



Hip and Knee Replacements in Canada

CJRR Annual Report

2020–2021



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For permission or information, please contact CIHI:

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

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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). These surgeries are among the top 3 most performed inpatient surgeries in Canada.¹ The COVID-19 pandemic has had an impact on hospital care in Canada, with the Canadian Institute for Health Information (CIHI) reporting fewer inpatient surgeries done² since the start of the pandemic in March 2020, including a large drop in the number of hip and knee replacements.

This report provides the latest available statistics on hip and knee replacements for 2020–2021 for patients age 18 and older. It includes data at the national and jurisdiction levels, as well as risk curves for revisions (repeat surgeries) based on factors such as age, type of procedure and prosthesis characteristics. This report also presents early findings on surgeries performed from April to December 2021 based on provisional data. Data sources include CIHI's Discharge Abstract Database–Hospital Morbidity Database (DAD-HMDB), the National Ambulatory Care Reporting System (NACRS) and the Canadian Joint Replacement Registry (CJRR).

For the first time, this report also includes results based on data collected directly from patients who had hip or knee replacements in Ontario, Manitoba and Alberta. These patient-reported outcome measures (PROMs) provide information from the patient's perspective and support a patient-centred approach to care.

Impact of COVID-19

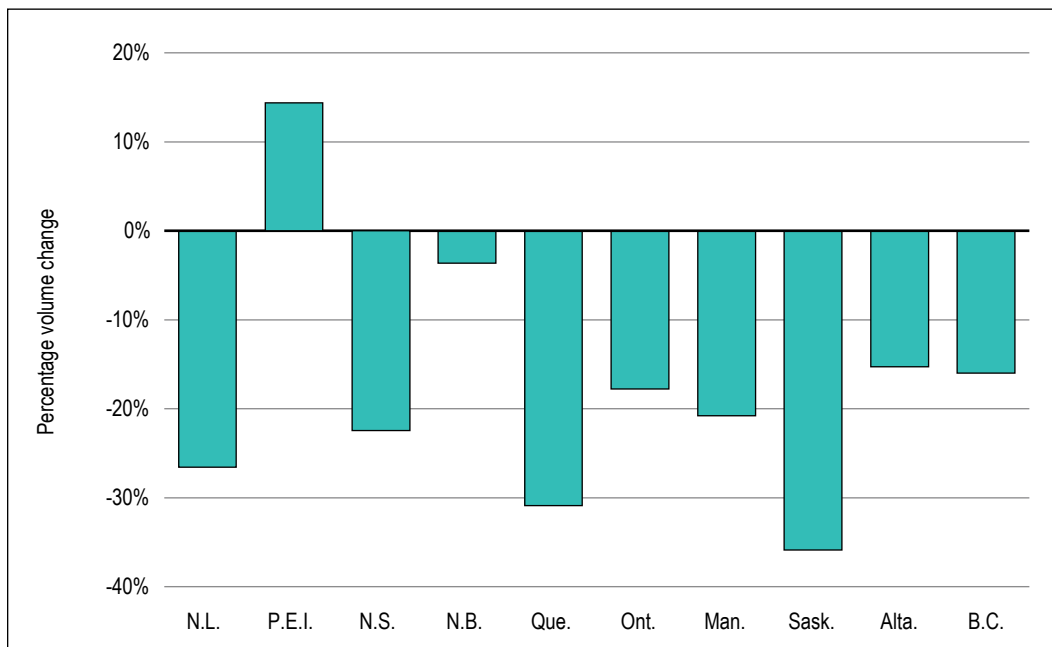
In 2020–2021, the number of hip and knee replacements performed decreased by 12.9% and 26.4%, respectively, compared with the previous year. The drop in the number of hip and knee replacements varied by province and territory.

- Over the past 2 decades, the number of joint replacements performed in Canada increased each year. However, in the past 2 years, this trend has not continued.
- Since hip and knee replacements are largely planned surgeries, this change in trend was likely the result of health systems cancelling planned surgeries to provide additional hospital capacity to care for patients with COVID-19.
 - In addition to the volume decrease from 2019–2020 to 2020–2021, analysis based on provisional data from April to December 2021 shows that hip and knee replacements continue to be affected by pandemic-related measures. During this period, there were 11.7% and 24.1% fewer hip and knee surgeries, respectively, compared with a similar pre-pandemic period.ⁱ

i. There were 34,331 hip and 35,719 knee replacements during this period, versus 38,886 and 47,064 from April to December 2019.

- Figure 1 illustrates the provincial differences in the volume of hip and knee surgeries performed compared with pre-pandemic activity, with all provinces except Prince Edward Island showing volume decreases compared with 2019–2020. In late 2019, P.E.I. hired an additional surgeon, which increased the number of orthopedic surgeons in the province by 20%.³

Figure 1 Percentage change in the actual volume of hip and knee replacements performed, by jurisdiction, 2020–2021 relative to 2019–2020



Note

Jurisdictions with fewer than 50 hip and knee replacements per year are not presented.

Sources

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

- Figure 2 compares the actual monthly volumes of these surgeries by jurisdiction from April 2020 to December 2021 against a similar pre-pandemic period. All jurisdictions showed large decreases in April and May 2020 due to the response to COVID-19 at the beginning of the pandemic. The jurisdictions presented similar patterns throughout the summer 2020 months as planned surgeries resumed. Beginning in the fall of 2020 and continuing throughout 2021, jurisdictional variations likely reflected the regional variation in waves of COVID-19 cases during this period.
- Whereas these results show the actual volume differences, they do not account for the expected annual growth in these joint replacements observed prior to 2019–2020. Using the average year-over-year increases from the previous 3 years before the pandemic, it is estimated that a total of 48,000 surgeries were not performed as would be expected during the past 2 years.ⁱⁱ

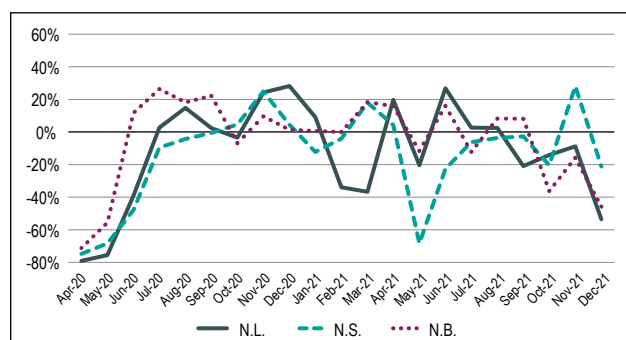
In 2020–2021, a higher proportion of hip replacements were due to hip fracture compared with the previous year. This finding suggests patients requiring urgent treatment were prioritized during the pandemic. Also, a higher proportion of these surgeries were done as day surgeries, a shift in practice that likely resulted from hospitals working to free up bed capacity during peak waves of the pandemic.

- Osteoarthritis (OA) was still the most common reason overall for having a hip or knee replacement. However, a higher proportion of non-OA replacements were performed. In 2020–2021, 26.4% of hip replacements were due to hip fracture compared with 23.6% the previous year (and 23.0% in 2018–2019). Since hip fracture patients require urgent treatment, these surgeries were prioritized whereas scheduled joint replacements were cancelled. At the start of the pandemic, when few replacements were performed in April and May 2020, two-thirds of hip replacements were due to fracture whereas almost all knee replacements were due to OA.

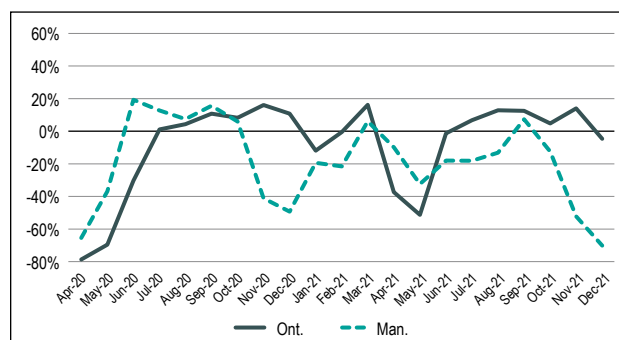
ii. From 2016–2017 to 2018–2019, there was an average annual increase of 5.0% for hip replacements and 5.5% for knee replacements.

Figure 2 Percentage change in the actual volume of surgeries performed by month, by jurisdiction, April 2020 to December 2021 relative to pre-pandemic period

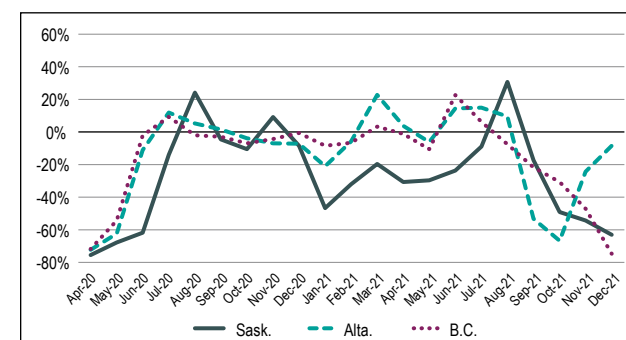
a) Hip replacements — Newfoundland and Labrador, Nova Scotia, New Brunswick



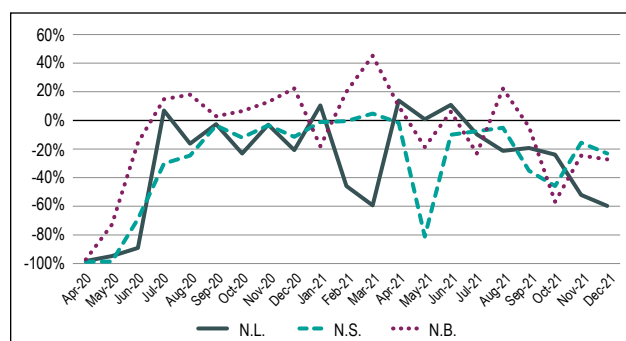
b) Hip replacements — Ontario, Manitoba



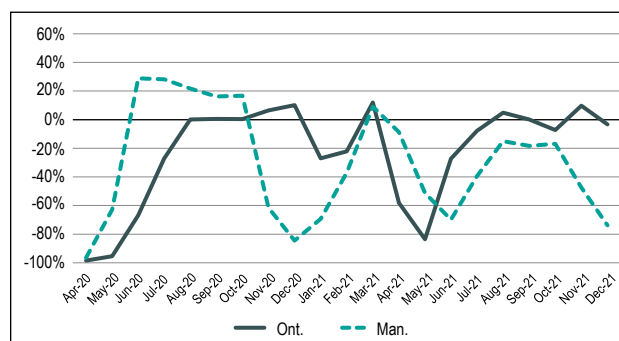
c) Hip replacements — Saskatchewan, Alberta, British Columbia



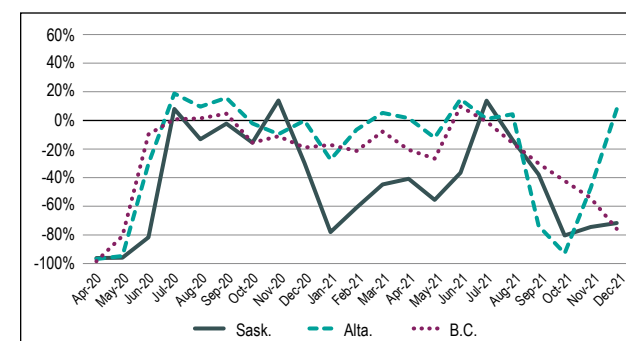
d) Knee replacements — Newfoundland and Labrador, Nova Scotia, New Brunswick



e) Knee replacements — Ontario, Manitoba



f) Knee replacements — Saskatchewan, Alberta, British Columbia



Notes

Excludes data for jurisdictions with fewer than 50 hip or knee replacements during any month.

Excludes Quebec data since data for April to December 2021 was not available at the time this report was developed.

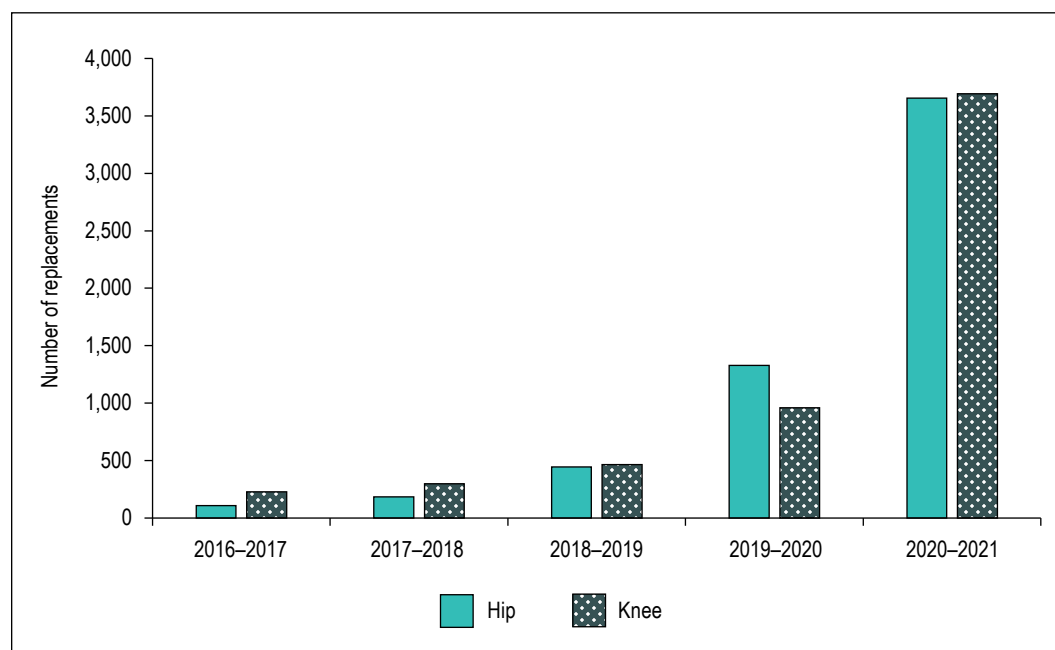
Data for March 2020 to March 2021 is complete. Data for April to December 2021 is provisional and is subject to change; this data should be interpreted with caution. Learn about [how to use CIHI's provisional health data](#).

Sources

Hospital Morbidity Database and National Ambulatory Care Reporting System, March 2019 to February 2020 (pre-pandemic data) and March 2020 to December 2021 (pandemic data; April 2021 to December 2021 is provisional data), Canadian Institute for Health Information.

- Figure 3 illustrates the growth in the number of joint replacements performed as day surgeries in the past 5 years. In 2020–2021, 6.6% of joint replacements (3,656 hips and 3,694 knees) were performed as day surgeries, a nearly 3-fold increase compared with the 1.7% performed as day surgeries in 2019–2020. Across the country, several jurisdictions performed more day surgeries compared with the previous year. However, the increase was primarily driven by Ontario, where 68.9% of the joint replacement day surgeries were performed.
 - Provisional data for April to December 2021 shows 4,030 hip and 4,777 knee replacements performed as day surgeries, representing 11.7% and 13.4% of all replacements done, respectively. These numbers reflect an increase from 5.0% and 5.1%, respectively, compared with the same period in 2020.

Figure 3 Number of hip and knee replacements performed as day surgeries, Canada, 2016–2017 to 2020–2021



Sources

Hospital Morbidity Database and National Ambulatory Care Reporting System, 2016–2017 to 2020–2021, Canadian Institute for Health Information.

Annual statistics for hip and knee replacements, 2020–2021

- 55,300 hip and 55,285 knee replacements were performed in 2020–2021. These numbers were 12.9% and 26.4% lower, respectively, compared with 2019–2020, and 1.2% and 17.7% lower, respectively, compared with 5 years ago. In the 3 years that preceded the pandemic, the average annual volume increases were 5.0% and 5.5%, respectively.
- A higher proportion of patients were female, with 56% of hip replacements and 57% of knee replacements performed on female patients, compared with male patients.ⁱⁱⁱ
- Most patients were age 65 and older. Among hip replacement patients, the most common age group for male patients and female patients was age 75 and older (female patients, 43.9%; male patients, 31.4%). For knee replacements, the most common age group was 65 to 74 (female patients, 41.5%; male patients, 42.4%).
- The most common diagnosis for primary hip and knee replacement patients was OA, at 69.4% and 99.3%, respectively.
- With fewer replacements overall, there were 17.4% fewer hip and knee revisions performed compared with the previous year (8,520 in 2020–2021 versus 10,320 in 2019–2020).
- The top 3 reasons for hip and knee revisions combined were infection (31.3%), aseptic loosening (15.0%) and instability (14.8%).
- On average, patients undergoing revision surgery stayed in hospital more than twice as long as patients undergoing primary surgery (9.2 days versus 3.8 days, respectively).
- The average inpatient cost for a revision surgery (including inpatient physician costs and excluding rehabilitation) was more than \$19,600 — almost 75% higher than for a primary joint surgery (\$11,258).
- In 2020–2021, the average estimated cost for a hip or knee replacement hospitalization was 11.8% higher than in 2019–2020 (\$11,793 versus \$10,547).
- Over \$1.3 billion (including physician costs and excluding rehabilitation costs) was spent on hip and knee replacement surgeries in Canada. This figure is \$157 million less than the previous year, with 20.2% fewer replacements performed.
- For results specific to hip or knee replacements, see [Data tables](#).

iii. 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.

- Patients treated with cemented hemiarthroplasty after hip fracture have 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.^{iv}
- For knee replacements, we found that regardless of the type of fixation used (cemented, hybrid, cementless), revision risk for total knee replacement is similar.
- For more details and results by other risk factors, see [Revision risk curves](#).

Patient-reported data

Hip and knee replacements are performed to improve patients' quality of life by reducing their pain and increasing their mobility. Therefore, patients' perspectives on the outcomes of their surgeries are equally important as other clinical outcomes such as revision risk. PROMs are used to assess a patient's health status at a particular point in time. For hip and knee replacement patients, reporting on their health status before and after surgery can provide additional information to health care teams and administrators regarding the effectiveness of the surgery and the care delivered. Provinces and hospitals are increasingly collecting this data to support the delivery of patient-centred, evidence-based care; clinical decision-making; and quality improvement efforts.

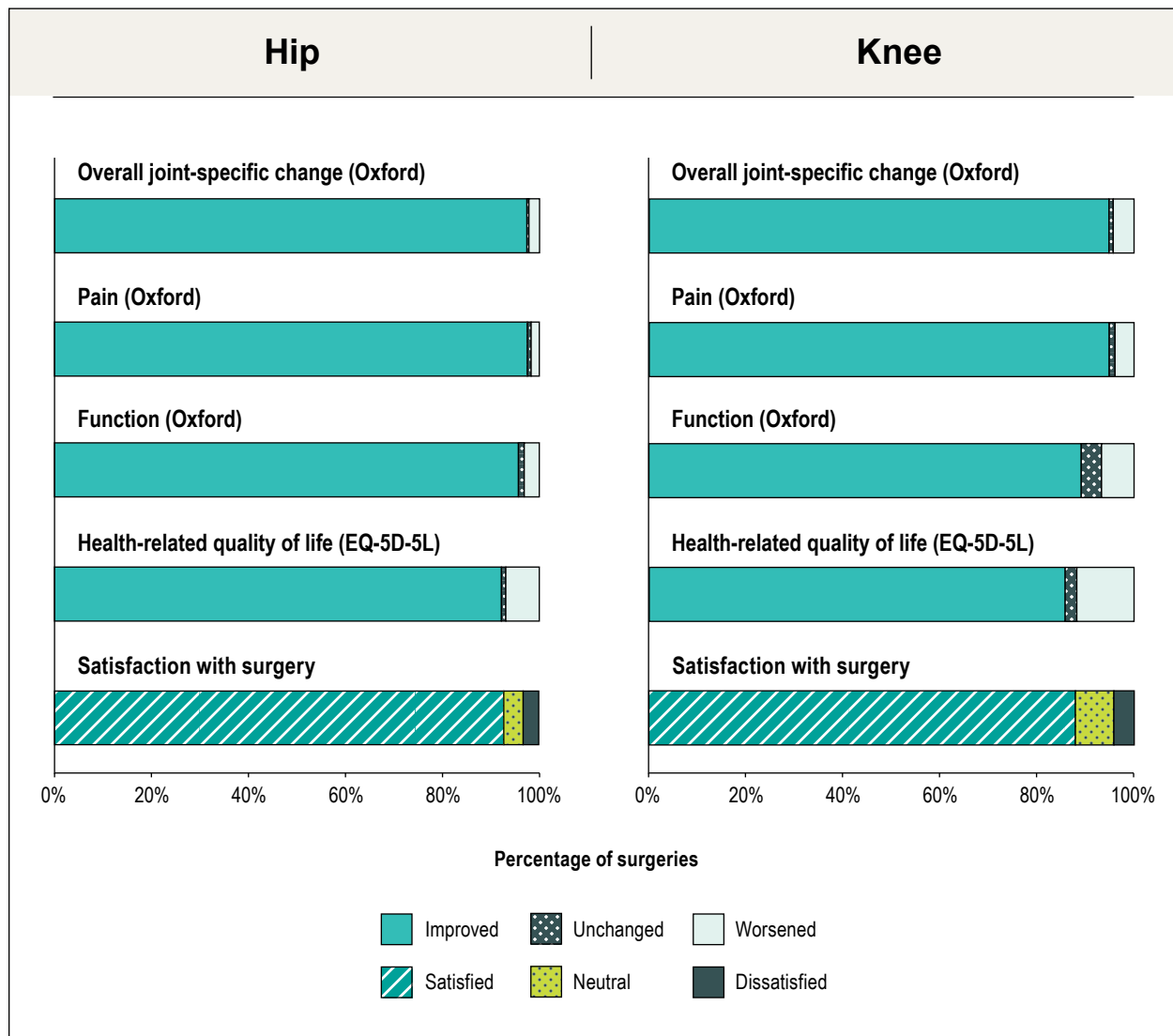
The analysis below used 6 years (2015–2016 to 2020–2021) of data from Ontario, Manitoba and Alberta to demonstrate patient-reported changes in pain, function and health-related quality of life before and after surgery. This data was collected from 7,989 patients, including 3,422 hip replacement and 4,567 knee replacement patients who completed PROMs both before (within 8 weeks) and after (9 to 15 months) surgery. On average, the patients who completed paired pre- and post-surgery PROMs were 66 and 68 years old, respectively. Refer to [Appendix C](#) for methodology details.

Patients reported higher health outcome scores 1 year after hip and knee replacement surgery compared with before surgery.

- Figure 4 illustrates increases in PROM scores and high satisfaction with the outcome of surgery for both hip and knee replacement patients 12 months after surgery. From a patient perspective, these surgeries offer important benefits to self-reported pain, function and health-related quality of life.
- Most patients were satisfied with the outcome of their surgery. However, 7% of hip replacement patients and 12% of knee replacement patients reported feeling neutral or dissatisfied with the outcome of their surgery after 1 year.
- Further investigation into the surgical procedures that showed little or no improvement or had poorer PROMs and satisfaction scores is recommended to identify opportunities for all patients to benefit from these surgeries.

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

Figure 4 12-month change in patient-reported outcomes and satisfaction with surgery, 2015–2016 to 2020–2021



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 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, 2015–2016 to 2019–2020; Winnipeg Regional Health Authority, 2016–2017 to 2020–2021; and Ontario PROMs Program co-executed by Ontario Ministry of Health, Ontario Health and Canadian Institute for Health Information, 2018–2019 to 2021–2022.

Surgical data: Discharge Abstract Database and National Ambulatory Care Reporting System, 2015–2016 to 2020–2021, Canadian Institute for Health Information.

Conclusion

In 2020–2021, fewer hip and knee replacements were performed compared with the previous year due to pandemic-related health system impacts. Even with these lower volumes, these surgeries accounted for over \$1.3 billion in annual hospital-related costs (including physician costs and excluding rehabilitation costs). As a result of the COVID-19 pandemic, approximately 48,000 fewer than expected hip and knee replacements were done in the past 2 fiscal years. While planned surgeries have mostly resumed, health systems continue to deal with rebooking cancelled surgeries, staffing shortages and beds needed for COVID-19 patients. CIHI also reported that in 2020 and 2021, a higher proportion of Canadians were waiting longer than the national wait time benchmark for hip and knee replacements.⁴

The past 2 years have seen a shift toward more replacements performed as day surgeries, with more than 3 times the number of day surgeries performed compared with the previous year. While this shift helped to free up inpatient capacity for COVID-19 patients in some jurisdictions, day surgery volumes still represent a small proportion of all replacements performed in Canada. It will be important to monitor patient outcomes following day surgery and any impact on patient selection.

PROMs are valuable mechanisms to incorporate the patient voice into measurements of clinical care. An analysis of PROMs data from 3 provinces demonstrates that most patients are making self-reported improvements in function and overall quality of life 1 year following hip and knee replacement surgery. Further investigation of the surgical procedures that showed little to no improvement in PROMs data is recommended to ensure all patients benefit optimally from these surgeries. Ultimately, PROMs enable more robust use of data to inform broader patient-centred, value-based care decisions for Canadians.

Data tables

Methodology details are available in [Appendix A](#).

Hip replacement

Table 1 Number of hip replacements, by jurisdiction of surgery, 2016–2017 to 2020–2021

Jurisdiction	2016–2017	2017–2018	2018–2019	2019–2020	2020–2021	5-year percentage change
Newfoundland and Labrador	914	966	1,069	1,051	893	-2.3%
Prince Edward Island	253	280	293	336	349	37.9%
Nova Scotia	1,778	2,056	2,073	2,220	1,882	5.8%
New Brunswick	1,524	1,456	1,529	1,696	1,655	8.6%
Quebec	10,778	11,050	11,761	11,831	9,319	-13.5%
Ontario	22,540	23,725	24,816	24,993	22,727	0.8%
Manitoba	2,026	2,156	2,249	2,524	2,135	5.4%
Saskatchewan	1,940	2,021	2,100	2,286	1,676	-13.6%
Alberta	6,014	6,163	6,240	6,562	5,728	-4.8%
British Columbia	8,187	8,593	9,851	9,945	8,892	8.6%
Yukon	0	0	0	11	8	—
Northwest Territories	27	26	35	41	36	33.3%
Canada	55,981	58,492	62,016	63,496	55,300	-1.2%

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, 2016–2017 to 2020–2021, Canadian Institute for Health Information.

Table 2 Number of hip replacements, by type of care, 2016–2017 to 2020–2021

Type of care	2016–2017	2017–2018	2018–2019	2019–2020	2020–2021	5-year percentage change
Acute	55,875	58,308	61,571	62,167	51,644	-7.6%
Day surgery	106	184	445	1,329	3,656	3,349.1%
Total	55,981	58,492	62,016	63,496	55,300	-1.2%

Sources

Discharge Abstract Database, Hospital Morbidity Database and National Ambulatory Care Reporting System, 2016–2017 to 2020–2021, Canadian Institute for Health Information.

Table 3 Age-standardized rate of hospitalizations for hip replacement, by jurisdiction of residence, 2016–2017 to 2020–2021

Jurisdiction	2016–2017	2017–2018	2018–2019	2019–2020	2020–2021	5-year percentage change
Newfoundland and Labrador	176	181	200	192	161	-8.5%
Prince Edward Island	195	198	197	221	224	14.9%
Nova Scotia	192	218	214	224	186	-3.1%
New Brunswick	195	183	184	203	194	-0.5%
Quebec	137	138	144	148	114	-16.8%
Ontario	184	189	194	189	167	-9.2%
Manitoba	189	197	204	225	184	-2.6%
Saskatchewan	209	216	218	232	163	-22.0%
Alberta	204	202	201	206	179	-12.3%
British Columbia	184	187	207	204	177	-3.8%
Yukon	225	229	223	267	151	-32.9%
Northwest Territories	123	155	219	188	132	7.3%
Nunavut	n/r	258	198	n/r	95	—
Canada	175	178	184	186	157	-10.3%

Notes

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

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

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, 2016–2017 to 2020–2021, Canadian Institute for Health Information.

Table 4 Number of hospitalizations for hip replacement and percentage by age group (years) for male patients, 2020–2021

Jurisdiction	Age 18–54 (%)	Age 55–64 (%)	Age 65–74 (%)	Age 75+ (%)	Total number of hospitalizations
Newfoundland and Labrador	14.2	22.3	35.7	27.9	373
Prince Edward Island	13.3	27.3	33.6	25.8	128
Nova Scotia	11.5	25.1	31.2	32.2	765
New Brunswick	10.3	24.4	34.9	30.4	708
Quebec	12.9	24.2	30.7	32.2	4,076
Ontario	11.2	26.9	30.9	31.1	9,868
Manitoba	11.9	24.1	31.9	32.2	945
Saskatchewan	10.2	27.2	31.0	31.6	684
Alberta	14.1	27.1	29.1	29.5	2,487
British Columbia	11.5	24.0	31.3	33.2	3,929
Yukon	n/r	n/r	n/r	n/r	n/r
Northwest Territories	n/r	40.9	27.3	n/r	22
Canada	11.9	25.7	31.0	31.4	23,985

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, 2020–2021, Canadian Institute for Health Information.

Table 5 Number of hospitalizations for hip replacement and percentage by age group (years) for female patients, 2020–2021

Jurisdiction	Age 18–54 (%)	Age 55–64 (%)	Age 65–74 (%)	Age 75+ (%)	Total number of hospitalizations
Newfoundland and Labrador	8.8	15.5	29.9	45.8	511
Prince Edward Island	5.9	18.3	32.4	43.4	219
Nova Scotia	7.9	18.7	30.7	42.7	1,108
New Brunswick	7.5	16.8	31.4	44.4	940
Quebec	6.1	15.3	28.5	50.2	5,163
Ontario	7.2	19.2	31.7	41.9	12,720
Manitoba	5.2	18.4	28.1	48.3	1,177
Saskatchewan	5.2	19.9	28.8	46.2	981
Alberta	8.4	21.3	29.4	41.0	3,199
British Columbia	6.6	18.6	32.2	42.7	4,905
Yukon	n/r	n/r	n/r	n/r	5
Northwest Territories	n/r	n/r	64.3	n/r	14
Canada	6.9	18.5	30.7	43.9	30,942

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, 2020–2021, Canadian Institute for Health Information.

Table 6 Number of hip replacements, by type of replacement and jurisdiction of surgery, 2020–2021

Jurisdiction	Number of primaries	Percentage of all replacements	Number of revisions	Percentage of all replacements
Newfoundland and Labrador	798	89.4%	95	10.6%
Prince Edward Island	322	92.3%	27	7.7%
Nova Scotia	1,721	91.2%	166	8.8%
New Brunswick	1,538	92.9%	118	7.1%
Quebec	8,582	92.0%	748	8.0%
Ontario	20,967	92.2%	1,769	7.8%
Manitoba	1,980	92.7%	155	7.3%
Saskatchewan	1,552	92.6%	125	7.5%
Alberta	5,251	91.6%	480	8.4%
British Columbia	8,221	92.4%	676	7.6%
Yukon	n/r	—	n/r	—
Northwest Territories	36	—	0	0.0%
Canada	50,968	92.1%	4,359	7.9%

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, 2020–2021, Canadian Institute for Health Information.

Table 7 Most responsible diagnosis for primary hip replacements, Canada, 2020–2021

Diagnosis groups*	Number of records	Percentage of total
Osteoarthritis	34,396	69.4%
Acute hip fracture	13,092	26.4%
Osteonecrosis (e.g., AVN)	1,096	2.2%
Old hip fracture (e.g., non-union, hardware failure)	438	0.9%
Tumour (primary and metastatic, including synovial)	404	0.8%
Inflammatory arthritis (e.g., RA, AS, SLE)	83	0.2%
Childhood hip problem (e.g., hip dysplasia)	54	0.1%
Infection (i.e., infectious arthritis)	15	0.0%
Total†	49,578	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 (n = 1,398).

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, 2020–2021, Canadian Institute for Health Information.

Table 8 Type of primary hip replacement due to osteoarthritis, Canada, 2020–2021

Type of primary procedure*	Number of procedures	Percentage of total
Total hip arthroplasty	33,954	99.4%
Partial hip arthroplasty	211	0.6%
Total†	34,165	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 (n = 432).

Sources

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

Table 9 Type of primary hip replacement due to hip fracture, Canada, 2020–2021

Type of primary procedure*	Number of procedures	Percentage of total
Bipolar hemiarthroplasty	6,908	54.1%
Modular monopolar hemiarthroplasty	3,484	27.3%
Total hip arthroplasty	2,041	16.0%
Monoblock monopolar hemiarthroplasty	198	1.6%
Hemiarthroplasty unspecified	132	1.0%
Total†	12,763	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 (n = 329).

Sources

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

Table 10 Type of fixation* for primary hip replacement due to hip fracture, Canada, 2020–2021

Jurisdiction	Number of surgeries using cement fixation	Percentage of surgeries using cement fixation	Number of surgeries using cementless fixation	Percentage of surgeries using cementless fixation
Newfoundland and Labrador	241	82.2%	50	17.2%
Prince Edward Island	n/r	n/r	n/r	n/r
Nova Scotia	347	77.5%	101	22.5%
New Brunswick	132	31.1%	292	68.9%
Quebec	1,752	65.9%	907	34.1%
Ontario	2,664	53.7%	2,301	46.3%
Manitoba	184	32.5%	382	67.5%
Saskatchewan	245	51.6%	230	48.4%
Alberta	687	52.4%	623	47.6%
British Columbia	1,129	60.2%	745	39.8%
Yukon	7	100.0%	0	0%
Northwest Territories	n/r	n/r	7	n/r
Canada	7,452	56.9%	5,640	43.1%

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, 2020–2021, Canadian Institute for Health Information.

Table 11 Reasons for hip revision, Canada, 2020–2021

Reason for revision*	Number of records	Percentage of total
Infection	1,189	27.2%
Aseptic loosening	747	17.1%
Instability	556	12.7%
Periprosthetic fracture	531	12.2%
Bearing wear (e.g., poly wear)	172	3.9%
Pain and other complications	172	3.9%
Implant fracture and dissociation	84	1.9%
Osteolysis	80	1.8%
Acetabular erosion	38	0.9%
Leg length discrepancy	11	0.3%
Remaining reasons†	789	18.1%
Total	4,369	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 stiffness, unspecified complications, other most responsible diagnosis codes not generally related to hip replacement revision surgery (e.g., cancer) and groups with small cell counts.

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, 2020–2021, 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, 2020–2021

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	3.1	2.0	2.0	3.0
Prince Edward Island	2.9	3.0	2.0	3.0
Nova Scotia	1.4	1.0	1.0	1.0
New Brunswick	2.7	2.0	1.0	3.0
Quebec	3.2	2.0	2.0	3.0
Ontario	1.8	1.0	1.0	2.0
Manitoba	2.7	2.0	2.0	3.0
Saskatchewan	3.7	3.0	2.0	4.0
Alberta	2.1	2.0	1.0	2.0
British Columbia	2.0	2.0	1.0	2.0
Northwest Territories	2.9	3.0	2.0	3.0
Canada	2.2	2.0	1.0	2.0

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, 2020–2021, 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, 2020–2021

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	9.8	7.0	4.0	12.0
Prince Edward Island	7.5	5.0	3.0	9.0
Nova Scotia	11.7	7.0	4.0	13.0
New Brunswick	10.1	8.0	5.0	12.0
Quebec	15.1	11.0	6.0	20.0
Ontario	8.9	7.0	4.0	10.0
Manitoba	11.3	7.0	4.0	13.0
Saskatchewan	8.1	6.0	5.0	10.0
Alberta	10.1	7.0	4.0	12.0
British Columbia	10.9	7.0	5.0	13.0
Yukon	8.0	8.0	6.0	11.0
Northwest Territories	7.0	7.0	4.0	9.0
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, 2020–2021, 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, 2020–2021

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	12.0	7.5	4.0	13.0
Prince Edward Island	7.4	6.0	3.0	9.0
Nova Scotia	12.8	5.0	2.0	12.0
New Brunswick	15.1	7.0	4.0	15.0
Quebec	14.1	7.5	3.0	16.0
Ontario	9.1	6.0	3.0	10.0
Manitoba	10.8	7.0	3.0	13.0
Saskatchewan	13.8	6.0	4.0	12.0
Alberta	10.5	6.0	3.0	12.0
British Columbia	10.7	5.0	2.0	11.0
Yukon	n/r	n/r	n/r	n/r
Canada	10.9	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, 2020–2021, Canadian Institute for Health Information.

Table 15 Primary hip replacements for osteoarthritis:* Estimated inpatient costs, by jurisdiction, 2020–2021

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	\$8,703	\$8,573	\$8,573	\$8,573
Prince Edward Island	\$9,617	\$9,606	\$9,606	\$9,606
Nova Scotia	\$7,343	\$7,281	\$7,281	\$7,281
New Brunswick	\$7,529	\$7,438	\$7,438	\$7,438
Quebec	\$9,426	\$9,034	\$9,034	\$9,034
Ontario	\$7,433	\$7,264	\$7,264	\$7,264
Manitoba	\$7,825	\$7,737	\$7,737	\$7,737
Saskatchewan	\$9,980	\$9,883	\$9,883	\$9,883
Alberta	\$10,516	\$10,246	\$10,246	\$10,246
British Columbia	\$8,805	\$8,720	\$8,720	\$8,720
Northwest Territories	\$14,979	\$14,839	\$14,839	\$14,839
Canada (excluding physician costs) [†]	\$8,554	\$8,368	\$8,368	\$8,368
Estimated physician cost based on 6 provinces [‡]	\$1,999	\$1,891	\$1,641	\$2,243
Canada total (including physician costs)	\$10,553	\$10,259	\$10,009	\$10,611

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 6 provinces (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, 2020–2021, Canadian Institute for Health Information.

Table 16 Primary hip replacements for acute hip fracture:*
Estimated inpatient costs, by jurisdiction, 2020–2021

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	\$15,017	\$12,124	\$12,124	\$18,524
Prince Edward Island	\$14,804	\$13,585	\$13,585	\$13,585
Nova Scotia	\$12,371	\$10,296	\$10,296	\$13,151
New Brunswick	\$12,670	\$10,519	\$10,519	\$13,435
Quebec	\$17,593	\$12,775	\$12,775	\$19,519
Ontario	\$13,747	\$10,272	\$10,272	\$15,695
Manitoba	\$12,627	\$10,941	\$10,941	\$10,941
Saskatchewan	\$16,173	\$13,976	\$13,976	\$13,976
Alberta	\$18,765	\$14,489	\$14,489	\$22,137
British Columbia	\$16,278	\$12,332	\$12,332	\$18,842
Yukon	\$16,981	\$16,334	\$16,334	\$16,334
Northwest Territories	\$27,504	\$20,984	\$20,984	\$26,801
Canada (excluding physician costs) [†]	\$15,605	\$11,833	\$11,833	\$18,080
Estimated physician cost based on 6 provinces [‡]	\$3,640	\$3,396	\$2,644	\$4,307
Canada total (including physician costs)	\$19,245	\$15,229	\$14,477	\$22,387

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 6 provinces (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, 2020–2021, Canadian Institute for Health Information.

Table 17 Revisions of hip replacements (all diagnoses): Estimated inpatient costs, by jurisdiction, 2020–2021

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	\$18,451	\$15,869	\$12,420	\$17,776
Prince Edward Island	\$16,424	\$13,916	\$13,916	\$18,843
Nova Scotia	\$14,664	\$10,548	\$10,548	\$15,096
New Brunswick	\$15,032	\$12,105	\$10,775	\$15,422
Quebec	\$22,582	\$16,721	\$13,086	\$22,253
Ontario	\$15,509	\$13,445	\$10,523	\$15,061
Manitoba	\$15,793	\$11,907	\$11,208	\$15,730
Saskatchewan	\$19,418	\$14,317	\$14,317	\$20,491
Alberta	\$21,364	\$18,965	\$14,842	\$21,243
British Columbia	\$16,415	\$12,632	\$12,632	\$17,105
Canada (excluding physician costs)*	\$17,910	\$12,878	\$12,122	\$17,350
Estimated physician cost based on 6 provinces†	\$4,187	\$3,651	\$2,639	\$5,917
Canada total (including physician costs)	\$22,097	\$16,529	\$14,761	\$23,267

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 6 provinces (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, 2020–2021, Canadian Institute for Health Information.

Knee replacement

Table 18 Number of knee replacements, by jurisdiction of surgery, 2016–2017 to 2020–2021

Jurisdiction	2016–2017	2017–2018	2018–2019	2019–2020	2020–2021	5-year percentage change
Newfoundland and Labrador	1,142	1,173	1,231	1,174	741	-35.1%
Prince Edward Island	305	330	360	373	462	51.5%
Nova Scotia	2,253	2,337	2,553	2,700	1,934	-14.2%
New Brunswick	2,005	1,906	2,017	1,891	1,801	-10.2%
Quebec	12,571	12,810	13,227	13,144	7,940	-36.8%
Ontario	28,793	30,692	32,136	31,971	24,105	-16.3%
Manitoba	2,281	2,423	2,745	2,904	2,164	-5.1%
Saskatchewan	2,386	2,601	2,655	2,933	1,671	-30.0%
Alberta	6,760	6,624	6,795	6,409	5,260	-22.2%
British Columbia	8,614	9,553	11,541	11,469	9,093	5.6%
Yukon	28	30	45	57	81	189.3%
Northwest Territories	31	23	40	48	33	6.5%
Canada	67,169	70,502	75,345	75,073	55,285	-17.7%

Sources

Discharge Abstract Database, Hospital Morbidity Database and National Ambulatory Care Reporting System, 2016–2017 to 2020–2021, Canadian Institute for Health Information.

Table 19 Number of knee replacements, by type of care, 2016–2017 to 2020–2021

Type of care	2016–2017	2017–2018	2018–2019	2019–2020	2020–2021	5-year percentage change
Acute	66,942	70,201	74,882	74,113	51,591	-22.9%
Day surgery	227	298	463	960	3,694	1,527.3%
Total	67,169	70,499	75,345	75,073	55,285	-17.7%

Sources

Discharge Abstract Database, Hospital Morbidity Database and National Ambulatory Care Reporting System, 2016–2017 to 2020–2021, Canadian Institute for Health Information.

Table 20 Age-standardized rate of hospitalization for knee replacement, by jurisdiction of residence, 2016–2017 to 2020–2021

Jurisdiction	2016–2017	2017–2018	2018–2019	2019–2020	2020–2021	5-year percentage change
Newfoundland and Labrador	207	207	216	201	125	-39.6%
Prince Edward Island	213	227	236	243	286	34.3%
Nova Scotia	242	245	256	263	183	-24.4%
New Brunswick	249	232	237	219	205	-17.7%
Quebec	158	157	160	165	97	-38.6%
Ontario	237	245	251	242	178	-24.9%
Manitoba	214	221	251	259	187	-12.6%
Saskatchewan	265	281	281	296	158	-40.4%
Alberta	228	215	216	198	159	-30.3%
British Columbia	194	209	241	232	178	-8.2%
Yukon	200	183	200	226	246	23.0%
Northwest Territories	126	103	143	171	105	-16.7%
Nunavut	n/r	320	469	n/r	238	—
Canada	209	214	222	217	155	-25.8%

Notes

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

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

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, 2016–2017 to 2020–2021, Canadian Institute for Health Information.

Table 21 Number of hospitalizations for knee replacement and percentage by age group (years) for male patients, 2020–2021

Jurisdiction	Age 18–54 (%)	Age 55–64 (%)	Age 65–74 (%)	Age 75+ (%)	Total number of hospitalizations
Newfoundland and Labrador	8.9	30.7	44.0	16.5	339
Prince Edward Island	5.4	26.3	46.2	22.0	186
Nova Scotia	4.7	32.9	41.6	20.9	791
New Brunswick	6.5	27.9	43.1	22.5	735
Quebec	5.8	28.1	43.3	22.9	3,611
Ontario	5.9	29.5	41.9	22.8	10,058
Manitoba	6.8	26.9	42.6	23.6	910
Saskatchewan	6.6	28.4	43.4	21.5	693
Alberta	6.2	30.8	40.9	22.1	2,227
British Columbia	5.9	26.9	43.2	24.0	4,034
Yukon	n/r	26.5	50.0	14.7	34
Northwest Territories	n/r	50.0	37.5	n/r	16
Canada	6.0	28.9	42.4	22.7	23,634

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, 2020–2021, Canadian Institute for Health Information.

Table 22 Number of hospitalizations for knee replacement and percentage by age group (years) for female patients, 2020–2021

Jurisdiction	Age 18–54 (%)	Age 55–64 (%)	Age 65–74 (%)	Age 75+ (%)	Total number of hospitalizations
Newfoundland and Labrador	12.3	24.8	45.9	17.0	399
Prince Edward Island	10.5	26.5	43.5	19.6	276
Nova Scotia	7.1	28.1	42.8	22.0	1,138
New Brunswick	9.1	27.2	42.0	21.6	1,061
Quebec	6.5	27.7	40.9	25.0	4,311
Ontario	7.3	28.9	41.1	22.7	14,017
Manitoba	7.2	31.2	40.1	21.6	1,251
Saskatchewan	8.7	29.1	41.1	21.2	974
Alberta	7.6	30.4	40.1	21.9	3,013
British Columbia	5.7	26.9	43.9	23.6	5,043
Yukon	n/r	36.2	36.2	n/r	47
Northwest Territories	0.0	29.4	35.3	35.3	17
Canada	7.2	28.5	41.5	22.8	31,547

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, 2020–2021, Canadian Institute for Health Information.

Table 23 Number of knee replacements, by type of replacement and jurisdiction of surgery, 2020–2021

Jurisdiction	Number of primaries	Percentage of all replacements	Number of revisions	Percentage of all replacements
Newfoundland and Labrador	680	91.6%	62	8.4%
Prince Edward Island	436	94.2%	27	5.8%
Nova Scotia	1,788	92.4%	147	7.6%
New Brunswick	1,680	92.9%	129	7.1%
Quebec	7,266	91.3%	694	8.7%
Ontario	22,426	92.8%	1,754	7.3%
Manitoba	2,027	93.0%	152	7.0%
Saskatchewan	1,480	88.3%	196	11.7%
Alberta	4,858	92.2%	412	7.8%
British Columbia	8,517	93.5%	588	6.5%
Yukon	n/r	—	n/r	—
Northwest Territories	n/r	—	n/r	—
Canada	51,158	92.5%	4,161	7.5%

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, 2020–2021, Canadian Institute for Health Information.

Table 24 Most responsible diagnosis for primary knee replacements, Canada, 2020–2021

Diagnosis grouping*	Number of records	Percentage of total
Osteoarthritis	50,213	99.3%
Inflammatory arthritis (e.g., RA, AS, SLE)	200	0.4%
Osteonecrosis (e.g., AVN)	49	0.1%
Fracture (femur or tibia)	44	0.1%
Tumour (primary and metastatic, including synovial)	29	0.1%
Infection (i.e., infectious arthritis)	7	0.0%
Total†	50,542	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 (n = 728).

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, 2020–2021, Canadian Institute for Health Information.

Table 25 Type of primary knee replacement, Canada, 2020–2021

Type of primary procedure*	Number of procedures	Percentage of total
Total knee arthroplasty, including patella	22,636	47.3%
Total knee arthroplasty, excluding patella	20,679	43.2%
Unicompartmental arthroplasty, medial	3,636	7.6%
Unicompartmental arthroplasty, unspecified	557	1.2%
Unicompartmental arthroplasty, lateral	177	0.4%
Patellofemoral arthroplasty (PFA)	162	0.3%
Total†	47,847	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 (n = 3,423).

Sources

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

Table 26 Reasons for knee revision, Canada, 2020–2021

Reason for revision*	Number of records	Percentage of total
Infection	1,488	35.6%
Aseptic loosening	751	18.0%
Instability	518	12.4%
Pain and other complications	152	3.6%
Arthritis in previously unresurfaced compartment	127	3.0%
Bearing wear (e.g., poly wear)	116	2.8%
Periprosthetic fracture	112	2.7%
Implant fracture and dissociation	85	2.0%
Stiffness	56	1.3%
Patella maltracking or instability	54	1.3%
Osteolysis	27	0.6%
Remaining reasons†	693	16.6%
Total	4,179	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 unspecified complications as well as other 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, 2020–2021, Canadian Institute for Health Information.

Table 27 Primary knee replacements: Acute care length of stay for hospitalization (in days), by jurisdiction of surgery, 2020–2021

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	3.2	3.0	2.0	3.0
Prince Edward Island	3.3	3.0	2.0	3.0
Nova Scotia	1.5	1.0	1.0	1.0
New Brunswick	2.4	2.0	1.0	3.0
Quebec	3.3	2.0	2.0	4.0
Ontario	1.8	1.0	1.0	2.0
Manitoba	2.9	2.0	2.0	3.0
Saskatchewan	4.0	3.0	3.0	5.0
Alberta	2.2	2.0	1.0	2.0
British Columbia	2.2	2.0	1.0	2.0
Yukon	2.6	2.0	2.0	3.0
Northwest Territories	3.1	3.0	2.5	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, 2020–2021, Canadian Institute for Health Information.

Table 28 Revisions of knee replacements: Acute care length of stay for hospitalization (in days), by jurisdiction of surgery, 2020–2021

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	12.4	5.0	3.0	12.0
Prince Edward Island	3.8	3.0	3.0	4.0
Nova Scotia	10.6	4.0	1.0	8.0
New Brunswick	10.3	4.0	2.0	8.0
Quebec	8.0	4.0	2.0	8.0
Ontario	6.3	3.0	2.0	7.0
Manitoba	13.3	7.0	3.0	11.5
Saskatchewan	7.6	5.0	3.0	9.0
Alberta	7.1	3.0	2.0	8.0
British Columbia	6.7	3.0	1.0	7.0
Yukon	n/r	n/r	n/r	n/r
Northwest Territories	n/r	n/r	n/r	n/r
Canada	7.4	3.0	2.0	7.0

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, 2020–2021, Canadian Institute for Health Information.

Table 29 Primary knee replacements: Estimated inpatient costs, by jurisdiction, 2020–2021

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	\$8,009	\$7,789	\$7,789	\$7,789
Prince Edward Island	\$9,120	\$8,727	\$8,727	\$8,727
Nova Scotia	\$6,782	\$6,615	\$6,615	\$6,615
New Brunswick	\$6,849	\$6,758	\$6,758	\$6,758
Quebec	\$8,581	\$8,207	\$8,207	\$8,207
Ontario	\$6,789	\$6,599	\$6,599	\$6,599
Manitoba	\$7,188	\$7,029	\$7,029	\$7,029
Saskatchewan	\$9,545	\$8,979	\$8,979	\$8,979
Alberta	\$9,595	\$9,308	\$9,308	\$9,308
British Columbia	\$8,060	\$7,922	\$7,922	\$7,922
Yukon	\$10,570	\$10,494	\$10,494	\$10,494
Northwest Territories	\$13,481	\$13,481	\$13,481	\$13,481
Canada (excluding physician costs)*	\$7,826	\$7,602	\$7,602	\$7,602
Estimated physician cost based on 6 provinces†	\$1,938	\$1,855	\$1,585	\$2,169
Canada total (including physician costs)	\$9,764	\$9,457	\$9,187	\$9,771

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 6 provinces (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, 2020–2021, Canadian Institute for Health Information.

Table 30 Revisions of knee replacements: Estimated inpatient costs, by jurisdiction, 2020–2021

Jurisdiction	Mean	Median	25th percentile	75th percentile
Newfoundland and Labrador	\$13,346	\$10,323	\$10,323	\$14,962
Prince Edward Island	\$12,019	\$11,567	\$11,567	\$11,567
Nova Scotia	\$12,540	\$11,202	\$8,767	\$12,707
New Brunswick	\$11,951	\$11,020	\$8,956	\$12,981
Quebec	\$15,465	\$10,877	\$10,877	\$15,766
Ontario	\$12,439	\$8,746	\$8,746	\$12,677
Manitoba	\$13,752	\$12,484	\$9,315	\$13,502
Saskatchewan	\$14,955	\$11,900	\$11,900	\$17,248
Alberta	\$16,926	\$12,336	\$12,336	\$17,881
British Columbia	\$14,470	\$10,500	\$10,500	\$15,219
Yukon	n/r	n/r	n/r	n/r
Northwest Territories	n/r	n/r	n/r	n/r
Canada (excluding physician costs)*	\$14,104	\$10,075	\$10,075	\$14,604
Estimated physician cost based on 6 provinces†	\$3,176	\$2,911	\$2,317	\$3,602
Canada total (including physician costs)	\$17,280	\$12,986	\$12,392	\$18,206

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 6 provinces (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, 2020–2021, Canadian Institute for Health Information.

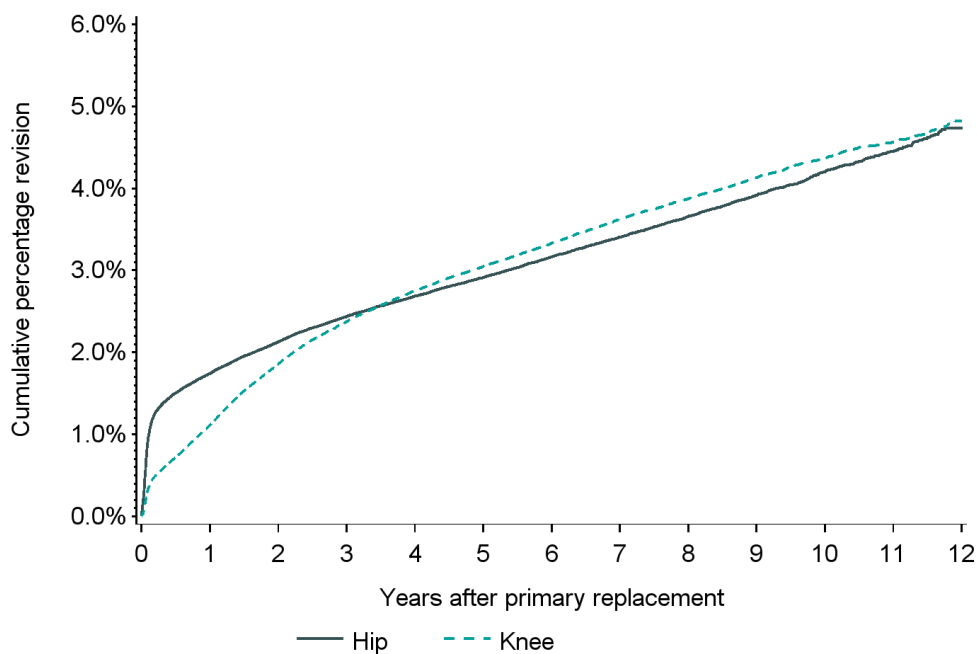
Revision risk curves

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 5 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 2020–2021, 394,555 primary hip replacements and 685,441 primary knee replacements were performed due to OA with up to 12 years of follow-up.^v

Figure 5 Cumulative percentage revision for primary hip and knee replacement due to osteoarthritis, Canada, 2009–2010 to 2020–2021



Sources

Discharge Abstract Database, Hospital Morbidity Database and National Ambulatory Care Reporting System, 2009–2010 to 2020–2021, Canadian Institute for Health Information.

^v OA is the most common primary diagnosis for both hip and knee replacements in Canada (over 70% of primary hip replacements and over 99% of primary knee replacements).

Joint	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Hip	1	1.74	1.70–1.78	351,765
	2	2.13	2.08–2.17	308,377
	3	2.44	2.39–2.49	265,420
	4	2.68	2.63–2.74	226,401
	5	2.91	2.85–2.97	189,705
	6	3.17	3.10–3.23	156,029
	7	3.41	3.34–3.47	124,306
	8	3.66	3.58–3.73	94,674
	9	3.92	3.84–4.00	68,087
	10	4.20	4.11–4.29	43,262
	11	4.45	4.34–4.56	20,936
	12	4.73	4.59–4.88	511
Knee	1	1.12	1.09–1.14	624,872
	2	1.86	1.82–1.89	549,290
	3	2.37	2.33–2.41	474,825
	4	2.75	2.71–2.79	407,384
	5	3.05	3.00–3.09	343,945
	6	3.33	3.28–3.38	284,470
	7	3.62	3.57–3.67	228,216
	8	3.87	3.82–3.93	174,475
	9	4.13	4.07–4.20	125,177
	10	4.36	4.29–4.43	79,433
	11	4.56	4.49–4.64	38,382
	12	4.82	4.71–4.93	914

Note

* At the end of each time period.

Sources

Discharge Abstract Database, Hospital Morbidity Database and National Ambulatory Care Reporting System, 2009–2010 to 2020–2021, Canadian Institute for Health Information.

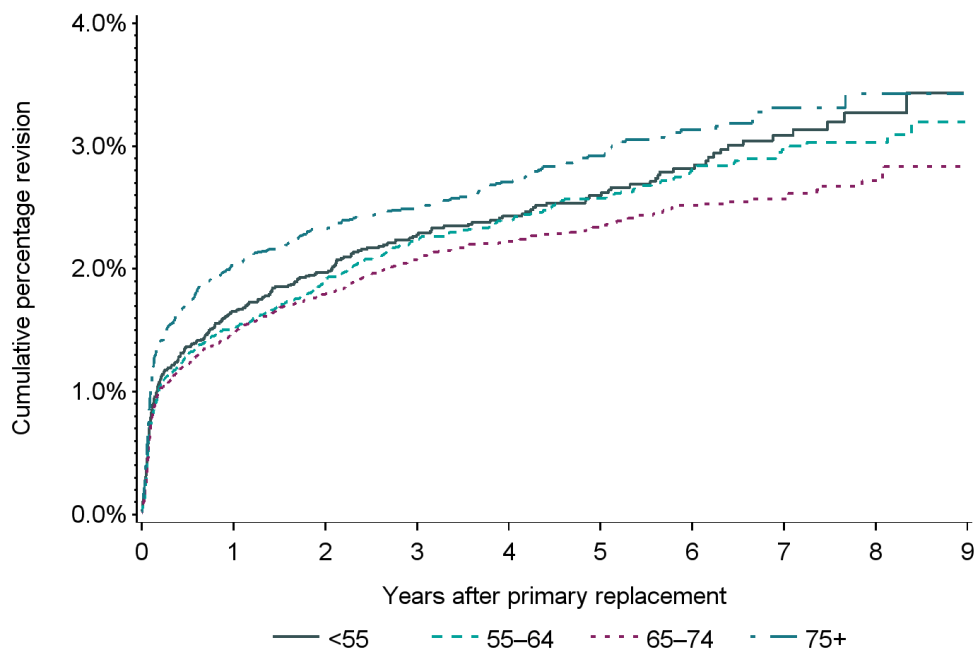
Revision risk curves based on CJRR data

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 568,243 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 6 Cumulative percentage revision for primary total hip replacement for male patients, by age (primary diagnosis of osteoarthritis), 2012–2013 to 2020–2021



Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, Canadian Institute for Health Information.

Age	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
<55	1	1.65	1.42–1.89	10,235
	2	1.97	1.71–2.23	8,683
	3	2.28	1.99–2.56	7,068
	4	2.43	2.13–2.73	5,786
	5	2.60	2.28–2.92	4,539
	6	2.82	2.47–3.17	3,351
	7	3.09	2.69–3.48	2,148
	8	3.27	2.82–3.72	1,020
55–64	1	1.51	1.36–1.67	21,460
	2	1.91	1.74–2.09	17,918
	3	2.24	2.04–2.43	14,368
	4	2.40	2.19–2.61	11,448
	5	2.58	2.35–2.80	8,656
	6	2.81	2.56–3.06	6,185
	7	2.97	2.70–3.25	3,813
	8	3.03	2.74–3.31	1,769
65–74	1	1.48	1.33–1.62	23,320
	2	1.80	1.64–1.96	19,563
	3	2.08	1.89–2.26	15,777
	4	2.22	2.03–2.41	12,517
	5	2.34	2.14–2.54	9,454
	6	2.52	2.30–2.73	6,650
	7	2.57	2.34–2.79	4,149
	8	2.72	2.45–2.98	1,864
75+	1	2.04	1.83–2.25	15,487
	2	2.33	2.10–2.55	12,945
	3	2.49	2.25–2.72	10,418
	4	2.71	2.45–2.96	8,244
	5	2.92	2.65–3.19	6,107
	6	3.13	2.84–3.43	4,240
	7	3.31	2.98–3.64	2,657
	8	3.43	3.06–3.79	1,202

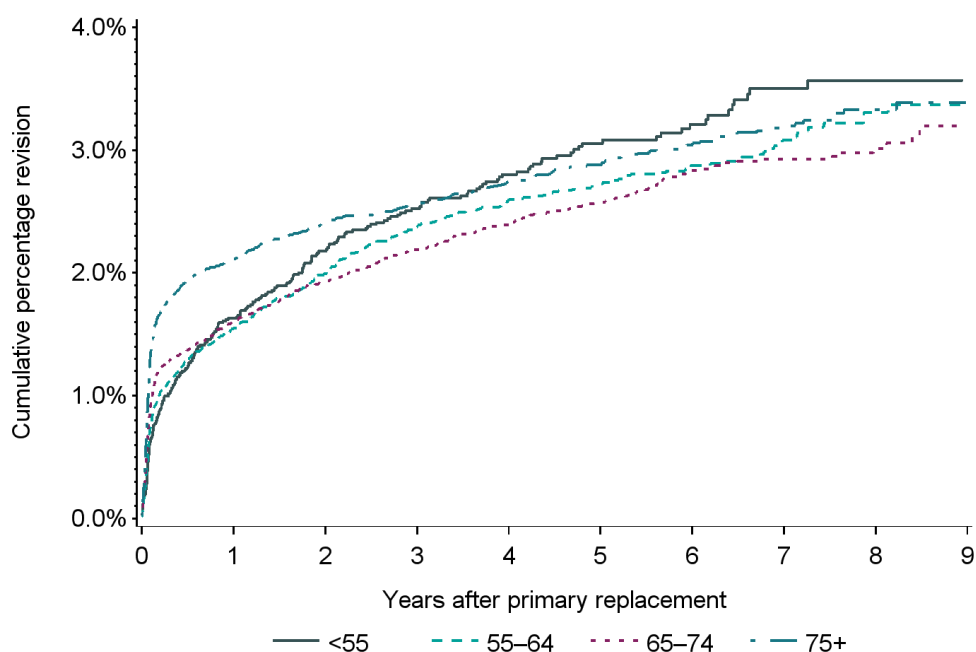
Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, Canadian Institute for Health Information.

Figure 7 Cumulative percentage revision for primary total hip replacement for female patients, by age (primary diagnosis of osteoarthritis), 2012–2013 to 2020–2021



Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, Canadian Institute for Health Information.

Age	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
<55	1	1.63	1.37–1.90	8,085
	2	2.18	1.87–2.49	6,967
	3	2.52	2.18–2.86	5,761
	4	2.80	2.43–3.17	4,738
	5	3.05	2.66–3.45	3,690
	6	3.21	2.79–3.63	2,747
	7	3.50	3.03–3.97	1,742
	8	3.57	3.08–4.05	790
55–64	1	1.55	1.39–1.71	21,086
	2	1.99	1.81–2.18	17,899
	3	2.37	2.17–2.58	14,627
	4	2.59	2.37–2.81	11,718
	5	2.72	2.49–2.95	8,916
	6	2.87	2.63–3.12	6,417
	7	3.08	2.80–3.36	4,027
	8	3.31	2.98–3.63	1,863

Age	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
65–74	1	1.60	1.46–1.73	31,074
	2	1.93	1.79–2.08	25,968
	3	2.19	2.03–2.35	20,930
	4	2.39	2.22–2.56	16,608
	5	2.58	2.39–2.76	12,551
	6	2.84	2.63–3.04	8,806
	7	2.93	2.71–3.14	5,538
	8	3.01	2.77–3.25	2,554
75+	1	2.12	1.95–2.28	25,597
	2	2.41	2.23–2.59	21,430
	3	2.57	2.38–2.76	17,387
	4	2.74	2.54–2.94	13,938
	5	2.88	2.67–3.09	10,750
	6	3.04	2.82–3.27	7,636
	7	3.20	2.96–3.44	4,800
	8	3.33	3.06–3.60	2,249

Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, Canadian Institute for Health Information.

Table 31 Reasons for revision of total hip replacement for osteoarthritis, by age and sex, 2012–2013 to 2020–2021

Sex	Age	Aseptic loosening	Infection	Instability	Periprosthetic fracture	Remaining reasons
Female	<55	27 (16.7%)	40 (24.7%)	40 (24.7%)	15 (9.3%)	40 (24.7%)
	55–64	81 (21.2%)	95 (24.8%)	75 (19.6%)	60 (15.7%)	72 (18.8%)
	65–74	81 (15.4%)	129 (24.5%)	102 (19.4%)	130 (24.7%)	85 (16.1%)
	75+	65 (13.6%)	97 (20.3%)	87 (18.2%)	156 (32.6%)	74 (15.5%)
Male	<55	37 (20.0%)	62 (33.5%)	36 (19.5%)	13 (7.0%)	37 (20.0%)
	55–64	80 (22.3%)	135 (37.6%)	54 (15.0%)	33 (9.2%)	57 (15.9%)
	65–74	79 (22.0%)	127 (35.4%)	57 (15.9%)	48 (13.4%)	48 (13.4%)
	75+	48 (17.6%)	80 (29.3%)	40 (14.7%)	60 (22.0%)	45 (16.5%)

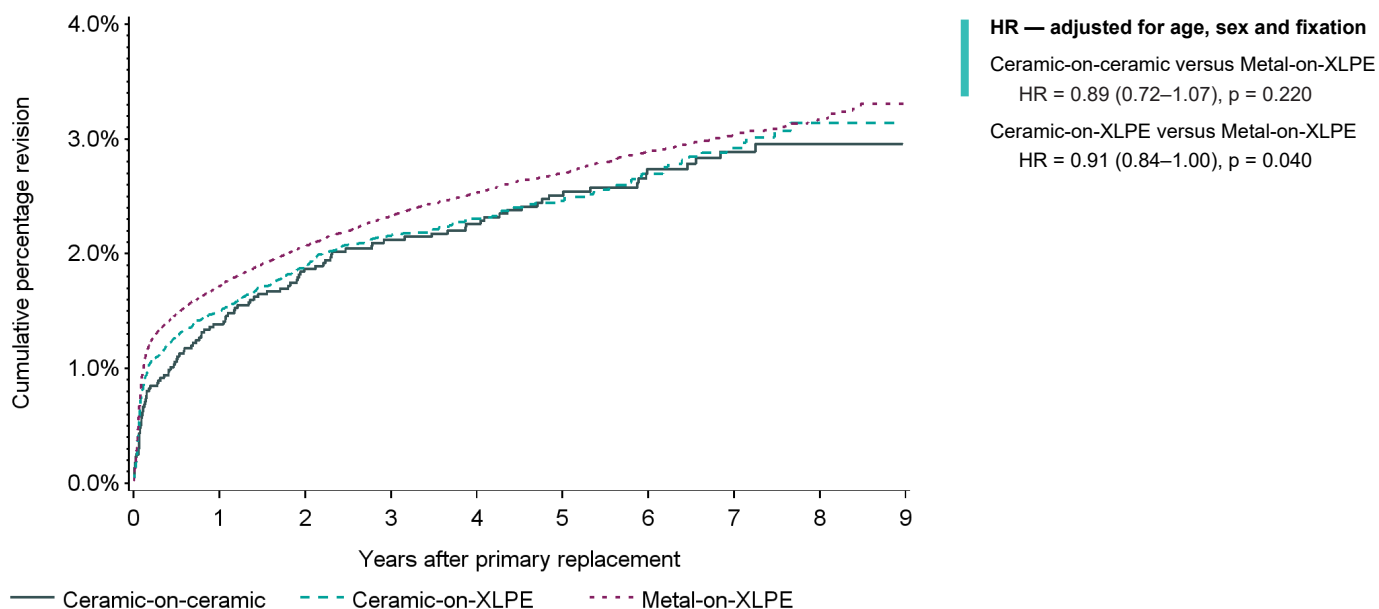
Note

Only revision records with a specific revision reason were included. Revisions with a reason listed as “other” (n = 778) and ones in the DAD and NACRS that could not be linked to a CJRR reason for revision (n = 838) were excluded. Remaining reasons for revision included bearing wear, osteolysis, pain of unknown origin, implant fracture, implant dissociation, acetabular erosion, 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 2020–2021, Canadian Institute for Health Information.

Figure 8 Cumulative percentage revision for primary total hip replacement, by bearing surface (primary diagnosis of osteoarthritis), 2012–2013 to 2020–2021



Notes

XLPE: Cross-linked polyethylene.

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 2020–2021, 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	1.39	1.04–1.73	4,180
	2	1.87	1.46–2.27	3,981
	3	2.12	1.69–2.55	3,732
	4	2.26	1.81–2.71	3,365
	5	2.51	2.03–2.99	2,902
	6	2.74	2.22–3.25	2,372
	7	2.89	2.35–3.43	1,656
	8	2.96	2.40–3.51	858

Bearing surface of primary replacement	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Ceramic-on-XLPE	1	1.50	1.37–1.63	28,334
	2	1.88	1.73–2.03	20,905
	3	2.16	1.99–2.32	14,256
	4	2.31	2.12–2.49	9,246
	5	2.46	2.26–2.66	5,775
	6	2.70	2.45–2.95	3,698
	7	2.92	2.63–3.22	2,281
	8	3.14	2.77–3.51	1,024
Metal-on-XLPE	1	1.72	1.64–1.79	109,042
	2	2.07	1.99–2.15	94,516
	3	2.33	2.24–2.42	79,025
	4	2.53	2.44–2.62	64,820
	5	2.69	2.59–2.79	49,970
	6	2.89	2.78–3.00	35,482
	7	3.04	2.92–3.16	21,853
	8	3.17	3.04–3.30	9,841

Notes

* At the end of each time period.

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 2020–2021, Canadian Institute for Health Information.

Table 32 Top reasons for revision of total hip replacement for osteoarthritis, by bearing surface, 2012–2013 to 2020–2021

Bearing surface	Aseptic loosening	Infection	Instability	Periprosthetic fracture
Ceramic-on-ceramic	19 (31.2%)	24 (39.3%)	11 (18.0%)	7 (11.5%)
Ceramic-on-XLPE	67 (20.9%)	108 (33.6%)	98 (30.5%)	48 (15.0%)
Metal-on-XLPE	361 (22.5%)	512 (32.0%)	331 (20.7%)	397 (24.8%)

Notes

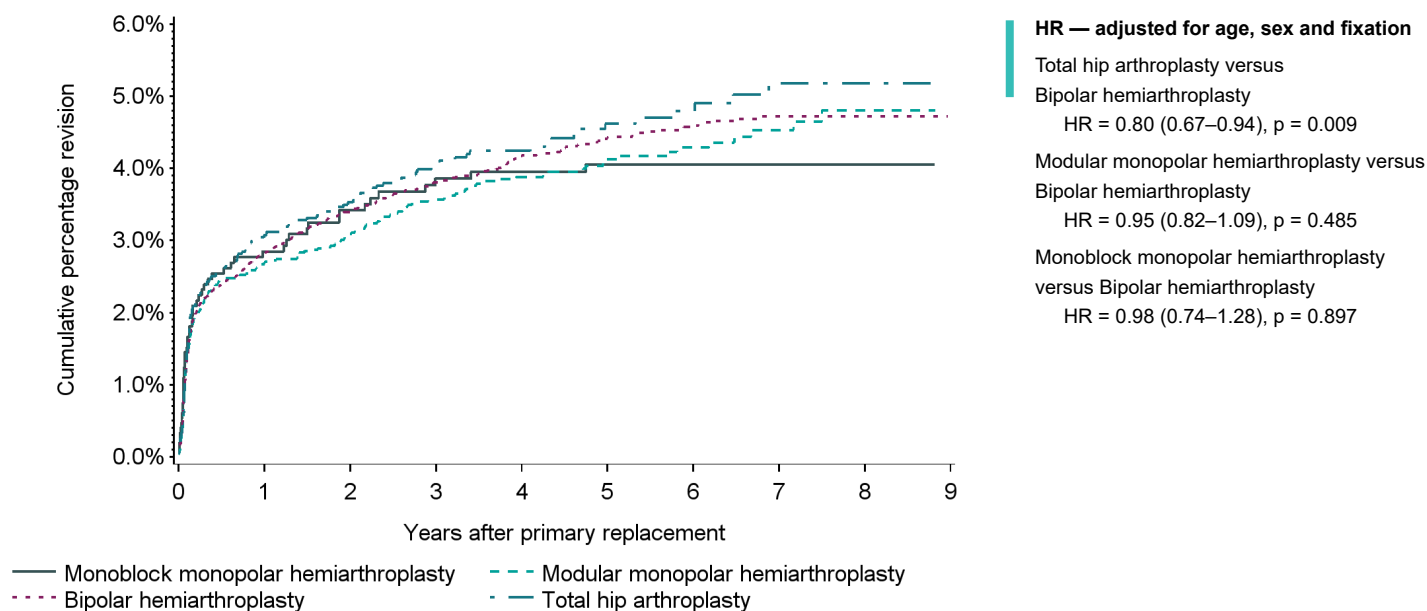
XLPE: Cross-linked polyethylene.

Only revision records with a specific revision reason were included. Revisions with a reason listed as “other” (n = 723) and ones in the DAD and NACRS that could not be linked to a CJRR reason for revision (n = 75) 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 (n = 403).

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, 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 2020–2021



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 2020–2021, 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	3.07	2.56–3.57	3,728
	2	3.53	2.98–4.08	3,003
	3	4.03	3.42–4.64	2,354
	4	4.24	3.61–4.88	1,811
	5	4.62	3.92–5.32	1,284
	6	4.80	4.06–5.54	923
	7	5.18	4.32–6.03	580
	8	5.18	4.32–6.03	255

Type of hip arthroplasty	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Modular monopolar hemiarthroplasty	1	2.69	2.31–3.07	5,704
	2	3.09	2.68–3.51	4,704
	3	3.57	3.11–4.03	3,724
	4	3.88	3.39–4.38	2,904
	5	4.13	3.60–4.66	2,126
	6	4.29	3.73–4.85	1,497
	7	4.53	3.91–5.15	867
	8	4.80	4.07–5.53	345
Bipolar hemiarthroplasty	1	2.84	2.61–3.06	17,321
	2	3.39	3.14–3.64	13,776
	3	3.81	3.54–4.08	10,778
	4	4.17	3.87–4.47	8,385
	5	4.43	4.11–4.74	6,234
	6	4.57	4.24–4.90	4,371
	7	4.72	4.37–5.07	2,688
	8	4.72	4.37–5.07	1,269
Monoblock monopolar hemiarthroplasty	1	2.85	1.98–3.72	1,239
	2	3.42	2.45–4.38	1,144
	3	3.86	2.82–4.89	1,058
	4	3.95	2.90–5.00	985
	5	4.05	2.99–5.12	909
	6	4.05	2.99–5.12	781
	7	4.05	2.99–5.12	580
	8	4.05	2.99–5.12	300

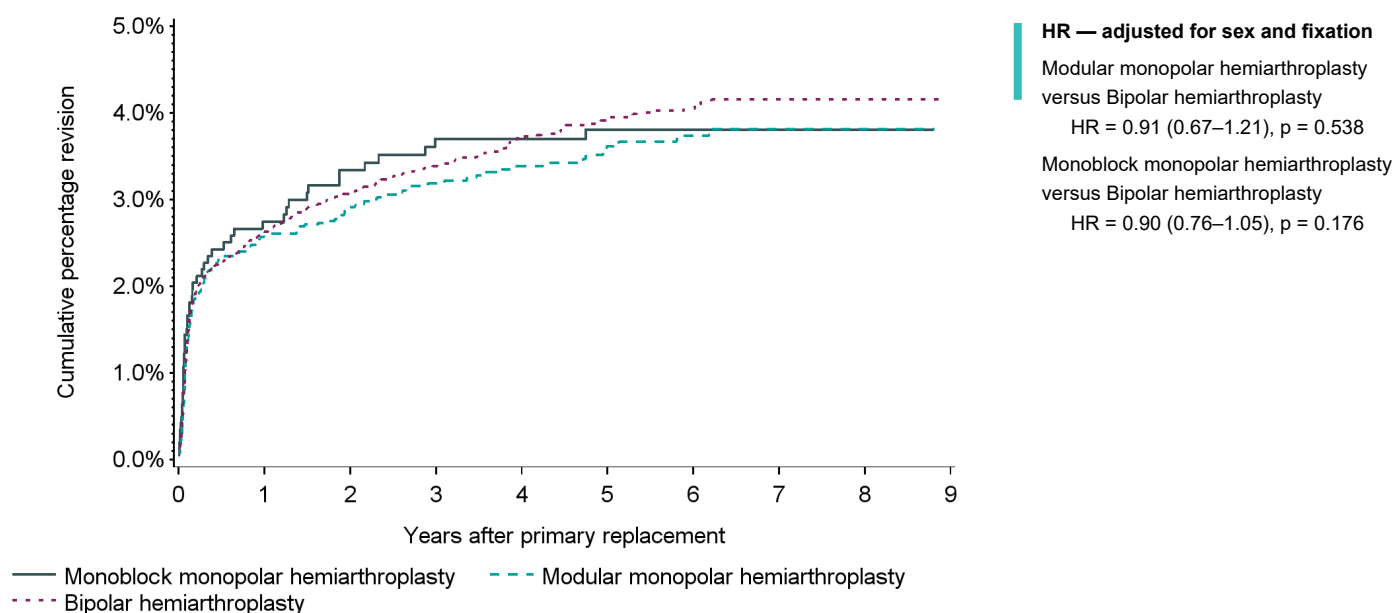
Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, 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 2020–2021



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 2020–2021, 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	2.63	2.40–2.85	15,234
	2	3.07	2.82–3.32	12,105
	3	3.39	3.11–3.66	9,459
	4	3.72	3.42–4.01	7,340
	5	3.93	3.61–4.25	5,445
	6	4.05	3.72–4.38	3,806
	7	4.16	3.81–4.50	2,315
	8	4.16	3.81–4.50	1,071

Type of hip arthroplasty	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Modular monopolar hemiarthroplasty	1	2.59	2.20–2.98	5,144
	2	2.91	2.49–3.33	4,237
	3	3.19	2.73–3.64	3,361
	4	3.38	2.91–3.86	2,607
	5	3.62	3.10–4.14	1,913
	6	3.74	3.19–4.28	1,336
	7	3.81	3.25–4.38	762
	8	3.81	3.25–4.38	303
Monoblock monopolar hemiarthroplasty	1	2.74	1.87–3.62	1,191
	2	3.34	2.36–4.31	1,106
	3	3.70	2.67–4.73	1,027
	4	3.70	2.67–4.73	957
	5	3.81	2.76–4.86	886
	6	3.81	2.76–4.86	763
	7	3.81	2.76–4.86	567
	8	3.81	2.76–4.86	294

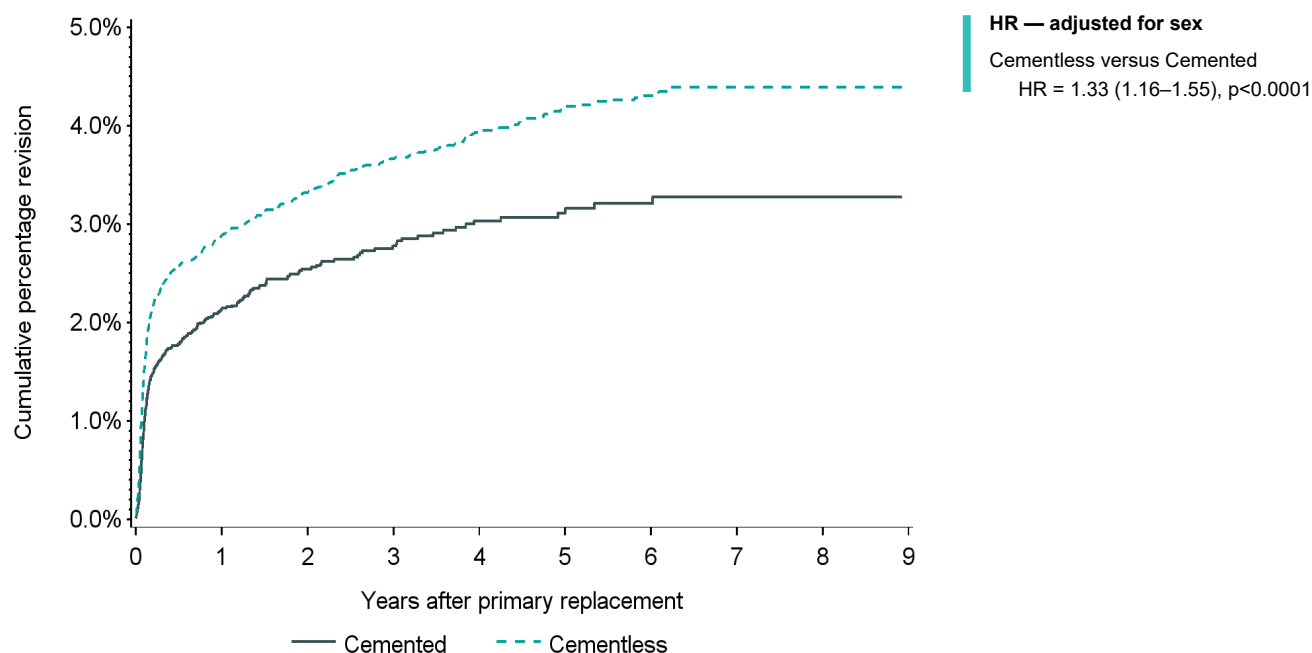
Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, 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 2020–2021



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 2020–2021, Canadian Institute for Health Information.

Femoral fixation	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Cemented	1	2.14	1.85–2.44	7,222
	2	2.54	2.21–2.88	5,347
	3	2.78	2.42–3.13	3,888
	4	3.03	2.64–3.43	2,921
	5	3.11	2.70–3.52	2,120
	6	3.21	2.78–3.64	1,488
	7	3.28	2.83–3.72	896
	8	3.28	2.83–3.72	448

Femoral fixation	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Cementless	1	2.89	2.64–3.14	14,347
	2	3.32	3.05–3.60	12,101
	3	3.67	3.38–3.96	9,959
	4	3.94	3.63–4.25	7,983
	5	4.19	3.86–4.53	6,124
	6	4.30	3.96–4.65	4,417
	7	4.40	4.04–4.75	2,748
	8	4.40	4.04–4.75	1,220

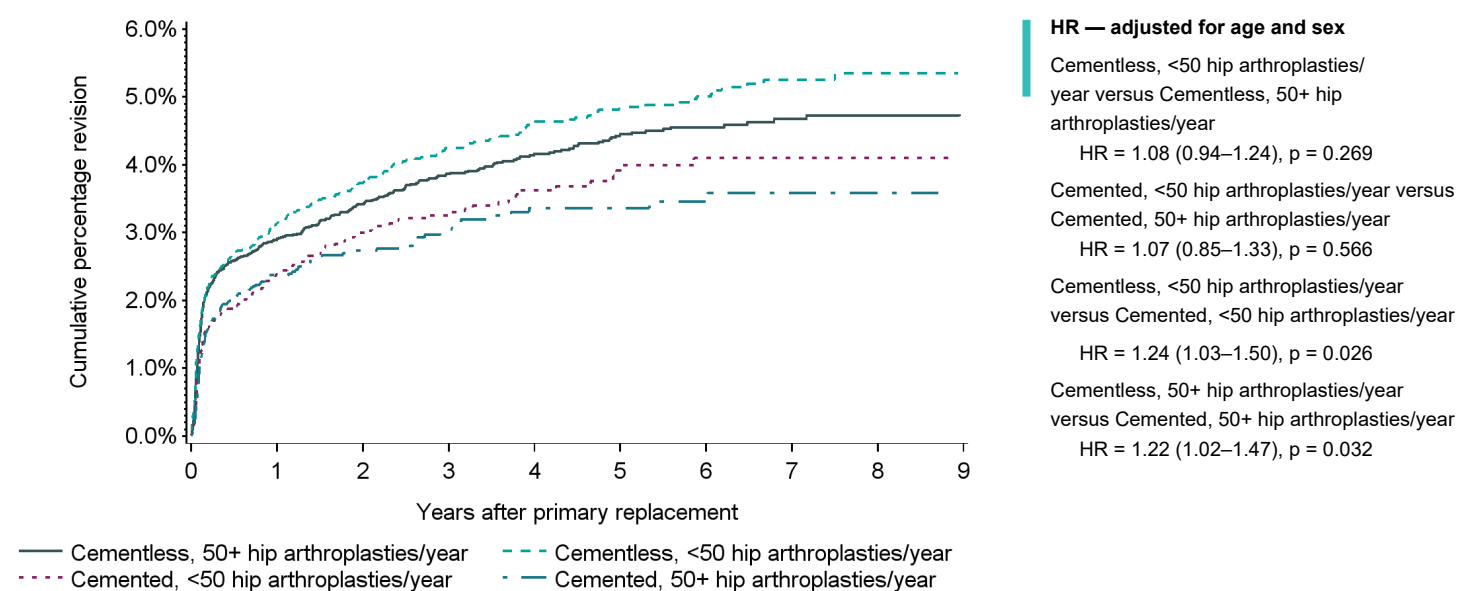
Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, 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 2020–2021

**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 2020–2021, 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	2.60–3.22	9,572
		2	3.42	3.08–3.76	8,096
		3	3.87	3.50–4.24	6,714
		4	4.16	3.77–4.55	5,356
		5	4.45	4.03–4.87	4,117
		6	4.56	4.12–4.99	2,957
		7	4.67	4.22–5.13	1,854
		8	4.73	4.26–5.20	884
	Fewer than 50 procedures a year	1	3.14	2.76–3.53	6,704
		2	3.73	3.31–4.16	5,686
		3	4.25	3.79–4.71	4,667
		4	4.62	4.12–5.11	3,811
		5	4.85	4.33–5.37	2,931
		6	5.01	4.47–5.55	2,171
		7	5.26	4.67–5.84	1,393
		8	5.35	4.74–5.96	629
Cemented	50 or more procedures a year	1	2.37	1.96–2.79	4,004
		2	2.73	2.27–3.19	2,897
		3	3.01	2.51–3.52	2,145
		4	3.36	2.80–3.93	1,601
		5	3.36	2.80–3.93	1,121
		6	3.46	2.87–4.05	750
		7	3.59	2.94–4.23	428
		8	3.59	2.94–4.23	220
	Fewer than 50 procedures a year	1	2.41	1.98–2.85	3,739
		2	3.00	2.49–3.50	2,882
		3	3.30	2.76–3.85	2,125
		4	3.62	3.02–4.22	1,614
		5	3.91	3.25–4.58	1,206
		6	4.10	3.39–4.81	876
		7	4.10	3.39–4.81	562
		8	4.10	3.39–4.81	281

Notes

* At the end of each time period.

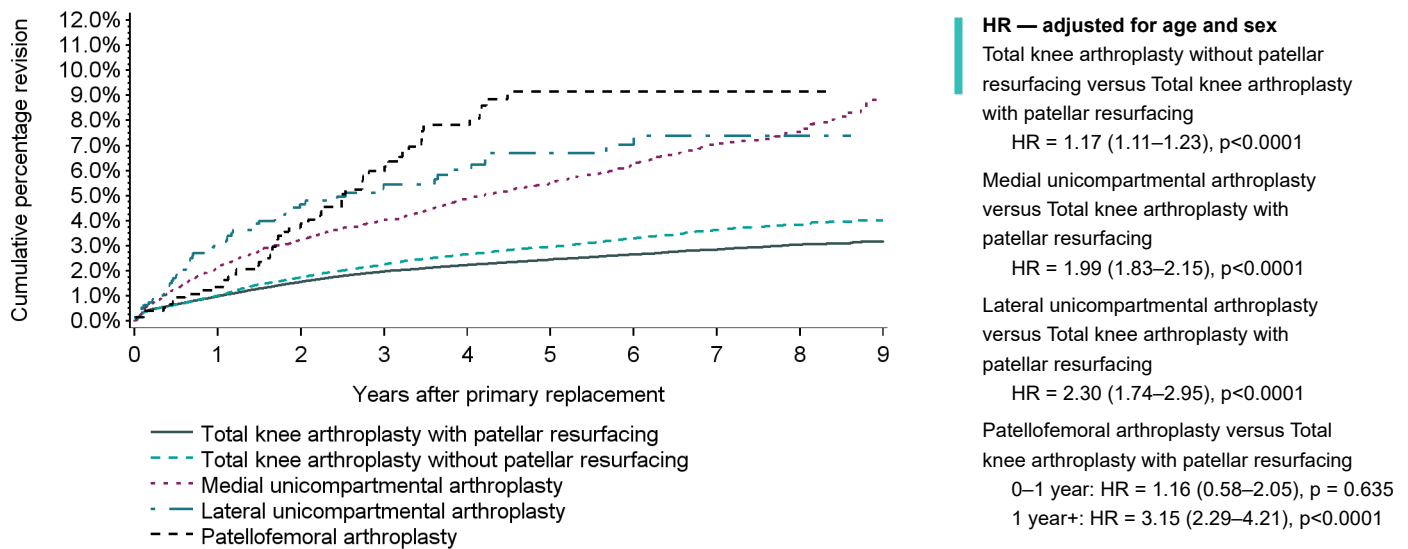
Surgeon volume refers to the number of hip arthroplasties performed by the surgeon in a fiscal year.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, 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 2020–2021



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 2020–2021, 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	0.93–1.03	165,502
	2	1.55	1.49–1.61	145,410
	3	1.97	1.90–2.03	123,235
	4	2.23	2.15–2.30	101,434
	5	2.44	2.36–2.52	79,422
	6	2.65	2.56–2.74	57,766
	7	2.84	2.75–2.94	37,170
	8	3.04	2.93–3.14	17,737
	9	3.16	3.03–3.29	67

Type of knee arthroplasty	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Total knee arthroplasty without patellar resurfacing	1	1.01	0.95–1.07	98,156
	2	1.73	1.65–1.81	77,552
	3	2.25	2.15–2.34	58,793
	4	2.65	2.54–2.76	44,837
	5	3.95	2.83–3.07	33,284
	6	3.30	3.16–3.44	23,538
	7	3.61	3.45–3.77	14,730
	8	3.84	3.66–4.02	6,694
Medial unicompartmental arthroplasty	1	2.12	1.87–2.36	12,453
	2	3.25	2.94–3.55	10,376
	3	4.02	3.67–4.37	8,416
	4	4.90	4.50–5.31	6,796
	5	5.50	5.05–5.94	5,355
	6	6.28	5.77–6.79	3,943
	7	7.05	6.47–7.63	2,571
	8	7.54	6.89–8.19	1,341
Lateral unicompartmental arthroplasty	1	3.05	1.94–4.16	856
	2	4.65	3.26–6.05	692
	3	5.44	3.89–6.99	548
	4	6.03	4.36–7.71	451
	5	6.69	4.87–8.51	337
	6	7.02	5.09–8.94	264
	7	7.37	5.33–9.41	174
	8	7.37	5.33–9.41	100
Patellofemoral arthroplasty	1	1.35	0.52–2.18	706
	2	3.87	2.43–5.30	604
	3	5.97	4.14–7.80	497
	4	7.81	5.66–9.97	371
	5	9.14	6.72–11.56	271
	6	9.14	6.72–11.56	190
	7	9.14	6.72–11.56	124
	8	9.14	6.72–11.56	58

Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, Canadian Institute for Health Information.

Table 33 Reasons for revision of total knee replacement for osteoarthritis, by type of procedure, 2012–2013 to 2020–2021

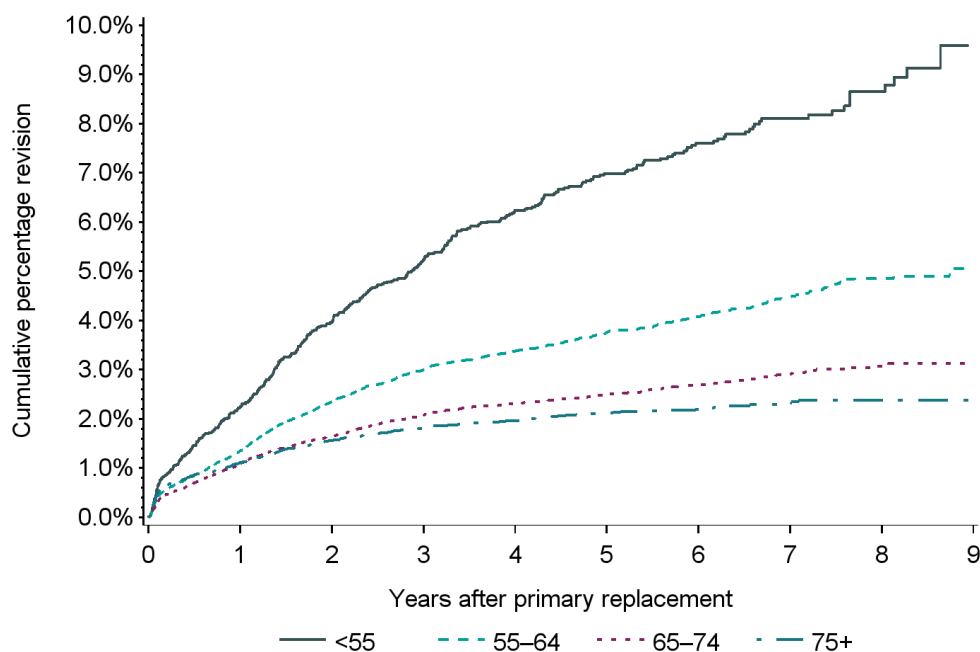
Primary procedure type	Infection	Instability	Aseptic loosening	Remaining reasons
Total knee arthroplasty with patellar resurfacing	870 (35.7%)	544 (22.3%)	460 (18.9%)	565 (23.2%)
Total knee arthroplasty without patellar resurfacing	439 (27.8%)	305 (19.3%)	267 (16.9%)	568 (36.0%)

Note

Only revision records with a specific revision reason were included. Revisions with a reason listed as “other” (n = 1,004) and ones in the DAD and NACRS that could not be linked to a CJRR reason for revision (n = 1,610) 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 2020–2021, Canadian Institute for Health Information.

Figure 14 Cumulative percentage revision for primary total knee replacement for male patients, by age (primary diagnosis of osteoarthritis), 2012–2013 to 2020–2021**Sources**

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, Canadian Institute for Health Information.

Age	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
<55	1	2.26	1.90–2.61	6,254
	2	3.98	3.50–4.46	5,399
	3	5.23	4.67–5.79	4,514
	4	6.23	5.60–6.86	3,733
	5	6.99	6.30–7.67	2,989
	6	7.60	6.86–8.34	2,263
	7	8.11	7.31–8.91	1,441
	8	8.65	7.74–9.56	683
55–64	1	1.35	1.23–1.48	29,972
	2	2.35	2.18–2.52	25,352
	3	2.99	2.79–3.19	20,702
	4	3.38	3.16–3.59	16,659
	5	3.75	3.52–3.99	12,917
	6	4.08	3.83–4.34	9,317
	7	4.49	4.19–4.78	5,861
	8	4.86	4.52–5.20	2,781
65–74	1	1.09	0.99–1.19	41,052
	2	1.65	1.53–1.77	34,266
	3	2.07	1.93–2.21	27,570
	4	2.32	2.16–2.47	21,838
	5	2.48	2.31–2.64	16,705
	6	2.69	2.51–2.87	11,861
	7	2.91	2.71–3.11	7,527
	8	3.07	2.84–3.29	3,464
75+	1	1.11	0.98–1.23	25,271
	2	1.56	1.41–1.71	21,052
	3	1.82	1.65–1.98	17,009
	4	1.97	1.79–2.14	13,476
	5	2.11	1.92–2.30	10,288
	6	2.20	2.00–2.39	7,265
	7	2.31	2.09–2.52	4,582
	8	2.37	2.15–2.60	2,136

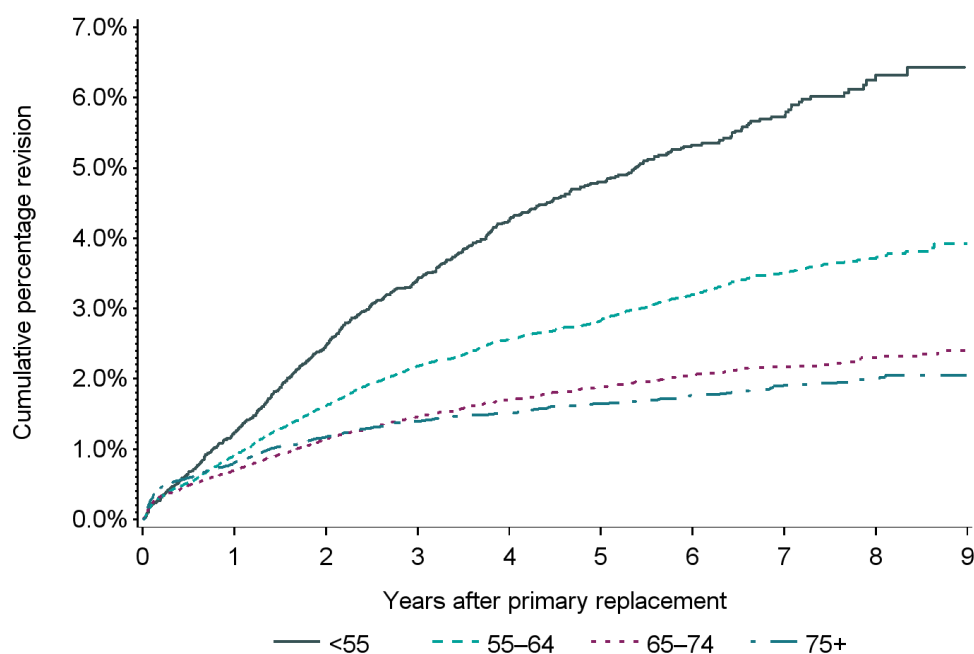
Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, Canadian Institute for Health Information.

Figure 15 Cumulative percentage revision for primary total knee replacement for female patients, by age (primary diagnosis of osteoarthritis), 2012–2013 to 2020–2021



Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, Canadian Institute for Health Information.

Age	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
<55	1	1.24	1.04–1.43	11,843
	2	2.47	2.19–2.75	10,316
	3	3.41	3.07–3.74	8,697
	4	4.24	3.86–4.63	7,227
	5	4.80	4.37–5.22	5,708
	6	5.32	4.86–5.79	4,271
	7	5.73	5.22–6.23	2,777
	8	6.32	5.72–6.92	1,311
55–64	1	0.92	0.83–1.00	46,573
	2	1.61	1.50–1.73	39,915
	3	2.18	2.05–2.32	33,064
	4	2.56	2.41–2.71	26,916
	5	2.83	2.66–2.99	20,834
	6	3.19	3.01–3.38	15,233
	7	3.50	3.29–3.71	9,817
	8	3.71	3.48–3.94	4,682

Age	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
65–74	1	0.69	0.63–0.76	63,926
	2	1.14	1.05–1.22	53,910
	3	1.46	1.36–1.55	43,763
	4	1.71	1.60–1.81	34,859
	5	1.88	1.76–2.00	26,694
	6	2.05	1.92–2.18	19,022
	7	2.17	2.03–2.30	12,073
	8	2.30	2.14–2.46	5,537
75+	1	0.81	0.72–0.90	38,767
	2	1.17	1.07–1.28	32,752
	3	1.40	1.28–1.52	26,709
	4	1.51	1.38–1.63	21,563
	5	1.65	1.51–1.78	16,571
	6	1.77	1.62–1.92	12,072
	7	1.91	1.74–2.07	7,822
	8	1.99	1.81–2.17	3,837

Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, Canadian Institute for Health Information.

Table 34 Reasons for revision of total knee replacement for osteoarthritis, by age and sex, 2012–2013 to 2020–2021

Sex	Age	Aseptic loosening	Infection	Instability	Remaining reasons
Female	<55	76 (21.5%)	75 (21.2%)	98 (27.7%)	105 (29.7%)
	55–64	176 (21.4%)	190 (23.1%)	209 (25.4%)	247 (30.1%)
	65–74	111 (15.8%)	210 (30.0%)	146 (20.8%)	234 (33.4%)
	75+	48 (13.0%)	130 (35.3%)	64 (17.4%)	126 (34.2%)
Male	<55	53 (18.9%)	98 (34.9%)	55 (19.6%)	75 (26.7%)
	55–64	131 (19.5%)	235 (34.9%)	150 (22.3%)	157 (23.3%)
	65–74	103 (18.8%)	219 (39.9%)	97 (17.7%)	130 (23.7%)
	75+	29 (10.7%)	152 (56.3%)	30 (11.1%)	59 (21.9%)

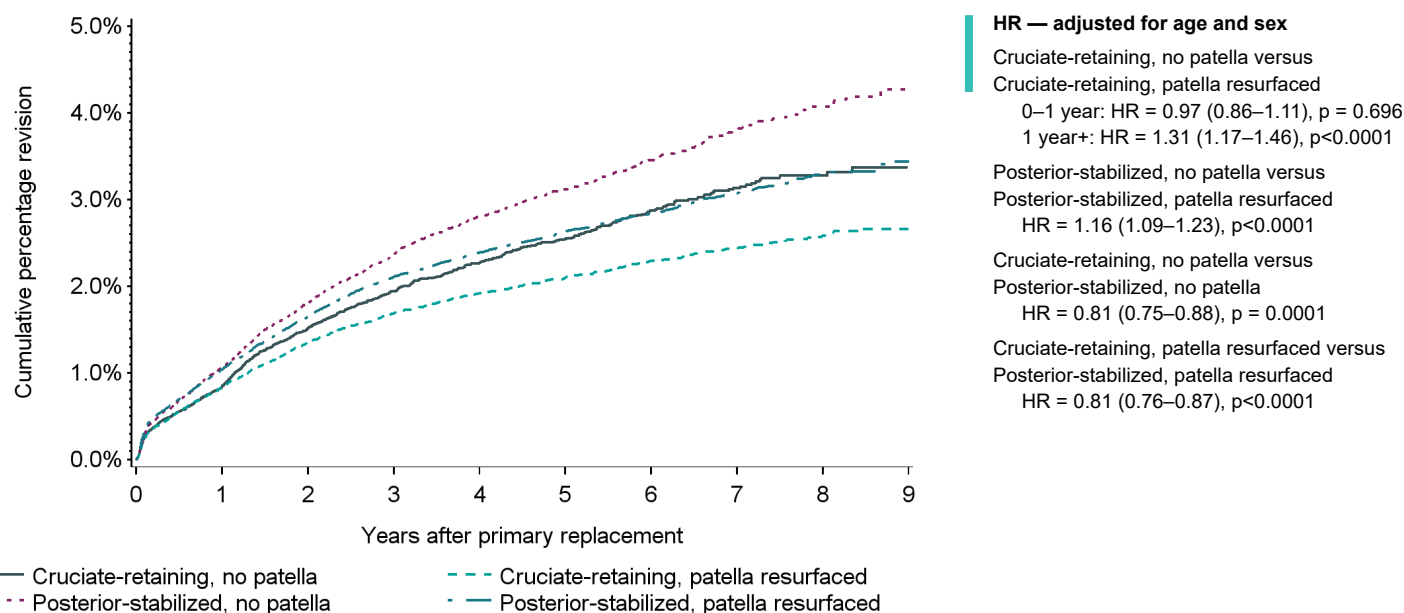
Note

Only revision records with a specific revision reason were included. Revisions with a reason listed as “other” (n = 1,004) and ones in the DAD and NACRS that could not be linked to a CJRR reason for revision (n = 1,610) were excluded. Remaining reasons for revision included bearing wear, osteolysis, pain of unknown origin, patellar maltracking, periprosthetic fracture, implant fracture, implant dissociation, arthritis in previously unresurfaced compartment 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 2020–2021, Canadian Institute for Health Information.

Figure 16 Cumulative percentage revision for primary total knee replacement, by stability and patella resurfacing (primary diagnosis of osteoarthritis), 2012–2013 to 2020–2021



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 2020–2021, 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	0.85	0.77–0.93	42,348
	2	1.51	1.39–1.62	31,894
	3	1.94	1.80–2.08	23,539
	4	2.27	2.11–2.42	17,666
	5	2.54	2.36–2.72	12,910
	6	2.87	2.67–3.08	9,086
	7	3.13	2.90–3.37	5,553
	8	3.28	3.02–3.53	2,548

Stability and patella resurfacing	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Cruciate-retaining, patella resurfaced	1	0.84	0.77–0.91	60,011
	2	1.35	1.25–1.44	52,055
	3	1.68	1.58–1.79	43,808
	4	1.92	1.80–2.03	36,287
	5	2.09	1.97–2.22	28,743
	6	2.29	2.16–2.42	21,311
	7	2.43	2.28–2.57	14,022
	8	2.58	2.42–2.75	6,788
Posterior-stabilized, no patella	1	1.07	0.98–1.16	51,451
	2	1.81	1.69–1.92	42,639
	3	2.37	2.23–2.51	33,173
	4	2.81	2.65–2.96	25,673
	5	3.12	2.95–3.29	19,450
	6	3.46	3.27–3.65	13,820
	7	3.79	3.57–4.00	8,842
	8	4.07	3.82–4.32	4,008
Posterior-stabilized, patella resurfaced	1	1.04	0.98–1.10	101,982
	2	1.65	1.57–1.73	90,363
	3	2.11	2.02–2.20	76,934
	4	2.39	2.29–2.49	63,153
	5	2.62	2.52–2.73	49,137
	6	2.84	2.73–2.96	35,504
	7	3.07	2.94–3.20	22,701
	8	3.29	3.14–3.43	10,768
	9	3.44	3.26–3.63	43

Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, Canadian Institute for Health Information.

Table 35 Reasons for revision of total knee replacement for osteoarthritis, by stability and patella resurfacing, 2012–2013 to 2020–2021

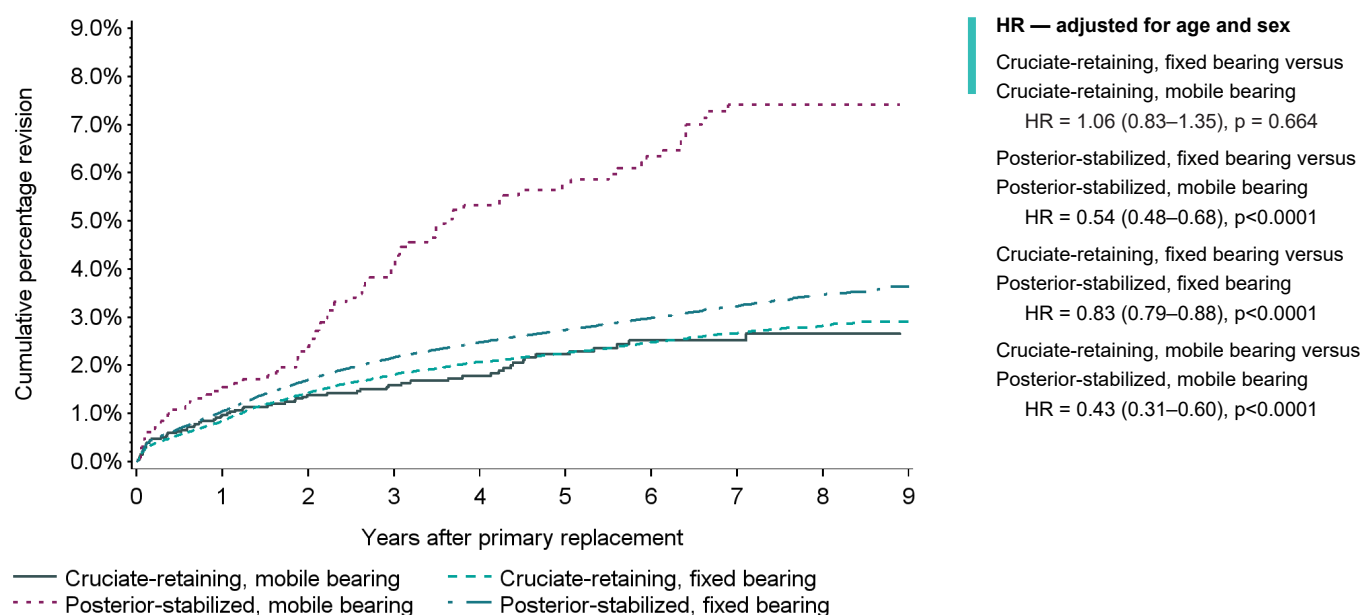
Stability and patella resurfacing	Infection	Instability	Aseptic loosening	Remaining reasons
Cruciate-retaining, no patella	146 (25.9%)	112 (19.9%)	104 (18.4%)	202 (35.8%)
Cruciate-retaining, patella resurfaced	264 (34.5%)	186 (24.3%)	133 (17.4%)	182 (23.8%)
Posterior-stabilized, no patella	270 (30.3%)	163 (18.3%)	141 (15.8%)	317 (35.6%)
Posterior-stabilized, patella resurfaced	572 (35.5%)	348 (21.6%)	323 (20.0%)	370 (22.9%)

Note

Only revision records with a specific revision reason were included. Revisions with a reason listed as “other” (n = 973) and ones in the DAD and NACRS that could not be linked to a CJRR reason for revision (n = 1,540) 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 2020–2021, Canadian Institute for Health Information.

Figure 17 Cumulative percentage revision for primary total knee replacement, by stability and mobility (primary diagnosis of osteoarthritis), 2012–2013 to 2020–2021**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 2020–2021, Canadian Institute for Health Information.

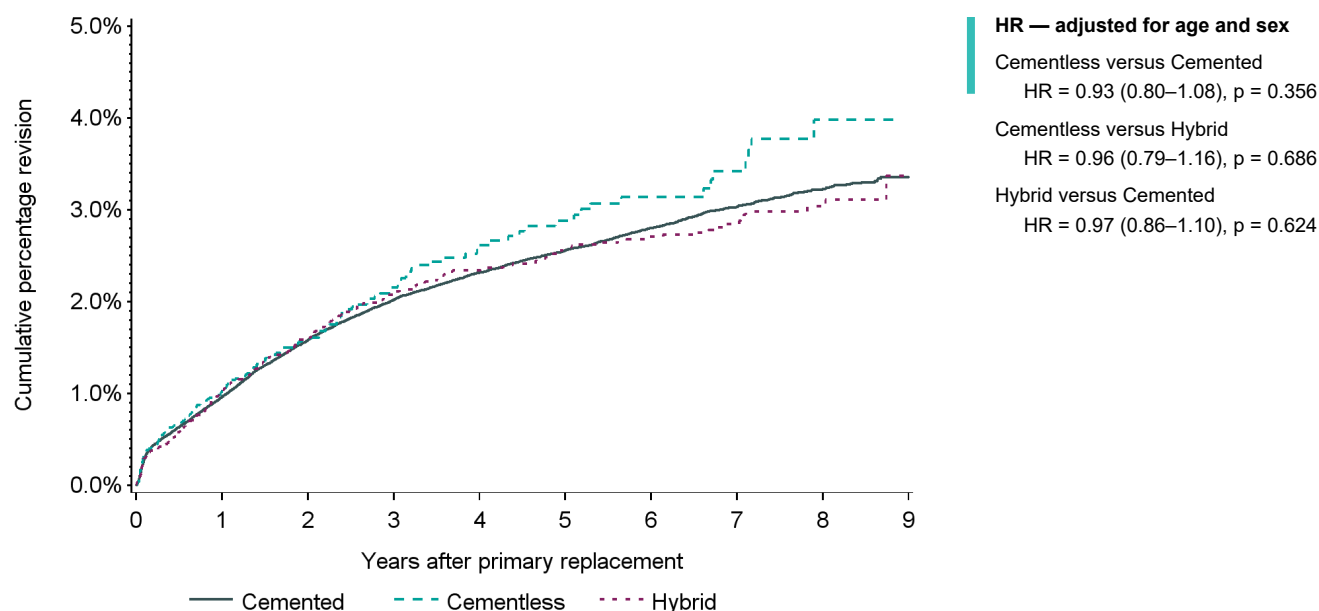
Stability and mobility	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Cruciate-retaining, fixed bearing	1	0.85	0.79–0.91	87,784
	2	1.42	1.34–1.50	73,638
	3	1.80	1.71–1.89	60,679
	4	2.06	1.96–2.16	49,469
	5	2.25	2.14–2.36	38,537
	6	2.48	2.36–2.59	28,109
	7	2.66	2.53–2.79	18,094
	8	2.81	2.67–2.96	8,569
Cruciate-retaining, mobile bearing	1	0.97	0.64–1.31	3,102
	2	1.38	0.97–1.79	2,711
	3	1.59	1.14–2.03	2,227
	4	1.78	1.30–2.26	1,868
	5	2.23	1.66–2.80	1,504
	6	2.51	1.88–3.15	1,155
	7	2.51	1.88–3.15	737
	8	2.65	1.96–3.34	371
Posterior-stabilized, fixed bearing	1	1.04	0.99–1.09	143,919
	2	1.69	1.63–1.76	126,201
	3	2.16	2.09–2.24	105,648
	4	2.48	2.39–2.56	85,793
	5	2.73	2.64–2.82	66,353
	6	2.98	2.88–3.08	47,647
	7	3.22	3.11–3.33	30,294
	8	3.46	3.33–3.58	14,116
	9	3.63	3.47–3.80	62
Posterior-stabilized, mobile bearing	1	1.55	0.87–2.22	1,236
	2	2.38	1.54–3.22	1,155
	3	4.01	2.91–5.11	1,061
	4	5.32	4.04–6.61	939
	5	5.75	4.40–7.09	846
	6	6.34	4.91–7.77	754
	7	7.41	5.81–9.01	641
	8	7.41	5.81–9.01	375

Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, Canadian Institute for Health Information.

Figure 18 Cumulative percentage revision for primary total knee replacement, by fixation (primary diagnosis of osteoarthritis), 2012–2013 to 2020–2021**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 2020–2021, Canadian Institute for Health Information.

Fixation	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Cemented	1	0.98	0.94–1.02	233,331
	2	1.60	1.55–1.65	199,023
	3	2.04	1.98–2.10	162,947
	4	2.33	2.27–2.40	130,856
	5	2.57	2.50–2.64	100,702
	6	2.82	2.75–2.90	72,642
	7	3.05	2.97–3.14	46,321
	8	3.25	3.15–3.34	21,827
	9	3.37	3.26–3.49	90

Fixation	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Cementless	1	1.02	0.81–1.23	7,342
	2	1.58	1.30–1.86	4,386
	3	2.16	1.78–2.53	2,969
	4	2.61	2.16–3.07	2,083
	5	2.88	2.37–3.39	1,611
	6	3.14	2.57–3.71	1,292
	7	3.42	2.77–4.07	878
	8	3.98	3.12–4.84	403
Hybrid	1	1.02	0.83–1.22	9,935
	2	1.58	1.33–1.82	9,128
	3	2.07	1.79–2.35	8,182
	4	2.33	2.03–2.64	7,007
	5	2.57	2.24–2.89	5,776
	6	2.70	2.36–3.04	4,342
	7	2.84	2.48–3.20	2,909
	8	3.03	2.63–3.43	1,404

Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, 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 2020–2021, with the main focus on 2020–2021 (April 1, 2020, to March 31, 2021). 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 or national Resource Intensity Weight (RIW) from the HMDB by the corresponding jurisdictional or national Cost of a Standard Hospital Stay (CSHS).

The RIW values are based on the 2021 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 6 provinces (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, 2020, to March 31, 2021 (fiscal year period).

Tables sourced from the DAD/HMDB and NACRS are based on discharge date or visit disposition date from April 1, 2020, to March 31, 2021 (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 2020–2021, the national-level coverage rate for hip and knee replacement with prosthesis was 73.9% 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 2020–2021, 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 12 years
 - **Primary and revision surgeries:** Discharge Abstract Database, Hospital Morbidity Database and National Ambulatory Care Reporting System, 2009–2010 to 2020–2021
- **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 9 years
 - **Primary surgeries:** Canadian Joint Replacement Registry, 2012–2013 to 2020–2021, and Discharge Abstract Database, 2020–2021
 - **Revision surgeries:** Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021
 - **Prosthesis characteristics:** Sourced from the International Prosthesis Library (IPL),^{vi} downloaded on June 22, 2021
 - **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](#)

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

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, 2021) was used.^{vii}
- 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.

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 9 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.

^{vii.} In-hospital death was identified using the DAD or NACRS.

- 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, June 22, 2021.
- 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 information reported in CJRR and the intervention code in the DAD. CCI codes do not uniquely identify whether cement was involved in the replacement. Less than 3.2% of hip procedures might have been misclassified as cemented when actually there was no cement involved (but rather bone paste, mixed bone grafts or synthetic graft or paste).

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, June 22, 2021.
- 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; diagnosed with osteoarthritis; had an elective, primary, unilateral total hip/knee arthroplasty; and completed a pre- and post-operative PROMs survey within the standard time frame.

PROMs data was available from 3 provinces: Ontario (EQ-5D-5L, Oxford Hip Score [OHS]/Oxford Knee Score [OKS], 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).

Total and subscale scores were computed according to the guidelines specified by the licensors of the EQ-5D-5L,⁵ Oxford Hip Score⁶ and Oxford Knee Score.⁷

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: Percentage change in the actual volume of hip and knee replacements performed, by jurisdiction, 2020–2021 relative to 2019–2020

Jurisdiction	Percentage change
Newfoundland and Labrador	-26.6%
Prince Edward Island	14.4%
Nova Scotia	-22.4%
New Brunswick	-3.7%
Quebec	-30.9%
Ontario	-17.8%
Manitoba	-20.8%
Saskatchewan	-35.9%
Alberta	-15.3%
British Columbia	-16.0%

Note

Jurisdictions with fewer than 50 hip and knee replacements per year are not presented.

Sources

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

Text alternative for Figure 2a: Percentage change in the actual volume of hip replacements performed by month, Newfoundland and Labrador, Nova Scotia and New Brunswick, April 2020 to December 2021 relative to pre-pandemic period

Month	Newfoundland and Labrador	Nova Scotia	New Brunswick
April 2020	-79.0%	-74.7%	-71.2%
May 2020	-75.5%	-68.3%	-55.6%
June 2020	-39.0%	-47.9%	11.7%
July 2020	2.7%	-9.6%	26.3%
August 2020	14.8%	-4.4%	18.2%
September 2020	2.3%	-0.5%	22.2%
October 2020	-3.5%	4.6%	-7.0%
November 2020	24.2%	24.8%	9.6%
December 2020	28.2%	4.4%	1.4%
January 2021	9.1%	-12.2%	0.6%
February 2021	-33.9%	-4.1%	0.0%
March 2021	-36.7%	18.0%	18.3%
April 2021	19.8%	4.3%	15.8%
May 2021	-20.4%	-68.3%	-11.7%
June 2021	26.8%	-22.6%	16.1%
July 2021	2.7%	-6.2%	-12.3%
August 2021	2.5%	-3.7%	8.2%
September 2021	-20.9%	-2.7%	8.2%
October 2021	-14.0%	-20.4%	-36.3%
November 2021	-8.8%	28.1%	-15.8%
December 2021	-53.5%	-21.1%	-45.8%

Note

Data for March 2020 to March 2021 is complete. Data for April to December 2021 is provisional and is subject to change; this data should be interpreted with caution. Learn about [how to use CIHI's provisional health data](#).

Sources

Hospital Morbidity Database and National Ambulatory Care Reporting System, March 2019 to February 2020 (pre-pandemic data) and March 2020 to December 2021 (pandemic data; April 2021 to December 2021 is provisional data), Canadian Institute for Health Information.

Text alternative for Figure 2b: Percentage change in the actual volume of hip replacements performed by month, Ontario and Manitoba, April 2020 to December 2021 relative to pre-pandemic period

Month	Ontario	Manitoba
April 2020	-79.0%	-65.8%
May 2020	-69.9%	-37.1%
June 2020	-30.5%	19.3%
July 2020	1.1%	12.7%
August 2020	4.2%	7.4%
September 2020	10.7%	15.6%
October 2020	8.2%	5.9%
November 2020	16.0%	-41.4%
December 2020	10.8%	-49.6%
January 2021	-12.0%	-19.5%
February 2021	-0.6%	-21.7%
March 2021	16.2%	6.0%
April 2021	-37.5%	-9.9%
May 2021	-51.5%	-32.6%
June 2021	-1.4%	-18.2%
July 2021	6.7%	-18.3%
August 2021	12.8%	-13.3%
September 2021	12.5%	7.3%
October 2021	4.7%	-12.7%
November 2021	14.0%	-52.5%
December 2021	-4.7%	-70.5%

Note

Data for March 2020 to March 2021 is complete. Data for April to December 2021 is provisional and is subject to change; this data should be interpreted with caution. Learn about [how to use CIHI's provisional health data](#).

Sources

Hospital Morbidity Database and National Ambulatory Care Reporting System, March 2019 to February 2020 (pre-pandemic data) and March 2020 to December 2021 (pandemic data; April 2021 to December 2021 is provisional data), Canadian Institute for Health Information.

Text alternative for Figure 2c: Percentage change in the actual volume of hip replacements performed by month, Saskatchewan, Alberta and British Columbia, April 2020 to December 2021 relative to pre-pandemic period

Month	Saskatchewan	Alberta	British Columbia
April 2020	-75.9%	-72.6%	-72.2%
May 2020	-68.1%	-62.7%	-54.6%
June 2020	-62.1%	-11.2%	-2.3%
July 2020	-14.1%	11.9%	9.2%
August 2020	24.2%	5.1%	-2.1%
September 2020	-4.6%	1.5%	-3.0%
October 2020	-10.7%	-4.0%	-7.0%
November 2020	9.1%	-7.0%	-4.5%
December 2020	-8.5%	-7.3%	-0.7%
January 2021	-47.0%	-21.2%	-8.5%
February 2021	-32.3%	-5.9%	-6.7%
March 2021	-19.8%	22.8%	3.2%
April 2021	-30.9%	3.7%	-1.3%
May 2021	-29.9%	-6.3%	-10.7%
June 2021	-23.8%	14.4%	22.7%
July 2021	-9.1%	14.9%	6.1%
August 2021	30.7%	9.5%	-7.6%
September 2021	-17.4%	-53.6%	-21.9%
October 2021	-49.3%	-67.1%	-30.9%
November 2021	-54.6%	-24.6%	-47.3%
December 2021	-63.4%	-8.6%	-75.1%

Note

Data for March 2020 to March 2021 is complete. Data for April to December 2021 is provisional and is subject to change; this data should be interpreted with caution. Learn about [how to use CIHI's provisional health data](#).

Sources

Hospital Morbidity Database and National Ambulatory Care Reporting System, March 2019 to February 2020 (pre-pandemic data) and March 2020 to December 2021 (pandemic data; April 2021 to December 2021 is provisional data), Canadian Institute for Health Information.

Text alternative for Figure 2d: Percentage change in the actual volume of knee replacements performed by month, Newfoundland and Labrador, Nova Scotia and New Brunswick, April 2020 to December 2021 relative to pre-pandemic period

Month	Newfoundland and Labrador	Nova Scotia	New Brunswick
April 2020	-98.3%	-98.7%	-97.1%
May 2020	-94.8%	-98.6%	-72.9%
June 2020	-89.1%	-68.9%	-15.6%
July 2020	6.9%	-30.2%	14.9%
August 2020	-16.3%	-24.6%	18.0%
September 2020	-2.6%	-3.6%	2.9%
October 2020	-23.1%	-12.0%	6.6%
November 2020	-3.1%	-3.4%	12.9%
December 2020	-20.7%	-11.5%	22.3%
January 2021	10.5%	-1.2%	-18.1%
February 2021	-45.9%	-0.5%	20.0%
March 2021	-59.4%	4.8%	45.3%
April 2021	13.9%	-1.7%	9.9%
May 2021	0.9%	-81.2%	-18.6%
June 2021	10.9%	-10.1%	6.1%
July 2021	-9.7%	-7.5%	-23.1%
August 2021	-21.3%	-5.1%	22.2%
September 2021	-19.3%	-35.2%	-4.6%
October 2021	-23.9%	-45.8%	-56.8%
November 2021	-52.0%	-15.6%	-24.6%
December 2021	-59.8%	-23.1%	-27.3%

Note

Data for March 2020 to March 2021 is complete. Data for April to December 2021 is provisional and is subject to change; this data should be interpreted with caution. Learn about [how to use CIHI's provisional health data](#).

Sources

Hospital Morbidity Database and National Ambulatory Care Reporting System, March 2019 to February 2020 (pre-pandemic data) and March 2020 to December 2021 (pandemic data; April 2021 to December 2021 is provisional data), Canadian Institute for Health Information.

Text alternative for Figure 2e: Percentage change in the actual volume of knee replacements performed by month, Ontario and Manitoba, April 2020 to December 2021 relative to pre-pandemic period

Month	Ontario	Manitoba
April 2020	-98.0%	-96.0%
May 2020	-95.1%	-62.6%
June 2020	-66.4%	29.2%
July 2020	-26.8%	28.5%
August 2020	0.4%	22.1%
September 2020	0.9%	16.5%
October 2020	0.6%	17.0%
November 2020	6.8%	-61.2%
December 2020	10.4%	-84.1%
January 2021	-26.7%	-69.0%
February 2021	-21.8%	-36.8%
March 2021	12.3%	9.4%
April 2021	-57.7%	-8.4%
May 2021	-83.2%	-50.9%
June 2021	-27.0%	-69.5%
July 2021	-7.4%	-39.0%
August 2021	5.1%	-14.7%
September 2021	0.5%	-18.1%
October 2021	-7.0%	-16.6%
November 2021	10.0%	-47.2%
December 2021	-3.0%	-73.5%

Note

Data for March 2020 to March 2021 is complete. Data for April to December 2021 is provisional and is subject to change; this data should be interpreted with caution. Learn about [how to use CIHI's provisional health data](#).

Sources

Hospital Morbidity Database and National Ambulatory Care Reporting System, March 2019 to February 2020 (pre-pandemic data) and March 2020 to December 2021 (pandemic data; April 2021 to December 2021 is provisional data), Canadian Institute for Health Information.

Text alternative for Figure 2f: Percentage change in the actual volume of knee replacements performed by month, Saskatchewan, Alberta and British Columbia, April 2020 to December 2021 relative to pre-pandemic period

Month	Saskatchewan	Alberta	British Columbia
April 2020	-96.0%	-96.6%	-98.2%
May 2020	-95.7%	-94.5%	-80.6%
June 2020	-81.5%	-30.0%	-9.4%
July 2020	8.4%	19.3%	1.2%
August 2020	-12.8%	9.9%	1.9%
September 2020	-1.8%	16.3%	5.2%
October 2020	-15.2%	-1.8%	-15.2%
November 2020	14.4%	-9.3%	-10.8%
December 2020	-29.4%	0.2%	-18.6%
January 2021	-77.8%	-27.1%	-16.7%
February 2021	-60.7%	-6.0%	-20.9%
March 2021	-44.5%	5.6%	-7.4%
April 2021	-40.4%	1.9%	-20.3%
May 2021	-55.3%	-11.8%	-26.4%
June 2021	-36.2%	15.2%	10.1%
July 2021	14.2%	1.4%	-0.4%
August 2021	-13.2%	4.8%	-15.4%
September 2021	-37.5%	-73.5%	-29.8%
October 2021	-80.1%	-92.7%	-41.9%
November 2021	-74.2%	-47.0%	-54.0%
December 2021	-71.4%	8.3%	-75.5%

Note

Data for March 2020 to March 2021 is complete. Data for April to December 2021 is provisional and is subject to change; this data should be interpreted with caution. Learn about [how to use CIHI's provisional health data](#).

Sources

Hospital Morbidity Database and National Ambulatory Care Reporting System, March 2019 to February 2020 (pre-pandemic data) and March 2020 to December 2021 (pandemic data; April 2021 to December 2021 is provisional data), Canadian Institute for Health Information.

Text alternative for Figure 3: Number of hip and knee replacements performed as day surgeries, Canada, 2016–2017 to 2020–2021

Fiscal year	Hip	Knee
2016–2017	106	227
2017–2018	184	298
2018–2019	445	463
2019–2020	1,329	960
2020–2021	3,656	3,694

Sources

Hospital Morbidity Database and National Ambulatory Care Reporting System, 2016–2017 to 2020–2021, Canadian Institute for Health Information.

Text alternative for Figure 4: 12-month change in patient-reported outcomes and satisfaction with surgery, 2015–2016 to 2020–2021

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)	97.4%	94.8%
Unchanged overall joint-specific score based on the OHS/OKS	0.4%	0.9%
Worsened overall joint-specific score based on the OHS/OKS	2.2%	4.3%
Improved pain subscale score based on the OHS/OKS	97.5%	95.0%
Unchanged pain subscale score based on the OHS/OKS	0.8%	1.2%
Worsened pain subscale score based on the OHS/OKS	1.7%	3.9%
Improved function subscale score based on the OHS/OKS	95.7%	89.1%
Unchanged function subscale score based on the OHS/OKS	1.2%	4.2%
Worsened function subscale score based on the OHS/OKS	3.1%	6.7%
Improved health-related quality of life score based on the EQ-5D-5L	92.2%	85.8%
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	6.9%	11.8%
Felt satisfied with the results of the surgery	92.8%	87.9%
Felt neutral with the results of the surgery	4.0%	7.9%
Felt dissatisfied with the results of the surgery	3.2%	4.2%

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 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, 2015–2016 to 2019–2020; Winnipeg Regional Health Authority, 2016–2017 to 2020–2021; and Ontario PROMs Program co-executed by Ontario Ministry of Health, Ontario Health and Canadian Institute for Health Information, 2018–2019 to 2021–2022.

Surgical data: Discharge Abstract Database and National Ambulatory Care Reporting System, 2015–2016 to 2020–2021, Canadian Institute for Health Information.

Text alternative for Figure 5: Cumulative percentage revision for primary hip and knee replacement due to osteoarthritis, Canada, 2009–2010 to 2020–2021

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 12 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 5.0%. The curve for hip replacements shows a steep increase to around 1% quite close to the baseline (year 0). After that, there is a steady increase to 4.7% at 12 years. The curve for knee replacements shows an increase over time from 1.1% at year 1 to 4.8% at year 12. 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 2020–2021, Canadian Institute for Health Information.

Text alternative for Figure 6: Cumulative percentage revision for primary total hip replacement for male patients, by age (primary diagnosis of osteoarthritis), 2012–2013 to 2020–2021

The cumulative percentage revision for each age group is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 9 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 4.0%. The 4 curves have a similar shape: a steep increase to around 1% quite close to the baseline (year 0). After that, the increase is quite flat. The curve for age 75 and older is higher than the curves for the other 3 age groups, with a more profound steep increase, to about 1.5% close to year 0. 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 2020–2021, Canadian Institute for Health Information.

Text alternative for Figure 7: Cumulative percentage revision for primary total hip replacement for female patients, by age (primary diagnosis of osteoarthritis), 2012–2013 to 2020–2021

The cumulative percentage revision for each age group is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 9 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 4.0%. 3 of the 4 curves (age groups younger than 55, 55 to 64 and 65 to 74) have a very similar shape: a steep increase to about 1% quite close to the baseline (year 0). The curve for age 75 and older is considerably higher than those for the other 3,

with a more profound steep increase, to about 2%. After that, the increase is quite flat for all curves. Just after the 3-year mark, the 75 and older curve becomes closer to the others, and it overlaps with the first 2 younger groups after the 4-year mark, while the 65 to 74 curve starts to separate, becoming considerably lower. 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 2020–2021, 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 2020–2021

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 9 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 4.0%. The 3 curves have a similar shape: a steep increase to around 1% quite close to the baseline (year 0). After that, the increase is quite flat. 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 2020–2021, 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 2020–2021

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 9 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 2020–2021, 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 2020–2021

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 9 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. 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 2020–2021, 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 2020–2021

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 9 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 2020–2021, 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 2020–2021

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 9 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 higher than 1%, 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 2020–2021, 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 2020–2021

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 9 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 2020–2021, Canadian Institute for Health Information.

Text alternative for Figure 14: Cumulative percentage revision for primary total knee replacement for male patients, by age (primary diagnosis of osteoarthritis), 2012–2013 to 2020–2021

The cumulative percentage revision for each age group is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 9 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 10.0%. The highest curve and the curve with the steepest increase is for the age group younger than 55. The other 3 curves almost overlap up until the 1-year mark, after which they start diverging, with the 75+ group being the lowest, followed by 65 to 74, then 55 to 64. The increase for those 3 curves is steady over time. 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 2020–2021, Canadian Institute for Health Information.

Text alternative for Figure 15: Cumulative percentage revision for primary total knee replacement for female patients, by age (primary diagnosis of osteoarthritis), 2012–2013 to 2020–2021

The cumulative percentage revision for each age group is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 9 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 7.0%. The 4 curves have a very similar shape, although they diverge shortly after year 1, with the exception of the age groups 65 to 74 and 75+, which almost overlap. The increase is steady over time. The highest curve is for the age group younger than 55, then 55 to 64, followed by 65 to 74, then 75+. 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 2020–2021, Canadian Institute for Health Information.

Text alternative for Figure 16: Cumulative percentage revision for primary total knee replacement, by stability and patella resurfacing (primary diagnosis of osteoarthritis), 2012–2013 to 2020–2021

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 9 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 2020–2021, Canadian Institute for Health Information.

Text alternative for Figure 17: Cumulative percentage revision for primary total knee replacement, by stability and mobility (primary diagnosis of osteoarthritis), 2012–2013 to 2020–2021

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 9 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 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 2020–2021, Canadian Institute for Health Information.

Text alternative for Figure 18: Cumulative percentage revision for primary total knee replacement, by fixation (primary diagnosis of osteoarthritis), 2012–2013 to 2020–2021

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 9 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.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2020–2021, Canadian Institute for Health Information.

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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

12603-0422

