	2.15–2.34	48,895
	6	2.47	2.36–2.58	38,056
	7	2.65	2.53–2.76	27,740
	8	2.80	2.67–2.93	17,799
	9	2.88	2.75–3.02	8,456
Cruciate-retaining, mobile bearing	1	0.97	0.64–1.29	3,366
	2	1.37	0.98–1.76	3,078
	3	1.58	1.15–2.00	2,696
	4	1.77	1.32–2.23	2,200
	5	2.21	1.67–2.74	1,844
	6	2.44	1.86–3.01	1,484
	7	2.51	1.91–3.11	1,136
	8	2.60	1.98–3.22	730
	9	2.60	1.98–3.22	366
Posterior-stabilized, fixed bearing	1	1.04	0.99–1.09	154,058
	2	1.68	1.62–1.74	142,176
	3	2.14	2.06–2.21	124,779
	4	2.44	2.36–2.52	104,483
	5	2.69	2.60–2.77	84,807
	6	2.92	2.83–3.01	65,479
	7	3.15	3.05–3.25	46,994
	8	3.39	3.28–3.50	29,815
	9	3.54	3.42–3.66	13,872
	10	3.72	3.54–3.91	61
Posterior-stabilized, mobile bearing	1	1.58	0.92–2.23	1,307
	2	2.37	1.56–3.18	1,213
	3	4.09	3.01–5.18	1,130
	4	5.30	4.06–6.54	1,038
	5	5.68	4.39–6.97	932
	6	6.22	4.86–7.59	831
	7	7.51	5.97–9.06	741
	8	7.65	6.09–9.22	634
	9	8.01	6.37–9.65	370

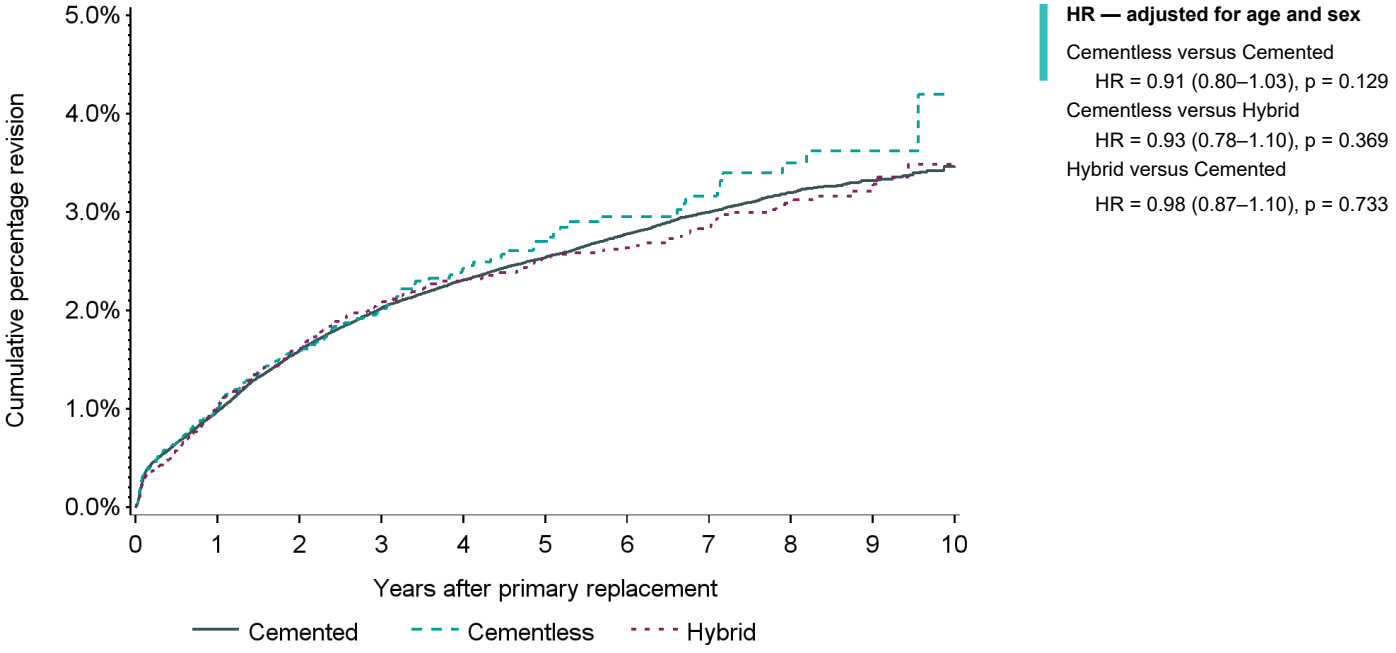
Note

* At the end of each time period. The cumulative percentage revision is not included if the number at risk for the group is less than 40.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Figure 16 Cumulative percentage revision for primary total knee replacement, by fixation (primary diagnosis of osteoarthritis), 2012–2013 to 2021–2022



Notes

HR: Hazard ratio.

p: P-value.

The risk of revision for cementless fixation around year 10 may be overestimated due to revisions occurring among a small number of patients at risk. Please interpret with caution.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Fixation	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Cemented	1	0.98	0.94–1.01	255,983
	2	1.59	1.54–1.64	230,598
	3	2.02	1.96–2.07	196,881
	4	2.31	2.25–2.37	161,165
	5	2.54	2.47–2.60	129,322
	6	2.78	2.71–2.85	99,377
	7	3.00	2.92–3.07	71,647
	8	3.20	3.11–3.28	45,561
	9	3.32	3.23–3.41	21,472
	10	3.46	3.33–3.59	89
Cementless	1	1.00	0.83–1.17	10,556
	2	1.59	1.36–1.83	7,263
	3	2.00	1.71–2.28	4,357
	4	2.43	2.07–2.78	2,936
	5	2.70	2.29–3.11	2,063
	6	2.96	2.49–3.42	1,599
	7	3.16	2.64–3.68	1,284
	8	3.50	2.89–4.12	870
	9	3.62	2.96–4.28	402
Hybrid	1	1.04	0.85–1.23	10,340
	2	1.60	1.36–1.84	9,832
	3	2.06	1.79–2.33	9,027
	4	2.29	2.00–2.59	8,106
	5	2.53	2.22–2.84	6,940
	6	2.64	2.32–2.96	5,714
	7	2.86	2.51–3.20	4,291
	8	3.09	2.71–3.46	2,875
	9	3.21	2.81–3.62	1,389

Note

* At the end of each time period. The cumulative percentage revision is not included if the number at risk for the group is less than 40.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Appendices

Appendix A: Methodology notes for annual statistics

Hospital statistics

Population reference period

Hip and knee replacements are based on data provided through the Discharge Abstract Database (DAD), Hospital Morbidity Database (HMDB) and the National Ambulatory Care Reporting System (NACRS), reflecting procedures performed in both acute care inpatient and day surgery settings in Canada. For information about day surgery data, please refer to CIHI's Emergency and Ambulatory Care web page.

Canadian Classification of Health Interventions (CCI) codes are used to identify hip and knee replacements. Coding methodology for hip and knee replacements (below) details the CCI codes for all hip and knee procedures included in this report.

Data is presented on a fiscal year basis from 2016–2017 to 2021–2022, with the main focus on 2021–2022 (April 1, 2021, to March 31, 2022). The number of replacements reported reflects the number of surgical episodes with a replacement within 1 hospitalization. For example, a simultaneous bilateral procedure within 1 episode of surgery is counted as 1 procedure. Procedures performed in different episodes of surgery within 1 hospitalization are counted individually.

Population age reporting

For the Data tables section, only procedures performed on patients age 18 and older were included. Note that less than 0.1% of all hip and knee replacement procedures were performed on patients younger than 18.

Geographic reporting

Jurisdictional analyses are based on where the procedure was performed, except for analyses involving age-standardized rates, which are based on a patient's province or territory of residence.

Joint replacement hospitalization cost estimate

The hospitalization cost estimate for hip and knee replacements is calculated by multiplying the provincial Resource Intensity Weight (RIW) from the HMDB by the corresponding jurisdictional Cost of a Standard Hospital Stay (CSHS).

The RIW values are based on the 2022 CMG+ (Case Mix Group) grouping methodology. The CSHS values are retrieved from CIHI's Your Health System: In Brief web tool.

Note: The following records are excluded from the cost estimation:

- If 1 hospitalization contains both primary and revision replacement procedures
- If 1 hospitalization contains both hip and knee replacement procedures
- If the replacement type is unknown

Only typical cases are included. Typical cases represent the completion of a full course of treatment at a single hospital, while atypical cases fall into 1 of 4 categories: deaths, sign-outs, transfers and long-stay outliers.

The hospitalization cost estimates do not include the following: payments made to physicians, rehabilitation or amortization expenses on land, buildings and building service equipment.

The national inpatient physician cost estimates are based on billing data from 7 provinces (Newfoundland and Labrador, Nova Scotia, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia) available in the Patient-Level Physician Billing Data Repository.

Clinical statistics

The Canadian Joint Replacement Registry (CJRR) is a national registry that collects demographic, administrative, clinical and prosthesis information on hip and knee replacement procedures performed in Canada. As of 2018–2019, hip and knee replacement prosthesis data can be submitted via the DAD hospitalization abstract (Group 20), depending on the province.

The main diagnosis groups align with information collected in other arthroplasty registries. Diagnosis information is based on data captured in CJRR and the DAD and is obtained directly from the diagnosis group collected in CJRR or derived from the most responsible diagnosis in the DAD-HMDB or the main diagnosis in NACRS. For a list of ICD-10-CA codes used, email cjrr@cihi.ca.

Reason for revision is obtained from revision reason collected in CJRR and the DAD. If this field has not been submitted, then it is derived from the most responsible diagnosis in the DAD-HMDB or the main diagnosis in NACRS. For a list of ICD-10-CA codes used, email cjrr@cihi.ca.

Population reference period

Tables sourced from CJRR present procedures based on surgery dates from April 1, 2021, to March 31, 2022 (fiscal year period).

Tables sourced from the DAD-HMDB and NACRS are based on discharge date or registration date from April 1, 2021, to March 31, 2022 (fiscal year period).

Hip and knee replacement with prosthesis coverage

As of April 1, 2018, hip and knee replacement with prosthesis information can also be submitted via the DAD in Group 20. In 2021–2022, the national-level coverage rate for hip and knee replacement with prosthesis was 68.4% of all replacement procedures performed in public acute care facilities across Canada. The coverage of hip and knee replacements with prosthesis data is based on the number of reported procedures in CJRR or the DAD (with Group 20 completed) compared with the number of procedures submitted to the DAD-HMDB and NACRS (when applicable) by each jurisdiction. In 2021–2022, the submission of hip and knee replacement with prosthesis was mandatory in Nova Scotia, Ontario, Manitoba and British Columbia. Submission is primarily voluntary in other provinces/territories.

Coding methodology for hip and knee replacements in the DAD-HMDB and NACRS for annual statistics

As of 2006–2007, all provinces and territories have adopted the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Canada* (ICD-10-CA) and the *Canadian Classification of Health Interventions* (CCI) as the coding standard for diagnoses and interventions.

For hip and knee replacements, CCI codes provide great specificity in the classification of partial versus total replacements.

Procedures coded as “abandoned” were excluded from analyses. Procedures coded as being performed out of hospital were also excluded to avoid double-counting cases.

Primaries and revisions were identified using a supplementary data element called a Status Attribute, where Status Attribute = P and Status Attribute = R, respectively.

Hip replacements

Table A1 CCI v2018 codes for hip replacements (1.SQ.53.^^ Implantation of internal device, pelvis)

Approach	Type of replacement	Description	Uncemented	Using bone autograft (uncemented)	Using bone homograft (uncemented)	Using combined sources of tissue (e.g., bone graft, cement/paste)	Using synthetic tissue (e.g., bone cement or paste)
Open approach	Partial	Prosthetic device, dual component (e.g., cup with protrusion ring or additional screw, plate fixation)	1.SQ.53.LA-PN	1.SQ.53.LA-PN-A	1.SQ.53.LA-PN-K	1.SQ.53.LA-PN-Q	1.SQ.53.LA-PN-N
		Prosthetic device, single component (e.g., cup)	1.SQ.53.LA-PM	1.SQ.53.LA-PM-A	1.SQ.53.LA-PM-K	1.SQ.53.LA-PM-Q	1.SQ.53.LA-PM-N

Table A2 CCI v2018 codes for hip replacements (1.VA.53.^^ Implantation of internal device, hip joint)

Approach	Type of replacement	Description	Uncemented	Using bone autograft (uncemented)	Using bone homograft (uncemented)	Using synthetic material (e.g., bone paste, cement, Dynagraft, Osteoset)	Using combined sources of tissue (e.g., bone graft, cement/paste)
Open approach (direct lateral, posterolateral, posterior, transgluteal)	Total	Dual component prosthetic device (femoral and acetabular)	1.VA.53.LA-PN	1.VA.53.LA-PN-A	1.VA.53.LA-PN-K	1.VA.53.LA-PN-N	1.VA.53.LA-PN-Q
	Partial	Single component prosthetic device (femoral)	1.VA.53.LA-PM	1.VA.53.LA-PM-A	1.VA.53.LA-PM-K	1.VA.53.LA-PM-N	1.VA.53.LA-PM-Q
	n/a	Cement spacer (temporary, impregnated with antibiotics)	n/a	n/a	n/a	1.VA.53.LA-SL-N	n/a
Open anterior (muscle sparing) approach (anterolateral, direct anterior)	Total	Dual component prosthetic device (femoral and acetabular)	1.VA.53.LL-PN	1.VA.53.LL-PN-A	1.VA.53.LL-PN-K	1.VA.53.LL-PN-N	1.VA.53.LL-PN-Q
	Partial	Single component prosthetic device (femoral)	1.VA.53.LL-PM	1.VA.53.LL-PM-A	1.VA.53.LL-PM-K	1.VA.53.LL-PM-N	1.VA.53.LL-PM-Q
	n/a	Cement spacer [temporary, impregnated with antibiotics]	n/a	n/a	n/a	1.VA.53.LL-SL-N	n/a

Note
n/a: Not applicable.

Knee replacements

Table A3 CCI v2018 codes for knee replacements (1.VG.53.^^ Implantation of internal device, knee joint)

Description	With synthetic material (e.g., bone paste, cement, Dynagraft, Osteoset)	Uncemented	With bone autograft	With bone homograft	With combined sources of tissue (e.g., bone graft, cement, paste)
Single component prosthetic device	1.VG.53.LA-PM-N	1.VG.53.LA-PM	1.VG.53.LA-PM-A	1.VG.53.LA-PM-K	1.VG.53.LA-PM-Q
Dual component prosthetic device	1.VG.53.LA-PN-N	1.VG.53.LA-PN	1.VG.53.LA-PN-A	1.VG.53.LA-PN-K	1.VG.53.LA-PN-Q
Tri component prosthetic device	1.VG.53.LA-PP-N	1.VG.53.LA-PP	1.VG.53.LA-PP-A	1.VG.53.LA-PP-K	1.VG.53.LA-PP-Q
Cement spacer (temporary) (impregnated with antibiotics)	1.VG.53.LA-SL-N	n/a	n/a	n/a	n/a
Partial component [e.g. tibial liner (insert) alone]	n/a	1.VG.53.LA-PR	n/a	n/a	n/a

Note
n/a: Not applicable.

Table A4 CCI v2018 codes for knee replacements (1.VP.53.^^ Implantation of internal device, patella)

Description	Cemented	Uncemented
Single component [patella only] prosthetic device	1.VP.53.LA-PM-N	1.VP.53.LA-PM
Dual component [patellofemoral] prosthetic device	1.VP.53.LA-PN-N	1.VP.53.LA-PN

Appendix B: Methodology notes for revision risk curves

Study population and data sources

- **For cumulative revision curves using hospitalization data:** Primary hip and knee replacement surgeries (total or partial) performed on patients age 18 and older in Canada, followed up to a maximum of 13 years
  - **Primary and revision surgeries:** Discharge Abstract Database, Hospital Morbidity Database and National Ambulatory Care Reporting System, 2009–2010 to 2021–2022
- **For cumulative revision curves using CJRR data:** Primary hip and knee replacement surgeries (total or partial) performed on patients age 18 and older from 3 provinces where CJRR submission is mandated (Ontario, Manitoba and British Columbia), followed up to a maximum of 10 years
  - **Primary surgeries:** Canadian Joint Replacement Registry, 2012–2013 to 2021–2022, and Discharge Abstract Database, 2021–2022
  - **Revision surgeries:** Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022
  - **Prosthesis characteristics:** Sourced from the International Prosthesis Library (IPL),[ix] downloaded on August 11, 2022
  - **GTIN product number:** Mapped to catalogue number based on Global Trade Item Number (GTIN) cross-reference tables from the following manufacturer websites:
    - Zimmer-Biomet
    - Johnson & Johnson
    - Smith & Nephew
    - Stryker

Survival analysis

- Time from the primary replacement to the first revision for a revised joint event. For censored surgeries, time from primary replacement to in-hospital death or the end of the study period (March 31, 2022) was used.[x]
- Stratified Kaplan–Meier survival analysis was used to estimate the survival curves, and the Cox proportional hazards model was used to compare different groups while adjusting for age, sex or cement fixation, as appropriate.
- The level of significance was set at 0.05 for all statistical tests.

ix. A standardized hip and knee arthroplasty product library owned by the International Society of Arthroplasty Registries. For more information, email cjrr@cihi.ca.

x. In-hospital death was identified using the DAD or NACRS.

Unit of analysis

- 1 primary hip or knee joint replacement surgery

Study outcome

- The cumulative percentage revision, also known as a joint replacement failure rate, is calculated as the probabilistic complement of the Kaplan–Meier survivorship function at the given time point, multiplied by 100.
- Cumulative percentage revision at 1 to 10 years is presented with 95% confidence interval at each year. Number of cases at risk by the end of each time period is also reported. The cumulative percentage revision is displayed until the number at risk for the group reaches 40.
- Hazard ratios for specific comparisons adjusted for age, sex and cement fixation, as appropriate, are presented with 95% confidence intervals and p-values. Analytical comparisons of revision rates using the proportional hazards model are based on all available data.

Considerations

- The first occurrence of a revision surgery was identified by linkage to the primary surgery using encrypted health care number and the jurisdiction issuing the health care number, as well as a match for joint type (hip or knee) and replacement side (left or right). As such, surgeries with an invalid health care number or surgery side were excluded from the analysis.
- Patients who died during the primary replacement surgery were excluded from the analysis.
- Bilateral replacement patients are double-counted because different prostheses may be used for each side.
- The revision surgery could have been performed in any Canadian province or territory; however, each jurisdiction manages its own health care numbers, so any patient movements may result in slight under-reporting.
- Quebec does not provide CIHI with information on procedures done on individuals from out of province; thus any revision surgery done in Quebec following a primary surgery performed outside of Quebec for non-Quebec residents is not available for this analysis.
- This analysis assumes that the survivorship of a replacement on one side is independent from survivorship on the other side, even if performed on the same patient.
- Revisions done on the same day as the primary surgery were excluded from this analysis, as were revisions recorded as occurring earlier than the primary surgery.

- Re-revisions are not included, even though patients may have more than one revision on the same side.
- Only in-hospital deaths could be identified using the data sources for this analysis, which could potentially influence the results for the oldest age group more than for other groups. As a result, the true probability of revision may be under-estimated.

Definitions for derived categories

Bearing surface for total hip replacement

- For the bearing surface analysis, CJRR catalogue numbers submitted for the total hip replacements identified in the cohort were linked to the IPL.
- Bearing surface was determined as the material of the femoral head on the material of the acetabular articulating surface (the insert, if one existed; otherwise, the acetabular component).
  - Bearing surface materials were categorized as ceramic, metal, cross-linked polyethylene and non-cross-linked polyethylene.
  - A joint replacement's bearing surface was considered missing if linkage to the IPL indicated
    - Missing bearing surface material for the femoral or acetabular articulating surface; and/or
    - More than one material for femoral or acetabular articulating surface identified.

Monopolar hemiarthroplasty: Monoblock versus modular

- This information is collected in CJRR using the data element Primary Procedure Type.
- Among procedures identified as monopolar hemiarthroplasties, the following criteria were used:
  - If it had a femoral component but no femoral head, it was considered a **monoblock** monopolar hemiarthroplasty.
  - If it had a femoral component and a femoral head, it was considered a **modular** monopolar hemiarthroplasty.
  - If it did not have a femoral component, the procedure type was **unknown**. These were removed from the cohort for analyses examining the procedure type of partial hip replacements.

Fixation for hip replacement: Cement used versus cementless

- This was determined based on cement sticker information reported in CJRR and the CCI intervention code in the DAD. In the CCI structure, non-uncemented (i.e., “cemented”) interventions can involve the use of materials other than cement, such as bone paste, mixed bone grafts, or synthetic graft or paste. As a result, the small proportion of replacements identified as cemented using CCI (less than 4.1%) may not have used cement as the fixation material, although cement is the most common fixation material used.

Fixation for knee replacement: Cemented, cementless, hybrid

- CJRR catalogue numbers submitted for the total knee replacements identified in the cohort were linked to the IPL.
- A joint replacement’s fixation was considered missing if linkage to the IPL indicated
  - Missing fixation for the femoral or tibial component in the IPL; and/or
  - More than one fixation type was identified.

Surgeon arthroplasty volume

- This was determined as the number of hip replacements a surgeon performed in a fiscal year. It was dichotomized as low volume (fewer than 50 hip replacements a year) and high volume (50 or more hip replacements a year) based on the univariate distribution of the variable.

Knee stability

- Stability can be determined from both the femoral component and the tibial insert; however, the stability of the insert is sufficient for determining stability of the construct. If the insert information was missing, stability of the femoral component was considered. Records where stability was other than minimally stabilized (cruciate-retaining) or posterior-stabilized, as well as those where stability information was not available, were excluded from the cohort for analyses examining the effect of stability.

Knee bearing mobility

- Mobility can be determined from both the tibial component and the tibial insert; however, the mobility of the insert is sufficient for determining mobility of the construct. If the insert information was missing, bearing mobility of the tibial component was considered. Bearing mobility was classified into mobile (rotating, sliding, or rotating and sliding) and fixed. Records where mobility information was not available were excluded from the cohort for analyses examining the effect of knee bearing mobility.

Appendix C: Methodology notes for patient-reported outcomes

Data was reported if the patient was at least 20 years old at the time of surgery; had an elective, primary, unilateral hip/knee arthroplasty; and completed a pre- and post-operative PROMs survey within the standard time frame from a subset of hospitals in Ontario, Manitoba and Alberta. Patients with a subsequent hip or knee replacement during the 1-year follow-up period were excluded. Day surgery records were available only for Ontario given the surgical data period (2019–2020 to 2021–2022) and criteria of the eligible population. Results are specific to the data set, which may not be representative of the broader population.

PROMs data was available from 3 provinces: Ontario (Oxford Hip Score [OHS]/Oxford Knee Score [OKS], EQ-5D-5L, Satisfaction), Manitoba (OHS/OKS, Satisfaction) and Alberta (EQ-5D-5L). Pain and function are the 2 subscales that make up the overall joint-specific score (OHS/OKS).

The Oxford Hip and Knee Scores represent a summary score to assess pain and function. The EQ-5D-5L Index represents a summary score valuing a patient's health based on 5 domains (mobility, self-care, usual activities, pain and discomfort, and anxiety and depression). The satisfaction question asks patients how satisfied they are with the results of their joint replacement on a 5-point scale from "very satisfied" to "very dissatisfied." Scores were computed according to the guidelines specified by the licensors of the OHS/OKS[14, 15] and EQ-5D-5L.[16]

Refer to CIHI's *PROMs Data Collection Manual: Hip and Knee Arthroplasty 2021* for details on the national standards. The manual includes guidelines on the collection time frames, recommended PROMs instruments and minimum data set for collection.

Appendix D: Text alternative for figures

Text alternative for Figure 1: Number of hip and knee replacements for OA, by type of care, Canada, 2015–2016 to 2021–2022

Type of care	2015–2016	2016–2017	2017–2018	2018–2019	2019–2020	2020–2021	2021–2022
Acute inpatient	92,573	97,677	102,542	109,543	108,386	77,954	75,906
Day surgery	157	240	371	749	2,060	6,943	14,041

Note
Includes hip and knee replacements with osteoarthritis as the most responsible diagnosis or main diagnosis.
Sources
Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2015–2016 to 2021–2022, Canadian Institute for Health Information.

Text alternative for Figure 2: Number and percentage of hip and knee replacements for OA performed as day surgeries, Canada, 2015–2016 to 2021–2022

Metric	2015–2016	2016–2017	2017–2018	2018–2019	2019–2020	2020–2021	2021–2022
Hip volume	45	80	148	398	1,214	3,477	6,613
Knee volume	112	160	223	351	846	3,466	7,428
Hip percentage of total	0.1	0.2	0.4	1.0	2.9	10.1	18.0
Knee percentage of total	0.2	0.3	0.3	0.5	1.2	6.9	14.0

Note
Includes hip and knee replacements submitted as day surgeries and with osteoarthritis as the most responsible diagnosis or main diagnosis.
Sources
Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2015–2020 to 2021–2022, Canadian Institute for Health Information.

Text alternative for Figure 3: Selected demographic characteristics of patients having hip or knee replacements as day surgeries, 2021–2022 compared with 2015–2016

In 2021–2022, there was an overall increase in the median age and proportion of females and rural residents receiving hip or knee replacements as day surgeries. In 2021–2022, the median age for patients having a hip or knee replacement as day surgery was 65, compared with 62 in 2015–2016. The proportion of female patients grew to 53% in 2021–2022 from 50% in 2015–2016. The number of patients living in a rural community also grew to 18% in 2021–2022 compared with 10% in 2015–2016.

Note

Includes hip and knee replacements submitted as day surgeries and with osteoarthritis as the most responsible diagnosis or main diagnosis.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2015–2020 to 2021–2022, Canadian Institute for Health Information.

Text alternative for Figure 4: 30-day hospital re-visit and 30-day readmission rates for hip and knee replacements performed as day surgeries, Canada, 2019–2020 to 2021–2022

Joint	Type of care	2019–2020	2020–2021	2021–2022
Hip	Hospital re-visit	10.8	8.6	8.8
	Readmission	2.8	1.6	1.8
Knee	Hospital re-visit	9.2	10.5	11.2
	Readmission	2.4	1.6	1.7

Notes

Includes hip and knee replacements submitted as day surgeries and with osteoarthritis as the most responsible diagnosis or main diagnosis.

Re-visits include inpatient hospitalizations, ambulatory care visits and emergency department visits where available. Readmissions include inpatient hospitalizations only.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2019–2020 to 2021–2022, Canadian Institute for Health Information.

Text alternative for Figure 5: 12-month change in patient-reported outcomes and satisfaction with surgery, 2019–2020 to 2021–2022

Classification of the 12-month change in PROMs score and satisfaction with surgery	Hip	Knee
Improved overall joint-specific score based on the Oxford Hip Score (OHS)/Oxford Knee Score (OKS)	97.7%	95.1%
Unchanged overall joint-specific score based on the OHS/OKS	0.4%	1.1%
Worsened overall joint-specific score based on the OHS/OKS	1.9%	3.8%
Improved health-related quality of life score based on the EQ-5D-5L	94.3%	88.1%
Unchanged health-related quality of life score based on the EQ-5D-5L	0.9%	2.4%
Worsened health-related quality of life score based on the EQ-5D-5L	4.8%	9.5%
Felt satisfied with the results of the surgery	92.5%	86.7%
Felt neutral with the results of the surgery	3.8%	8.2%
Felt dissatisfied with the results of the surgery	3.7%	5.2%

Note

Improvement is based on the PROMs change score, which is the difference in score from pre-surgery to 1 year post-surgery. A change score greater than 0 indicates an improved outcome, a change score equal to 0 indicates an unchanged outcome and a change score less than 0 indicates a worsened outcome. Not all positive change scores indicate a meaningful improvement to the patient.

Sources

PROMs data: Alberta Bone and Joint Health Institute, 2018–2019 to 2022–2023; Winnipeg Regional Health Authority, 2018–2019 to 2022–2023; and Ontario PROMs Program co-executed by Ontario Ministry of Health, Ontario Health and Canadian Institute for Health Information, 2018–2019 to 2022–2023.

Surgical data: Discharge Abstract Database and National Ambulatory Care Reporting System, 2019–2020 to 2021–2022, Canadian Institute for Health Information.

Text alternative for Figure 6: 12-month satisfaction rating of hip and knee replacement patients by characteristic and patient-reported outcome, 2019–2020 to 2021–2022

Patient characteristics and patient-reported outcomes	Percentage not satisfied for hip	Percentage satisfied for hip	Percentage not satisfied for knee	Percentage satisfied for knee
Younger than 65	5.9%	94.1%	13.8%	86.2%
65 and older	8.5%	91.5%	13.1%	86.9%
Male	6.9%	93.1%	13.6%	86.4%
Female	8.0%	92.0%	13.1%	86.9%
Day surgery care	5.5%	94.5%	14.4%	85.6%
Inpatient care	8.0%	92.0%	13.2%	86.8%
Oxford score improved	6.1%	93.9%	11.0%	89.0%
Oxford score not improved	60.9%	39.1%	60.5%	39.5%
EQ-5D-5L Index improved	6.6%	93.4%	10.7%	89.3%
EQ-5D-5L Index not improved	47.1%	52.9%	40.5%	59.5%

Notes

Improvement is based on the PROMs change score, which is the difference in score from pre-surgery to 1 year post-surgery. A change score greater than 0 indicates an outcome that has improved and a change score equal to or less than 0 indicates an outcome that has not improved. Not all positive change scores indicate a meaningful improvement to the patient.
The satisfaction rating was collapsed to 2 categories where the term “satisfied” refers to respondents who reported being “very satisfied” or “satisfied,” while the term “not satisfied” refers to those who reported feeling “neutral,” “dissatisfied” or “very dissatisfied.”

Sources

PROMs data: Winnipeg Regional Health Authority, 2018–2019 to 2022–2023; and Ontario PROMs Program co-executed by Ontario Ministry of Health, Ontario Health and Canadian Institute for Health Information, 2018–2019 to 2022–2023.
Surgical data: Discharge Abstract Database and National Ambulatory Care Reporting System, 2019–2020 to 2021–2022, Canadian Institute for Health Information.

Text alternative for Figure 7: Cumulative percentage revision for primary hip and knee replacement due to osteoarthritis, Canada, 2009–2010 to 2021–2022

The cumulative percentage revision for primary hip and knee replacements due to osteoarthritis is plotted as 2 separate curves. The x-axis represents the number of years after primary replacement and ranges from 0 to 13 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 6.0%. The curve for hip replacements shows a steep increase to around 1% quite close to the baseline (year 0). After that, there is an increase to 4.8% at 13 years. The curve for knee replacements shows an increase over time from 1.1% at year 1 to 4.9% at year 13. The table below the figure includes the related statistics.

Sources

Discharge Abstract Database–Hospital Morbidity Database and National Ambulatory Care Reporting System, 2009–2010 to 2021–2022, Canadian Institute for Health Information.

Text alternative for Figure 8: Cumulative percentage revision for primary total hip replacement, by bearing surface (primary diagnosis of osteoarthritis), 2012–2013 to 2021–2022

The cumulative percentage revision for each bearing surface (ceramic-on-XLPE, ceramic-on-ceramic and metal-on-XLPE) is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 10 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 4.0%. The 3 curves have a similar steep increase to around 1% quite close to the baseline (year 0). After that, there is a steady increase up to year 9. At year 10, the risk of revision for ceramic-on-ceramic jumps. However, due to revisions occurring among a small number of patients at risk, please interpret this result with caution. The table below the figure includes the related statistics.

Note
XLPE: Cross-linked polyethylene.
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Text alternative for Figure 9: Cumulative percentage revision for primary hip replacement, by type of procedure (primary diagnosis of acute hip fracture), 2012–2013 to 2021–2022

The cumulative percentage revision for each replacement type (total, monoblock monopolar, modular monopolar and bipolar hemiarthroplasty) is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 10 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 6.0%. All curves look very similar, with a steep increase to about 2% quite close to the baseline (year 0). After that, the increase is quite flat. The table below the figure includes the related statistics.

Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Text alternative for Figure 10: Cumulative percentage revision for primary partial hip replacement, by type of procedure (primary diagnosis of acute hip fracture, patients age 70 and older), 2012–2013 to 2021–2022

The cumulative percentage revision for each hemiarthroplasty type (modular monopolar, monoblock monopolar and bipolar) is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 10 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 5.0%. The bipolar and modular monopolar curves look very similar, with a steep increase to just under 2% quite close to the baseline (year 0); after that, the increase is quite flat. The curve representing monoblock monopolar hemiarthroplasties is slightly higher than the other 2 curves at years 2 to 4 and is in between the other 2 curves after year 4. The table below the figure includes the related statistics.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Text alternative for Figure 11: Cumulative percentage revision for primary partial hip replacement, by femoral fixation (primary diagnosis of acute hip fracture, patients age 70 and older), 2012–2013 to 2021–2022

The cumulative percentage revision for each of the 2 femoral fixation approaches, cemented and cementless, is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 10 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 5.0%. The curve for the cementless femoral fixation is higher and increases in a steeper manner shortly after the baseline (year 0). After that, the increase is quite flat for both curves. The table below the figure includes the related statistics.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Text alternative for Figure 12: Cumulative percentage revision for primary partial hip replacement, by femoral fixation and surgeon hip arthroplasty volume (primary diagnosis of acute hip fracture), 2012–2013 to 2021–2022

The cumulative percentage revision for each of the 4 groups studied (cemented, 50+ hip arthroplasties a year; cemented, fewer than 50 hip arthroplasties a year; cementless, 50+ hip arthroplasties a year; cementless, fewer than 50 hip arthroplasties a year) is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 10 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 6.0%. The cemented curves (both 50+ and fewer than 50 arthroplasties) are considerably lower than the cementless curves. All 4 curves have a steep increase shortly after the baseline (year 0); cemented curves reach just below 2%, while cementless ones are close to 2.5%. When comparing the cementless curves, the one for fewer than 50 is considerably higher than the 50+ one. The table below the figure includes the related statistics.

Note
Surgeon volume refers to the number of hip arthroplasties performed by the surgeon in a fiscal year.
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Text alternative for Figure 13: Cumulative percentage revision for primary total and partial knee replacement, by type of procedure (primary diagnosis of osteoarthritis), 2012–2013 to 2021–2022

The cumulative percentage revision for each knee replacement type (medial, lateral and patellofemoral partials, as well as total knee arthroplasties with and without patellar resurfacing) is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 10 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 12.0%. The total knee replacement curves are lower than the partial ones, with the total knee replacement with patellar resurfacing being the lowest. Near 2.5 years, the lateral unicompartmental curve is the highest. The patellofemoral curve has the steepest increase and after 2.5 years becomes the highest after overlapping the lateral curve. The table below the figure includes the related statistics.

Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Text alternative for Figure 14: Cumulative percentage revision for primary total knee replacement, by stability and patella resurfacing (primary diagnosis of osteoarthritis), 2012–2013 to 2021–2022

The cumulative percentage revision for each of the 4 groups studied (cruciate-retaining, no patella; cruciate-retaining, patella resurfaced; posterior-stabilized, no patella; posterior-stabilized, patella resurfaced) is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 10 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 5.0%. All curves have a similar shape, although they diverge slowly after year 1. The posterior-stabilized with no patella curve is highest and the cruciate-retaining with patella resurfaced curve is lowest. The cruciate-retaining with no patella and the posterior-stabilized with patella resurfaced curves almost overlap. The table below the figure includes the related statistics.

Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Text alternative for Figure 15: Cumulative percentage revision for primary total knee replacement, by stability and mobility (primary diagnosis of osteoarthritis), 2012–2013 to 2021–2022

The cumulative percentage revision for each of the 4 groups studied (cruciate-retaining, mobile bearing; cruciate-retaining, fixed bearing; posterior-stabilized, mobile bearing; posterior-stabilized, fixed bearing) is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 10 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 9.0%. Both fixed curves (posterior-stabilized and cruciate-retaining) have a similar shape. The posterior-stabilized and mobile bearing curve is the highest and diverges significantly from all others after the 2-year mark. The cruciate-retaining and mobile bearing curve has a flat increase up to year 9 and a jump at year 10. The table below the figure includes the related statistics.

Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

Text alternative for Figure 16: Cumulative percentage revision for primary total knee replacement, by fixation (primary diagnosis of osteoarthritis), 2012–2013 to 2021–2022

The cumulative percentage revision for each of the 3 groups (cemented, cementless and hybrid) is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 10 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 5.0%. The curves almost overlap up until the 3-year mark, after which they start diverging slightly with the cementless curve being the highest. The table below the figure includes the related statistics.

Note

The risk of revision for cementless fixation around year 10 may be overestimated due to revisions occurring among a small number of patients at risk. Please interpret with caution.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2021–2022, Canadian Institute for Health Information.

References

1. Canadian Institute for Health Information. Hospital stays in Canada. Accessed June 9, 2023.
2. Statistics Canada. COVID-19 in Canada: A two-year update on social and economic impacts. Accessed June 13, 2023.
3. DeFrance M, et al. Are 20% of patients actually dissatisfied following total knee arthroplasty? A systematic review of the literature. *The Journal of Arthroplasty*. 2023.
4. Hafkamp F, et al. Do dissatisfied patients have unrealistic expectations? A systematic review and best-evidence synthesis in knee and hip arthroplasty patients. *EFORT Open Reviews*. 2020.
5. Enkhjargal B, et al. Conceptualisation of patient satisfaction: A systematic narrative literature review. *Perspectives in Public Health*. 2015.
6. Canadian Institute for Health Information. Surgeries impacted by COVID-19: An update on volumes and wait times. Accessed June 9, 2023.
7. CBC News. Victoria hospital offers innovative same-day hip and knee replacement surgery. September 2, 2020.
8. CTV News. Home in six hours: Toronto hospital offers same-day joint replacement surgery. April 11, 2018.
9. Hamilton Health Sciences. Hip replacement surgery and home in one day. Accessed June 9, 2023.
10. Eastern Health. Eastern Health completes first outpatient hip and knee replacement surgeries. Accessed June 9, 2023.
11. Bodrogi A, Dervin GF, Beaule PE. Management of patients undergoing same-day discharge primary total hip and knee arthroplasty. *Canadian Medical Association Journal*. 2020.
12. CBC News. Ontario expanding number and range of surgeries offered at for-profit clinics. January 16, 2023.
13. CBC News. Alberta Health redirects thousands of orthopedic surgeries to independent clinics to tackle backlog. January 23, 2023.

14. Oxford University Innovation. The Oxford Hip Score (OHS). Accessed June 9, 2023.

15. Oxford University Innovation. The Oxford Knee Score (OKS). Accessed June 9, 2023.

16. EuroQol. EQ-5D user guides. Accessed June 9, 2023.

media@cihi.ca

CIHI Ottawa
495 Richmond Road
Suite 600
Ottawa, Ont.
K2A 4H6
613-241-7860

CIHI Toronto
4110 Yonge Street
Suite 300
Toronto, Ont.
M2P 2B7
416-481-2002

CIHI Victoria
880 Douglas Street
Suite 600
Victoria, B.C.
V8W 2B7
250-220-4100

CIHI Montréal
1010 Sherbrooke Street West
Suite 602
Montréal, Que.
H3A 2R7
514-842-2226

cihi.ca

36490-0823