



Hip and Knee Replacements in Canada: Canadian Joint Replacement Registry 2013 Annual Report

Types of Care



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The page features decorative wavy lines in grey and teal that flow across the background, framing the central content area.

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Healthier Canadians.

Our Mandate

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Our Values

Respect, Integrity, Collaboration,
Excellence, Innovation

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Executive Summary

Hip and Knee Replacements in Canada: Canadian Joint Replacement Registry 2013 Annual Report draws on data from two data holdings at the Canadian Institute for Health Information (CIHI): the Hospital Morbidity Database (HMDB) and the Canadian Joint Replacement Registry (CJRR). The purpose of this report is to characterize the epidemiology of hip and knee replacement procedures performed in Canada using selected clinical and surgical parameters. The report presents overall volumes and rates, as well as trends over time, for procedures performed in 2010–2011.

The HMDB is a pan-Canadian database that captures administrative, clinical and demographic information on all acute care hospitalizations, including joint replacement procedures and revisions. CJRR is a pan-Canadian registry that collects additional patient, clinical, surgical and prosthesis information on hip and knee replacement procedures from participating surgeons and hospitals. While data in this year's report was obtained on a voluntary basis, future CJRR reports will also include data from provinces that are mandated to report as of 2012–2013—a directive that has increased CJRR's coverage.

Hospital Statistics

In 2010–2011, there were 93,446 hospitalizations for all hip and knee replacements in Canada. This represents a five-year increase of 13.0% (from 82,717 replacements in 2006–2007) and a one-year increase of 3.6% from 2009–2010.

This breaks down to 42,713 acute care hospitalizations for hip replacements (including total replacements, partial replacements and resurfacing procedures) and 50,733 acute care hospitalizations for knee replacements in Canada. These figures represent a five-year increase of 10.6% for hip replacements and 15.0% for knee replacements, compared with 2006–2007. The number of knee replacements has consistently exceeded that of hip replacements; the difference was just less than 20% in 2010–2011.

The overall pan-Canadian age-standardized hospitalization rate for all hip replacements in 2010–2011 was 93.5 per 100,000; this rate has been stable for four years (since 2007–2008). Females had higher age-standardized hip replacement rates than males (98.9 versus 85.9), a trend that has been evident over the past several years. The overall age-standardized knee replacement rate across Canada was 115.5; again, females had a higher rate (130.4) than males (99.5). Both sexes had slight increases in knee replacement rates over the five-year period since 2006–2007.

Looking at variation by jurisdiction of patient residence in 2010–2011, Ontarians had the highest number of hip and knee replacements (38,840 joint replacements, representing more than 40% of the national total). However, the highest age-standardized rates were seen among residents of Saskatchewan (119.1 and 153.0 per 100,000 for hips and knees, respectively) and Manitoba (113.9 and 131.6 for hips and knees, respectively); the Canadian rates were 93.5 and 115.5 for hips and knees, respectively. The lowest rates were found among residents of Quebec (70.8 for hips and 83.4 for knees).

Sex differences persisted in that, overall, females had higher age-standardized rates than males for both hip and knee replacements, across all jurisdictions. Looking at volumes by age group, the sex gap was greater among hip replacement recipients: 27% of male hip replacement recipients were age 65 to 74, whereas nearly half of all female recipients were age 75 and older at the time of surgery.

Interesting trends in 2010–2011 were evident for those age 45 to 64; these people made up 29.6% and 38.3% of hip and knee replacement recipients, respectively. Those age 55 to 64 had the second-highest volume of knee replacements among both males and females, exceeded only by those age 65 to 74. Further, the age groups 45 to 54 and 55 to 64 were the only ones that had a five-year increase in age-specific rates, for both sexes and for both hip and knee replacements. Males age 45 to 54 and 55 to 64 who underwent hip replacement had five-year increases of 8.8% and 11.0%, respectively; among women, increases were 5.3% and 4.6% for the same age groups, respectively. Among knee replacement recipients, males age 45 to 54 and 55 to 64 had even higher increases, at 17.9% and 18.8%, respectively, whereas women had increases of 14.4% and 7.1% for the same age groups. In contrast, rate decreases were the norm for other age groups.

The median length of stay (LOS) was five days for hip replacements and four days for knee replacements, which has been steady over the past five years. LOS variations were seen across jurisdictions (in terms of where the procedure was performed rather than patient residence) and by sex.

Looking at specific types of hip procedures more closely, partial hip replacements had the longest LOS (median of eight days nationally, compared with four days for total hip replacements and three days for hip resurfacing procedures). Partial hip replacement rates were higher among females than males, particularly among those age 75 and older. Variations in age-standardized rates of different types of hip replacements were apparent across jurisdictions.

Clinical and Surgical Statistics

In 2010–2011, there were 17,303 hip replacements and 23,463 knee replacements reported voluntarily to CJRR; these represent 43.8% of all hip and knee replacements performed in Canada that year. Starting in 2012–2013, Ontario and British Columbia have mandated reporting to CJRR, which is expected to increase the registry's coverage to more than 80% nationally.

The most common diagnosis grouping for hip replacements reported to CJRR was degenerative osteoarthritis (OA) (82.1%), followed by acute hip fracture (6.3%) and osteonecrosis (3.5%). The most common diagnosis grouping for knee replacements was degenerative OA (95.4%), followed by inflammatory arthritis (2.2%) and post-traumatic OA (1.4%).

Among the joint replacements reported, 10.1% of hip replacements and 5.9% of knee replacements were revision procedures. The most common reason for revision was aseptic loosening, for both types of joint replacements.

Based on the calculation of body mass index, higher proportions of both hip and knee replacement recipients were obese (39.2% and 58.1%, respectively) when compared with the

general Canadian population. It is estimated that only 25.1% of the general Canadian population is obese.

Low-molecular-weight heparin was the most popular deep vein thrombosis preventive agent used, with 71.9% of hip replacement and 68.4% of knee replacement patients receiving the drug.

Among revisions of hip replacements, the most common component replaced was the femoral head (93.8%). Recent trends have seen increased use of large-sized femoral heads (36 mm or larger) in both primary (42.5%) and revision (48.8%) procedures. The most common bearing surface combination for hip replacements was metal-on-polyethylene (75.2%). Among revisions of knee replacements, the most common component replaced was the tibial component (86.7%).

The most common fixation method differed between hip and knee replacements. While hip replacements used mostly cementless fixation methods (82.8%), 89.5% of knee replacements used cemented techniques.

Future Directions

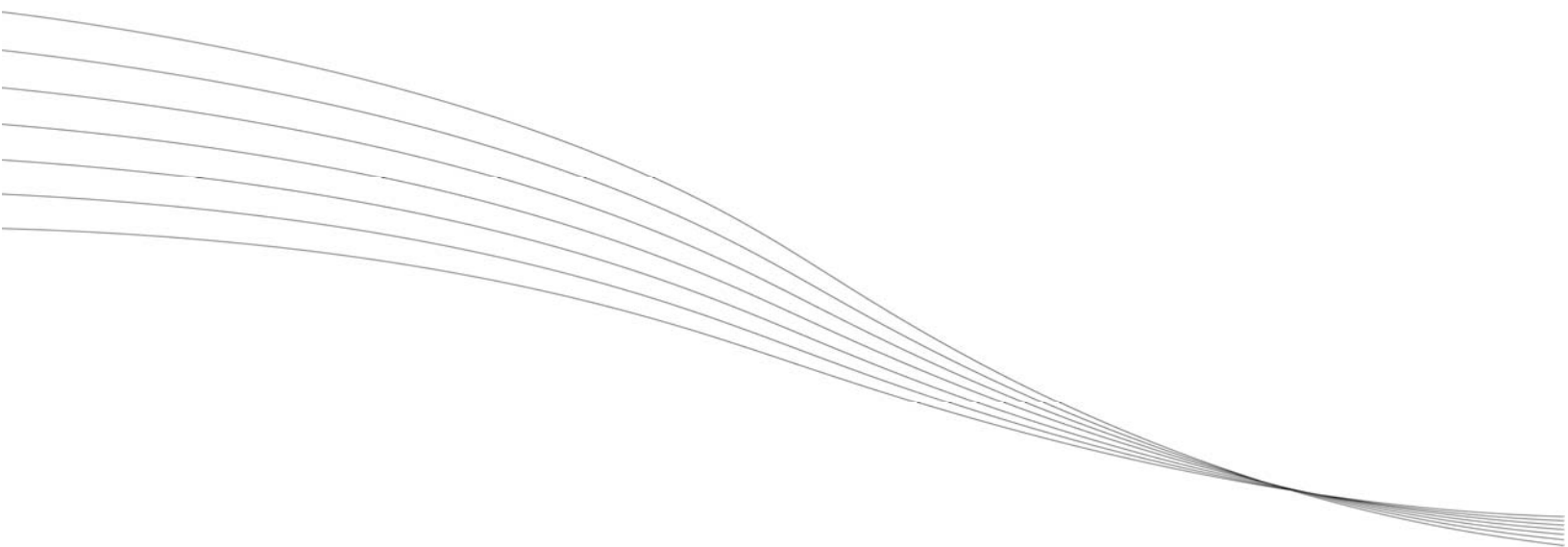
CJRR recently went through significant changes that will improve its ability to contribute to safety and quality improvements for Canadians who have hip or knee replacements.

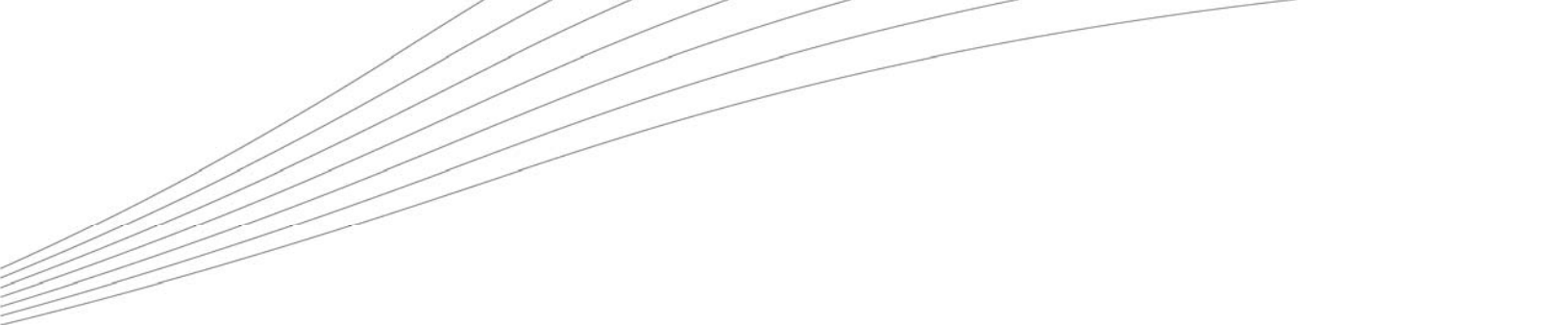
As of 2012–2013, CJRR has implemented a new minimum data set (MDS) based on that proposed by the International Society of Arthroplasty Registries. The MDS replaced the longer set of data elements that is reported in this document. The MDS has reduced the burden of data collection on data providers while meeting the minimum needs of an arthroplasty registry, making CJRR more palatable for uptake across more parts of the country.

Also as of 2012–2013, the governments of Ontario and B.C. have mandated reporting to CJRR, which is expected to increase CJRR's coverage to more than 80% of all hip and knee replacements performed in Canada. CJRR continues to work in collaboration with key policy-makers and orthopedic surgeons in other jurisdictions to further encourage mandated reporting to CJRR.

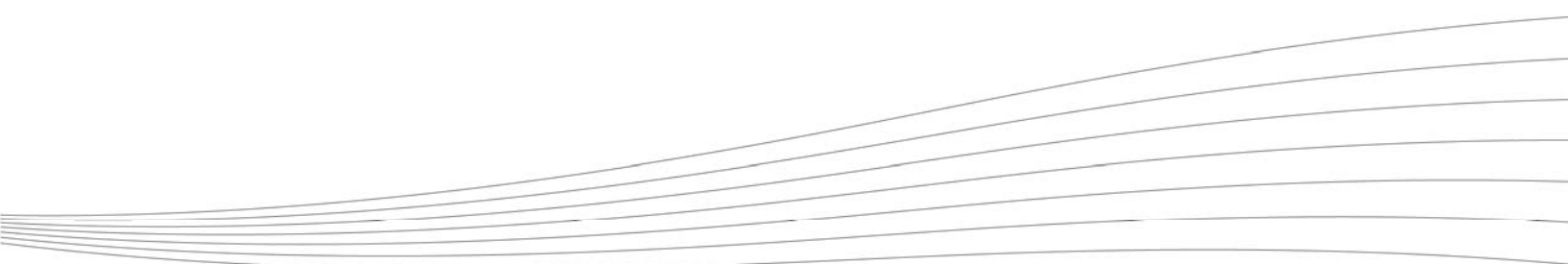
CJRR is also moving toward fully electronic data collection. Paper data collection forms are being phased out in favour of data submission via electronic files or CJRR's web-based data entry tool. These changes will improve data quality, data security and timeliness of data submission.

With these changes, CJRR will play a growing role in safety and quality initiatives across the country related to hip and knee replacements. As implants and surgical techniques continue to evolve, CJRR data will be even more important in understanding related health outcomes from clinical, administrative and policy perspectives.





Chapter 1: Introduction



The purpose of this report is to characterize hip and knee replacement procedures performed in Canada according to their epidemiology (including volumes and trends over time) and by selected clinical and surgical parameters. Data was obtained from the Hospital Morbidity Database (HMDB) and the Canadian Joint Replacement Registry (CJRR).

About the Canadian Joint Replacement Registry

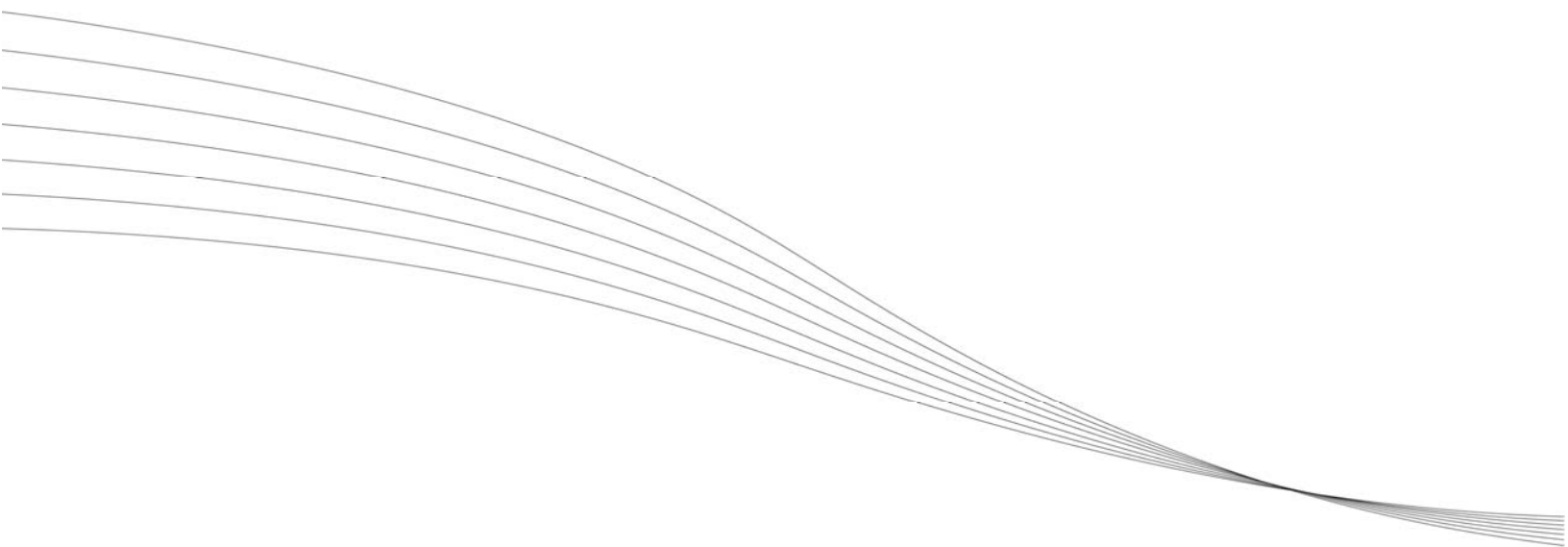
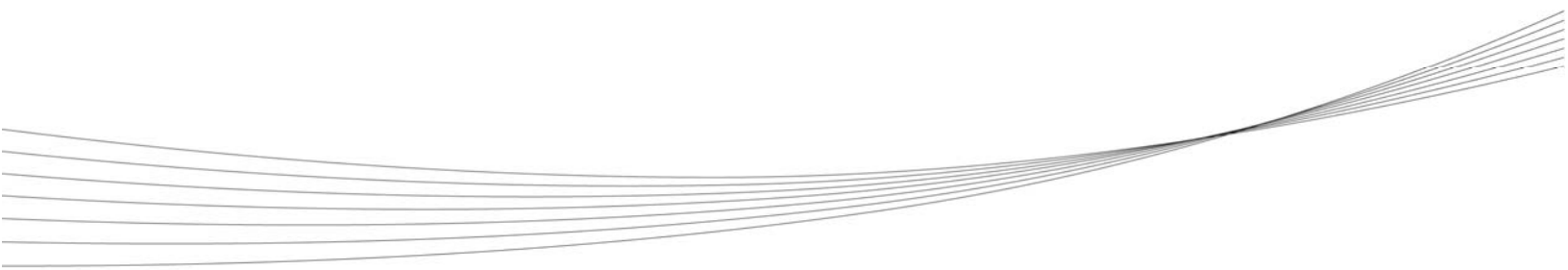
CJRR is a pan-Canadian information system for hip and knee replacement operations with a mandate to record and analyze the level of activity, clinical parameters and outcomes of primary and revision hip and knee replacement operations over time. The registry was developed through a joint effort between the Canadian Institute for Health Information (CIHI) and orthopedic surgeons in Canada. The goal of CJRR is to provide information to help improve the quality of care and clinical outcomes of joint replacement recipients. More information on CJRR can be found at www.cihi.ca/cjrr.

CIHI captures administrative information (including diagnoses and procedure codes) and demographic information on all discharges from acute care facilities in Canada, including hip and knee joint replacements and revisions, through the HMDB. CJRR was developed to provide a rich set of additional patient, clinical, surgical and prosthesis information to complement what is captured in the HMDB, to enable more in-depth analysis of hip and knee replacements and revisions.

In addition to the partnership between CIHI and orthopedic surgeons across the country, several key partners have contributed greatly to the successful development and implementation of CJRR, including the Canadian Orthopaedic Association; orthopedic patients; the Arthritis Society of Canada; and federal, provincial and territorial ministries of health.

Privacy and Confidentiality

As the custodian of numerous registries and databases, CIHI has stringent policies for ensuring that the privacy, confidentiality and security of its data holdings are protected. Information on CIHI's privacy and confidentiality policies and procedures is available on CIHI's website at www.cihi.ca.





Chapter 2: Methodology



Hospitalization Statistics From the HMDB

Chapter 3 of this report presents data based on the HMDB, which is managed by CIHI. The figures and tables provide data on hospitalizations for hip and knee replacements (primary and revision procedures) performed in acute care hospitals in Canada, based on discharges from April 1, 2006, to March 31, 2011.

Canadian Classification of Health Interventions (CCI) codes were used to identify hip and knee replacements from 2006–2007 to 2010–2011. This report contains some methodological changes from previously published CJRR reports. Partial hip replacements as well as knee replacements involving the patella or patellofemoral compartment only were excluded from previous CJRR annual reports. For completeness of reporting, they have been included in this report using a consistent methodology across presented time trends. As a result of these methodological changes, counts and calculations may differ from those in previously published reports. Appendix B details the CCI codes for all hip and knee procedures included in this report.

Counts reported were based on the number of hospitalizations, not procedures. That is, if bilateral procedures were performed on the same day (in the same operative episode), only one hospitalization was counted.

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

With the exception of length-of-stay analyses, provincial analyses in Chapter 3 were based on a patient’s province or territory of residence, not where the procedure was performed. The patient’s geographical location was assigned based on postal code, using the Postal Code Conversion File (PCCF) from Statistics Canada. Patients with incomplete postal codes or unknown residence were excluded from provincial analyses as well as national counts, where indicated.

For the calculation of age-standardized rates, national and provincial fiscal population estimates were used based on October 1 of the given fiscal year, as provided by Statistics Canada. The 1991 Canadian population was used as the standard to determine the age-standardized rates.

All analyses were conducted using the SAS (version 9.2, Cary, North Carolina) statistical software package.

Clinical and Surgical Statistics From CJRR

Chapter 4 of this report presents data based on CJRR. The figures and tables provide data on clinical and surgical details for hip and knee replacements (primary and revision procedures), based on surgery dates from April 1, 2003, to March 31, 2010, that were submitted on a voluntary basis from participating surgeons across Canada.

In 2010–2011, CJRR captured approximately 43.8% of the hip and knee replacements and revisions performed in Canada, as compared with the HMDB (see Table 1). CJRR participation rates vary greatly by jurisdiction, resulting in the capture of no procedures in one province and almost 89% in others. For more information, please see *Data Quality Documentation for Users: Canadian Joint Replacement Registry, 2010–2011* on CJRR’s web page at www.cihi.ca/cjrr.

Table 1: Hip and Knee Replacements in CJRR as a Percentage of HMDB, 2010–2011

Jurisdiction	All Hip and Knee Replacements		
	In CJRR*	In HMDB	Coverage
Newfoundland and Labrador	412	1,309	31.5%
Prince Edward Island	0	380	0.0%
Nova Scotia	2,783	3,180	87.5%
New Brunswick	1,854	2,350	78.9%
Quebec	8,851	17,017	50.4%
Ontario[†]	8,787	38,864	22.6%
Manitoba	3,497	3,951	88.5%
Saskatchewan	2,899	3,504	82.7%
Alberta	5,573	9,520	58.5%
British Columbia[†]	6,437	13,283	48.5%
Territories[‡]	65	88	73.9%
Canada	40,888	93,446	43.8%

Notes

* Excludes procedures done in private facilities.

† As of 2012–2013, Ontario and B.C. have mandated CJRR data submission. It is anticipated that this will increase national coverage from 44% to 83%.

‡ Territories include Yukon, Northwest Territories and Nunavut.

Numbers are based on the province in which the joint replacement was performed.

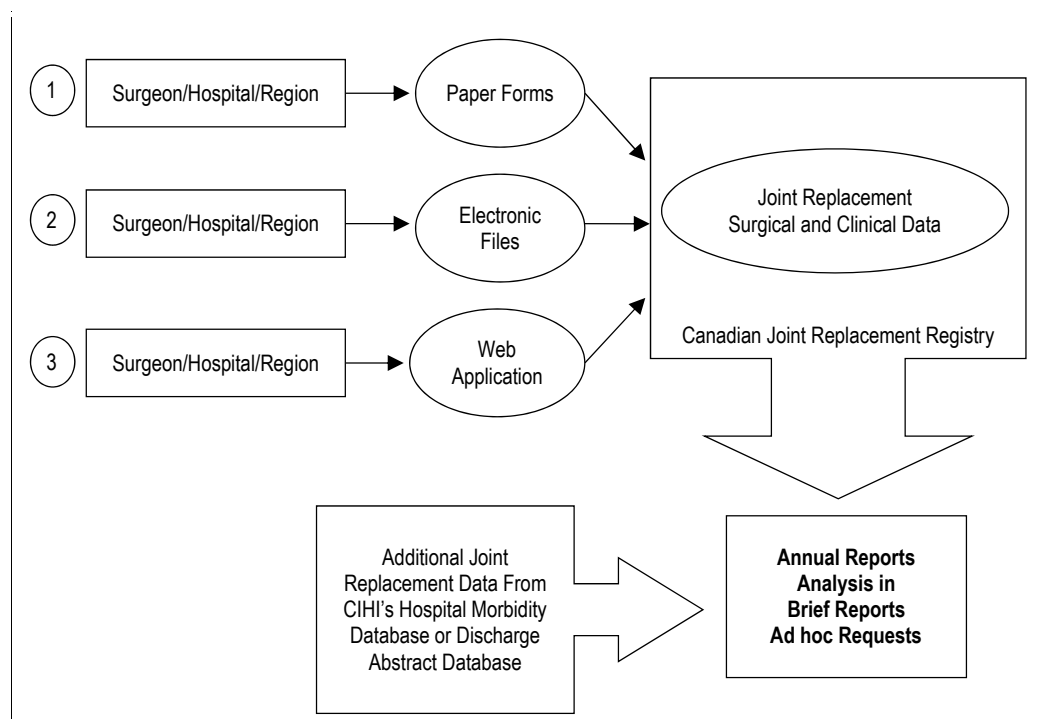
Sources

Hospital Morbidity Database and Canadian Joint Replacement Registry, 2010–2011, Canadian Institute for Health Information.

As seen in Table 1, a limitation of the data reported from CJRR is under-coverage, as not all eligible surgeons participate in CJRR. Furthermore, it is not known whether each participating surgeon submitted data for all procedures performed. Response bias is possible but not quantifiable.

The flow of data collection in CJRR is shown in Figure 1. Data is currently submitted to the database in one of three ways: electronic file submissions, web-based data submissions or paper data collection forms.

Figure 1: Canadian Joint Replacement Registry Data Flow Diagram



All data submitted to CJRR is subjected to standardized edit checks. These checks flag data elements that do not meet criteria for logic, value range and/or completeness. Erroneous data is flagged for follow-up with the original data supplier.

Surgical and clinical data presented here is based on hip and knee replacements and revisions performed in Canadian acute care hospitals. Data is presented on a fiscal year basis, from 2003–2004 to 2010–2011, with the main focus on the latter (April 1, 2010, to March 31, 2011). Fiscal year is defined by the date of surgery recorded. In instances in which surgery date was not available, admission date was used as a proxy. Note that surgical data presented here may be updated in future reports, as the registry continues to accept data beyond the deadline for the reporting period.

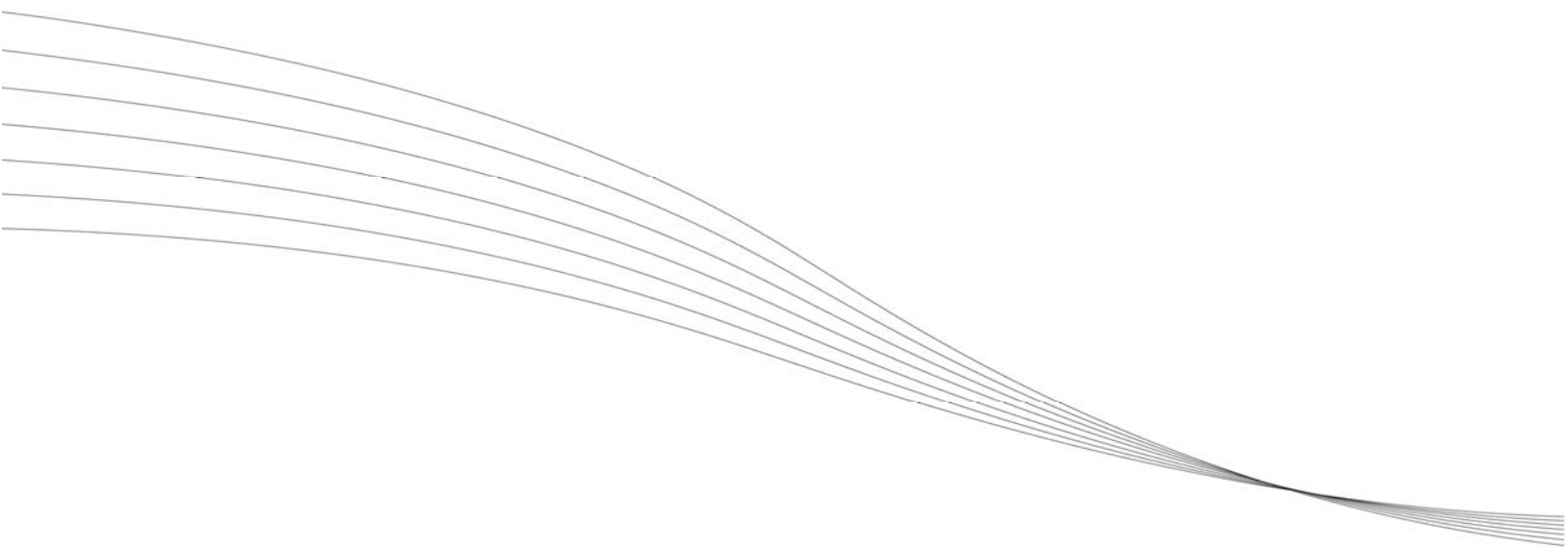
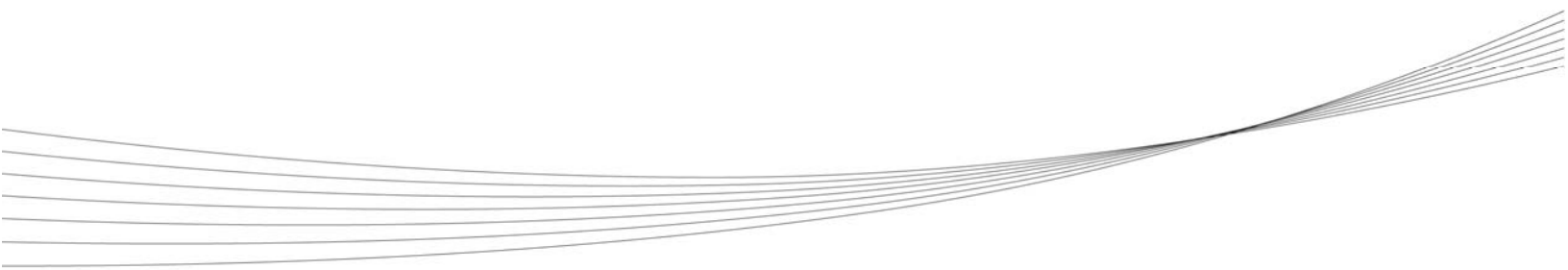
Unless otherwise indicated, for the clinical and surgical data presented in Chapter 4, the reported province refers to where the procedure was performed, not where the patient resides.

As well, in Chapter 4, cases are counted by number of procedures. A bilateral procedure is submitted as two separate procedures to CJRR.

Throughout this chapter, the term “components replaced” is used to refer to components replacing existing artificial implants in the case of revision procedures.

CJRR is continually updated with procedures done in both current and past fiscal years. As a result, figures in this report may differ from those in previous annual reports.

CJRR’s coding methodology is presented in Appendix C.





Chapter 3: Hospitalization Statistics



Methodological Highlights

- Analyses for this chapter are based on the HMDB.
- Counts reported were based on the number of hospitalizations, not procedures.
- Changes to the methodology and definitions may result in different counts and calculations than in previously published reports.
 - For hip replacements, partial hip replacements are now included in HMDB analyses.
 - For knee replacements, replacement of the patella only and of the patellofemoral compartment are now included in HMDB analyses.
- Please refer to Appendix B for methodological details pertaining to coding hip and knee replacements in the HMDB.

This chapter provides information on hospitalization rates in Canada for hip and knee replacements in 2010–2011, as well as historical trends at the provincial/territorial and pan-Canadian levels. Data of particular interest includes patient demographics (including province/territory of residence) and length of stay in hospital.

Pan-Canadian Overview of Hip and Knee Replacements

In 2010–2011, there were 93,446 hospitalizations for all hip and knee replacements in Canada. This represents a five-year increase of 13.0% (from 82,717 in 2006–2007) and a one-year increase of 3.6% from 2009–2010.

In 2010–2011, there were 42,713 acute care hospitalizations for hip replacements, as follows:

- Total hip replacements: 31,666 (74.1%)
- Partial hip replacements: 10,230 (24.0%)
- Hip resurfacing procedures: 817 (1.9%)

Collectively, this represents a five-year increase of 10.6% (from 38,611 procedures in 2006–2007).

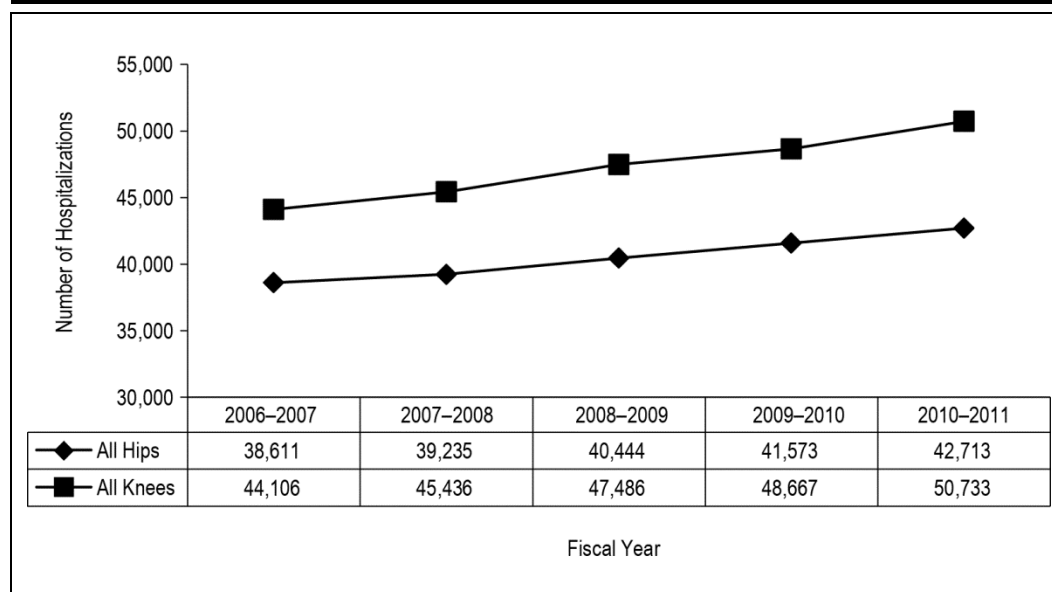
In 2010–2011, there were 50,733 knee replacements in Canada, which is a 15.0% increase from 2006–2007, when 44,106 procedures were performed.

Compared with 2009–2010 figures, 2010–2011 saw one-year increases of 2.7% and 4.2% for hip and knee replacements, respectively.

The number of knee replacements consistently exceeded the number of hip replacements in Canada (by 14.2% in 2006–2007 and by nearly 20% in 2010–2011).

Figure 2 shows the number of hospitalizations for all acute care hip and knee replacement hospitalizations in Canada from 2006–2007 to 2010–2011.

Figure 2: Number of Hospitalizations for All Hip and All Knee Replacement Procedures in Canada, 2006–2007 to 2010–2011



Source

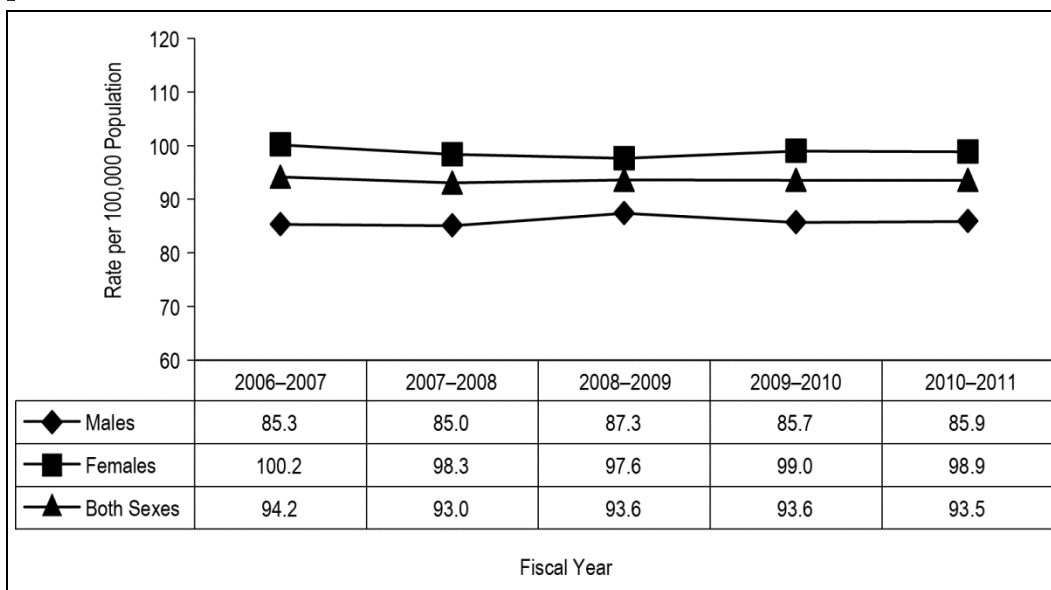
Hospital Morbidity Database, 2006–2007 to 2010–2011, Canadian Institute for Health Information.

Age-Standardized Hospitalization Rates

Age standardization takes into account changes in age structure across populations and time, by calculating rates against a standard population. The age-standardized rates shown throughout this report are reported per 100,000 population unless otherwise specified.

The pan-Canadian age-standardized hospitalization rate for all hip replacements in 2010–2011 was 93.5 per 100,000; this has been fairly consistent since 2007–2008 (Figure 3). The 2010–2011 age-standardized rate for males was 85.9, while that for females was 98.9, a difference of 13.0. Since 2006–2007, the age-standardized rate for hip replacements has decreased slightly from 94.2 (–0.7%). The age-standardized rate for all hip replacements was consistently higher for females than for males over the entire reporting period. The rate for males has had a slight increase since 2006–2007 (0.6%), whereas the rate for females had a 1.3% decrease.

Figure 3: Age-Standardized Hospitalization Rates (per 100,000 Population) for All Hip Replacements, by Sex, Canada, 2006–2007 to 2010–2011



Note

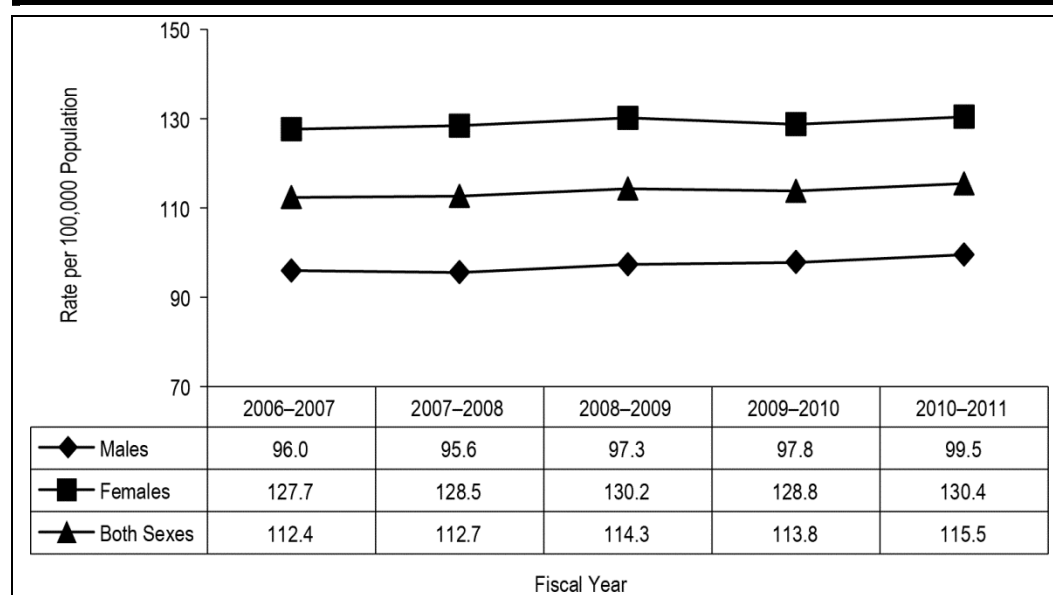
The 1991 Canadian population was used as the standard for rate calculation.

Source

Hospital Morbidity Database, 2006–2007 to 2010–2011, Canadian Institute for Health Information.

Larger differences, both between sexes and over time, were observed for the age-standardized knee hospitalization rates (Figure 4). In 2010–2011, the overall age-standardized knee hospitalization rate was 115.5 per 100,000 (99.5 for males and 130.4 for females). Unlike for hip replacement hospitalizations, both males and females have had increases in age-standardized knee replacement hospitalization rates (3.7% and 2.2%, respectively) since 2006–2007.

Figure 4: Age-Standardized Hospitalization Rates (per 100,000 Population) for All Knee Replacements, by Sex, Canada, 2006–2007 to 2010–2011



Note

The 1991 Canadian population was used as the standard for rate calculation.

Source

Hospital Morbidity Database, 2006–2007 to 2010–2011, Canadian Institute for Health Information.

Jurisdictional Variations

Table 2 presents the number of hip replacement procedures by jurisdiction of patient residence for the five years from 2006–2007 to 2010–2011.

Of the 42,660 hip replacements done in 2010–2011 where provincial jurisdiction of residence is known, most (39.9%) were performed on patients who resided in Ontario. This is a slight decrease from five years prior, when 42.0% of patients were from Ontario.

All jurisdictions, with the exception of Prince Edward Island, saw a five-year increase in hospitalizations for all hip replacements. From 2006–2007 to 2010–2011, Nova Scotia and Quebec showed the largest percentage increases (26.3% and 24.3%, respectively), whereas hospitalizations in P.E.I. decreased (–14.2%).

Table 2: Number of Hospitalizations for All Hip Replacements, by Jurisdiction, 2006–2007 to 2010–2011

Jurisdiction	Total Number of All Hip Replacements					Five-Year Percentage Change
	2006–2007	2007–2008	2008–2009	2009–2010	2010–2011	
Newfoundland and Labrador	516	559	544	601	584	13.2
Prince Edward Island	218	211	232	212	187	-14.2
Nova Scotia	1,146	1,196	1,324	1,397	1,447	26.3
New Brunswick	969	954	964	1,004	1,088	12.3
Quebec	6,391	6,968	7,235	7,680	7,941	24.3
Ontario	16,153	16,202	16,450	16,632	17,038	5.5
Manitoba	1,717	1,645	1,678	1,571	1,848	7.6
Saskatchewan	1,524	1,459	1,601	1,708	1,702	11.7
Alberta	3,555	3,786	3,864	4,354	4,347	22.3
British Columbia	6,225	6,077	6,385	6,238	6,399	2.8
Territories*	69	61	72	84	79	14.5
Canada[†]	38,483	39,118	40,349	41,481	42,660	10.9

Notes

* Territories include Yukon, Northwest Territories and Nunavut.

† Total counts exclude cases with unknown jurisdiction of residence.

Numbers are based on patients' province or territory of residence.

Source

Hospital Morbidity Database, 2006–2007 to 2010–2011, Canadian Institute for Health Information.

Table 3 presents the number of knee replacement procedures by jurisdiction of patient residence between 2006–2007 and 2010–2011.

Of the 50,730 knee replacements performed in 2010–2011 with known jurisdiction of residence, 21,802 (43.0%) were performed on patients residing in Ontario. This is a decrease from five years prior, when 47.0% of patients were from Ontario.

Jurisdictional variations were more apparent in knee replacements than in hip replacements. Nova Scotia had the largest five-year increase at 59.1%, followed by the territories (53.5%), Quebec (46.2%) and Newfoundland and Labrador (43.8%). Other jurisdictions have experienced a decrease in knee replacements since 2006–2007 (Manitoba at -9.1% and P.E.I. at -11.1%).

Table 3: Number of Hospitalizations for All Knee Replacements, by Jurisdiction, 2006–2007 to 2010–2011

Jurisdiction	Total Number of All Knee Replacements					Five-Year Percentage Change
	2006–2007	2007–2008	2008–2009	2009–2010	2010–2011	
Newfoundland and Labrador	509	573	624	676	732	43.8
Prince Edward Island	235	202	206	245	209	-11.1
Nova Scotia	1,122	1,204	1,495	1,657	1,785	59.1
New Brunswick	969	1,037	1,046	1,117	1,178	21.6
Quebec	6,208	6,521	7,217	7,832	9,076	46.2
Ontario	20,699	21,530	21,557	21,559	21,802	5.3
Manitoba	2,199	1,989	2,095	1,941	1,998	-9.1
Saskatchewan	1,613	1,570	1,801	2,276	2,002	24.1
Alberta	4,000	4,337	4,338	4,698	4,928	23.2
British Columbia	6,437	6,367	6,992	6,526	6,888	7.0
Territories*	86	88	96	117	132	53.5
Canada†	44,077	45,418	47,467	48,644	50,730	15.1

Notes

* Territories include Yukon, Northwest Territories and Nunavut.

† Total counts exclude cases with unknown jurisdiction of residence.

Numbers are based on patients' province or territory of residence.

Source

Hospital Morbidity Database, 2006–2007 to 2010–2011, Canadian Institute for Health Information.

Table 4 shows the distribution of primary and revision hip and knee procedures by jurisdiction of patient residence. Most hospitalizations for both hip and knee replacements in Canada were for primary procedures (90.0% and 92.8%, respectively), a general trend that was consistent across provinces and territories.

Table 4: Number of Hospitalizations, by Type of Replacement and Jurisdiction, 2010–2011

Jurisdiction	All Hip Replacements		All Knee Replacements	
	Primary	Revision	Primary	Revision
Newfoundland and Labrador	517	70	690	42
Prince Edward Island	172	15	186	23
Nova Scotia	1,281	170	1,625	160
New Brunswick	962	129	1,098	80
Quebec	7,234	757	8,546	547
Ontario	15,347	1,748	20,178	1,634
Manitoba	1,651	201	1,818	180
Saskatchewan	1,569	137	1,910	93
Alberta	3,937	426	4,547	387
British Columbia	5,773	641	6,392	497
Territories*	70	9	123	9
Canada[†]	38,513	4,303	47,113	3,652

Notes

* Territories include Yukon, Northwest Territories and Nunavut.

† Total counts exclude cases with unknown jurisdiction of residence.

Numbers are based on patients' province or territory of residence.

If a patient had both a primary and a revision procedure in the same hospitalization, a count was recorded for both.

Source

Hospital Morbidity Database, 2010–2011, Canadian Institute for Health Information.

Age-Standardized Rates by Jurisdiction

Looking at age-standardized rates by jurisdiction, Table 5 shows variations across Canada for all hip replacement procedures, with Manitoba and Saskatchewan having the highest rates of hip replacements (113.9 and 119.1 per 100,000, respectively). Quebec had the lowest rate of hospitalization for all hip replacements (70.8), followed by Newfoundland and Labrador (80.1). From 2006–2007 to 2010–2011, some provinces had an increased age-standardized rate for hip replacements; the greatest increases were seen in Nova Scotia (17.2%) and Quebec (10.8%). On the other hand, decreases were found in Ontario (-5.8%), B.C. (-9.0%) and P.E.I. (-23.7%). In 2010–2011, the eastern provinces appeared to have relatively lower hip replacement rates (with the exception of Nova Scotia) than the central and western provinces. The national age-standardized rate of hospitalization for all hip replacement procedures decreased slightly (-0.7%) from 94.2 in 2006–2007 to 93.5 in 2010–2011.

Table 5: Age-Standardized Rate (per 100,000) for All Hip Replacements, by Jurisdiction, 2006–2007 to 2010–2011

Jurisdiction	Age-Standardized Rate					Five-Year Percentage Change
	2006–2007	2007–2008	2008–2009	2009–2010	2010–2011	
Newfoundland and Labrador	76.2	83.7	77.8	83.8	80.1	5.1
Prince Edward Island	116.5	108.0	114.1	103.2	88.9	-23.7
Nova Scotia	87.9	90.4	98.8	101.8	103.1	17.2
New Brunswick	94.2	90.3	89.0	91.1	97.5	3.5
Quebec	63.9	67.5	68.4	70.4	70.8	10.8
Ontario	104.0	101.4	100.2	98.6	98.0	-5.8
Manitoba	113.8	106.7	108.7	98.9	113.9	0.0
Saskatchewan	114.2	106.1	116.7	122.1	119.1	4.3
Alberta	101.8	103.3	103.1	112.8	109.2	7.3
British Columbia	110.2	104.6	106.5	100.7	100.3	-9.0
Canada*	94.2	93.0	93.6	93.6	93.5	-0.7

Notes

* Total counts exclude cases with unknown jurisdiction of residence.

Results are presented by patients' province of residence, rather than for the province of the facility where hospitalization occurred.

Patients with incomplete postal codes were excluded from rate calculations.

The 1991 Canadian population was used as the standard for rate calculations.

The territories were suppressed due to small numbers that would create unstable results; however, their numbers were included in Canadian calculations.

Source

Hospital Morbidity Database, 2006–2007 to 2010–2011, Canadian Institute for Health Information.

Similar trends in age-standardized hospitalization rates were seen among knee replacements (Table 6). Manitoba and Saskatchewan had the highest rates of knee replacement at 131.6 and 153.0, respectively, in 2010–2011, while Quebec had the lowest rate (83.4), followed by Newfoundland and Labrador (97.9). Over the five-year period, some provinces had an increased age-standardized rate for knee replacements, with the greatest increases seen in Nova Scotia (43.9%), Quebec (30.2%) and Newfoundland and Labrador (28.8%). Decreases were found in Ontario (-5.8%), Manitoba (-15.0%) and P.E.I. (-21.1%). The national age-standardized rate of hospitalization for knee replacement procedures increased by 2.8%, from 112.4 to 115.5 (in 2006–2007 and 2010–2011, respectively).

Table 6: Age-Standardized Rate (per 100,000) for All Knee Replacements, by Jurisdiction, 2006–2007 to 2010–2011

Jurisdiction	Age-Standardized Rate					Five-Year Percentage Change
	2006–2007	2007–2008	2008–2009	2009–2010	2010–2011	
Newfoundland and Labrador	76.0	83.4	88.0	91.9	97.9	28.8
Prince Edward Island	130.5	108.4	108.3	123.1	102.9	-21.1
Nova Scotia	89.9	94.7	114.6	123.2	129.4	43.9
New Brunswick	98.5	103.2	101.0	106.0	109.4	11.1
Quebec	64.1	65.4	70.3	74.0	83.4	30.2
Ontario	138.7	140.4	136.4	132.7	130.7	-5.8
Manitoba	154.8	139.0	143.9	130.2	131.6	-15.0
Saskatchewan	131.0	126.2	140.4	176.0	153.0	17.0
Alberta	119.8	124.7	120.3	125.4	126.5	5.7
British Columbia	112.1	114.1	122.1	109.9	112.4	0.2
Canada*	112.4	112.7	114.3	113.8	115.5	2.8

Notes

* Total counts exclude cases with unknown jurisdiction of residence.

Results are presented by patients' province of residence, rather than for the province of the facility where hospitalization occurred.

Patients with incomplete postal codes were excluded from rate calculations.

The 1991 Canadian population was used as the standard for rate calculations.

The territories were suppressed due to small numbers that would create unstable results; however, their numbers were included in Canadian calculations.

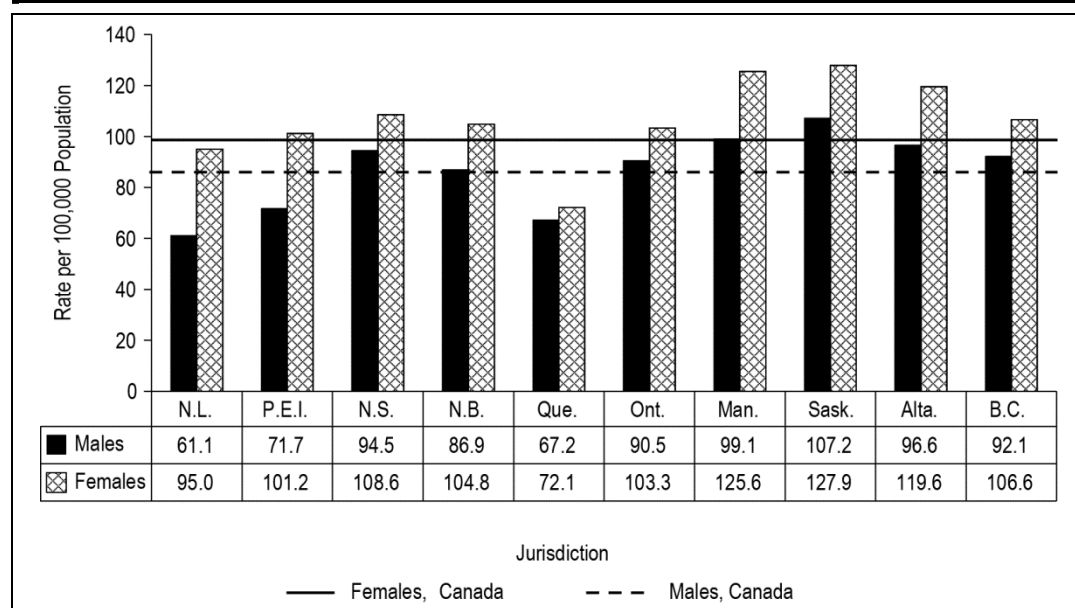
Source

Hospital Morbidity Database, 2006–2007 to 2010–2011, Canadian Institute for Health Information.

Age-Standardized Rates by Jurisdiction and Sex

Age-standardized rates for hip replacements were consistently higher for females than for males across all provinces (Figure 5). Eight jurisdictions had rates higher than the national age-standardized rate for females (98.9), whereas only seven had a higher rate for males than the national average (85.9).

Figure 5: Age-Standardized Rates (per 100,000 Population) for All Hip Replacements, by Jurisdiction and Sex, Canada, 2010–2011



Notes

Results are presented by patients' province of residence, rather than for the province of the facility where hospitalization occurred.

Patients with incomplete postal codes were excluded from rate calculations.

The 1991 Canadian population was used as the standard for rate calculations.

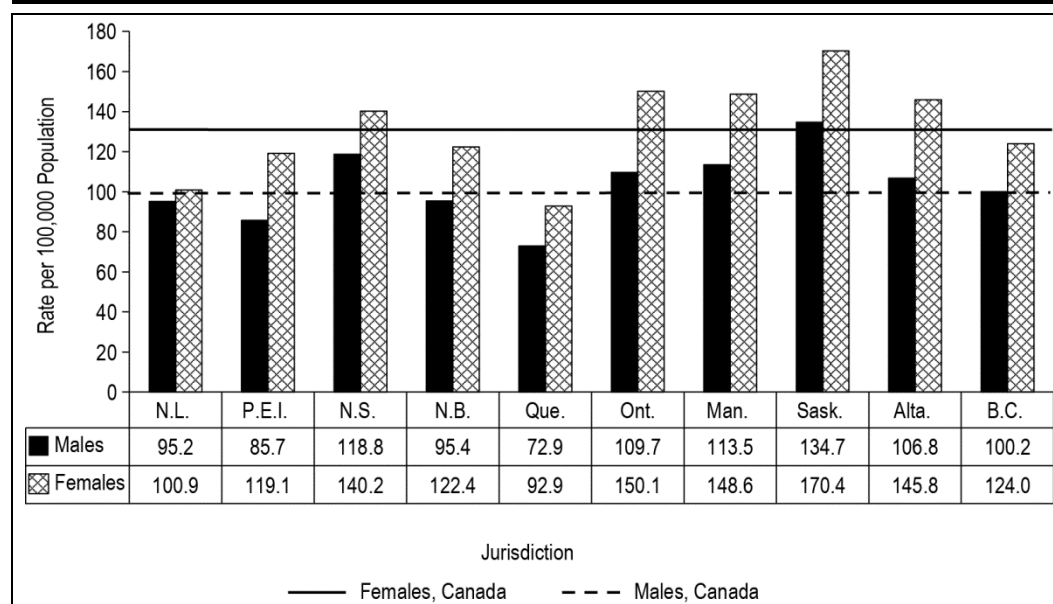
The territories were suppressed due to small numbers that would create unstable results; however, their numbers were included in Canadian calculations.

Source

Hospital Morbidity Database, 2010–2011, Canadian Institute for Health Information.

Similar to the rates for hip replacements, the age-standardized rates for knee replacements were also consistently higher for females than for males across all provinces (Figure 6). Five jurisdictions had rates higher than the national age-standardized rate for females (130.4), whereas six had a higher rate for males than the national average (99.5).

Figure 6: Age-Standardized Rates (per 100,000 Population) for All Knee Replacements, by Jurisdiction and Sex, Canada, 2010–2011



Notes

Results are presented by patients' province of residence, rather than for the province of the facility where hospitalization occurred.

Patients with incomplete postal codes were excluded from rate calculations.

The 1991 Canadian population was used as the standard for rate calculations.

The territories were suppressed due to small numbers that would create unstable results; however, their numbers were included in Canadian calculations.

Source

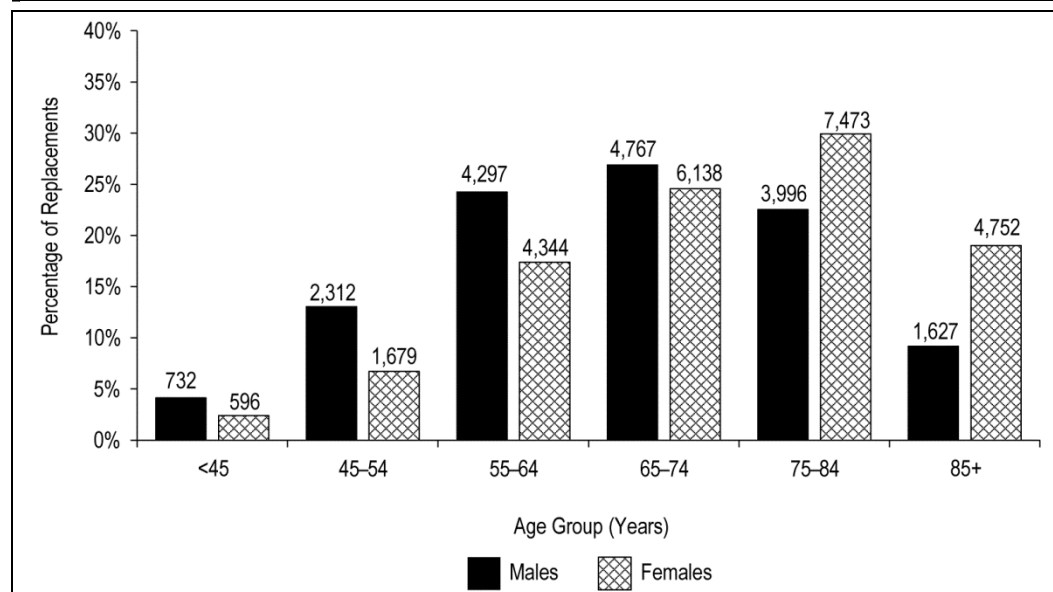
Hospital Morbidity Database, 2010–2011, Canadian Institute for Health Information.

The gap between the sexes was greater for the age-standardized knee replacement rates than for hip replacement rates. This difference was greatest in Ontario, where the age-standardized knee replacement rate for males was 109.7 and that for females was 150.1 (difference of 40.3 per 100,000). In comparison, the greatest gap between the sexes among hip replacement rates was seen in Newfoundland and Labrador (61.1 for males and 95.0 for females, for a difference of 33.9 per 100,000).

Patient Demographics

The age distribution of hip replacement recipients differed between the sexes (Figure 7). Males tended to be younger at the time of hip replacement (average age of 67.3) than females (average age of 72.5). Most (26.9%) male hip replacement recipients were age 65 to 74, whereas nearly half of all females were 75 and older at the time of surgery. Almost three times as many female patients as male patients were age 85 and older.

Figure 7: Age Distribution of All Hip Replacement Recipients, by Sex, Canada, 2010–2011



Notes

N = 17,731 males.

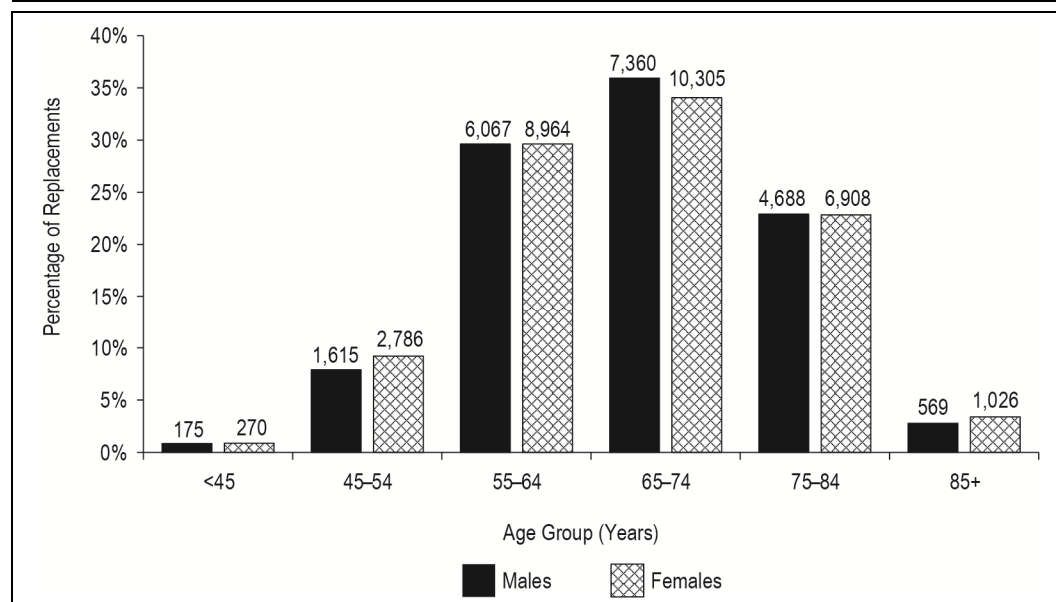
N = 24,982 females.

Source

Hospital Morbidity Database, 2010–2011, Canadian Institute for Health Information.

Figure 8 shows the age distribution of knee replacement recipients by sex. Unlike for hip replacements, these trends were very similar by sex (the average ages for males and females at the time of knee replacement were 67.5 and 67.4, respectively). For both sexes, most patients were age 65 to 74 (35.9% and 34.1% for males and females, respectively).

Figure 8: Age Distribution of All Knee Replacement Recipients, by Sex, Canada, 2010–2011



Notes

N = 20,474 males.

N = 30,259 females.

Source

Hospital Morbidity Database, 2010–2011, Canadian Institute for Health Information.

Table 7 shows the age-specific rates for all hip replacements by sex as well as the five-year change for the years 2006–2007 to 2010–2011. The age-specific rates increased with increasing age for both males and females. In 2010–2011, the highest age-specific rates were among those age 85 and older for males and females (754.5 and 1,074.4 per 100,000, respectively). The largest percentage increases from 2006–2007 in hip replacement rates by sex were observed among males age 55 to 64 (11.0%) and among females age 45 to 54 (5.3%). However, a five-year decrease was observed in all age groups younger than 45 and 65 and older for both sexes.

Table 7: Age-Specific Rates (per 100,000) for All Hip Replacements, by Age Group and Sex, Canada, 2006–2007 to 2010–2011

Age Group	Males					Five-Year Percentage Change
	2006–2007	2007–2008	2008–2009	2009–2010	2010–2011	
<45	7.9	7.5	8.1	7.8	7.3	-7.4
45–54	78.2	81.3	84.0	83.5	85.1	8.8
55–64	183.2	189.6	198.7	195.2	203.3	11.0
65–74	383.2	384.3	390.5	378.0	382.2	-0.3
75–84	607.9	578.5	584.5	578.4	569.7	-6.3
85+	784.0	785.4	798.5	786.8	754.5	-3.8
Overall	95.9	97.6	102.0	101.9	104.2	8.7

Age Group	Females					Five-Year Percentage Change
	2006–2007	2007–2008	2008–2009	2009–2010	2010–2011	
<45	6.6	6.4	6.5	5.9	6.2	-6.8
45–54	59.0	60.2	64.7	61.8	62.1	5.3
55–64	190.1	186.8	187.6	192.9	198.9	4.6
65–74	462.0	455.4	451.0	460.1	452.2	-2.1
75–84	859.5	832.1	812.9	835.7	821.4	-4.4
85+	1,106.9	1,103.9	1,051.3	1,065.6	1,074.4	-2.9
Overall	139.2	138.8	138.8	142.7	144.5	3.8

Source

Hospital Morbidity Database, 2006–2007 to 2010–2011, Canadian Institute for Health Information.

Table 8 shows the age-specific rates for all knee replacements. In 2010–2011, the highest age-specific rates were seen among those age 75 to 84 for males and females (669.0 and 760.7 per 100,000, respectively). The largest percentage increases from 2006–2007 were observed among males age 55 to 64 and females age 45 to 54 (18.8% and 14.4%, respectively). As with the rates for hip replacements, a five-year decrease was observed in all age groups younger than 45 and 65 and older for both sexes.

Table 8: Age-Specific Rates (per 100,000) for All Knee Replacements, by Age Group and Sex, Canada, 2006–2007 to 2010–2011

Age Group	Males					Five-Year Percentage Change
	2006–2007	2007–2008	2008–2009	2009–2010	2010–2011	
<45	1.7	1.8	1.7	1.9	1.7	3.4
45–54	50.4	52.5	57.3	61.3	59.5	17.9
55–64	242.0	253.0	271.9	278.8	287.4	18.8
65–74	597.7	592.3	580.6	581.8	590.8	-1.2
75–84	687.9	659.8	673.2	650.3	669.0	-2.7
85+	289.0	267.8	270.9	273.5	264.2	-8.6
Overall	106.9	108.8	113.4	116.3	120.5	12.7

Age Group	Females					Five-Year Percentage Change
	2006–2007	2007–2008	2008–2009	2009–2010	2010–2011	
<45	2.8	2.8	3.1	2.7	2.8	-1.2
45–54	90.1	92.0	99.8	101.9	103.2	14.4
55–64	383.7	388.4	396.1	408.3	410.8	7.1
65–74	762.1	761.7	768.1	751.6	760.3	-0.2
75–84	777.0	791.7	785.6	747.4	760.7	-2.1
85+	246.5	232.1	216.2	219.8	232.2	-5.8
Overall	162.3	165.6	169.8	170.5	175.3	8.0

Source

Hospital Morbidity Database, 2006–2007 to 2010–2011, Canadian Institute for Health Information.

Length of Stay for Hip and Knee Replacements in Canada

This section presents length of stay (LOS) using the median, interquartile range (IQR) and 90th percentile.ⁱ

The median LOS figures for male and female hip replacement recipients in 2010–2011 were similar, at four and five days, respectively (Table 9). This represents a one-day decrease for both sexes from the previous year. However, the top 10% of male patients stayed in acute care for longer than 13 days, whereas the top 10% of female patients stayed more than 16 days. Overall, the median LOS for both sexes combined remained at five days for the fourth straight year.

i. The median is a measure of central tendency, the middle of a data distribution. The median is less sensitive to extreme scores than the mean, which makes it a better measure for highly skewed distributions. The IQR is a corresponding measure of variability, being equal to the difference between the third and the first quartiles. Fifty percent of cases have an LOS within the IQR. Median, IQR and 90th percentile are reported throughout this section.

Table 9: Length of Stay (Days) for All Hip Replacements, by Sex, Canada, 2006–2007 to 2010–2011

Fiscal Year	Males			Females			Both Sexes		
	Median	IQR	90th Percentile	Median	IQR	90th Percentile	Median	IQR	90th Percentile
2006–2007	5	4	14	6	5	18	6	5	16
2007–2008	5	3	14	6	5	18	5	5	16
2008–2009	5	4	14	6	5	17	5	4	16
2009–2010	5	4	13	6	5	17	5	4	16
2010–2011	4	4	13	5	4	16	5	5	15

Note

IQR: interquartile range.

Source

Hospital Morbidity Database, 2006–2007 to 2010–2011, Canadian Institute for Health Information.

The median and 90th percentile for LOS for all knee replacements have been fairly consistent over the past several years, as seen in Table 10. In 2010–2011, the median LOS for males, females and both sexes combined was four days, with 10% of all patients remaining in acute care for longer than eight days.

Table 10: Length of Stay (Days) for All Knee Replacements, by Sex, Canada, 2006–2007 to 2010–2011

Fiscal Year	Males			Females			Both Sexes		
	Median	IQR	90th Percentile	Median	IQR	90th Percentile	Median	IQR	90th Percentile
2006–2007	5	3	9	5	3	9	5	2	9
2007–2008	4	3	9	5	3	8	5	3	9
2008–2009	4	3	8	5	3	8	4	3	8
2009–2010	4	3	8	4	3	8	4	3	8
2010–2011	4	2	8	4	3	8	4	3	8

Note

IQR: interquartile range.

Source

Hospital Morbidity Database, 2006–2007 to 2010–2011, Canadian Institute for Health Information.

Overall, the median and 90th percentile LOS in hospital for hip replacements varied across jurisdictions (Table 11). Alberta had the shortest median LOS regardless of sex (four days for both males and females). In contrast, P.E.I. had the longest median LOS (eight days for males and nine days for females). The national average median LOS was four days for males and five days for females.

Table 11: Length of Stay (Days) for All Hip Replacements, by Jurisdiction, Canada, 2010–2011

Jurisdiction	Males			Females		
	Median	IQR	90th Percentile	Median	IQR	90th Percentile
Newfoundland and Labrador	6	6	21	7	6	18
Prince Edward Island	8	10.5	32	9	9	20
Nova Scotia	4	3	13.5	5	5	21
New Brunswick	6	4	15	6	5	15
Quebec	5	4	17	7	7	25
Ontario	4	3	10	5	3	12
Manitoba	5	3	12	6	4	13
Saskatchewan	5	3	11	6	4	14
Alberta	4	3	13	4	5	15
British Columbia	4	3	15	5	5	16
Northwest Territories	4	2	15	6	4.5	14
Canada	4	4	13	5	4	16

Notes

IQR: interquartile range.

Jurisdictional analysis is based on the location of the facility where the procedure was performed.

Source

Hospital Morbidity Database, 2010–2011, Canadian Institute for Health Information.

Overall, the median and 90th percentile LOS in hospital for knee replacements varied across jurisdiction by sex. As seen in Table 12, for males, the shortest median LOS was seen in Western Canada and the two territories (three days). For females, B.C. again had the shortest median LOS (three days). P.E.I. had the longest median LOS for both sexes (seven days and eight days for males and females, respectively). The national average median LOS for knee replacements was four days for both males and females.

Table 12: Length of Stay (Days) for All Knee Replacements, by Jurisdiction, Canada, 2010–2011

Jurisdiction	Males			Females		
	Median	IQR	90th Percentile	Median	IQR	90th Percentile
Newfoundland and Labrador	5	3	10	5	2	8
Prince Edward Island	7	4	16	8	3	12
Nova Scotia	4	2	7	4	1	7
New Brunswick	4	2	10	5	2	9
Quebec	6	3	10	6	3	11
Ontario	4	2	6	4	2	6
Manitoba	5	2	8	5	2	8
Saskatchewan	5	2	8	5	2	8
Alberta	3	2	7	4	2	6
British Columbia	3	1	7	3	2	7
Northwest Territories	3	2	7	4	2	6
Yukon	3	1	4	4	2	9
Canada	4	2	8	4	3	8

Notes

IQR: interquartile range.

Jurisdictional analysis is based on the location of the facility where the procedure was performed.

Source

Hospital Morbidity Database, 2010–2011, Canadian Institute for Health Information.

Hip Replacements: In-Depth Analysis

This section of the report takes a more in-depth look at the different types of hip replacement procedures: total hip replacements, partial hip replacements and hip resurfacings. Please refer to Appendix B for the standard codes used to differentiate between these types.

Table 13 shows the age-standardized rates for hip replacements by type of procedure performed. In 2010–2011, females had a higher rate of total and partial hip replacements; however, for hip resurfacing procedures, the rate for males was more than four times that for females. For both sexes combined, the age-standardized rates for total hip replacements, partial hip replacements and hip resurfacings were 71.6, 20.1 and 1.8 per 100,000, respectively.

Table 13: Age-Standardized Hospitalization Rates (per 100,000 Population) for All Hip Replacements, by Sex and Type of Procedure, 2010–2011

Type of Procedure	Males	Females	Both Sexes
Total Hip Replacement	67.8	74.4	71.6
Partial Hip Replacement	15.1	23.7	20.1
Hip Resurfacing	3.0	0.7	1.8
Overall	85.9	98.9	93.5

Note

The 1991 Canadian population was used as the standard for rate calculation.

Source

Hospital Morbidity Database, 2010–2011, Canadian Institute for Health Information.

Of all the hip replacement procedures performed in 2010–2011 with known province or territory of residence, 31,639 (74.2%) were total hip replacements, 10,204 (23.9%) were partial hip replacements and 815 (1.9%) were hip resurfacing procedures (Table 14). Jurisdictional variations in types of hip replacements performed can be seen. Hip resurfacing procedures made up 4.3% of procedures for Alberta patients, more than double the national average.

Table 14: Number of Hospitalizations for All Hip Replacements, by Jurisdiction and Type of Procedure, 2010–2011

Jurisdiction	Total Hip Replacement	Partial Hip Replacement	Hip Resurfacing	All Hip Replacements*
Newfoundland and Labrador	366 (62.7%)	213 (36.5%)	5 (0.9%)	584
Prince Edward Island	113 (60.8%)	73 (39.2%)	<5 [†] (—)	186
Nova Scotia	1,073 (74.2%)	356 (24.6%)	18 (1.2%)	1,447
New Brunswick	785 (72.2%)	291 (26.7%)	12 (1.1%)	1,088
Quebec	5,491 (69.1%)	2,317 (29.2%)	133 (1.7%)	7,941
Ontario	13,169 (77.3%)	3,492 (20.5%)	377 (2.2%)	17,038
Manitoba	1,346 (72.8%)	487 (26.4%)	15 (0.8%)	1,848
Saskatchewan	1,232 (72.4%)	454 (26.7%)	16 (0.9%)	1,702
Alberta	3,192 (73.4%)	967 (22.2%)	188 (4.3%)	4,347
British Columbia	4,799 (75.0%)	1,549 (24.2%)	51 (0.8%)	6,399
Territories [‡]	73 (93.6%)	5 (6.4%)	<5 [†] (—)	78
Canada [§]	31,639 (74.2%)	10,204 (23.9%)	815 (1.9%)	42,658

Notes

* Numbers exclude suppressed cells.

† Value suppressed due to small cell size.

‡ Territories include Yukon, Northwest Territories and Nunavut.

§ Total counts exclude cases with unknown jurisdiction of residence.

— Percentage suppressed to ensure confidentiality.

Numbers are based on patients' province or territory of residence.

Source

Hospital Morbidity Database, 2010–2011, Canadian Institute for Health Information.

As expected, age-standardized rates for hip replacements were highest for total hip replacements and lowest for hip resurfacing procedures across all jurisdictions; the Canadian rates were 71.6, 20.1 and 1.8 per 100,000 for total hip replacements, partial hip replacements and hip resurfacings, respectively (Table 15). Across the country, Saskatchewan had the highest rate of total hip replacements, at 92.2, whereas Quebec and Newfoundland and Labrador had the lowest rates (50.8 and 50.4, respectively). P.E.I. had the highest rate of partial hip replacements (31.3), while Quebec (18.7) and Ontario (18.0) had the lowest. Finally, Alberta had the highest rate of hip resurfacing procedures in the country, at 4.0; the second-highest rate was in Ontario, at 2.2 per 100,000.

Table 15: Age-Standardized Rate (per 100,000) for All Hip Replacements, by Jurisdiction and Type of Procedure, 2010–2011

Jurisdiction	Total Hip Replacement	Partial Hip Replacement	Hip Resurfacing	All Hip Replacements
Newfoundland and Labrador	50.4	29.0	0.7	80.1
Prince Edward Island	57.1	31.3	—	88.9
Nova Scotia	78.9	22.8	1.4	103.1
New Brunswick	72.1	24.1	1.3	97.5
Quebec	50.8	18.7	1.3	70.8
Ontario	77.8	18.0	2.2	98.0
Manitoba	87.5	25.4	0.9	113.9
Saskatchewan	92.2	25.6	1.3	119.1
Alberta	81.9	23.3	4.0	109.2
British Columbia	78.1	21.4	0.9	100.3
Canada*	71.6	20.1	1.8	93.5

Notes

* Total counts exclude cases with unknown jurisdiction of residence.

— Rate suppressed due to low volume of procedures.

Results are presented by patients' province of residence, rather than for the province of the facility where hospitalization occurred.

Patients with incomplete postal codes were excluded from rate calculations.

The 1991 Canadian population was used as the standard for rate calculations.

The territories were suppressed due to small numbers that would create unstable results; however, their numbers were included in Canadian calculations.

Source

Hospital Morbidity Database, 2010–2011, Canadian Institute for Health Information.

From Table 16 it can be seen that the age group with the highest rate of total hip replacements for both sexes was age 75 to 84 (415.4 and 541.0 per 100,000 for males and females, respectively). Overall, older females tended to have a higher rate of hip replacements than males, with the exception of partial hip replacement patients, where females had a higher rate across all age groups.

This sex difference was much more apparent in older partial hip replacement patients. The age-specific rate of partial hip replacements in females older than 85 was 715.5 per 100,000, more than 1.5 times that of males.

Hip resurfacing rates, however, were much higher among younger males than younger females. For those younger than age 45, the age-specific rates were 1.1 and 0.3 per 100,000 for males and females, respectively. This difference increased dramatically for those age 45 to 54 (11.7 and 1.4 per 100,000 for males and females, respectively). The gap between the sexes in hip resurfacing rates diminished among older patients.

Table 16: Age-Specific Rates (per 100,000) for All Hip Replacements, by Age Group, Sex and Type of Procedure, Canada, 2010–2011

Age Group	Males			
	Total Hip Replacement	Partial Hip Replacement	Hip Resurfacing	All Hip Replacements
<45	5.9	0.3	1.1	7.3
45–54	69.6	3.8	11.7	85.1
55–64	182.2	12.7	8.3	203.3
65–74	334.2	45.3	2.7	382.2
75–84	415.4	152.7	1.6	569.7
85+	283.2	467.5	3.7	754.5
Overall	82.4	17.9	3.9	104.2

Age Group	Females			
	Total Hip Replacement	Partial Hip Replacement	Hip Resurfacing	All Hip Replacements
<45	5.5	0.3	0.3	6.2
45–54	56.0	4.7	1.4	62.1
55–64	181.1	16.4	1.4	198.9
65–74	380.3	70.8	1.2	452.2
75–84	541.0	277.5	2.9	821.4
85+	354.6	715.5	4.3	1,074.4
Overall	102.1	41.5	0.9	144.5

Source

Hospital Morbidity Database, 2010–2011, Canadian Institute for Health Information.

As shown in Table 17, a large variation in LOS can be seen across the types of hip replacement procedures. Across both sexes, partial hip replacements had the longest LOS, with medians of 9 days and 8 days and 90th percentiles of 30 days and 27 days for male and female patients, respectively. Hip resurfacing patients had the shortest median LOS of only three days for males and four days for females. Total hip replacement LOS was four days and five days for males and females, respectively.

Table 17: Length of Stay (Days) for All Hip Replacements, by Sex and Type of Procedure, Canada, 2010–2011

Type of Procedure	Males			Females			Both Sexes		
	Median	IQR	90th Percentile	Median	IQR	90th Percentile	Median	IQR	90th Percentile
Total Hip Replacement	4	3	9	5	4	11	4	3	10
Partial Hip Replacement	9	11	30	8	10	27	8	10	28
Hip Resurfacing	3	2	5	4	3	11	3	1	6
All Hip Replacements	4	4	13	5	4	16	5	5	15

Note

IQR: interquartile range.

Source

Hospital Morbidity Database, 2010–2011, Canadian Institute for Health Information.

Across jurisdictions, the variation in LOS by sex seen in Table 17 was also evident (Table 18). Alberta and B.C. had among the shortest median LOS for males and females undergoing total hip replacements (three days and four days, respectively). However, these provinces also had longer-than-average median LOS for partial hip replacements (10 days and 9 days for males and females, respectively). Newfoundland and Labrador had the longest median LOS for males receiving partial hip replacements, at 13.5 days, while females in the province had a median LOS of 9 days, just one day longer than the national average. Across all jurisdictions and both sexes, partial hip replacements had the longest median LOS among the different types of hip replacement procedures, with 10% of patients remaining in acute care for more than 40 days in some provinces.

Table 18: Length of Stay (Days) for All Hip Replacements, by Jurisdiction and Type of Procedure, Canada, 2010–2011

Jurisdiction	Males								
	Total Hip Replacement			Partial Hip Replacement			Hip Resurfacing		
	Median	IQR	90th Percentile	Median	IQR	90th Percentile	Median	IQR	90th Percentile
Newfoundland and Labrador	5	3	11	13.5	15.5	30			
Prince Edward Island	8	11	32	6.5	7.5	41			
Nova Scotia	4	2	8	9	12	36	3.5	2	5.5
New Brunswick	5	4	11	8.5	11	26	5.5	2	14
Quebec	5	3	11	10	15	37	4	2	6.5
Ontario	4	2	8	7	7	21	3	1	5
Manitoba	5	3	10	7	8	20	3	2	9
Saskatchewan	4	2	8	9	8	22	6	5	11
Alberta	3	2	8	10	13	42	3	1	3
British Columbia	3	2	8	10	12	35	3	1	4
Northwest Territories	4	2	10	—	—	—			
Canada	4	3	9	9	11	30	3	2	5

(continued on next page)

Table 18: Length of Stay (Days) for All Hip Replacements, by Jurisdiction and Type of Procedure, Canada, 2010–2011 (cont'd)

Jurisdiction	Females								
	Total Hip Replacement			Partial Hip Replacement			Hip Resurfacing		
	Median	IQR	90th Percentile	Median	IQR	90th Percentile	Median	IQR	90th Percentile
Newfoundland and Labrador	6	3	13	9	8.5	25	—	—	—
Prince Edward Island	9	7	16	12	11	27			
Nova Scotia	5	3	13	8	7	37	—	—	—
New Brunswick	6	4	13	8	8	20	5.5	3	18
Quebec	6	3	14	11	15	38	6	3	12
Ontario	4	3	9	7	6	19	4	2	8
Manitoba	6	3	10	7	8	21	—	—	—
Saskatchewan	5	3	11	7	6	20	—	—	—
Alberta	4	3	9	9	10	29	3	1	20
British Columbia	4	3	9	9	10	28	3	5	84
Northwest Territories	6	4.5	14						
Canada	5	4	11	8	10	27	4	3	11

Notes

— Cell suppressed due to low volume of procedures.

Empty cells indicate no data was available.

Jurisdictional analysis is based on the location of the facility where the procedure was performed.

Source

Hospital Morbidity Database, 2010–2011, Canadian Institute for Health Information.

Throughout this section of the report, variations in volume, rates and LOS were seen among different hip replacement procedures. Variations were expected, given that the indications for each type of procedure differ. For instance, partial hip replacements are typically the surgical intervention performed following acute hip fractures.

Summary of Findings

In 2010–2011, there were 42,713 hospitalizations for all hip replacements, an increase of 10.6% since 2006–2007. Hospitalizations for all knee replacements increased by 15.0% over the same period, to 50,733 in 2010–2011. Most hip and knee replacements in Canada were primary procedures (90.0% and 92.8%, respectively).

Despite the trend toward increases in volume, the overall pan-Canadian age-standardized rate for all hip replacements decreased slightly, from 94.2 per 100,000 population in 2006–2007 to 93.5 in 2010–2011, while the overall age-standardized rate for all knee replacements increased 2.8%, from 112.4 to 115.5 over the same period. In general, age-standardized rates for females were higher than for males, for both hip and knee replacements.

Substantial jurisdictional variation in the age-standardized rates of hip and knee replacement was seen in 2010–2011. Saskatchewan had the highest rates of both hip replacements (119.1) and knee replacements (153.0 per 100,000). Quebec had the lowest age-standardized rates of hip and knee replacements in the country, at 70.8 and 83.4 per 100,000, respectively.

The highest age-specific rates for all hip replacements were noted in those age 85 and older for both males and females (754.5 and 1,074.4 per 100,000, respectively). The highest age-specific rates for all knee replacements, however, were noted among those age 75 to 84 for both males and females (699.0 and 760.7, respectively).

In general, the median LOS in acute care has decreased in the five years since 2006–2007. In 2010–2011, the median LOS for both sexes combined was five days for all hip replacements and four days for all knee replacements.

An in-depth analysis of hip replacement procedures found that of the 42,713 hospitalizations for all hip replacements, 74.1% were for total hip replacements, 24.0% were for partial hip replacements and 1.9% were for hip resurfacing procedures. There were also jurisdictional differences in age-standardized hip replacement rates by type. Saskatchewan had the highest rate for total hip replacements (92.2 per 100,000) and Newfoundland and Labrador had the lowest (50.4). P.E.I. had the highest partial hip replacement rate (31.1 per 100,000) and Ontario had the lowest rate (18.0). For hip resurfacing procedures, Alberta had the highest rate (4.0 per 100,000) and Newfoundland and Labrador had the lowest rate (0.7). In 2010–2011, the median LOS for both sexes combined was three days for hip resurfacing procedures, four days for total hip replacements and eight days for partial hip replacements.



Chapter 4: Clinical and Surgical Statistics



Methodological Highlights

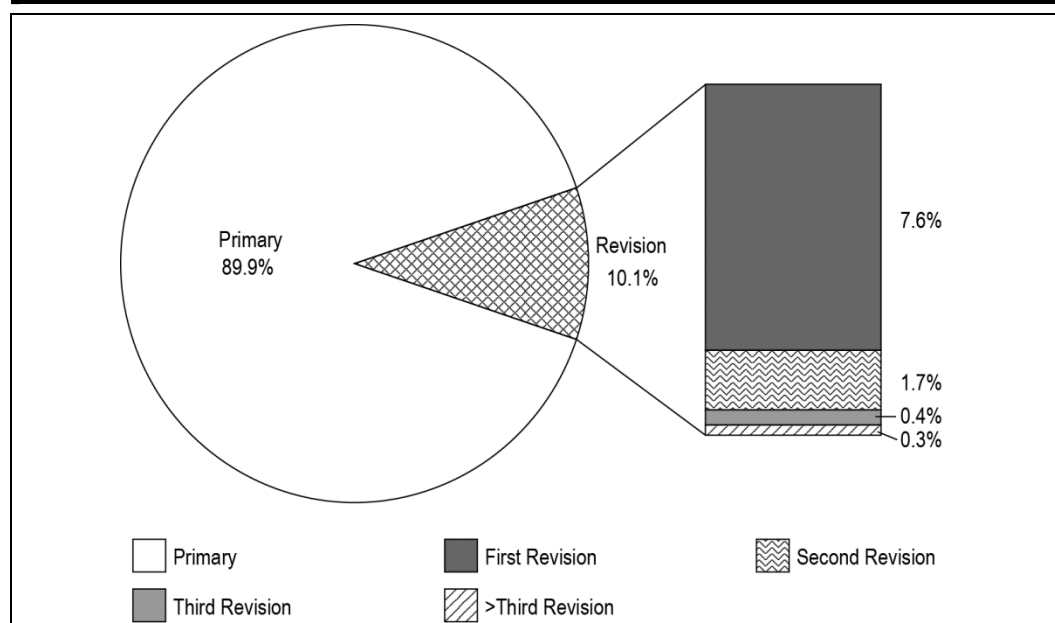
- Analyses for this chapter are based on CJRR.
- Data submission by orthopedic surgeons to CJRR is voluntary; not all eligible surgeons participate. As well, participating surgeons may not have submitted all procedures. Of the 93,446 hip and knee replacements performed in hospital in 2010–2011, 40,888 were captured in CJRR. This represents 43.8% of all joint replacement procedures (40.6% of all hip replacements and 46.4% of all knee replacements).
- Throughout this chapter, the term “components replaced” is used to refer to components replacing existing artificial implants in the case of revision procedures.
- CJRR is continually updated with procedures for both current and past fiscal years. As a result, figures in this report may differ from those in previous annual reports.
- CJRR’s coding methodology is presented in Appendix C.

This section provides additional clinical and surgical information about hip and knee replacement procedures performed in Canada that was captured in CJRR.

Type of Joint Replacement

In 2010–2011, there were 17,303 hip replacements with known type reported to CJRR. Of these, 89.9% were primary replacements, while 10.1% involved revisions of previously implanted joints (mainly first revisions) (Figure 9).

Figure 9: Type of Hip Replacements Captured in CJRR, 2010–2011



Note

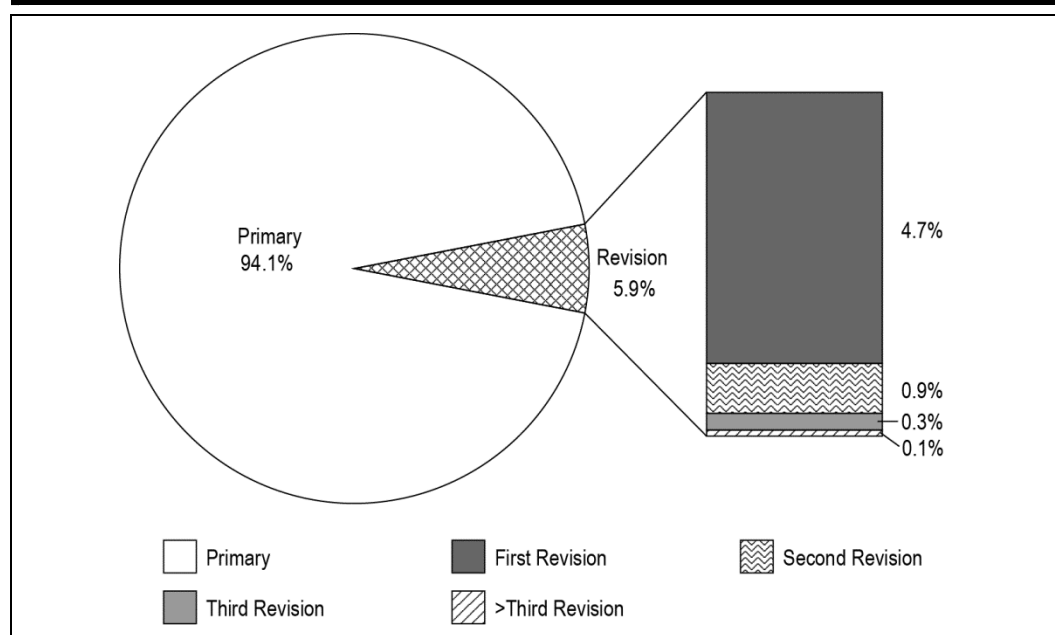
N = 17,303 hip replacements.

Source

Canadian Joint Replacement Registry, 2010–2011, Canadian Institute for Health Information.

In 2010–2011, of the 23,463 knee replacements reported to CJRR with known type, 22,073 (94.1%) were primary procedures, while the remaining 5.9% involved revisions (Figure 10).

Figure 10: Type of Knee Replacements Captured in CJRR, 2010–2011



Note

N = 23,463 knee replacements.

Source

Canadian Joint Replacement Registry, 2010–2011, Canadian Institute for Health Information.

Tables 19 and 20 assess the year-over-year trend in hip and knee replacement procedures reported to CJRR, by procedure type. Since 2003–2004, more than 90% of primary hip replacements have been total replacements. This proportion has decreased slightly, from 96.3% in 2003–2004 to 92.9% in 2010–2011. Similarly, since 2003–2004, more than 90% of primary knee replacements have been total replacements. However, this proportion has increased slightly, from 91.6% in 2003–2004 to 95.6% in 2010–2011.

Table 19: Primary Hip Replacements by Type of Procedure, 2003–2004 to 2010–2011

Type of Procedure	2003–2004	2004–2005	2005–2006	2006–2007	2007–2008	2008–2009	2009–2010	2010–2011
Total Hip Replacement	9,671	11,979	11,186	11,451	10,809	12,161	13,358	14,308
Partial Hip Replacement	304	336	423	316	511	641	733	884
Hip Resurfacing	64	224	185	243	394	358	295	213
Overall	10,039	12,539	11,794	12,010	11,714	13,160	14,386	15,405

Note

Historical figures may differ from those reported in previous reports, due to the use of a different methodology.

Source

Canadian Joint Replacement Registry, 2003–2004 to 2010–2011, Canadian Institute for Health Information.

Table 20: Primary Knee Replacements by Type of Procedure, 2003–2004 to 2010–2011

Type of Procedure	2003–2004	2004–2005	2005–2006	2006–2007	2007–2008	2008–2009	2009–2010	2010–2011
Total Knee Replacement	12,733	16,371	16,078	16,234	16,499	18,476	20,381	20,987
Partial Knee Replacement	1,167	1,535	1,407	1,242	1,113	1,037	1,096	927
Overall	13,900	17,906	17,485	17,476	17,612	19,513	21,477	21,959

Note

Partial replacements include unicompartmental and patellofemoral arthroplasty procedures.

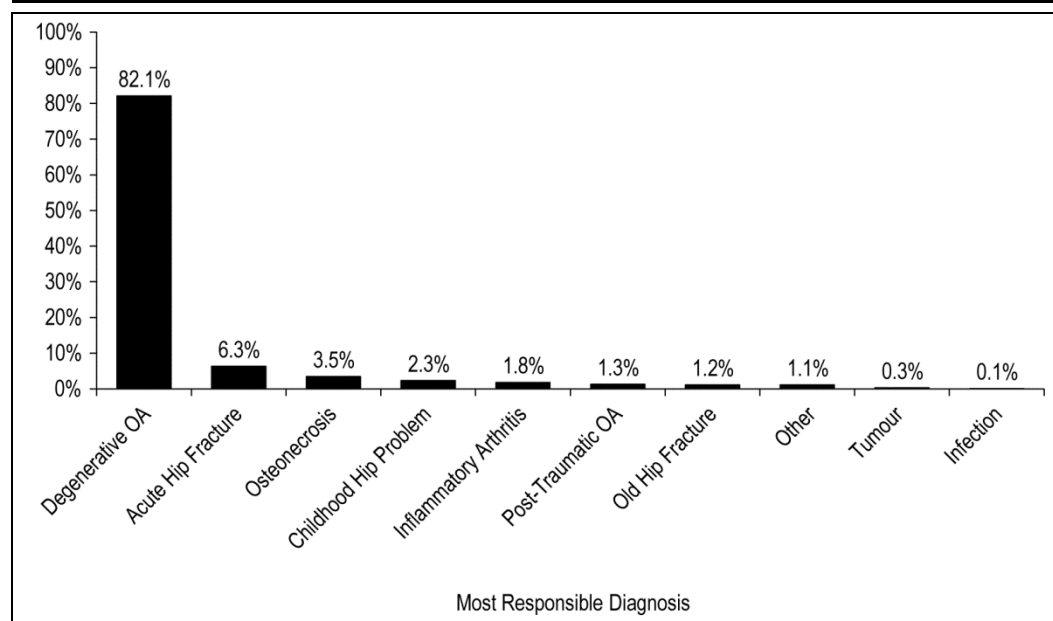
Source

Canadian Joint Replacement Registry, 2003–2004 to 2010–2011, Canadian Institute for Health Information.

Most Responsible Diagnosis

For primary hip replacements, surgeons were asked to record only the most responsible diagnosis grouping applicable for each procedure. Figure 11 shows that in 2010–2011, degenerative osteoarthritis (OA) was the most common diagnosis grouping indicated by surgeons (82.1%). The remaining categories included acute hip fracture (6.3%), osteonecrosis (3.5%) and childhood hip problem (2.3%).

Figure 11: Most Responsible Diagnosis for Primary Hip Replacements, 2010–2011



Notes

N = 15,557 hip replacements.

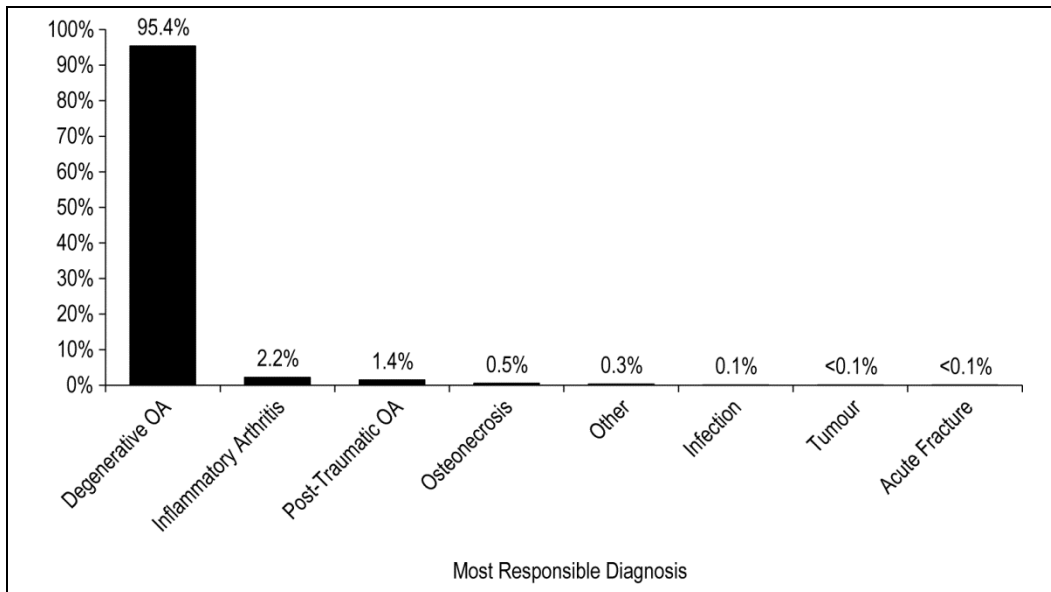
OA: osteoarthritis.

Source

Canadian Joint Replacement Registry, 2010–2011, Canadian Institute for Health Information.

Similarly, for primary knee replacements performed in 2010–2011, degenerative OA was the most common diagnosis grouping indicated by surgeons (95.4%) (Figure 12). Inflammatory arthritis (2.2%) was the leading other category.

Figure 12: Most Responsible Diagnosis for Primary Knee Replacements, 2010–2011



Notes

N = 22,073 knee replacements.

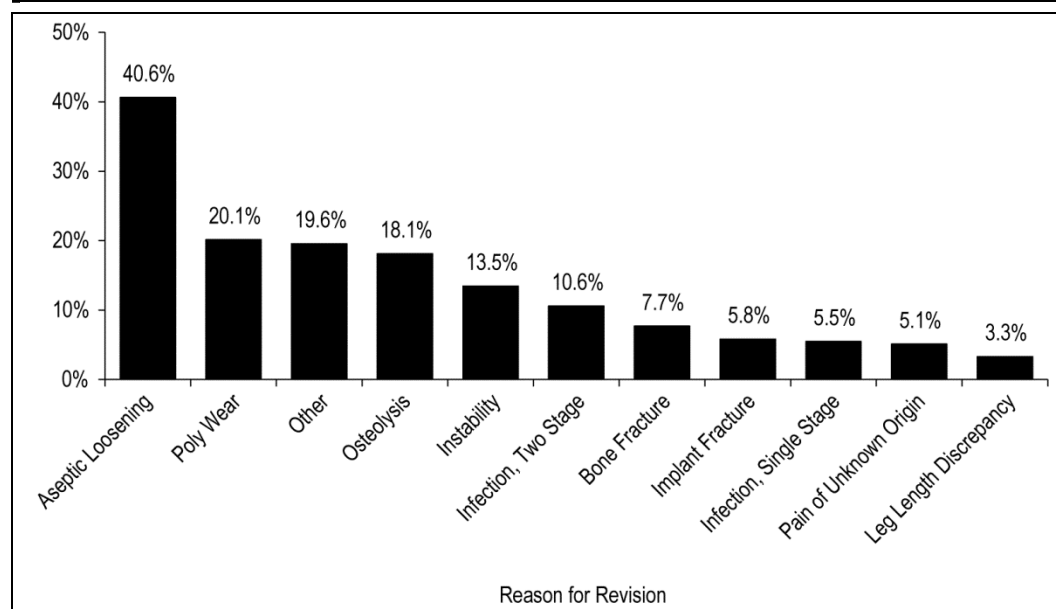
OA: osteoarthritis.

Source

Canadian Joint Replacement Registry, 2010–2011, Canadian Institute for Health Information.

Among the hip replacement revisions reported to CJRR in 2010–2011, the most common reason for revision was aseptic loosening (40.6%), followed by poly wear (20.1%), osteolysis (18.1%) and instability (13.5%) (Figure 13). Other reasons not elsewhere listed made up almost one-fifth (19.6%) of the reported reasons for revisions.

Figure 13: Reasons for Hip Revisions, 2010–2011



Note

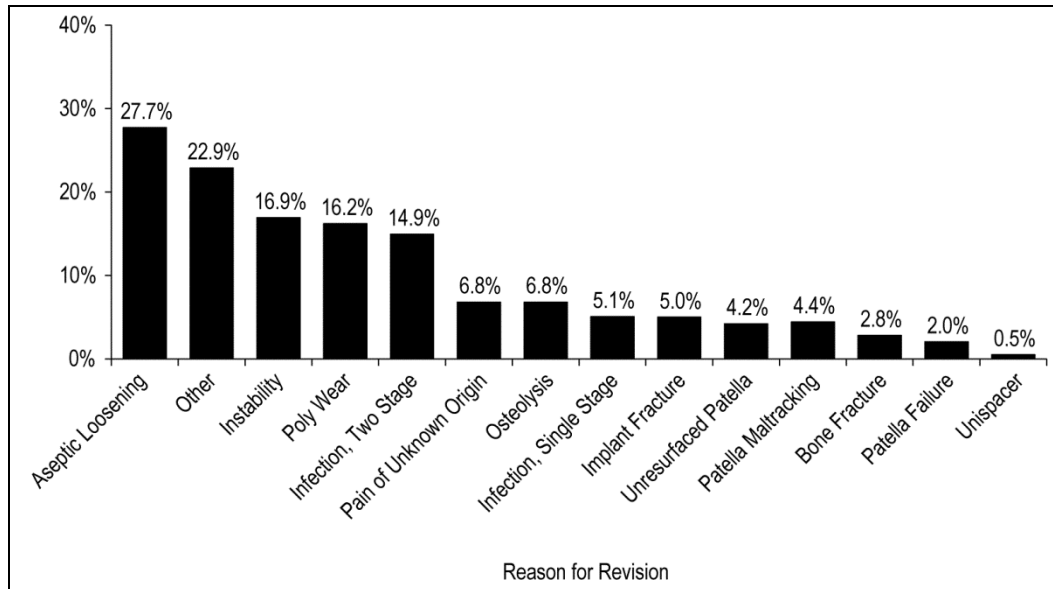
Surgeons were asked to indicate one or more reasons for revision from a list provided. Since more than one option was possible, percentages shown may not sum to 100%.

Source

Canadian Joint Replacement Registry, 2010–2011, Canadian Institute for Health Information.

Similarly, among the knee replacement revisions reported to CJRR in 2010–2011, the most common reason for revision was aseptic loosening (27.7%), followed by instability (16.9%), poly wear (16.2%) and two-stage infections (14.9%) (Figure 14). Other reasons not elsewhere listed made up 22.9% of the reported reasons for revision.

Figure 14: Reasons for Knee Revisions, 2010–2011



Note

Surgeons were asked to indicate one or more reasons for revision from a list provided. Since more than one option was possible, percentages shown may not sum to 100%.

Source

Canadian Joint Replacement Registry, 2010–2011, Canadian Institute for Health Information.

Body Mass Index

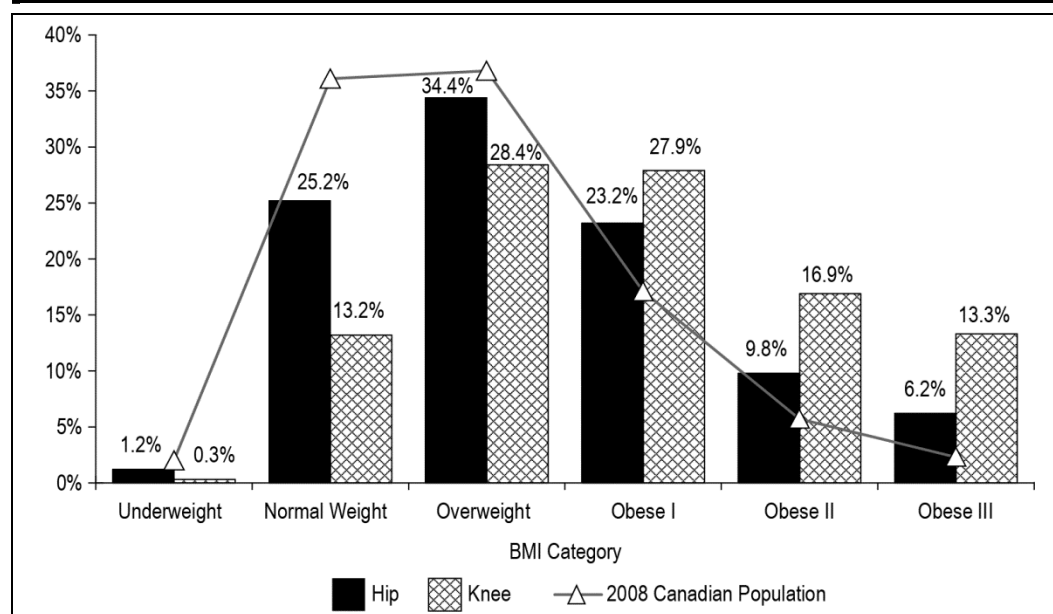
Body mass index (BMI) is calculated as weight in kilograms divided by the square of height in metres. Based on international standards citing differentiation between subgroups within the obese category, patients reported to CJRR were assigned to one of the following BMI categories:

- Underweight: less than 18.5;
- Normal weight: 18.5 to 24.9;
- Overweight: 25.0 to 29.9;
- Obese, class I: 30.0 to 34.9;
- Obese, class II: 35.0 to 39.9; and
- Obese, class III: 40.0 and higher.^{1–3}

Calculations of BMI values were available for 64.2% (n = 11,106) of hip replacement patients and 70.6% (n = 16,558) of knee replacement patients.

Figure 15 shows that a high proportion of both hip and knee replacement recipients in 2010–2011 were obese, compared with the BMI distribution of the general Canadian population. Among hip replacement patients, 34.4% were classified as overweight, followed by those in the normal weight category (25.2%) and obese, class I category (23.2%). Knee replacement patients tended to have higher BMI values. The majority of patients were classified as overweight or obese, class I (28.4% and 27.9%, respectively), followed by obese, class II (16.9%).

Figure 15: Hip and Knee Replacements in CJRR by BMI Category, Comparison With Canadian Population, 2010–2011



Notes

N = 11,106 hip replacements.

N = 16,558 knee replacements.

Sources

Canadian Joint Replacement Registry, 2010–2011, Canadian Institute for Health Information.

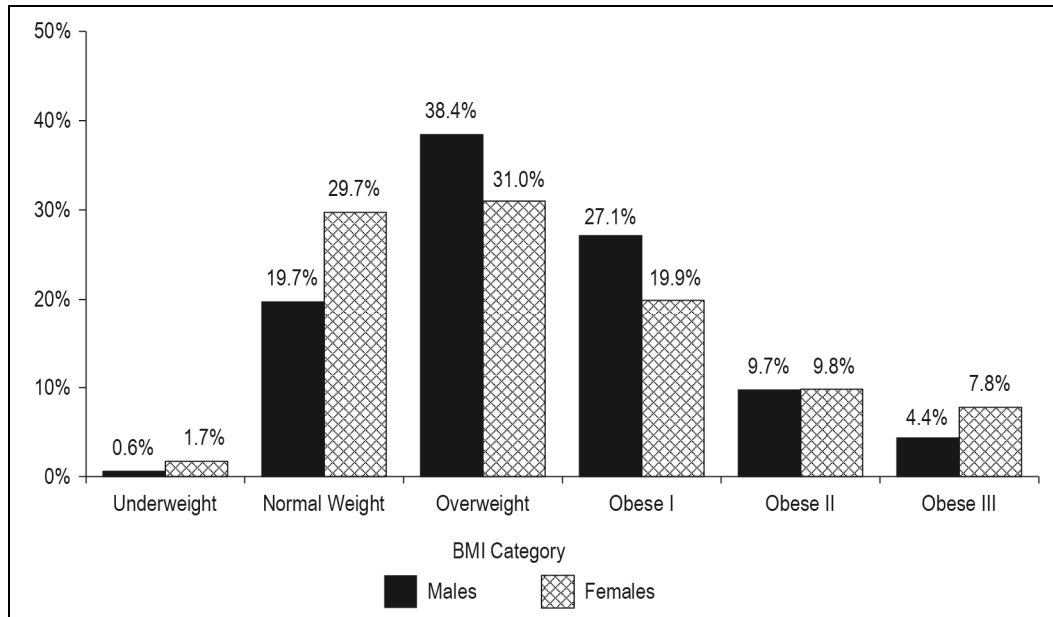
Statistics Canada. CANSIM Table 105-05071: Measured adult body mass index (BMI), by age group and sex, household population aged 18 and over excluding pregnant females, Canada (excluding territories).

<http://www5.statcan.gc.ca/cansim/pick-choisir?lang=eng&p2=33&id=1050507>. Updated June 24, 2009.

Accessed February 8, 2013.

Looking at hip replacements only by sex (Figure 16), more males than females were categorized as overweight (38.4% versus 31.0%, respectively) and obese, class I (27.1% versus 19.9%, respectively). However, more females were categorized in the highest obesity category (obese, class III) than males (7.8% versus 4.4%, respectively).

Figure 16: Sex and BMI Category for Hip Replacements, 2010–2011



Note

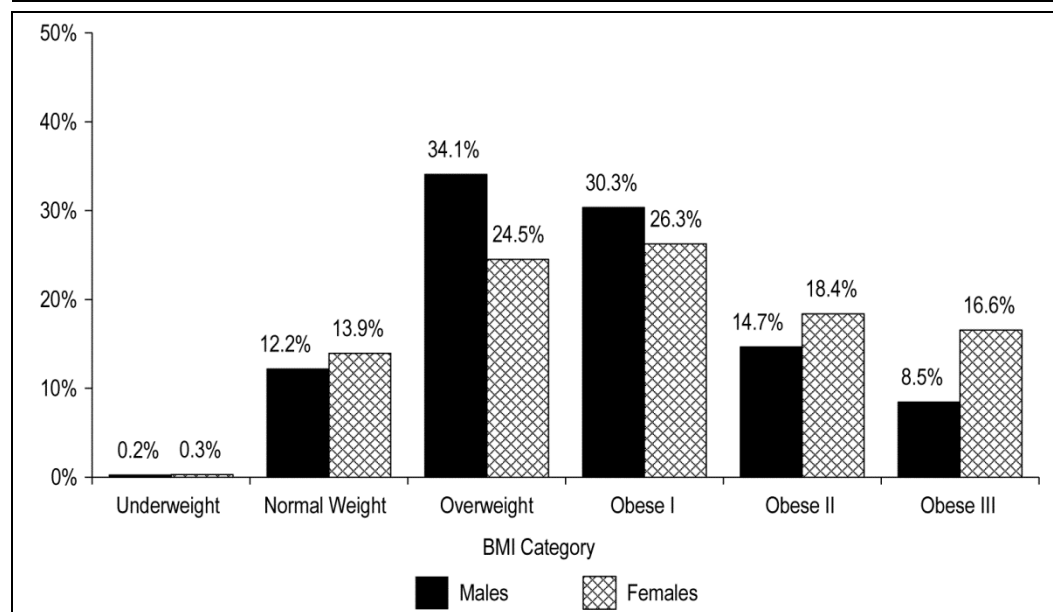
N = 11,103 hip replacements.

Source

Canadian Joint Replacement Registry, 2010–2011, Canadian Institute for Health Information.

Looking at knee replacements only by sex (Figure 17), again, more males than females were categorized as overweight (34.1% versus 24.5%, respectively) and obese, class I (30.3% versus 26.3%, respectively). However, more females were categorized in the other obesity categories: obese, class II, and obese, class III. In the latter category, the proportion of females was nearly twice that of males (16.6% versus 8.5%, respectively).

Figure 17: Sex and BMI Category for Knee Replacements, 2010–2011



Note

N = 16,555 knee replacements.

Source

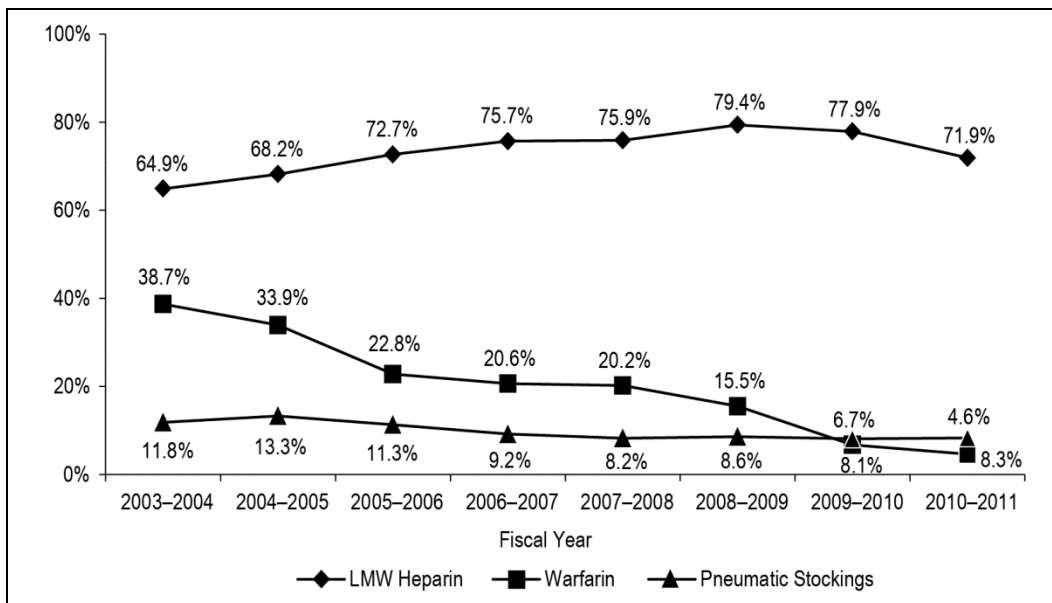
Canadian Joint Replacement Registry, 2010–2011, Canadian Institute for Health Information.

Deep Vein Thrombosis Preventive Agents Used

One of the major risks facing patients who undergo orthopedic surgery in the lower extremities is formation of a blood clot in a deep vein, a complication called deep vein thrombosis (DVT), a form of venous thromboembolic disease. In response to this potential risk, pharmacologic agents such as aspirin, warfarin and heparin, and non-medicinal measures such as pneumatic compression stockings, are used as DVT prophylactic (preventive) therapy.

Figures 18 and 19 show the use of common DVT preventive agents in hip and knee replacements reported to CJRR. Among hip replacements in 2010–2011, nearly 97% of all patients received DVT prophylaxis, and low-molecular-weight (LMW) heparin was the most commonly used DVT preventive agent (71.9%). Overall, the use of LMW heparin has increased from 64.9% in 2003–2004, with a slight decrease from 2009–2010 to 2010–2011. The use of warfarin has decreased dramatically over the eight years, from 38.7% in 2003–2004 to 4.6% in 2010–2011. The use of pneumatic stockings has been relatively stable in recent years but overtook warfarin as the second-most-used DVT preventive agent in 2009–2010.

Figure 18: Deep Vein Thrombosis Preventive Agents Used in Hip Replacements, 2003–2004 to 2010–2011



Notes

LMW: low molecular weight.

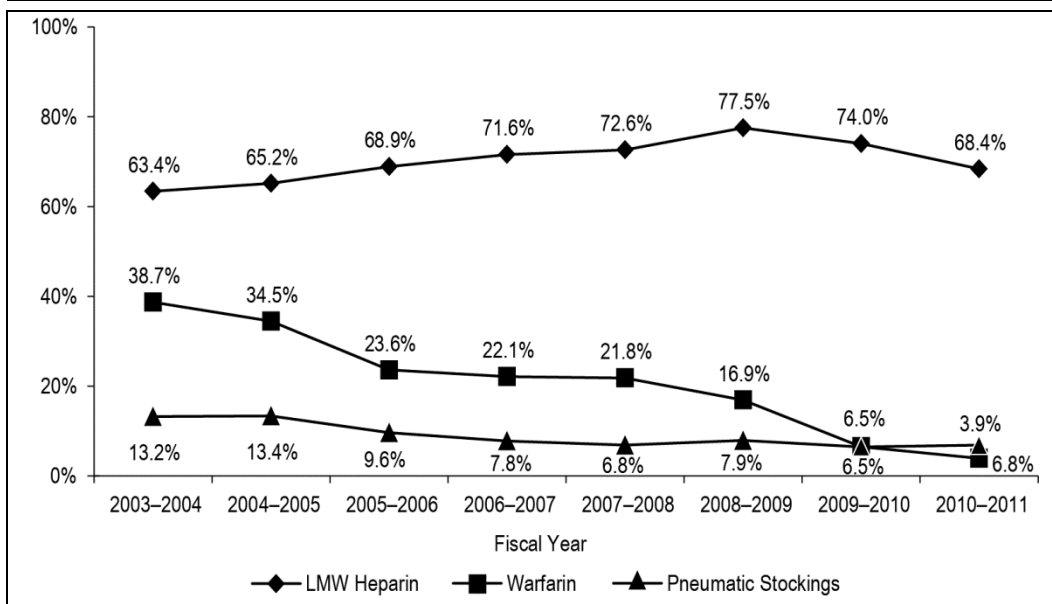
Surgeons were asked to indicate one or more deep vein thrombosis preventive agents from a list provided.

Since more than one option was possible, percentages shown may not sum to 100%.

Source

Canadian Joint Replacement Registry, 2003–2004 to 2010–2011, Canadian Institute for Health Information.

Figure 19: Deep Vein Thrombosis Preventive Agents Used in Knee Replacements, 2003–2004 to 2010–2011



Notes

LMW: low molecular weight.

Surgeons were asked to indicate one or more deep vein thrombosis preventive agents from a list provided.

Since more than one option was possible, percentages shown may not sum to 100%.

Source

Canadian Joint Replacement Registry, 2003–2004 to 2010–2011, Canadian Institute for Health Information.

Similarly, among knee replacements, almost 97% of patients received DVT prophylaxis, with LMW heparin being the most commonly used DVT preventive agent. Its use has increased from 63.4% in 2003–2004 to 68.4% in 2010–2011. As for hip replacements, the use of warfarin has decreased dramatically over the eight years, from 38.7% in 2003–2004 to 3.9% in 2010–2011. The use of pneumatic stockings has been relatively stable in recent years but overtook warfarin as the second-most-used DVT preventive agent as of 2009–2010.

Warfarin use in both hip and knee replacements showed a similar year-over-year decline. One possible reason for this decrease is that warfarin often requires post-operative blood monitoring, whereas new DVT preventive agents have been developed that do not require daily blood monitoring (such as LMW heparin and rivaroxaban).

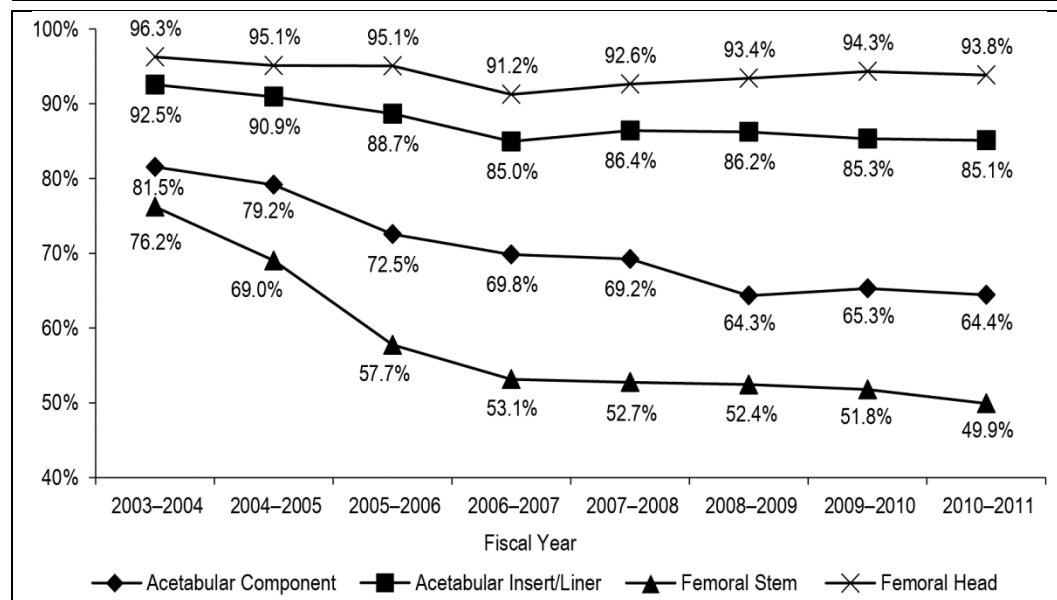
Joint Replacement Prosthesis Characteristics

Throughout this report, the term “component replaced” refers to components replacing existing artificial implants, as in the case of revision procedures.

Components Implanted in Hip Replacements

Four basic components (or implant parts) are used for hip replacements: the acetabular component, acetabular insert/liner, femoral component and femoral head.

Figure 20: Components Replaced in Hip Revision Procedures, 2003–2004 to 2010–2011



Source

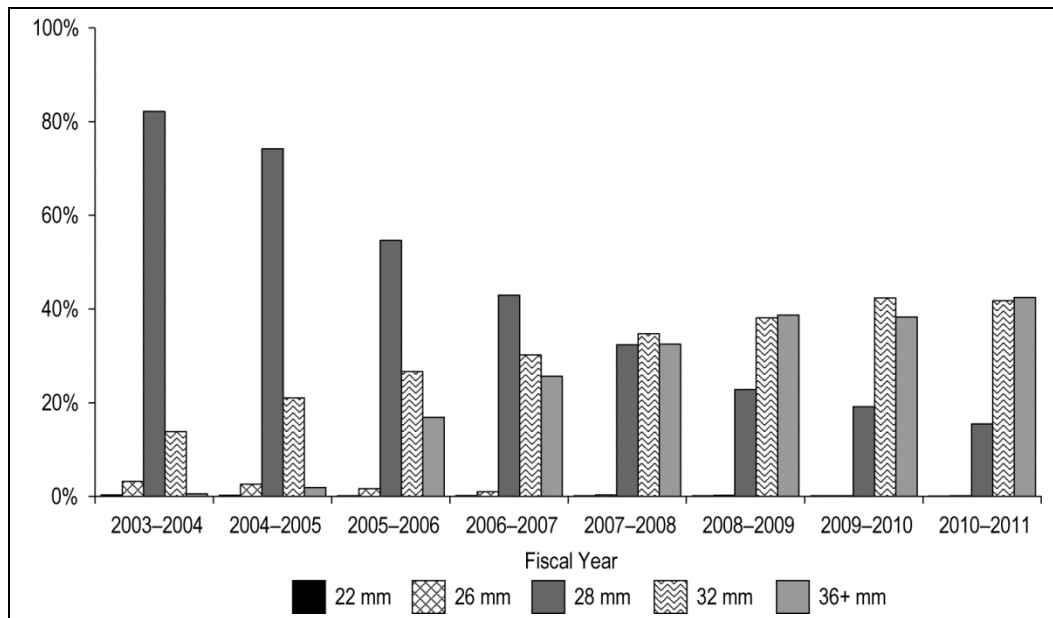
Canadian Joint Replacement Registry, 2003–2004 to 2010–2011, Canadian Institute for Health Information.

Figure 20 shows that, for hip revisions reported in CJRR, the femoral head was by far the most common component replaced (93.8%), while the femoral stem was the least common (half of revision procedures). Replacements of the femoral stem have decreased dramatically since 2003–2004, when more than three-quarters of revisions (76.2%) had this component replaced. Since 2006–2007, the proportion of replaced components has remained relatively stable.

Femoral Head Size in Hip Replacements

The durability and stability of a hip implant depends on many factors, such as the design and type of prosthetic used. One aspect of particular interest is the size of the femoral head implanted. Figures 21 and 23 show the size of femoral head used for primary and revision hip replacements, respectively.

Figure 21: Femoral Head Size Trends for Primary Hip Replacements, 2003–2004 to 2010–2011



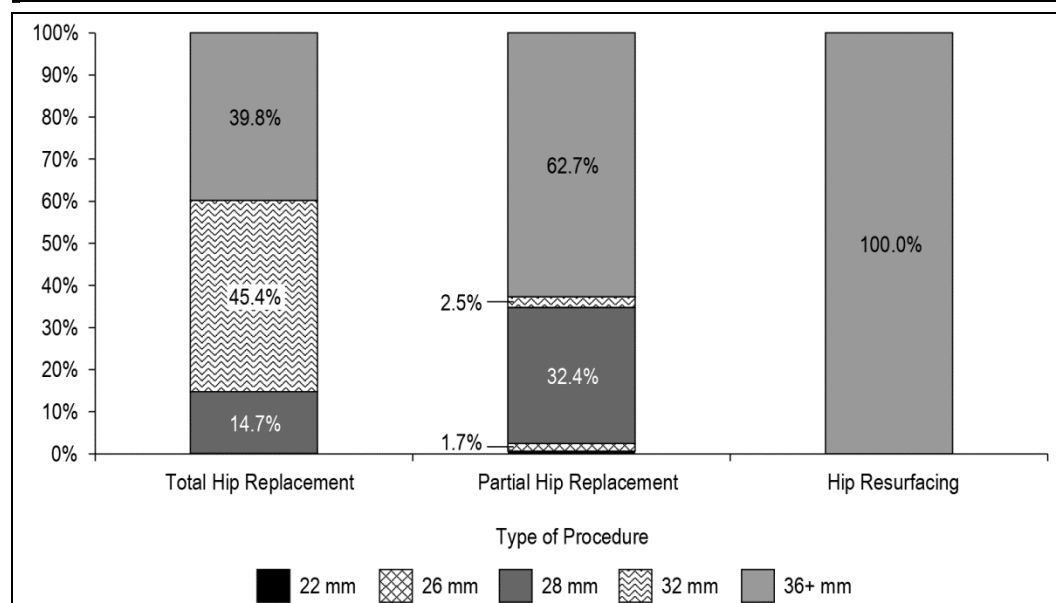
Source

Canadian Joint Replacement Registry, 2003–2004 to 2010–2011, Canadian Institute for Health Information.

Figure 21 clearly shows a recent trend toward the use of larger femoral head sizes for primary hip replacements. In 2003–2004, 28 mm femoral heads were used for the vast majority of primary hip replacements (82.2% of all procedures). The use of this size has declined dramatically over the years, dropping to only 15.5% of all procedures in 2010–2011 (an 81.1% decrease over eight years). Conversely, the use of larger femoral heads has increased steadily from 2003–2004 (32 mm: 13.8%; 36+ mm: 0.5%) to 2010–2011 (32 mm: 41.8%; 36+ mm: 42.5%). In 2007–2008, large femoral head sizes outnumbered 28 mm femoral heads for the first time. In 2010–2011, the most popular femoral head sizes used were 32 mm and 36+ mm, together making up nearly 85% of all primary hip replacements. Large (36+ mm) femoral head use has increased rapidly, increasing more than eight-fold from 1.9% of all procedures in CJRR in 2004–2005 to 16.9% one year later. This trend toward larger femoral heads is consistent with findings from other national joint registry data.⁴

The use of various sizes also differed among different types of primary hip replacement procedures, as seen in Figure 22. As expected, hip resurfacing procedures used large femoral heads. In fact, 100% of all hip resurfacing procedures in 2010–2011 reported femoral head sizes of 36+ mm. Most total hip replacements were performed using 32 mm femoral heads (45.4%), followed by 36+ mm (39.8%). Among partial hip replacements, there was more variation in femoral head size, but still a tendency for larger sizes (36+ mm: 62.7%; 28 mm: 32.4%).

Figure 22: Femoral Head Size by Type of Primary Hip Replacement Procedure, 2010–2011

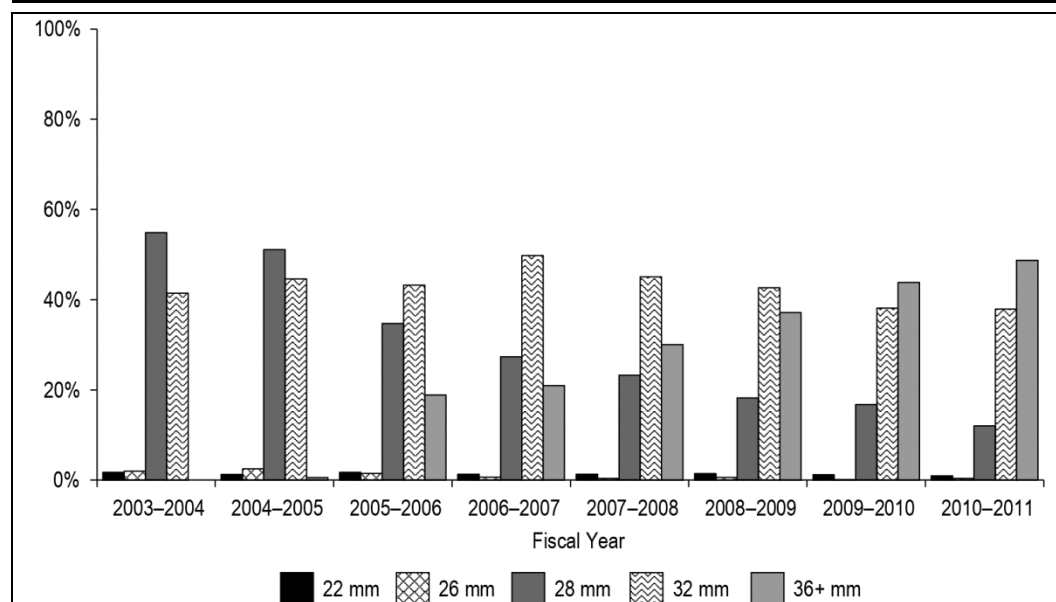


Source

Canadian Joint Replacement Registry, 2010–2011, Canadian Institute for Health Information.

Among revision hip procedures, a trend is also evident toward larger femoral head sizes in recent years, although it is not as dramatic (Figure 23). In 2003–2004, 28 mm was the most common femoral head size (54.9%), whereas in 2010–2011, the most common femoral head size was 36+ mm (48.8%), followed by 32 mm (37.9%).

Figure 23: Femoral Head Size Trends for Revision Hip Replacements, 2003–2004 to 2010–2011



Source

Canadian Joint Replacement Registry, 2003–2004 to 2010–2011, Canadian Institute for Health Information.

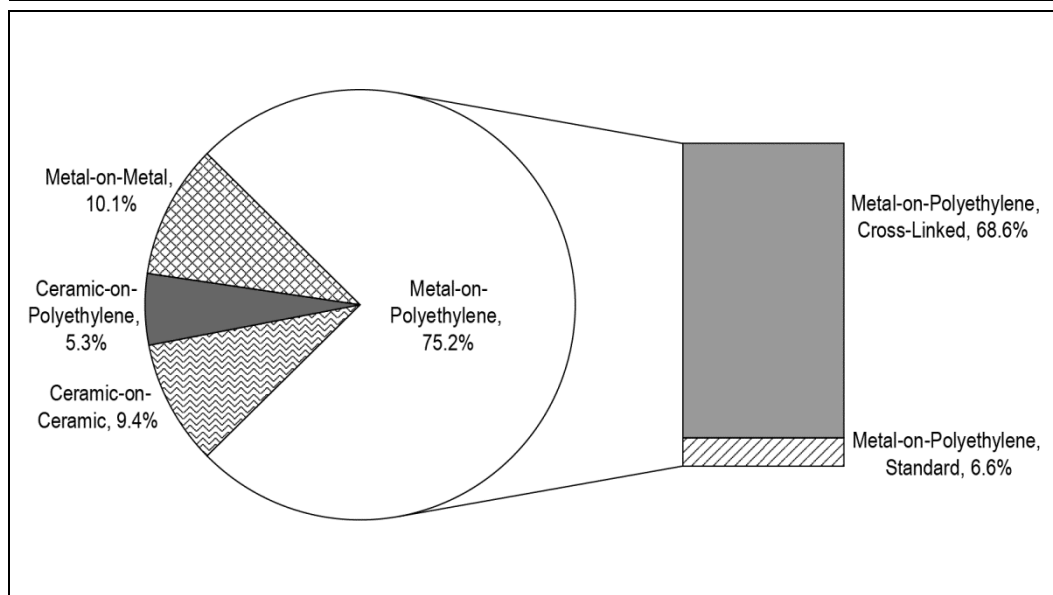
Bearing Surfaces for Hip Replacements

Another important characteristic of hip replacements is the combination of materials that make up the bearing (or articulating) surface of the implanted hip joint, namely, the material used for the articulating femoral head and the acetabular components.

With the exception of metal-on-metal bearings, which were verified by CJRR, bearing surface materials were as reported by data submitters. As a result, this report employs a slightly different methodology to define bearing surface materials, and care should be taken when comparing these figures with previously reported figures.

As seen in Figure 24, the most common bearing surface among hip replacements in 2010–2011 was metal-on-polyethylene (or plastic) (75.2%). Within the metal-on-polyethylene category, metal-on-cross-linked polyethylene was used in 68.5% of procedures. A metal-on-metal bearing surface combination was used in 10.1% of all hip replacements that reported bearing surface materials.

Figure 24: Bearing Surfaces for Hip Replacements, 2010–2011



Note

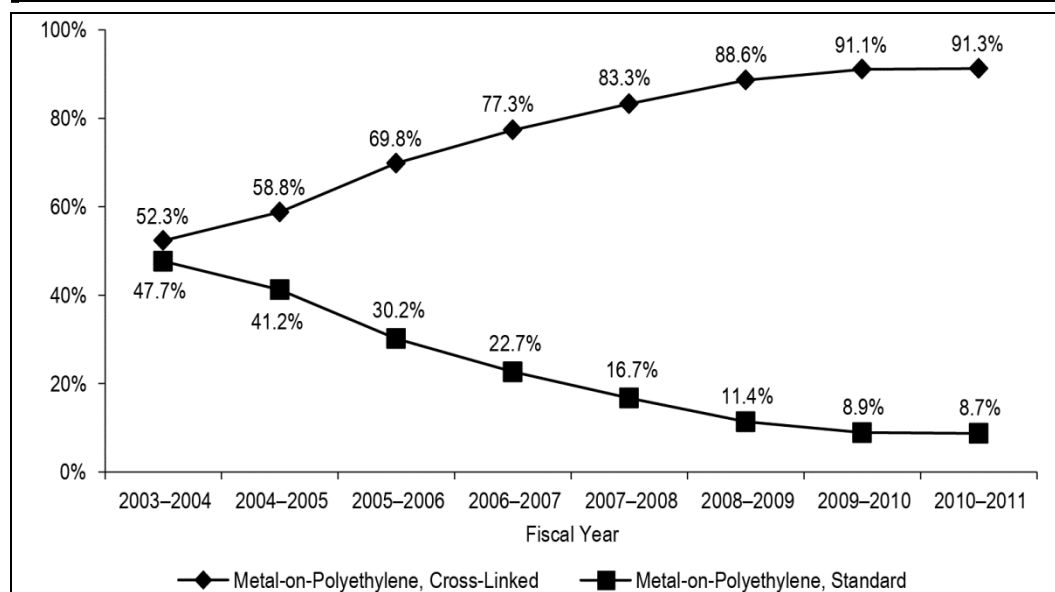
N = 11,948 hip bearing surfaces.

Source

Canadian Joint Replacement Registry, 2010–2011, Canadian Institute for Health Information.

Figure 25 takes a closer look at the use of metal-on-polyethylene bearing surfaces for hip replacements over time. The use of metal-on-cross-linked polyethylene has increased, from 52.3% of all metal-on-polyethylene bearing surfaces for hip replacements in 2003–2004 to 91.3% in 2010–2011, representing a 74.4% increase over eight years. The trend in increasing preference for cross-linked polyethylene over standard polyethylene is consistent with findings from other national joint registry data.⁵

Figure 25: Types of Metal-on-Polyethylene Bearing Surfaces for Hip Replacements, 2003–2004 to 2010–2011



Note

The denominator for percentage calculations excludes records that have no information available on bearing surfaces.

Source

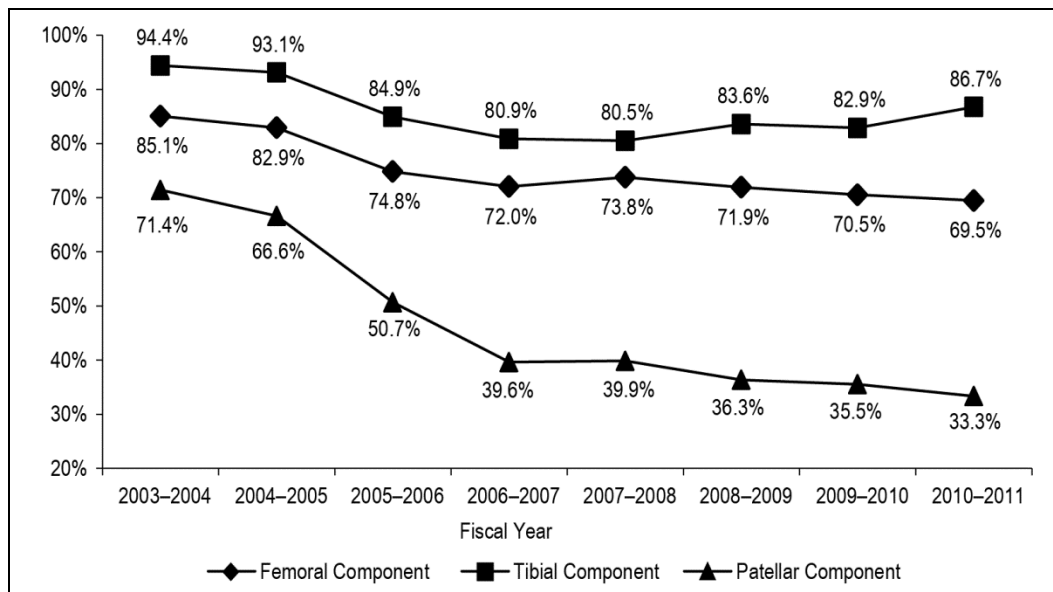
Canadian Joint Replacement Registry, 2003–2004 to 2010–2011, Canadian Institute for Health Information.

Components Implanted in Knee Replacements

Three basic components (or implant parts) are used for knee replacements: the femoral component, tibial component and patellar component.

Figure 26 shows that, for knee revisions reported to CJRR, the tibial component was the most common component replaced, while the patellar component was the least common. In 2010–2011, based on data reported to CJRR, 86.7% of tibial components, 69.5% of femoral components and 33.3% of patellar components were replaced. It is interesting to note that the year-over-year trend varied among the three components. Replacements of femoral or tibial components decreased steadily from 2003–2004 to 2006–2007, but have remained relatively stable since. On the other hand, the patellar component was replaced in 71.4% of all knee replacements in 2003–2004, which decreased dramatically to 39.6% of procedures in 2006–2007, representing a four-year decrease of 44.5%.

Figure 26: Components Replaced in Knee Revision Procedures, 2003–2004 to 2010–2011



Source

Canadian Joint Replacement Registry, 2003–2004 to 2010–2011, Canadian Institute for Health Information.

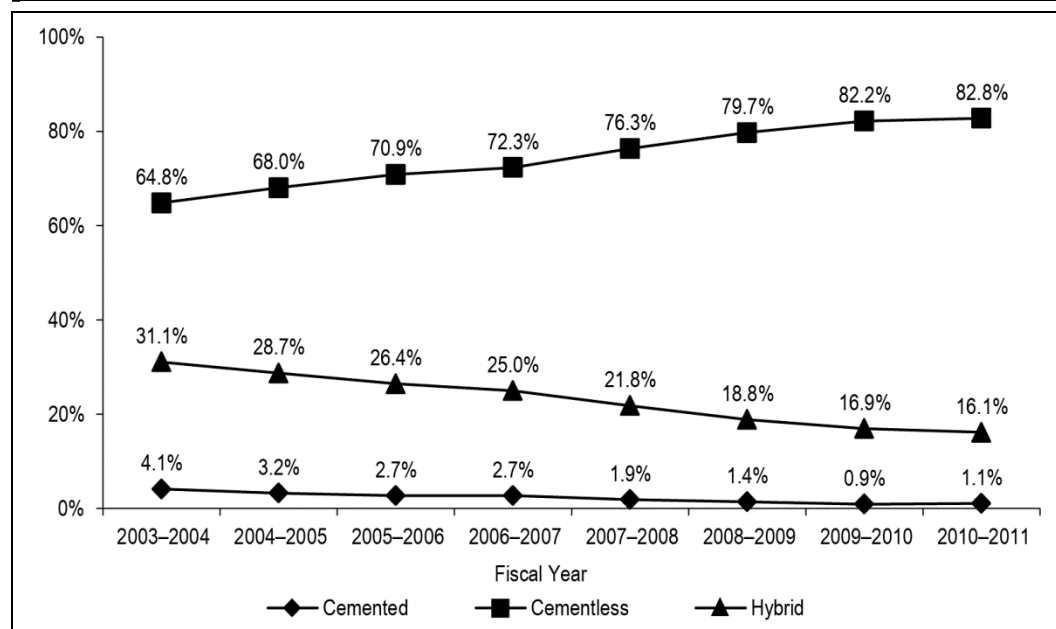
Fixation Method

Surgeons employ three different methods of fixation to secure orthopedic implants:

1. Cemented: using bone cement to adhere the implant to the patient's remaining natural bone stock;
2. Cementless: for example, where the implants are secured using bone screws or are press fit into position; and
3. Hybrid: a combination of cemented and cementless implant parts.

For hip replacements, the cementless approach was the most common fixation method (82.8%) in 2010–2011, followed by the hybrid method (16.1%) (Figure 27). Use of the cementless fixation method has increased steadily over time, from 64.8% of all procedures in 2003–2004, which represents a 27.8% increase over the eight-year reporting period; the use of the hybrid fixation method has decreased from 31.1% in 2003–2004. The increasing preference for cementless fixation for hip replacements over hybrid and cemented methods is consistent with findings from other national joint registry data.^{4, 6}

Figure 27: Fixation Method for Hip Replacements, 2003–2004 to 2010–2011

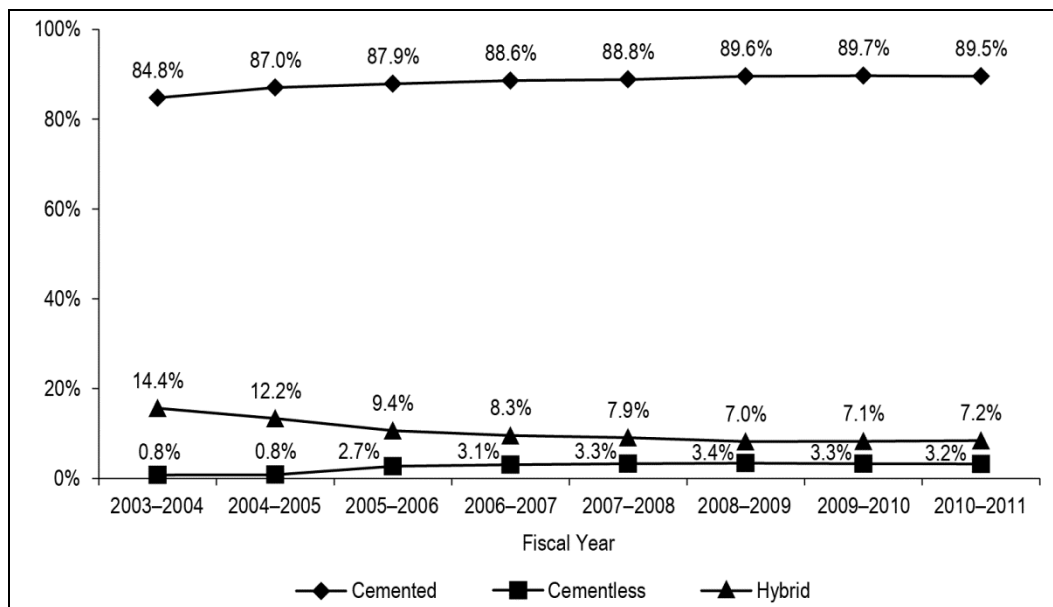


Source

Canadian Joint Replacement Registry, 2003–2004 to 2010–2011, Canadian Institute for Health Information.

For knee replacements, however, the cemented approach was by far the most common fixation method used (Figure 28), representing 89.5% of procedures in 2010–2011. Only 7.2% used a hybrid method. Use of the cemented approach has been consistently high since 2003–2004, whereas use of the hybrid method has decreased, from 14.4% to 7.2%. Year over year, the cementless fixation method has always been the least favoured, ranging from 0.8% of all procedures in 2003–2004, to 3.2% in 2010–2011. The strong preference for cemented knee replacements over cementless options is consistent with findings from other national joint registry data.^{4, 6–8}

Figure 28: Fixation Method for Knee Replacements, 2003–2004 to 2010–2011



Source

Canadian Joint Replacement Registry, 2003–2004 to 2010–2011, Canadian Institute for Health Information.

Summary of Findings

Of the hip replacements reported to CJRR in 2010–2011, most (89.9%) were primary procedures (of which 92.9% were total hip replacements, 5.7% were partial hip replacements and 1.4% were hip resurfacing procedures), while 10.1% involved revision of the previously implanted hip joint. Among knee replacements reported to CJRR in the same year, 94.1% were primary procedures (of which 95.6% were total knee replacements) and 5.9% were revisions.

Degenerative OA was indicated as the most common diagnosis grouping for both primary hip replacements (82.1% of all procedures) and primary knee replacements (95.4% of all procedures). The most common reason for hip and knee replacement revision was aseptic loosening, with 40.6% of all hip revisions and 27.7% of all knee revisions indicating this.

Just more than one-third (34.4%) of hip replacement patients fell in the overweight BMI category (BMI 25.0 to 29.9) in 2010–2011. Among knee replacement patients, almost equal proportions of patients were categorized as overweight and obese, class I (BMI 30.0 to 34.9), at 28.4% and 27.9% of all knee replacement patients, respectively.

For both hip and knee replacements, LMW heparin was the most commonly used DVT preventive agent, with 71.9% of hip replacement recipients and 68.4% of knee replacement recipients receiving the agent in 2010–2011.

In 2010–2011, the most commonly replaced component in hip replacement revision procedures was the femoral head, contributing to more than 93.8% of revisions. Three-quarters of hip replacements used a metal-on-polyethylene bearing surface combination (with metal-on–cross-linked polyethylene being more common than metal-on–standard polyethylene), while metal-on-metal hip replacements made up only 10.1% of all hip replacements in CJRR. A trend in increasing femoral head sizes can be seen across primary and revision hip replacement procedures, as well as across different type of procedures (total hip replacements, partial hip replacements and hip resurfacing procedures). In 2010–2011, femoral head sizes 36+ mm were used in 42.5% of primary and 48.8% of revision procedures. More than 82% of hip replacements used a cementless fixation method.

The most commonly replaced component in revision knee replacements in 2010–2011 was the tibial component, which was involved in 86.7% of procedures. That year, 89.5% of knee replacements were performed using a cemented fixation method.



Chapter 5: Future Directions



CJRR has recently undergone significant changes that will improve its ability to contribute to safety and quality improvements for Canadians who have hip or knee replacement procedures.

As of 2012–2013, CJRR has implemented a new minimum data set (MDS) based on that proposed by the International Society of Arthroplasty Registries. The MDS replaced the longer set of data elements that is reported in this report. The MDS has reduced the burden of data collection on data providers while meeting the minimum needs of an arthroplasty registry, making CJRR more palatable for uptake across more parts of the country.

Also as of 2012–2013, the governments of Ontario and B.C. have mandated CJRR reporting; this directive is expected to increase CJRR's coverage to more than 80% of all hip and knee replacements performed in Canada. CJRR continues to work in collaboration with key policy-makers and orthopedic surgeons in other jurisdictions to further encourage mandated reporting to CJRR.

CJRR is also moving toward fully electronic data collection. Paper data collection forms are being phased out in favour of data submission via electronic files or CJRR's web-based data entry tool. These changes will improve data quality, data security and timeliness of data submission.

With these changes, CJRR will play a growing role in safety and quality initiatives across the country related to hip and knee replacements. As implants and surgical techniques continue to evolve, CJRR data will be even more important in understanding related health outcomes from clinical, administrative and policy perspectives.





Appendices



Appendix A: CJRR Advisory Committee

- Dr. Eric Bohm (Chair), Concordia Hospital, Manitoba
- Dr. Michael Dunbar (Co-Chair), Queen Elizabeth II Health Sciences Centre, Nova Scotia
- Ms. Alison Bartel, Nursing Representative, Concordia Hospital, Manitoba
- Dr. Robert Bourne, London Health Sciences Centre, Ontario
- Mr. Dave Brar, British Columbia Ministry of Health
- Dr. Martin Lavigne, Hôpital Maisonneuve-Rosemont, Quebec
- Dr. Brendan Lewis, Western Memorial Regional Hospital, Newfoundland and Labrador
- Dr. Olga Huk, L'Hôpital général juif Sir Mortimer B. Davis, Quebec
- Dr. Darren Kerr, Saint John Regional Hospital, New Brunswick
- Dr. Paul Kim, The Ottawa Hospital, Ontario
- Dr. Hans Kreder, Sunnybrook and Women's College Health Sciences Centre, Ontario
- Dr. Jim MacKenzie, Alberta Hip and Knee Clinic, Alberta
- Dr. Roderick Martin, General Hospital (Health Sciences Centre), Newfoundland and Labrador
- Dr. Bassam Masri, Vancouver General Hospital, British Columbia
- Ms. Lynn Moore, The Arthritis Society of Canada, Ontario
- Mr. John Pipe, Patient Representative, Ontario
- Dr. Emil Schemitsche, Canadian Orthopaedic Association
- Mr. Douglas Thomson, Canadian Orthopaedic Association
- Dr. James Waddell, St. Michael's Hospital, Ontario
- Dr. Jason Werle, Alberta Hip and Knee Clinic, Alberta
- Dr. Allan Woo, Saskatoon Orthopedic and Sports Medicine Center, Saskatchewan

Appendix B: Hip and Knee Replacement Coding Methodology, HMDB

As of 2006–2007, all provinces and territories have adopted the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Canada* and *Canadian Classification of Health Interventions* (ICD-10-CA/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. Data from 2006–2007 to 2008–2009 used version 2006 of ICD-10-CA/CCI, while data from 2009–2010 onward used version 2009 of ICD-10-CA/CCI.

Hip Replacements

Table B-1 outlines the CCI codes used to identify hip replacements in the HMDB in this report. The specific rubrics of interest were 1.SQ.53 *Implantation of internal device, pelvis* and 1.VA.53 *Implantation of internal device, hip joint*. Revisions were identified using a supplementary code called a Status Attribute, where Status Attribute = R identified that the procedure was a revision. Version 2009 CCI codes allowed hip resurfacing procedures to be identified using the Extent Attribute code, where Extent Attribute = 02 identified a hip resurfacing procedure. Partial and total hip replacements were as defined in Table B-1.

Table B-1: CCI Codes for Hip Replacements

Rubric*		CCI Codes				
Type	1.SQ.53.^ ^{^^} Implantation of internal device, pelvis	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)
P	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
P	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
Type	1.VA.53.^ ^{^^} Implantation of internal device, hip joint	Bone homograft (uncemented)	Uncemented	Bone autograft (uncemented)	With synthetic material (e.g. bone paste, cement, Dynagraft, Osteoset)	Using combined sources of tissue (e.g. bone graft, cement, paste)
Open Approach						
T	Dual component prosthetic device (femoral and acetabular)	1.VA.53.LA-PN-K	1.VA.53.LA-PN	1.VA.53.LA-PN-A	1.VA.53.LA-PN-N	1.VA.53.LA-PN-Q
P	Single component prosthetic device (femoral)	1.VA.53.LA-PM-K	1.VA.53.LA-PM	1.VA.53.LA-PM-A	1.VA.53.LA-PM-N	1.VA.53.LA-PM-Q
T	Cement spacer (temporary, impregnated with antibiotics)	—	—	—	1.VA.53.LA-SL-N	—
Robotics-Assisted Approach (e.g. Telemanipulation of Tools)						
T	Dual component prosthetic device (femoral and acetabular)	1.VA.53.PN-PN-K	1.VA.53.PN-PN	1.VA.53.PN-PN-A	1.VA.53.PN-PN-N	1.VA.53.PN-PN-Q
P	Single component prosthetic device (femoral)	1.VA.53.PN-PM-K	1.VA.53.PN-PM	1.VA.53.PN-PM-A	1.VA.53.PN-PM-N	1.VA.53.PN-PM-Q

Notes

* P = partial hip replacement; T = total hip replacement.

Compared with previous analyses, partial hip replacements have been added to the inclusion criteria for this report.

1.SQ.53.^^{^^} *Implantation of internal device, pelvis* includes the following:

- Arthroplasty (cup), acetabulum alone
- Hemiarthroplasty, acetabulum
- Implantation, acetabulum alone
- Replacement, acetabulum alone, using prosthetic device

1.VA.53.^^{^^} *Implantation of internal device, hip joint* includes the following:

- Arthroplasty with implantation prosthetic device, hip
- Hemiarthroplasty with implantation prosthetic device, hip
- Replacement, hip, using prosthetic device
- Reduction with fixation and implantation of prosthetic device, hip

Knee Replacements

Table B-2 outlines the CCI codes used to identify knee replacements in the HMDB in this report. The specific rubrics of interest were 1.VG.53 *Implantation of internal device, knee joint* and 1.VP.53 *Implantation of internal device, patella*. Revisions were identified using a supplementary code called a Status Attribute, where Status Attribute = R identified that the procedure was a revision.

Table B-2: CCI Codes for Knee Replacements

Rubric*	CCI Codes				
1.VG.53.^ Implantation of internal device, knee joint	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	—	—	—	—

1.VP.53.^ Implantation of internal device, patella	Cemented	Uncemented
Single component	1.VP.53.LA-PM-N	1.VP.53.LA-PM

Notes

* Compared with previous analyses, 1.VP.53.^ has been added to the inclusion criteria for this report.

1.VG.53.^ *Implantation of internal device, knee joint* includes the following:

- Replacement with implantation of prosthetic device, knee
- Hemiarthroplasty with implantation of prosthetic device, knee
- Replacement, knee, using prosthetic device

1.VP.53.^ *Implantation of internal device, patella* includes the following:

- Patellaplasty, using prosthetic implant device
- Replacement, patella (only), using prosthetic device
- Replacement, patellofemoral (only), using prosthetic device

Appendix C: Hip and Knee Replacement Type Coding Methodology, CJRR

Throughout this report, the type of joint replacement procedure was determined based on information provided by the data supplier and on whether specific components were replaced during the procedure. The coding methodology for each type of joint replacement is described below.

Hip Replacements

Partial hip replacement: The procedure was flagged as a hemiarthroplasty by the data submitter.

Hip resurfacing: Both the femoral head and acetabular component were verified as being used specifically for hip resurfacing procedures by CJRR. Verification was performed by cross-referencing implant product catalogue or reference numbers.

Total hip replacement: The procedure was assumed to be a total hip replacement if

- It was not otherwise identified as a partial hip replacement or a hip resurfacing procedure; or
- At least one of the femoral component or femoral head was replaced **and** at least one of the acetabular component or acetabular liner was replaced.

Knee Replacements

Partial knee replacement: The procedure was flagged as a unicompartmental knee arthroplasty by the data submitter.

Total knee replacement: The procedure was assumed to be a total knee replacement if

- It was not otherwise identified as a partial knee replacement; or
- The femoral component, tibial component and patellar component were all replaced.

Appendix D: Glossary

acetabulum

The acetabulum is the cup-shaped socket of the hip joint. In Latin, the word “acetabulum” means cup, specifically a vinegar cup. The acetabulum is a feature of the pelvis. The head (upper end) of the femur (the thigh bone) fits into the acetabulum and articulates with it, forming a ball-and-socket joint.

age-specific rate

An age-specific rate is the rate measured in a particular age group. The numerator and the denominator for this rate refer to the same age group, that is, both have the same age distribution.

age-standardized rate

Age standardization is a common analytical technique used to compare rates over time, since it takes into account changes in age structure across populations and time.

aseptic loosening

Aseptic loosening is the loosening of the total joint without involvement of bacteria.

bearing surfaces

Bearing surfaces refer to the type of material used for the hip prostheses (that is, femoral and acetabular components). Surface types include cobalt chrome, stainless steel, metal, ceramic alumina, standard polyethylene and cross-linked polyethylene.

body mass index (BMI)

Body mass index is a relationship between weight and height that is associated with body fat and health risk. The equation is $BMI = \text{body weight in kilograms} / \text{the square of height in metres}$.

deep vein thrombosis (DVT)

Deep vein thrombosis is a condition where a blood clot is present in a deep vein (a vein that accompanies an artery). DVT affects mainly the veins in the lower leg and the thigh. It involves the formation of a clot (thrombus) in the larger veins of the area. This clot may interfere with circulation and may break off and travel through the blood stream (embolize). A resulting embolus can lodge in the brain, lungs, heart or other area, causing severe damage to that organ.

degenerative osteoarthritis (OA)

Degenerative osteoarthritis refers to deterioration of the articular cartilage that lines a joint, which results in narrowing of the joint space and pain; it is also referred to as osteoarthritis.

fixation method

As hip and knee joint prostheses are replaced, they are fixed to securely position the joint and allow for natural bone growth. Three major categories of fixation methods were analyzed in this report for both hip and knee replacements:

- **Cemented:** The components involved (femoral and acetabular for hip and femoral, tibial and patellar for knee) are fixed by bone cement.
- **Cementless:** None of the components are cemented (for example, screws are used).
- **Hybrid:** One component is cemented and the other is not.

hip replacement

This surgery is performed to replace all or part of the hip joint with an artificial device. The hip is essentially a ball-and-socket joint, linking the ball at the head of the thigh bone (femur) with the cup-shaped socket in the pelvic bone. A hip prosthesis is surgically implanted to replace the damaged bone within the hip joint.

hip resurfacing (surface replacement)

Hip resurfacing is a type of hip replacement. It is a bone-conserving alternative to conventional total hip replacement in which the femoral head is resurfaced with a metal cap (a conventional replacement removes the femoral head and replaces it with a metal prosthesis) and the neck, stem and acetabulum (socket) are relined with a metal cup-shaped implant.

interquartile range (IQR)

The interquartile range is a measure of variability, being equal to the difference between the third and first quartiles.

knee replacement

Knee joint replacement is surgery to replace a painful damaged or diseased knee joint with an artificial joint. The orthopedic surgeon makes a cut over the affected knee. The patella (knee cap) is moved out of the way, and the ends of the femur (thigh bone) and tibia (shin bone) are cut to fit the prosthesis. Similarly, the under-surface of the knee cap is cut to allow for placement of an artificial component.

median

The median is a measure of central tendency—the middle of a distribution. The median is less sensitive to extreme scores than the mean, which makes it a better measure for highly skewed distributions.

most responsible diagnosis

The principal or primary diagnosis relating to the patient's admission to the hospital is reported on the discharge abstract that is submitted to CIHI. The most responsible diagnosis captures the key reason for the patient's admission to the hospital. This helps define the exact cause or reason for a patient's hip or knee replacement procedure.

osteolysis

Osteolysis is an active process of bone breaking down and dissolving.

osteonecrosis

In Greek, osteonecrosis means "death of bone," often as a result of obstruction of its blood supply.

partial replacement (hemiarthroplasty)

This surgical procedure replaces one half of the joint with an artificial surface and leaves the other part in its natural (pre-operative) state.

poly wear

"Poly wear" is short for polyethylene wear. The patterns of poly wear include deformation, delamination, breakage, pitting, abrasion and third-body wear.

primary replacement

A primary replacement is the first replacement procedure, where the natural bone is replaced with an artificial joint prosthesis.

revision

Revisions are modifications to or replacements of an existing artificial hip or knee joint prosthesis/component. A revision procedure may be necessary when an existing old or worn-out hip or knee component needs to be removed and replaced with a new or improved prosthesis. This may include removing one or more hip or knee components as necessary.

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