Hip and Knee Replacements in Canada: Canadian Joint Replacement Registry 2014 Annual Report

June 2014

Types of Care

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

Our Vision

Better data. Better decisions.
Healthier Canadians.

Our Mandate

To lead the development and maintenance of comprehensive and integrated health information that enables sound policy and effective health system management that improve health and health care.

Our Values

Respect, Integrity, Collaboration, Excellence, Innovation

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Acknowledgements

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Summary

Hip and Knee Replacements in Canada: Canadian Joint Replacement Registry 2014 Annual Report reports on data from the Hospital Morbidity Database (HMDB) and the Canadian Joint Replacement Registry (CJRR), operated by the Canadian Institute for Health Information (CIHI).

In 2012–2013, there were 47,137 acute care hospitalizations for all hip replacements and 57,718 for all knee replacements in Canada, representing a five-year increase of 16.5% and 21.5%, respectively.

- The pan-Canadian age-standardized hospitalization rate for all hip replacements (per 100,000 population age 20 and older) was 135.6. This rate has been stable since 2008–2009, while the knee age-standardized replacement rate (per 100,000 population age 20 and older) was 172.3, an increase of 8.4% over this five-year period.
- A key measure of success for joint replacements is how long patients benefit from their prosthetic implant before needing a revision surgery. Revisions are more complex than primary procedures and have a number of implications for both the patient and the health care system. Among the joint replacements reported to the HMDB, 9.4% of hip replacements and 6.7% of knee replacements were revision procedures. These figures have been stable since 2008–2009. Reducing the need for revisions is better for patients and the health system.
- The median length of stay (LOS) was four days for hip replacements, which is one day less than in previous years, and four days for knee replacements, which did not change from previous years.

As of 2012–2013, CJRR implemented a new minimum data set (MDS) based on data elements recommended by the International Society of Arthroplasty Registries. With the implementation of mandatory reporting by British Columbia and Ontario, CJRR coverage increased from 42% (for 2011–2012) to 74% of all hip and knee replacements performed in Canada during 2012–2013. Based on the CJRR data,

- The most common most responsible diagnosis for both hip and knee replacements continues to be degenerative arthritis (76.5% for hip, 97.1% for knee).
- The most common reason for revision for both hip and knee replacements continues to be aseptic loosening (26.3% for hip, 22.5% for knee).
- The most common bearing surface combination for hip replacements was metal-on-polyethylene (based on 2011–2012 data, the latest available).
- The most common fixation method differed between hip and knee replacements: 83.8% of hip replacements involved cementless methods, while 89.1% of knee replacements involved cemented techniques (based on 2011–2012 data, the latest available).

Highlights

Hip and Knee Replacements in Canada: Canadian Joint Replacement Registry 2014 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 (including elective and urgent cases) performed in Canada using selected clinical and surgical parameters. This report presents overall volumes and rates, as well as trends over time. It focuses on procedures performed in 2012–2013; however, in a few instances, supplementary information is provided from 2011–2012 data due to changes in CJRR data elements.

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 jurisdictions, regions and individual surgeons.

Hospitalization Information

- There were 104,855 hospitalizations for all hip and knee replacements; this represents a five-year increase of 19.2% (from 87,930 replacements in 2008–2009) and a one-year increase of 5.1% from 2011–2012.
- The total breaks down to 47,137 acute care hospitalizations for hip replacements (all types, including total, partial and resurfacing) and 57,718 acute care hospitalizations for knee replacements in Canada. These figures represent a five-year increase of 16.5% for hip replacements and 21.5% for knee replacements.
- The number of knee replacements has consistently exceeded that of hip replacements (by 22.4% in 2012–2013).
- The pan-Canadian age-standardized hospitalization rate for all hip replacements (per 100,000 population age 20 and older) in 2012–2013 was 135.6; this rate has been stable since 2008–2009. Females had a higher age-standardized hip replacement rate than males (143.2 versus 124.8 per 100,000), a trend that has been evident over the past several years.
- The age-standardized knee replacement rate (per 100,000 population age 20 and older) across Canada was 172.3; as with the rate for hip replacements, females had a higher rate than males (197.5 and 145.5, respectively). Both sexes had increases in knee replacement rates over the five-year period since 2008–2009.
- Looking at variation by jurisdiction of patient residence, Ontarians had the highest number of hip and knee replacements (43,394 joint replacements, representing 41% of the national total). However, the highest age-standardized rates (per 100,000 population age 20 and older) were among residents of Saskatchewan (181.3 and 258.5 for hips and knees, respectively). The lowest age-standardized rates (per 100,000 population age 20 and older) were among residents of Quebec (104.2 for hips, 124.2 for knees).

- The median length of stay (LOS) was four days for hip replacements (one day less than in previous years) and four days for knee replacements, which is unchanged from previous years. LOS variations were observed across jurisdictions (where the procedure was performed) 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.
- When all types of joint replacements (including primary and revision, unilateral and bilateral, elective and emergency) are considered, the total in-hospital cost of hip and knee replacements in Canada is estimated at $963 million,[i] using CIHI's Patient Cost Estimator (PCE) and 2010–2011 data.[1]

Clinical and Surgical Information

- In 2012–2013, data for 32,307 hip replacements and 45,830 knee replacements was reported to CJRR.
- Among the joint replacements reported, 8.7% of hip replacements and 5.2% of knee replacements were revision procedures.
- The most common diagnosis grouping for hip replacements reported to CJRR was degenerative arthritis (76.5%), followed by acute hip fracture (13.7%). For knee replacements, the most common diagnosis grouping was degenerative arthritis (97.1%), followed by inflammatory arthritis (1.5%).
- The most common reason for revision for both hips and knees was aseptic loosening.

With CJRR's implementation of the MDS in 2012–2013, some of the original data elements were retired. Information on body mass index, deep vein thrombosis preventive agents, fixation method and surgeon-reported implant characteristics is no longer available in the 2012–2013 CJRR data set; however, the 2011–2012 results for these data elements are presented in this report.

- Based on the calculation of body mass index, high proportions of both hip and knee replacement recipients were classified as obese (39.9% and 59.5%, respectively).
- In 2011–2012, low-molecular-weight heparin was the most popular deep vein thrombosis preventive agent used, with 65.1% of hip replacement and 61.6% of knee replacement patients receiving the drug.
- Among revisions of hip replacements, the most common component replaced was the femoral head (92.1%). Large femoral heads (36 mm or larger) were used in 43.5% of primary and 49.5% of revision procedures.

i. Cost estimates provided by the PCE represent the estimated average hospital cost of services provided to the average typical patient. Hospital-related expenditures do not include other expenditures such as physician payments and rehabilitation. Atypical cases are included in the calculation of the estimated total cost.

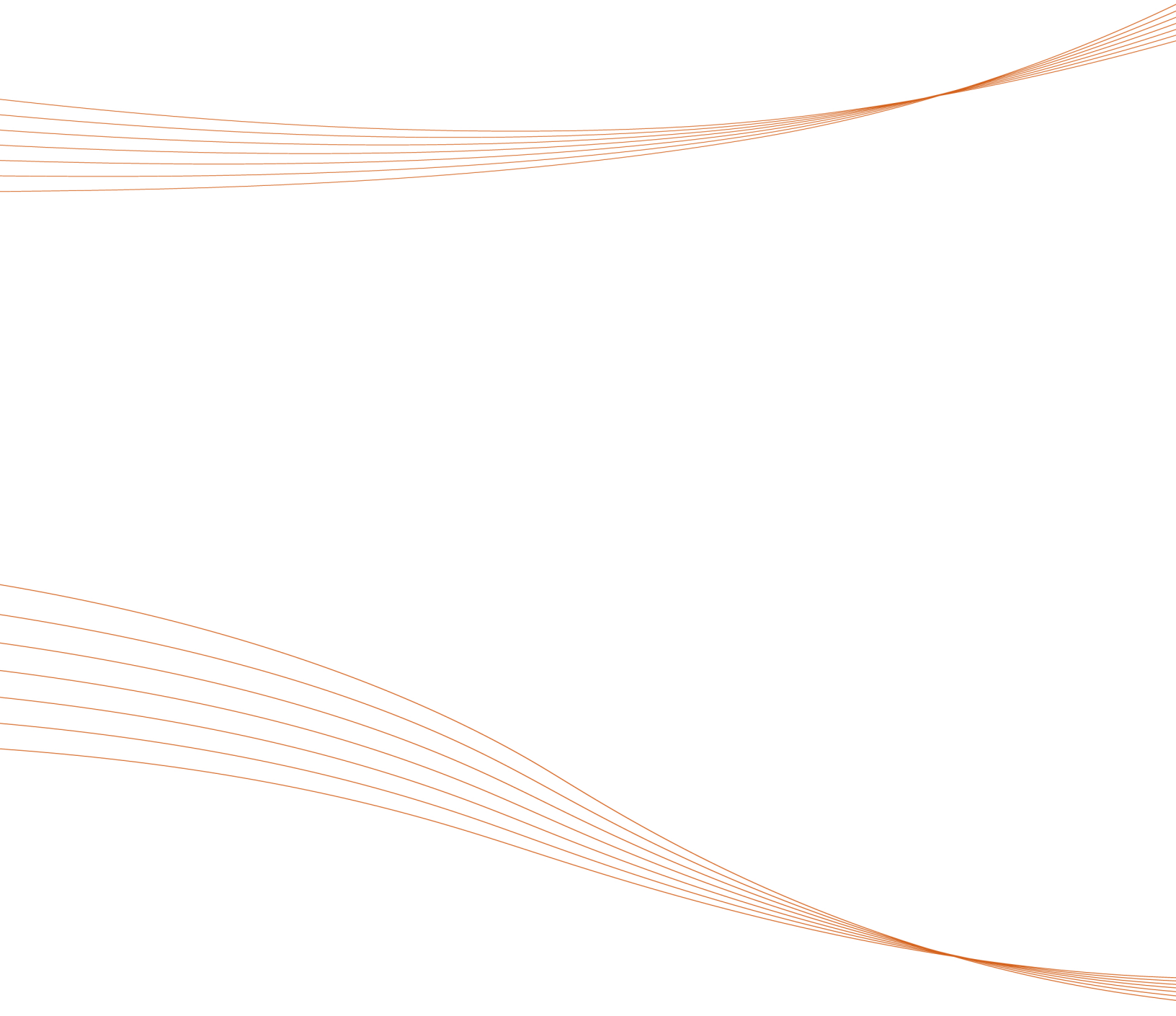
- The most common bearing surface combination for hip replacements was metal-on-polyethylene (81.2%), based on surgeons' reports.
- The most common fixation method differed between hip and knee replacements. While hip replacements involved mostly cementless methods (83.8%), 89.1% of knee replacements involved cemented techniques.

Future Directions

CJRR continues to undergo significant changes to improve its ability to contribute to quality and outcome improvements for Canadians who have hip or knee replacements.

- CJRR continues to work in collaboration with key policy-makers and orthopedic surgeons in other jurisdictions to further encourage mandated reporting to CJRR.
- CJRR has adopted fully electronic data collection. As of 2013–2014, paper data collection forms are no longer accepted. CJRR can receive data one of two ways: via electronic file or through the CJRR's web-based data entry tool.
- As of 2013–2014, the registry is able to receive scanned implant barcodes. Barcode scanning reduces the likelihood of data entry errors as well as the level of effort needed to capture the medical device information.
- With product characteristics no longer being captured in the MDS, the CJRR program team is developing an internal product information library to enable efficient identification of implant characteristics from product number information collected based on product catalogue numbers. Accurate and timely product information from manufacturers is required to support this goal.

As the number of hip and knee replacement procedures continues to rise and the implants and surgical techniques used continue to evolve, CJRR data will be even more important for 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 for this report was obtained from two CIHI data sources: the Hospital Morbidity Database (HMDB) and the Canadian Joint Replacement Registry (CJRR).

About the Canadian Joint Replacement Registry

CJRR is a pan-Canadian source of information about hip and knee replacements. It was established to record and analyze clinical parameters and outcomes of primary and revision hip and knee replacements over time. The registry was developed through a joint effort between 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.

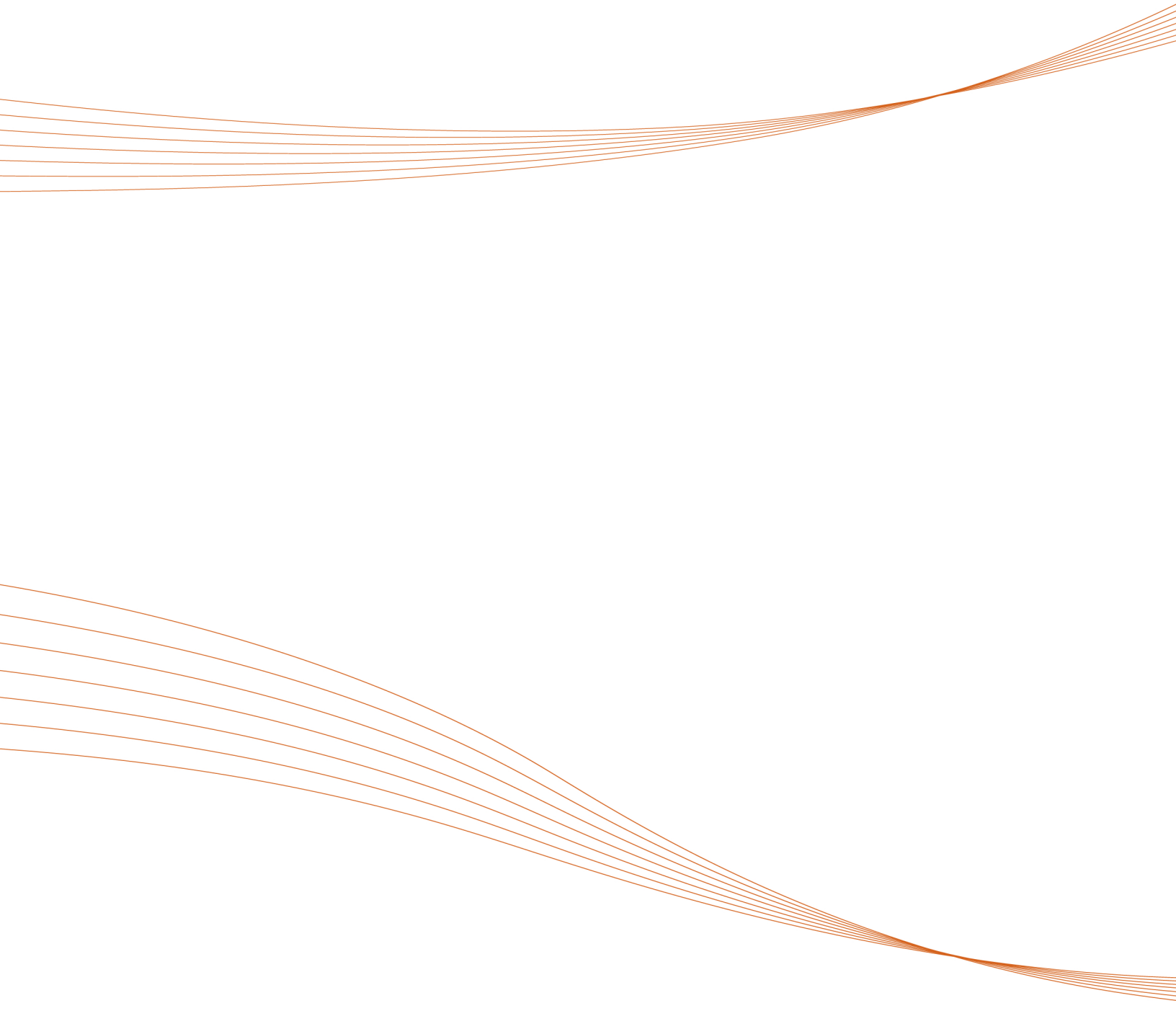
The HMDB data was used to produce the hospitalization statistics, and CJRR data was used for the clinical and surgical statistics. The HMDB captures administrative information (including diagnoses and procedure codes) and demographic information on all discharges from acute care facilities in Canada, including all hip and knee joint replacements and revisions. CJRR was developed to provide additional patient and prosthesis information to complement what is captured in the HMDB in order to enable more in-depth analysis of hip and knee replacements, including revisions and other outcomes. For more information, refer to Appendix B: Methodological Notes, HMDB, and Appendix C: Methodological Notes, CJRR.

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 and provincial ministries of health.

CJRR was historically a voluntary registry. As of 2012–2013, the governments of Ontario and British Columbia mandated reporting to CJRR, which contributed to an increase in CJRR's coverage from 42% to 74%. The government of Manitoba mandated electronic province-wide submission via Manitoba Health as of 2013–2014, transforming CJRR from a completely voluntary to a primarily mandated registry.

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 are protected. Information on CIHI's privacy and confidentiality policies and procedures is available on CIHI's website at www.cihi.ca.



Chapter 2: Hospitalization Information

Methodological Highlights

- Analyses for this chapter are based on the HMDB.
- Counts reported were based on the number of hospitalizations, not procedures.
- For both hip and knee replacements, total and partial replacements and elective and urgent cases are included in the analyses.
- For age-standardized rates, the number of hospitalizations includes both total and partial replacements for patients age 20 and older. The age restriction is a change to the methodology that will result in different counts and calculations than in previously published reports.

This chapter provides information on hospitalization rates in Canada for hip and knee replacements in 2012–2013, 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.

When all types of joint replacements (including primary and revision, unilateral and bilateral, elective and emergency) are considered, the total in-hospital cost of hip and knee replacements in Canada is estimated at $963 million,[ii] using CIHI's Patient Cost Estimator (PCE) and 2010–2011 data.[1]

Pan-Canadian Overview of Hip and Knee Replacements

In 2012–2013, there were 104,855 hospitalizations for hip and knee replacements in Canada. This represents a five-year increase of 19.2% (from 87,930 in 2008–2009) and a one-year increase of 5.1%.

In 2012–2013, there were 47,137 acute care hospitalizations for hip replacements, broken down as follows:

- Total hip replacements: 35,645 (75.6%)
- Partial hip replacements: 10,961 (23.3%)
- Hip resurfacing procedures: 531 (1.1%)

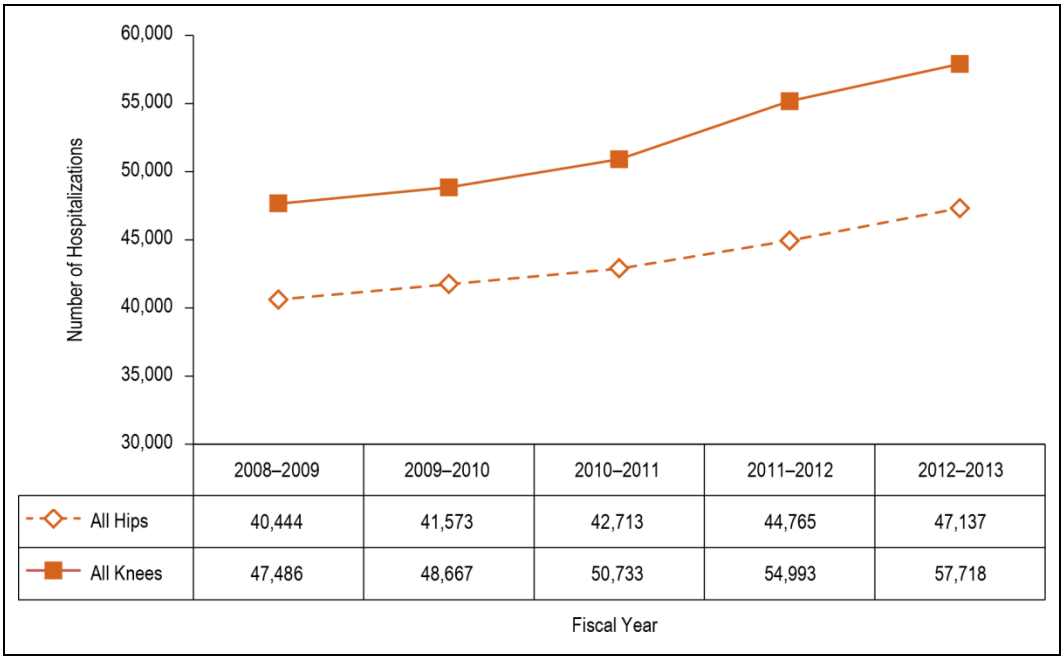
Collectively, this represents a five-year increase of 16.5% (from 40,444 procedures in 2008–2009).

In 2012–2013, there were 57,718 knee replacements in Canada, which is a 21.5% increase from 2008–2009, when 47,486 procedures were performed. A comparison of figures for 2011–2012 and 2012–2013 shows a one-year increase of 5.3% and 5.0% for hip and knee replacements, respectively. The number of knee replacements consistently exceeded the number of hip replacements in Canada (by 17.4% in 2008–2009 and by 22.4 % in 2012–2013).

ii. Cost estimates provided by the PCE represent the estimated average hospital cost of services provided to the average typical patient. Hospital-related expenditures do not include other expenditures such as physician payments and rehabilitation. Atypical cases are included in the calculation of the estimated total cost.

Figure 1 shows the number of hospitalizations for all acute care hip and knee replacement hospitalizations in Canada from 2008–2009 to 2012–2013.

Figure 1: Number of Hospitalizations for All Hip and All Knee Replacement Procedures in Canada, 2008–2009 to 2012–2013



	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013
All Hips	40,444	41,573	42,713	44,765	47,137
All Knees	47,486	48,667	50,733	54,993	57,718

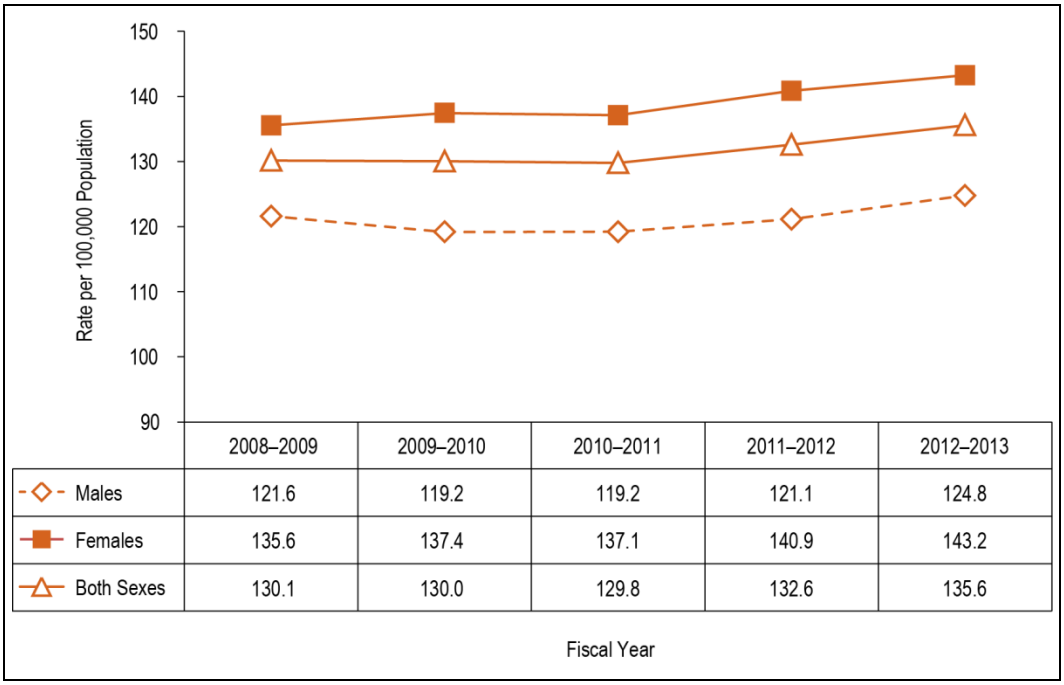
Source
Hospital Morbidity Database, 2008–2009 to 2012–2013, Canadian Institute for Health Information.

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 age 20 and older, unless otherwise specified.

The pan-Canadian age-standardized hospitalization rate for all types of hip replacements for patients age 20 and older in 2012–2013 was 135.6 per 100,000, up 4.2% from 130.1 in 2008–2009 (Figure 2). The 2012–2013 age-standardized rate for males age 20 and older was 124.8, while that for females was 143.2, a difference of 18.4. 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 a lower five-year increase than the rate for females (2.6% versus 5.6%).

Figure 2: Age-Standardized Hospitalization Rates (per 100,000 Population Age 20 and Older) for All Hip Replacements, by Sex, Canada, 2008–2009 to 2012–2013



	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013
Males	121.6	119.2	119.2	121.1	124.8
Females	135.6	137.4	137.1	140.9	143.2
Both Sexes	130.1	130.0	129.8	132.6	135.6

Note

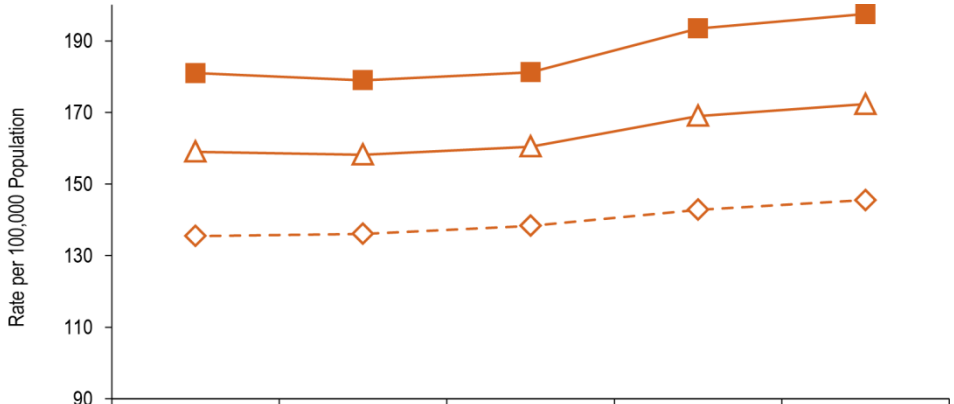
The 1991 Canadian population was used as the standard for rate calculation.

Source

Hospital Morbidity Database, 2008–2009 to 2012–2013, Canadian Institute for Health Information.

Larger differences, both between sexes and over time, were observed for the age-standardized knee hospitalization rates (Figure 3). In 2012–2013, the overall age-standardized knee hospitalization rate (age 20 and older) was 172.3 per 100,000 (145.5 for males and 197.5 for females). Both males and females have had increases in age-standardized knee replacement hospitalization rates (7.4 % and 9.1%, respectively) since 2008–2009.

Figure 3: Age-Standardized Hospitalization Rates (per 100,000 Population Age 20 and Older) for All Knee Replacements, by Sex, Canada, 2008–2009 to 2012–2013



	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013
Males	135.5	136.1	138.3	142.8	145.5
Females	181.0	179.0	181.2	193.5	197.5
Both Sexes	159.0	158.2	160.5	169.0	172.3

Note
The 1991 Canadian population was used as the standard for rate calculation.
Source
Hospital Morbidity Database, 2008–2009 to 2012–2013, Canadian Institute for Health Information.

Jurisdictional Variations

Table 1 presents the number of hip replacement hospitalizations by jurisdiction of patient residence for the five years from 2008–2009 to 2012–2013.

Of the 47,075 hip replacements done in 2012–2013 where provincial jurisdiction of residence is known, Ontario patients made up the highest percentage (39.7%) of these procedures nationally.

All jurisdictions had increases in hospitalizations for all hip replacements over the last five years. From 2008–2009 to 2012–2013, the territories, Newfoundland and Labrador and Alberta showed the highest percentage increases in terms of volume (62.5 %, 31.9 % and 30.4%, respectively).

Table 1: Number of Hospitalizations for All Hip Replacements, by Jurisdiction, 2008–2009 to 2012–2013

Jurisdiction	All Hip Replacements					Five-Year Percentage Change
	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013	
Newfoundland and Labrador	542	598	584	691	715	31.9
Prince Edward Island	232	212	187	239	252	8.6
Nova Scotia	1,328	1,398	1,447	1,434	1,551	16.8
New Brunswick	967	1,006	1,088	1,160	1,114	15.2
Quebec	7,235	7,680	7,941	8,472	8,916	23.2
Ontario	16,476	16,665	17,038	17,679	18,709	13.6
Manitoba	1,679	1,573	1,848	1,803	1,830	9.0
Saskatchewan	1,598	1,706	1,702	1,721	1,899	18.8
Alberta	3,869	4,358	4,347	4,743	5,046	30.4
British Columbia	6,388	6,239	6,399	6,721	6,926	8.4
Territories*	72	84	79	55	117	62.5
Canada†	**40,386**	**41,519**	**42,660**	**44,718**	**47,075**	**16.6**

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, 2008–2009 to 2012–2013, Canadian Institute for Health Information.

Table 2 presents the number of knee replacement hospitalizations by jurisdiction of patient residence between 2008–2009 and 2012–2013.

Of the 57,698 knee replacements performed in 2012–2013 with known jurisdiction of residence, 24,685 (42.8%) were performed on patients residing in Ontario. This is a small decrease from five years prior, when 45.4% of patients were from Ontario.

Jurisdictional variations were higher among knee replacements than hip replacements. The territories had the largest five-year increase at 69.8%, followed by Prince Edward Island (61.7%). The only jurisdiction that has experienced a decrease in knee replacements since 2008–2009 is Manitoba at -0.6%.

Table 2: Number of Hospitalizations for All Knee Replacements, by Jurisdiction, 2008–2009 to 2012–2013

Jurisdiction	All Knee Replacements					Five-Year Percentage Change
	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013	
Newfoundland and Labrador	624	676	732	911	909	45.7
Prince Edward Island	206	245	209	268	333	61.7
Nova Scotia	1,494	1,657	1,785	1,876	1,940	29.9
New Brunswick	1,048	1,121	1,178	1,362	1,376	31.3
Quebec	7,217	7,832	9,076	9,866	10,289	42.6
Ontario	21,568	21,566	21,802	23,507	24,685	14.5
Manitoba	2,095	1,942	1,999	2,111	2,082	-0.6
Saskatchewan	1,803	2,275	2,001	2,069	2,552	41.5
Alberta	4,336	4,698	4,928	5,770	6,051	39.6
British Columbia	6,993	6,527	6,888	7,140	7,318	4.6
Territories*	96	117	132	101	163	69.8
Canada†	**47,480**	**48,656**	**50,730**	**54,981**	**57,698**	**21.5**

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, 2008–2009 to 2012–2013, Canadian Institute for Health Information.

Table 3 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 (90.4% and 93.2%, respectively). Saskatchewan had the highest ratio of primary versus revision procedures for both hip and knee replacements (13:1 and 21:1, respectively), followed by Alberta and the territories at 11:1 for hip replacements and Newfoundland and Labrador at 17:1 for knee replacements. Newfoundland and Labrador, Nova Scotia, New Brunswick and Manitoba had the lowest ratio of primary versus revision hip procedures (8:1), while Nova Scotia had the lowest ratio for knee procedures (9:1), followed by P.E.I. and Manitoba at 11:1. The ratios provide an indication of the relative volumes of primary versus revision procedures. These measures can be influenced by factors such as patient demographics.

Table 3: Number of Hospitalizations, by Type of Replacement and Jurisdiction, 2012–2013

Jurisdiction	All Hip Replacements			All Knee Replacements		
	Primary	Revision	Primary: Revision Ratio	Primary	Revision	Primary: Revision Ratio
Newfoundland and Labrador	609	79	8:1	823	48	17:1
Prince Edward Island	228	24	10:1	303	28	11:1
Nova Scotia	1,316	160	8:1	1,668	181	9:1
New Brunswick	899	115	8:1	1,138	99	11:1
Quebec	7,863	802	10:1	9,335	624	15:1
Ontario	16,781	1,838	9:1	22,955	1,637	14:1
Manitoba	1,627	194	8:1	1,908	168	11:1
Saskatchewan	1,754	135	13:1	2,422	117	21:1
Alberta	4,588	413	11:1	5,517	456	12:1
British Columbia	6,139	670	9:1	6,650	501	13:1
Territories*	106	10	11:1	149	13	12:1
Canada†	**41,910**	**4,440**	**9:1**	**52,868**	**3,872**	**14:1**

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.

Less than 2% of hip replacements and less than 2% of knee replacements were excluded due to unknown type.

Source

Hospital Morbidity Database, 2012–2013, Canadian Institute for Health Information.

Age-Standardized Rates by Jurisdiction

Table 4, which presents age-standardized rates by jurisdiction, shows variations across Canada for all hip replacement procedures. Alberta and Saskatchewan had the highest rates of hip replacements (163.7 and 181.3 per 100,000, respectively) in 2012–2013. Quebec had the lowest rate of hospitalization for all hip replacements (104.2), followed by Newfoundland and Labrador (130.5). From 2008–2009 to 2012–2013, the age-standardized rate for hip replacements increased in the majority of the provinces; the greatest rate increases were in Newfoundland and Labrador (21.2%) and Alberta (14.0%). The only decrease during this time period was in B.C. (-3.6%). The national age-standardized rate of hospitalization for all hip replacement procedures increased from 130.1 in 2008–2009 to 135.6 in 2012–2013.

Table 4: Age-Standardized Rate (per 100,000 Population Age 20 and Older) for All Hip Replacements, by Jurisdiction, 2008–2009 to 2012–2013

Jurisdiction	Age-Standardized Rate					Five-Year Percentage Change
	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013	
Newfoundland and Labrador	107.7	115.8	110.6	127.1	130.5	21.2
Prince Edward Island	158.8	144.0	123.1	156.1	160.5	1.1
Nova Scotia	137.4	141.0	142.2	137.0	145.5	5.9
New Brunswick	124.2	126.1	135.0	140.1	131.7	6.1
Quebec	95.1	98.0	98.5	102.0	104.2	9.6
Ontario	139.4	137.0	136.1	137.5	141.0	1.1
Manitoba	150.4	137.3	157.5	151.1	152.8	1.6
Saskatchewan	161.3	168.9	164.3	165.1	181.3	12.4
Alberta	143.6	157.1	151.5	160.4	163.7	14.0
British Columbia	148.1	140.0	139.3	142.8	142.7	-3.6
Canada*	**130.1**	**130.0**	**129.8**	**132.6**	**135.6**	**4.2**

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 unknown jurisdiction of residence were excluded from rate calculations.

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

The territories (Yukon, the Northwest Territories and Nunavut) were suppressed due to small numbers; however, their numbers were included in Canadian calculations.

Source

Hospital Morbidity Database, 2008–2009 to 2012–2013, Canadian Institute for Health Information.

Similar trends in age-standardized hospitalization rates were observed among knee replacements (Table 5). In 2012–2013, P.E.I. and Saskatchewan had the highest rates of knee replacement at 215.3 and 258.5 per 100,000, respectively; Quebec had the lowest rate (124.2), followed by B.C. (156.0). Over the five-year period, some provinces had an increased age-standardized rate for knee replacements, with the greatest increases seen in P.E.I. (43.2%) and Saskatchewan (32.6%). Decreases were found in Manitoba (-9.0%) and B.C. (-8.1%). The national age-standardized rate of hospitalization for knee replacement procedures increased by 8.4%, from 159.0 to 172.3 over the five-year period.

Table 5: Age-Standardized Rate (per 100,000 Population Age 20 and Older) for All Knee Replacements, by Jurisdiction, 2008–2009 to 2012–2013

Jurisdiction	Age-Standardized Rate					Five-Year Percentage Change
	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013	
Newfoundland and Labrador	122.5	127.5	135.4	162.9	157.5	28.6
Prince Edward Island	150.4	171.4	143.3	180.4	215.3	43.2
Nova Scotia	159.1	171.1	179.6	184.9	187.1	17.6
New Brunswick	140.7	147.8	151.7	169.4	167.1	18.8
Quebec	97.7	102.9	115.9	122.6	124.2	27.1
Ontario	189.7	184.4	181.6	190.3	194.2	2.4
Manitoba	199.6	181.0	182.4	189.3	181.6	-9.0
Saskatchewan	195.0	244.0	211.8	213.3	258.5	32.6
Alberta	167.4	174.5	175.9	199.5	202.3	20.8
British Columbia	169.8	152.9	156.3	157.0	156.0	-8.1
Canada*	**159.0**	**158.2**	**160.5**	**169.0**	**172.3**	**8.4**

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 unknown jurisdiction of residence were excluded from rate calculations.

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

The territories (Yukon, the Northwest Territories and Nunavut) were suppressed due to small numbers; however, their numbers were included in Canadian calculations.

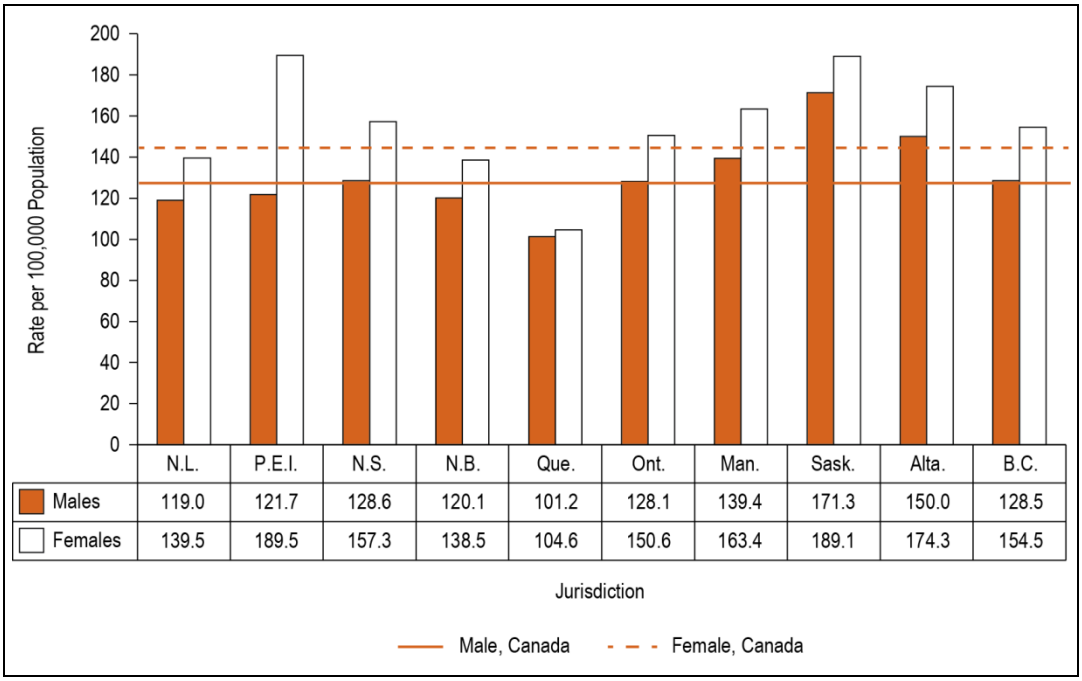
Source

Hospital Morbidity Database, 2008–2009 to 2012–2013, 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 4). Seven jurisdictions had rates higher than the national age-standardized rate for females (143.2 per 100,000), whereas only six had a higher rate for males than the national average (124.8 per 100,000).

Figure 4: Age-Standardized Rates (per 100,000 Population Age 20 and Older) for All Hip Replacements, by Jurisdiction and Sex, Canada, 2012–2013



	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Males	119.0	121.7	128.6	120.1	101.2	128.1	139.4	171.3	150.0	128.5
Females	139.5	189.5	157.3	138.5	104.6	150.6	163.4	189.1	174.3	154.5

Notes

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

Patients with unknown jurisdiction of residence were excluded from rate calculations.

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

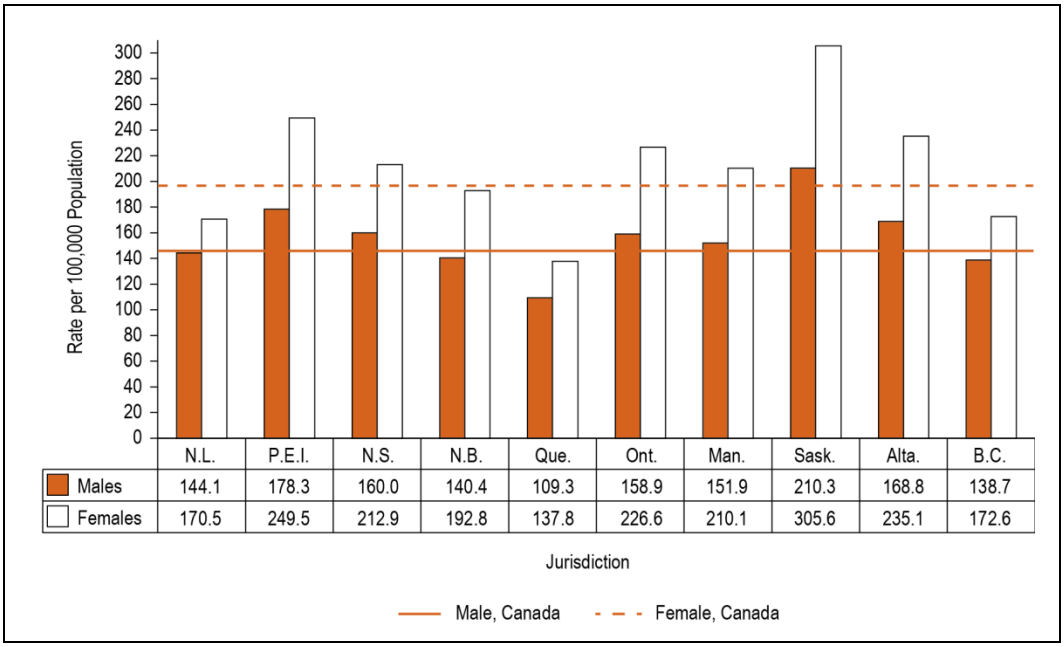
The territories (Yukon, the Northwest Territories and Nunavut) were suppressed due to small numbers; however, their numbers were included in Canadian calculations.

Source

Hospital Morbidity Database, 2012–2013, 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 5). Six jurisdictions had rates higher than the national age-standardized rate for females (197.5 per 100,000), and six had a higher rate for males than the national average (145.5 per 100,000).

Figure 5: Age-Standardized Rates (per 100,000 Population Age 20 and Older) for All Knee Replacements, by Jurisdiction and Sex, Canada, 2012–2013



	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Males	144.1	178.3	160.0	140.4	109.3	158.9	151.9	210.3	168.8	138.7
Females	170.5	249.5	212.9	192.8	137.8	226.6	210.1	305.6	235.1	172.6

Notes

Results are presented by patients' province of residence, rather than for the province of the facility where hospitalization occurred.
Patients with unknown jurisdiction of residence were excluded from rate calculations.
The 1991 Canadian population was used as the standard for rate calculations.
The territories (Yukon, the Northwest Territories and Nunavut) were suppressed due to small numbers; however, their numbers were included in Canadian calculations.

Source

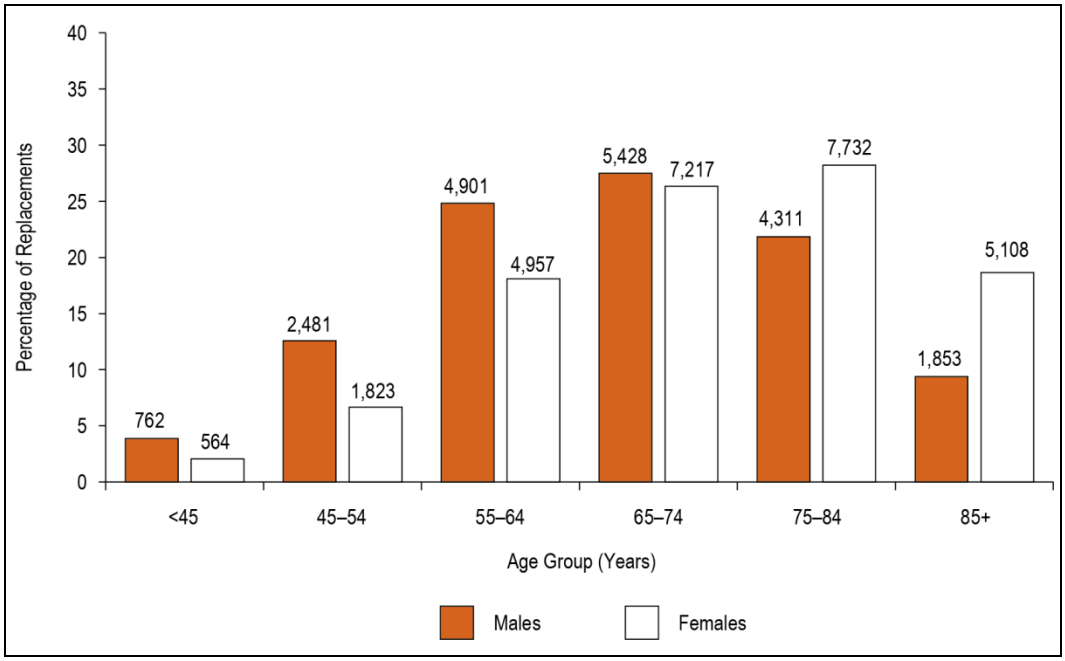
Hospital Morbidity Database, 2012–2013, Canadian Institute for Health Information.

The gap between the sexes was greater for the age-standardized knee replacement rates than for hip replacement rates. This difference was greatest in Saskatchewan, where the age-standardized knee replacement rate for males was 210.3 and that for females was 305.6 (difference of 95.3 per 100,000). In comparison, the greatest gap between the sexes among hip replacement rates was seen in P.E.I. (121.7 for males and 189.5 for females, a difference of 67.7 per 100,000).

Patient Demographics

The age distribution of hip replacement recipients differed between the sexes (Figure 6). Males tended to be younger at the time of hip replacement (average age of 67.3) than females (average age of 72.4). Most male hip replacement recipients (27.5%) were age 65 to 74, whereas nearly half of all females (46.9%) were 75 and older at the time of surgery. Almost three times as many female patients as male patients were age 85 and older.

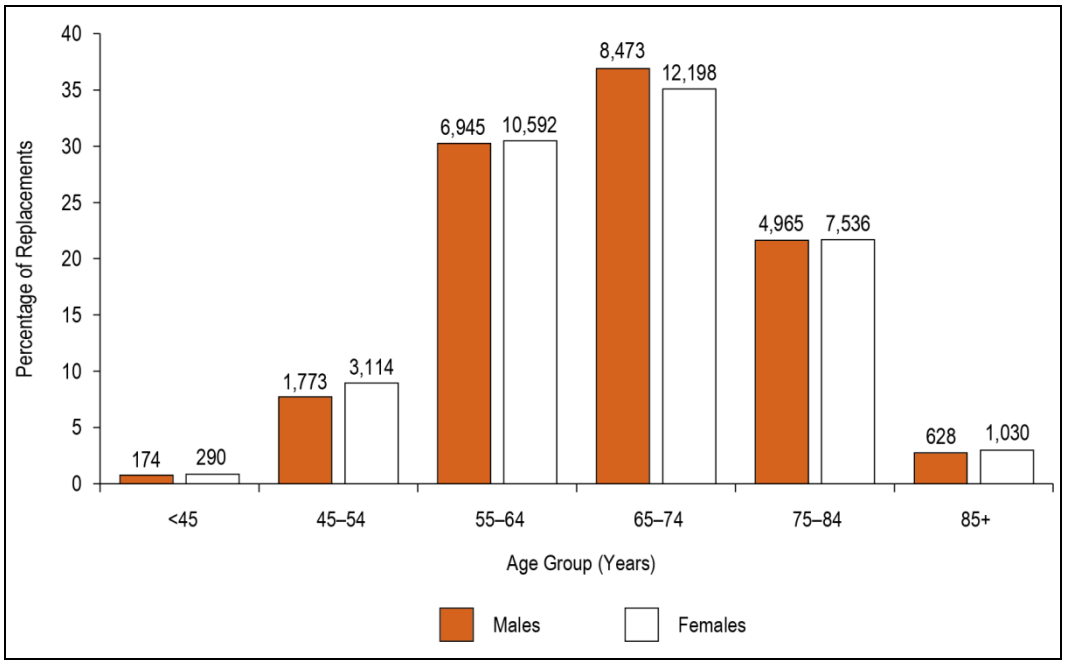
Figure 6: Age Distribution of All Hip Replacement Recipients, by Sex, Canada, 2012–2013



Notes
N = 19,736 males.
N = 27,401 females.
Source
Hospital Morbidity Database, 2012–2013, Canadian Institute for Health Information.

Figure 7 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 67.4 and 67.2, respectively). For both sexes, most patients were age 65 to 74 (36.9% and 35.1% for males and females, respectively).

Figure 7: Age Distribution of All Knee Replacement Recipients, by Sex, Canada, 2012–2013



Notes
N = 22,958 males.
N = 34,760 females.
Source
Hospital Morbidity Database, 2012–2013, Canadian Institute for Health Information.

Table 6 shows the age-specific rates for all hip replacements by sex as well as the five-year change. The age-specific rates increased with increasing age for both males and females. In 2012–2013, the highest age-specific rates were among those age 85 and older for males and females (780.7 and 1,085.1 per 100,000, respectively). The largest percentage increases from 2008–2009 in hip replacement rates by sex were observed among males age 55 to 64 (10.3%) and among females age 55 to 64 (14.5%). However, a five-year decrease was observed in the age group younger than 45 for both sexes.

Table 6: Age-Specific Rates (per 100,000) for All Hip Replacements, by Age Group and Sex, Canada, 2008–2009 to 2012–2013

Age Group	Males					Five-Year Percentage Change
	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013	
<45	8.1	7.8	7.3	7.0	7.6	-6.8
45–54	85.0	84.2	85.3	86.0	91.8	8.1
55–64	201.1	197.7	205.2	209.8	221.8	10.3
65–74	395.6	382.0	386.4	392.2	398.6	0.8
75–84	587.5	580.8	572.2	603.8	596.7	1.6
85+	818.9	803.4	766.2	739.6	780.7	-4.7
Overall	**102.8**	**102.6**	**104.8**	**108.5**	**114.0**	**11.0**

Age Group	Females					Five-Year Percentage Change
	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013	
<45	6.5	6.0	6.2	6.0	5.8	-11.5
45–54	65.2	62.2	62.2	66.1	68.0	4.2
55–64	189.7	195.1	200.7	212.2	217.2	14.5
65–74	456.2	465.1	457.3	481.2	489.6	7.3
75–84	815.0	837.5	824.4	834.3	840.1	3.1
85+	1,071.5	1,084.8	1,085.7	1,046.6	1,085.1	1.3
Overall	**139.7**	**143.6**	**145.2**	**150.8**	**155.9**	**11.6**

Source
Hospital Morbidity Database, 2008–2009 to 2012–2013, Canadian Institute for Health Information.

Table 7 shows the age-specific rates for all knee replacements. In 2012–2013, the highest age-specific rates were seen among those age 75 to 84 for males (687.2 per 100,000) and those age 65 to 74 for females (827.5 per 100,000). The largest percentage increases from 2008–2009 were observed among males and females age 55 to 64 (14.5% and 16.0%, respectively). A five-year decrease was observed in the older-than-85 age group for both sexes and in the younger-than-45 age group for females.

Table 7: Age-Specific Rates (per 100,000) for All Knee Replacements, by Age Group and Sex, Canada, 2008–2009 to 2012–2013

Age Group	Males					Five-Year Percentage Change
	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013	
<45	1.7	2.0	1.8	1.8	1.7	0.9
45–54	57.6	61.6	59.6	66.7	65.6	13.8
55–64	274.7	281.5	289.8	298.5	314.4	14.5
65–74	586.6	587.9	596.5	617.5	622.2	6.1
75–84	676.5	652.4	671.3	676.4	687.2	1.6
85+	277.4	278.8	268.0	275.8	264.6	-4.6
Overall	**114.0**	**116.9**	**121.0**	**127.5**	**132.6**	**16.3**

Age Group	Females					Five-Year Percentage Change
	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013	
<45	3.1	2.7	2.8	3.1	3.0	-5.1
45–54	100.3	102.2	103.2	115.1	116.1	15.8
55–64	400.0	412.4	414.1	446.0	464.1	16.0
65–74	775.1	758.6	767.8	813.1	827.5	6.8
75–84	786.6	748.1	762.0	809.9	818.8	4.1
85+	220.1	223.1	234.4	237.7	218.8	-0.6
Overall	**170.6**	**171.3**	**175.9**	**191.0**	**197.8**	**16.0**

Source
Hospital Morbidity Database, 2008–2009 to 2012–2013, 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.[iii]

The median LOS was similar for male and female hip replacement recipients in 2012–2013, at four and five days, respectively (Table 8). These median LOS did not change from the previous year. However, 10% of male patients stayed in acute care longer than 12 days, whereas 10% of female patients stayed more than 15 days. Comparing figures for the previous year, patients in the top 10% (or 90th percentile) in terms of LOS stayed one day less, for both males and females. Overall, the median LOS for both sexes combined decreased from five days in the previous year to four days for 2012–2013.

iii. 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 8: Length of Stay (Days) for All Hip Replacements, by Sex, Canada, 2008–2009 to 2012–2013

	Males			Females			Both Sexes		
Fiscal Year	Median	IQR	90th Percentile	Median	IQR	90th Percentile	Median	IQR	90th Percentile
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
2011–2012	4	4	13	5	4	16	5	4	15
2012–2013	4	3	12	5	5	15	4	4	14

Note
IQR: Interquartile range.
Source
Hospital Morbidity Database, 2008–2009 to 2012–2013, 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 9. In 2012–2013, the median LOS for males, females and both sexes combined was four days, with 10% of all patients remaining in acute care longer than seven days.

Table 9: Length of Stay (Days) for All Knee Replacements, by Sex, Canada, 2008–2009 to 2012–2013

	Males			Females			Both Sexes		
Fiscal Year	Median	IQR	90th Percentile	Median	IQR	90th Percentile	Median	IQR	90th Percentile
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
2011–2012	4	2	7	4	2	8	4	2	8
2012–2013	4	2	7	4	2	7	4	2	7

Note
IQR: Interquartile range.
Source
Hospital Morbidity Database, 2008–2009 to 2012–2013, Canadian Institute for Health Information.

Overall, the median and 90th percentile LOS in hospital for hip and knee replacements varied across jurisdictions (Table 10). Alberta, B.C., Ontario and Nova Scotia had the shortest median LOS for hip replacements (four days). In contrast, P.E.I. had the longest median LOS (seven days). The national average median LOS for hip procedures was four days (four days for males and five days for females). For knee replacements, the shortest median LOS was three days, reported in Alberta, B.C. and Ontario, while the longest was six days, in P.E.I. The national average median LOS for knee replacements was four days (for both males and females).

Table 10: Length of Stay (Days) for All Hip and All Knee Replacements, by Jurisdiction, Canada, 2012–2013

Jurisdiction	All Hip Replacements			All Knee Replacements		
	Median	IQR	90th Percentile	Median	IQR	90th Percentile
Newfoundland and Labrador	5	4	15	5	2	8
Prince Edward Island	7	6	22	6	3.5	10
Nova Scotia	4	4	17	4	1	6
New Brunswick	5	5	16	4	3	8
Quebec	6	5	20.5	5	3	9
Ontario	4	3	11	3	1	6
Manitoba	5	4	14	5	2	8
Saskatchewan	5	4	14	5	2	8
Alberta	4	4	14	3	1	6
British Columbia	4	5	17	3	1	6
Northwest Territories	4.5	6	11	4	1	10
Canada	**4**	**4**	**14**	**4**	**2**	**7**

Notes
IQR: Interquartile range.
Jurisdictional analysis is based on the location of the facility where the procedure was performed.
Source
Hospital Morbidity Database, 2012–2013, 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, given clinical interest in monitoring trends for these procedures:

- Total hip replacement: The entire hip joint (both the femoral and acetabular articulating surfaces) is replaced with artificial implants.
- Partial hip replacement: Only parts of the hip joint (femoral component) are replaced with an artificial implant; typically, this surgical intervention may be performed following an acute hip fracture.
- Hip resurfacing: A bone-conserving alternative to conventional total hip replacement, in which the femoral head is resurfaced with a metal cap and the acetabulum is relined with a metal cup-shaped implant.

Refer to Appendix B for the standard Canadian Classification of Health Interventions (CCI) codes for each type.

Table 11 shows the age-standardized rates for hip replacements by type of procedure performed. In 2012–2013, females had a higher rate of total and partial hip replacements; however, for hip resurfacing procedures, the rate for males was almost 10 times that for females. For both sexes combined, the age-standardized rates for total hip replacements, partial hip replacements and hip resurfacings were 105.9, 28.0 and 1.6 per 100,000, respectively.

Table 11: Age-Standardized Hospitalization Rates (per 100,000 Population Age 20 and Older) for All Hip Replacements, by Sex and Type of Procedure, 2012–2013

Type of Procedure	Males	Females	Both Sexes
Total Hip Replacement	100.2	110.4	105.9
Partial Hip Replacement	21.7	32.5	28.0
Hip Resurfacing	2.9	0.3	1.6
Overall	**124.8**	**143.2**	**135.6**

Note
The 1991 Canadian population was used as the standard for rate calculation.
Source
Hospital Morbidity Database, 2012–2013, Canadian Institute for Health Information.

Of all the hip replacement procedures performed in 2012–2013 with known province or territory of residence, 35,624 (75.7%) were total hip replacements, 10,920 (23.2%) were partial hip replacements and 531 (1.1%) were hip resurfacing procedures. Jurisdictional variations in types of hip replacements performed can be seen in Table 12.

Table 12: Number of Hospitalizations for All Hip Replacements, by Jurisdiction and Type of Procedure, 2012–2013

Jurisdiction	Total Hip Replacement	Partial Hip Replacement	Hip Resurfacing	All Hip Replacements
Newfoundland and Labrador	506 (70.8%)	N/R**	N/R	**715**
Prince Edward Island	189 (75.0%)	N/R**	N/R**	**252**
Nova Scotia	1,132 (73.0%)	410 (26.4%)	9 (0.6%)	**1,551**
New Brunswick	801 (71.9%)	306 (27.5%)	7 (0.6%)	**1,114**
Quebec	6,444 (72.3%)	2,421 (27.2%)	51 (0.6%)	**8,916**
Ontario	14,637 (78.2%)	3,836 (20.5%)	236 (1.3%)	**18,709**
Manitoba	1,396 (76.3%)	420 (23.0%)	14 (0.8%)	**1,830**
Saskatchewan	1,382 (72.8%)	489 (25.8%)	28 (1.5%)	**1,899**
Alberta	3,811 (75.5%)	1,086 (21.5%)	149 (3.0%)	**5,046**
British Columbia	5,233 (75.6%)	1,663 (24.0%)	30 (0.4%)	**6,926**
Territories*	93 (79.5%)	19 (16.2%)	5 (4.3%)	**117**
Canada†	**35,624 (75.7%)**	**10,920 (23.2%)**	**531 (1.1%)**	**47,075**

Notes
* Territories include Yukon, Northwest Territories and Nunavut.
† Total counts exclude cases with unknown jurisdiction of residence.
N/R: Not reportable. In accordance with CIHI's privacy policy, cells with counts of 1 to 4 are suppressed. When only one small cell is present in the row or column, double cell suppression of the next smallest cell, regardless of its value, is performed (indicated by N/R**). Suppressed cells are included in the totals. Numbers are based on patients' province or territory of residence.
Source
Hospital Morbidity Database, 2012–2013, Canadian Institute for Health Information.

As expected, age-standardized rates (per 100,000 population age 20 and older) for hip replacements were highest for total hip replacements and lowest for hip resurfacing procedures across all jurisdictions; the Canadian rates for total hip replacements, partial hip replacements and hip resurfacings were 105.9, 28.0 and 1.6 per 100,000 respectively (Table 13). Across the country, Saskatchewan and Alberta had the highest rates of total hip replacements, at 140.0 and 126.3; whereas Newfoundland and Labrador and Quebec had the lowest rates (93.5 and 78.0, respectively). Saskatchewan and Newfoundland and Labrador had the highest rates of partial hip replacements (38.2 and 36.6), whereas Quebec (25.5) and Ontario (25.7) had the lowest. Finally, Alberta had the highest rate of hip resurfacing procedures in the country, at 4.1; the second-highest rate was in Saskatchewan, at 3.0 per 100,000. The jurisdictions with the lowest hip resurfacing rates—0.7 per 100,000—were B.C. and Quebec.

Table 13: Age-Standardized Rate (per 100,000 Population Age 20 and Older) for All Hip Replacements, by Jurisdiction and Type of Procedure, 2012–2013

Jurisdiction	Total Hip Replacement	Partial Hip Replacement	Hip Resurfacing	All Hip Replacements
Newfoundland and Labrador	93.5	36.6	—	**130.5**
Prince Edward Island	124.1	36.4	—	**160.5**
Nova Scotia	109.9	34.5	1.1	**145.5**
New Brunswick	98.5	32.3	1.0	**131.7**
Quebec	78.0	25.5	0.7	**104.2**
Ontario	113.5	25.7	1.8	**141.0**
Manitoba	121.6	30.1	1.1	**152.8**
Saskatchewan	140.0	38.2	3.0	**181.3**
Alberta	126.3	33.3	4.1	**163.7**
British Columbia	112.5	29.6	0.7	**142.7**
Canada*	**105.9**	**28.0**	**1.6**	**135.6**

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 unknown jurisdiction of residence were excluded from rate calculations.

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

The territories (Yukon, the Northwest Territories and Nunavut) were suppressed due to small numbers; however, their numbers were included in Canadian calculations.

Source

Hospital Morbidity Database, 2012–2013, Canadian Institute for Health Information.

From Table 14, it can be seen that the age group with the highest rate of total hip replacements for both sexes was 75 to 84 (432.7 and 566.9 per 100,000 for males and females, respectively). The difference among sexes was much more apparent in older partial hip replacement patients. The age-specific rate of partial hip replacements in females older than 85 was 735.0 per 100,000, more than 1.5 times the rate for 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 0.8 and 0.1 per 100,000 for males and females, respectively. This difference increased dramatically for those age 45 to 54 (8.4 and 0.9 per 100,000 for males and females, respectively).

Table 14: Age-Specific Rates (per 100,000) for All Hip Replacements, by Age Group, Sex and Type of Procedure, Canada, 2012–2013

Age Group	Males			
	Total Hip Replacement	Partial Hip Replacement	Hip Resurfacing	All Hip Replacements
<45	6.5	0.3	0.8	**1.7**
45–54	79.0	4.4	8.4	**65.6**
55–64	200.7	14.7	6.5	**314.4**
65–74	351.2	46.0	1.4	**622.2**
75–84	432.7	163.6	0.4	**687.2**
85+	301.2	479.0	0.4	**264.6**
Overall	**91.5**	**19.8**	**2.7**	**132.6**

Age Group	Females			
	Total Hip Replacement	Partial Hip Replacement	Hip Resurfacing	All Hip Replacements
<45	5.3	0.5	0.1	**3.0**
45–54	62.7	4.4	0.9	**116.1**
55–64	200.6	16.2	0.4	**464.1**
65–74	418.6	70.4	0.6	**827.5**
75–84	566.9	273.0	0.1	**818.8**
85+	348.6	735.0	1.5	**218.8**
Overall	**112.7**	**42.9**	**0.3**	**197.8**

Source
Hospital Morbidity Database, 2012–2013, Canadian Institute for Health Information.

As shown in Table 15, 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 8 days and 90th percentiles of 30 and 26 days for male and female patients, respectively. Hip resurfacing patients had the shortest median LOS of only three days for both males and females. Total hip replacement median LOS was four days for both sexes.

Table 15: Length of Stay (Days) for All Hip Replacements, by Sex and Type of Procedure, Canada, 2012–2013

Type of Procedure	Males			Females			Both Sexes		
	Median	IQR	90th Percentile	Median	IQR	90th Percentile	Median	IQR	90th Percentile
Total Hip Replacement	4	2	8	4	3	10	4	3	9
Partial Hip Replacement	8	11	30	8	10	26	8	10	27
Hip Resurfacing	3	1	4	3	4	11	3	1	5
All Hip Replacements	**4**	**3**	**12**	**5**	**5**	**15**	**4**	**4**	**14**

Note
IQR: Interquartile range.
Source
Hospital Morbidity Database, 2012–2013, Canadian Institute for Health Information.

Throughout this section of the report, variations in volume, rates and LOS were observed across 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 Hospitalization Findings

In 2012–2013, there were 47,137 hospitalizations for all hip replacements, an increase of 16.5% since 2008–2009. Hospitalizations for all knee replacements increased by 21.5% over the same period, to 57,718 in 2012–2013. Most hip and knee replacements in Canada were primary procedures (90.6% and 93.3%, respectively).

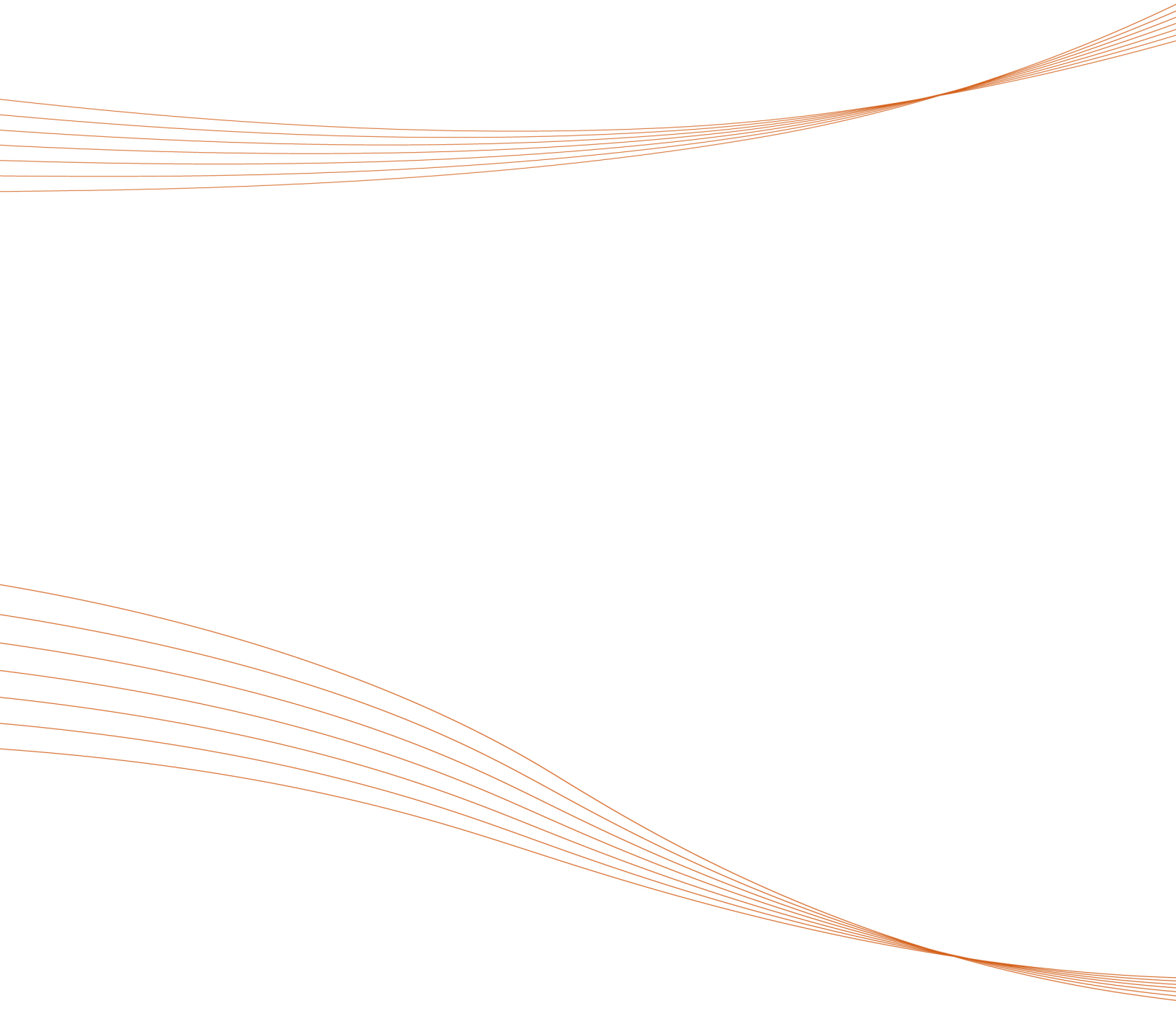
The overall pan-Canadian age-standardized rate for all hip replacements increased, from 130.1 per 100,000 population in 2008–2009 to 135.6 in 2012–2013, while the overall age-standardized rate for all knee replacements increased from 159.0 to 172.3 over the same period. In general, age-standardized rates 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 2012–2013. Saskatchewan had the highest rates of both hip replacements (181.3 per 100,000) and knee replacements (258.5 per 100,000). Quebec had the lowest age-standardized rates of hip and knee replacements in the country, at 104.2 and 124.2 per 100,000, respectively.

The highest age-specific rates for all hip replacements were among those age 85 and older for both males and females (780.7 and 1,085.1 per 100,000, respectively). The highest age-specific rates for all knee replacements, however, were among those age 75 to 84 for males and age 65 to 74 for females (687.2 and 827.5, respectively).

The median LOS in acute care for hip replacements has decreased in the five years since 2008–2009. In 2012–2013, the median LOS for both sexes combined was four days for all hip replacements and four days for all knee replacements. However, 10% of patients stayed longer than 14 days for hip replacements and longer than 7 days for knee replacements.

An in-depth analysis of hip replacement procedures found that 75.7% of hip replacements were total hip replacements, 23.2% were partial hip replacements and 1.1% were hip resurfacing procedures. There were also jurisdictional differences in age-standardized hip replacement rates by type. In 2012–2013, 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 3: Clinical and Surgical Information

Methodological Highlights

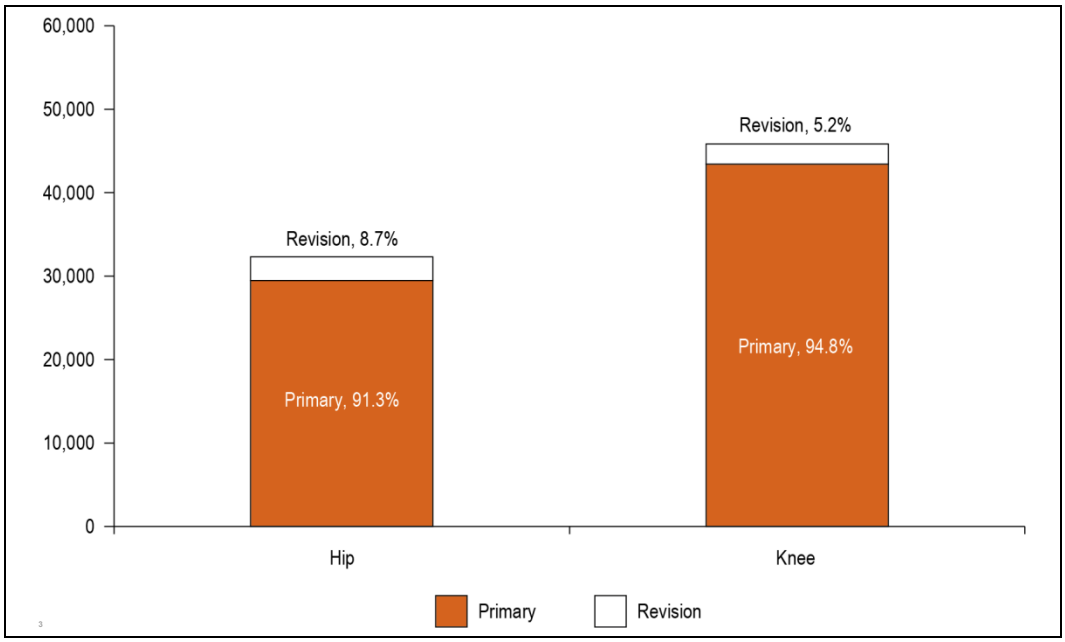
- Analyses for this chapter are based on CJRR Minimum Data Set (MDS) data for 2012–2013 and on pre-MDS data for 2008–2009 to 2011–2012.
- Up to 2011–2012, data submissions to CJRR were from orthopedic surgeons on a voluntary basis. Not all eligible surgeons participated, and participating surgeons may not have submitted all procedures. In 2011–2012, CJRR captured 42% of all joint replacement procedures performed in public acute care facilities across Canada. Beginning in 2012–2013, Ontario and British Columbia mandated reporting to the CJRR. Thus the national-level coverage rate increased to 74% for that year.
- CJRR data has been updated since previous reports. As a result, figures in this report may differ from those in previous annual reports.
- Fiscal year is defined by the date of surgery.
- 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 2012–2013, CJRR received MDS data for 32,307 hip and 45,830 knee replacements. Of the hip replacement data received, 91.3% were primary procedures and 8.7% were revisions; for knees, 94.8% were primary procedures and 5.2% were revisions (Figure 8). Data for revisions can be for first or subsequent revisions.

Figure 8: Type of Hip and Knee Replacements Captured in CJRR, 2012–2013



Notes
N = 32,307 hip replacements; N = 45,830 knee replacements.
Source
Canadian Joint Replacement Registry, 2012–2013, Canadian Institute for Health Information.

Table 16 assesses the year-over-year trend in hip replacement procedures reported to CJRR, by procedure type, as there is clinical interest in monitoring these procedures. Total hip replacements represented 83.6% of all primary hip procedures in 2012–2013 and more than 90% in prior years. Mandated reporting and more explicit CIHI coding guidelines for CJRR in 2012–2013 supported the increased submission of partial hip replacements, which may have been previously under-reported. In comparison, according to 2012–2013 HMDB data, total hip replacements accounted for 75.7% of all hip procedures.

Table 16: Primary Hip Replacements by Type of Procedure, 2008–2009 to 2012–2013

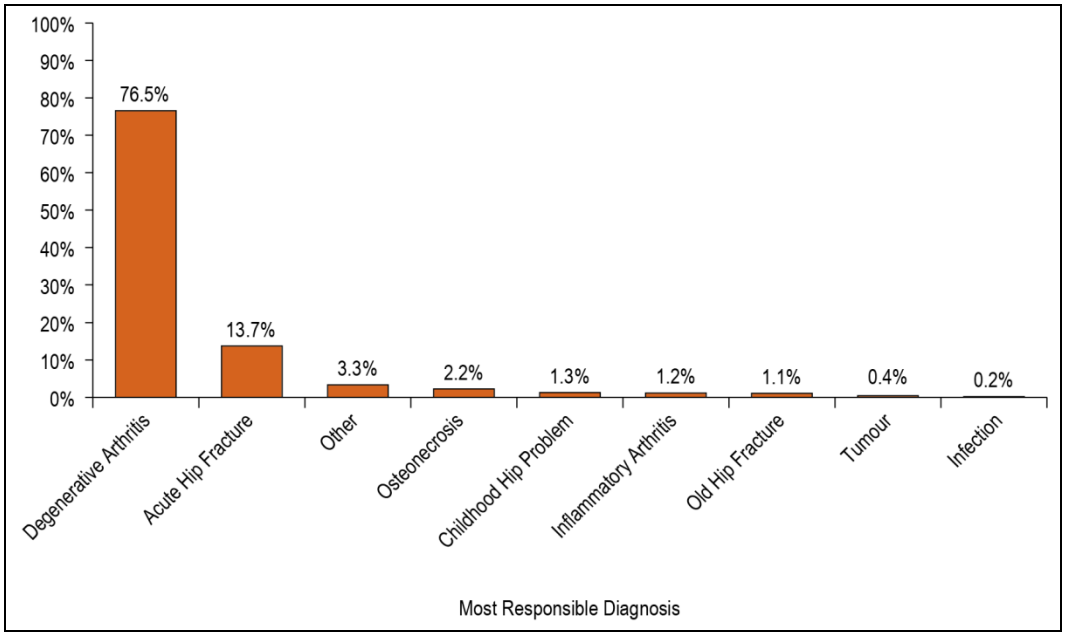
Type of Procedure	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013
Total Hip Replacement	11,486	12,586	13,494	13,890	24,515
Partial Hip Replacement	643	733	896	843	4,461
Hip Resurfacing	486	383	329	257	362
Overall	**12,615**	**13,702**	**14,719**	**14,990**	**29,338**

Note
Historical figures may differ from those reported in previous reports, due to the use of a different methodology.
Source
Canadian Joint Replacement Registry, 2008–2009 to 2012–2013, Canadian Institute for Health Information.

Most Responsible Diagnosis

For primary hip replacements, data providers were asked to record only the most responsible diagnosis grouping applicable for each procedure. Figure 9 shows that in 2012–2013, degenerative arthritis was the most common diagnosis grouping indicated by surgeons (76.5%), followed by acute hip fracture (13.7%).

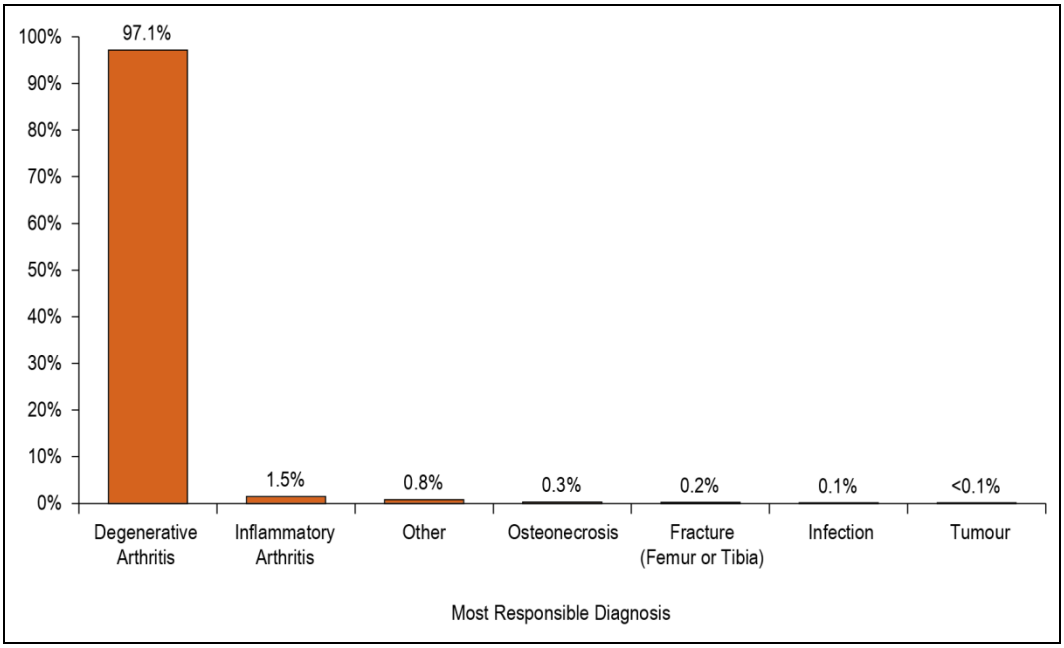
Figure 9: Most Responsible Diagnosis for Primary Hip Replacements, 2012–2013



Note
N = 29,486 primary hip replacements.
Source
Canadian Joint Replacement Registry, 2012–2013, Canadian Institute for Health Information.

Similarly, for primary knee replacements performed in 2012–2013, degenerative arthritis was the most common diagnosis grouping indicated by surgeons (97.1%) (Figure 10).

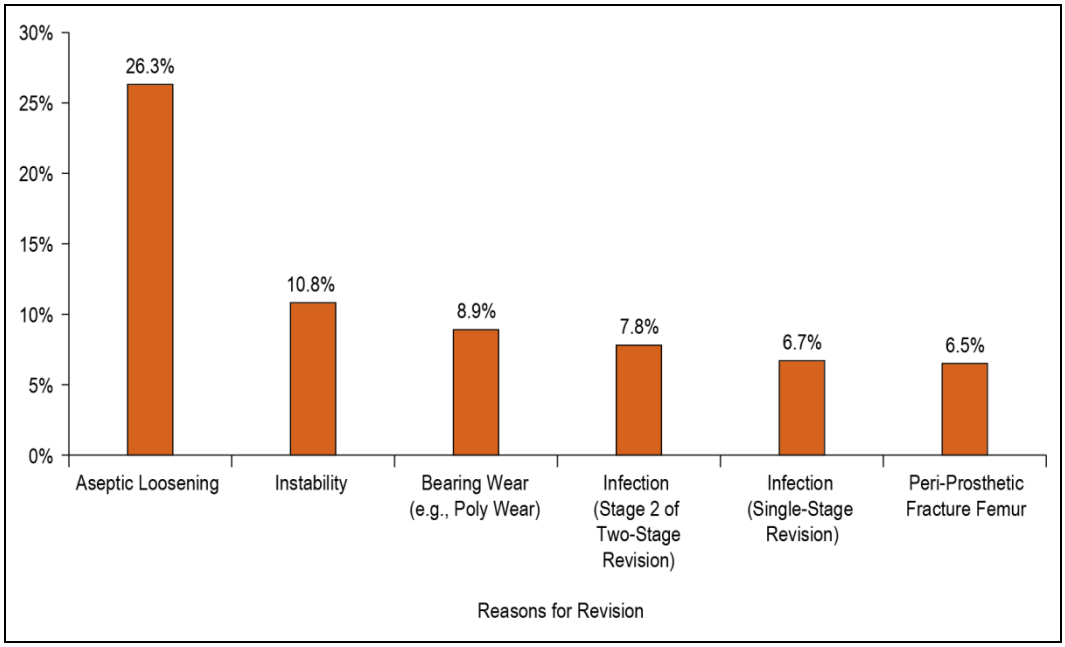
Figure 10: Most Responsible Diagnosis for Primary Knee Replacements, 2012–2013



Note
N = 43,425 primary knee replacements.
Source
Canadian Joint Replacement Registry, 2012–2013, Canadian Institute for Health Information.

Among the hip replacement revisions reported to CJRR in 2012–2013, the most common reason for revision was aseptic loosening (26.3%), followed by instability (10.8%) and bearing wear (8.9%) (Figure 11).

Figure 11: Reasons for Hip Revisions, 2012–2013



Notes

N = 2,767 revision hip replacements.

Less than 2% of records were excluded due to coding differences, as they were in pre-MDS format.

Less common reasons for hip revisions, such as osteolysis, pain of unknown origin, implant fracture, implant dissociation and leg length discrepancy, were each less than 5%.

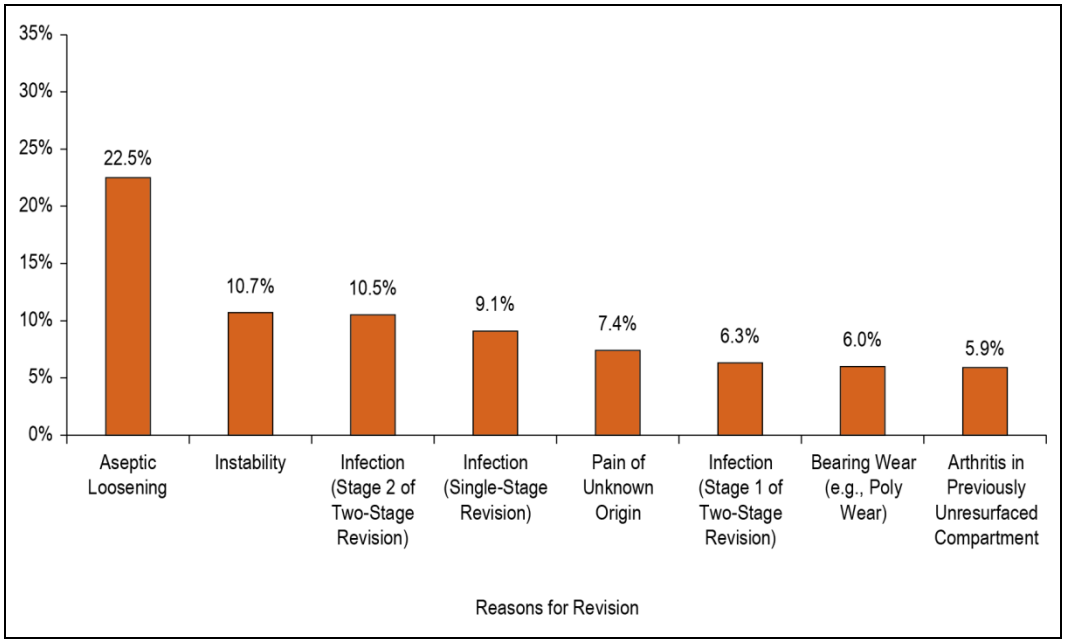
Reasons listed as “Other” accounted for 11.6%.

Source

Canadian Joint Replacement Registry, 2012–2013, Canadian Institute for Health Information.

Similarly, among the knee replacement revisions reported to CJRR in 2012–2013, the most common reason for revision was aseptic loosening (22.5%), followed by instability (10.7%) and infections (19.6%) (Figure 12).

Figure 12: Reasons for Knee Revisions, 2012–2013



Notes
N = 2,375 revision knee replacements.
Less than 2% of records were excluded due to coding differences, as they were in pre-MDS format.
Less common reasons for knee revisions, such as patella maltracking or instability, peri-prosthetic fracture, osteolysis, and implant fracture or implant dissociation, were each less than 3%.
Reasons listed as "Other" accounted for 14%.
Source
Canadian Joint Replacement Registry, 2012–2013, Canadian Institute for Health Information.

Body Mass Index

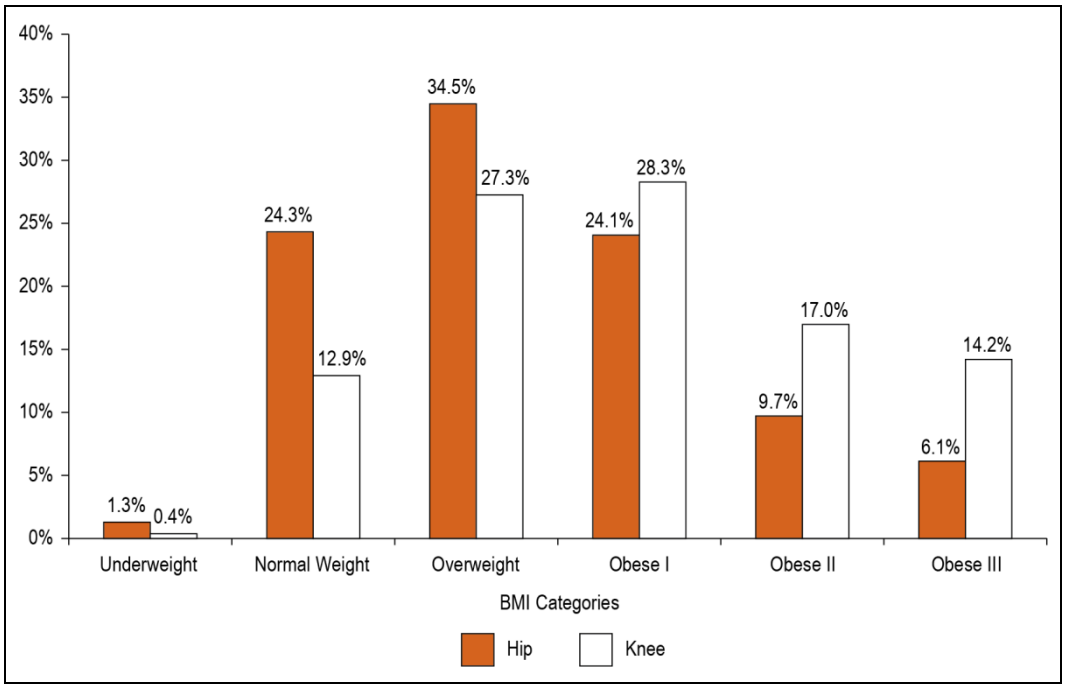
Body mass index (BMI) is calculated as weight in kilograms divided by the square of height in metres. Based on international standards citing differentiation between subgroups within the obese category, patients reported to CJRR were assigned to one of the following BMI categories:

- 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.[2]

Calculations of BMI values were available from 65.4 % (N = 11,208) of hip replacement records and 70.1% (N = 17,467) of knee replacement records in 2011–2012 data. As of 2012–2013, BMI data elements have been dropped from the CJRR MDS.

Figure 13 shows that a high proportion of both hip and knee replacement recipients in 2011–2012 were obese. Among hip replacement patients, 34.5% were classified as overweight, followed by those in the normal weight category (24.3%) and obese, class I category (24.1 %). Knee replacement patients tended to have higher BMI values. The majority of patients were classified as overweight or obese, class I (27.3% and 28.3%, respectively), followed by obese, class II (17.0%).

Figure 13: Hip and Knee Replacements in CJRR by BMI Category, 2011–2012



Notes

N = 11,208 hip replacements.

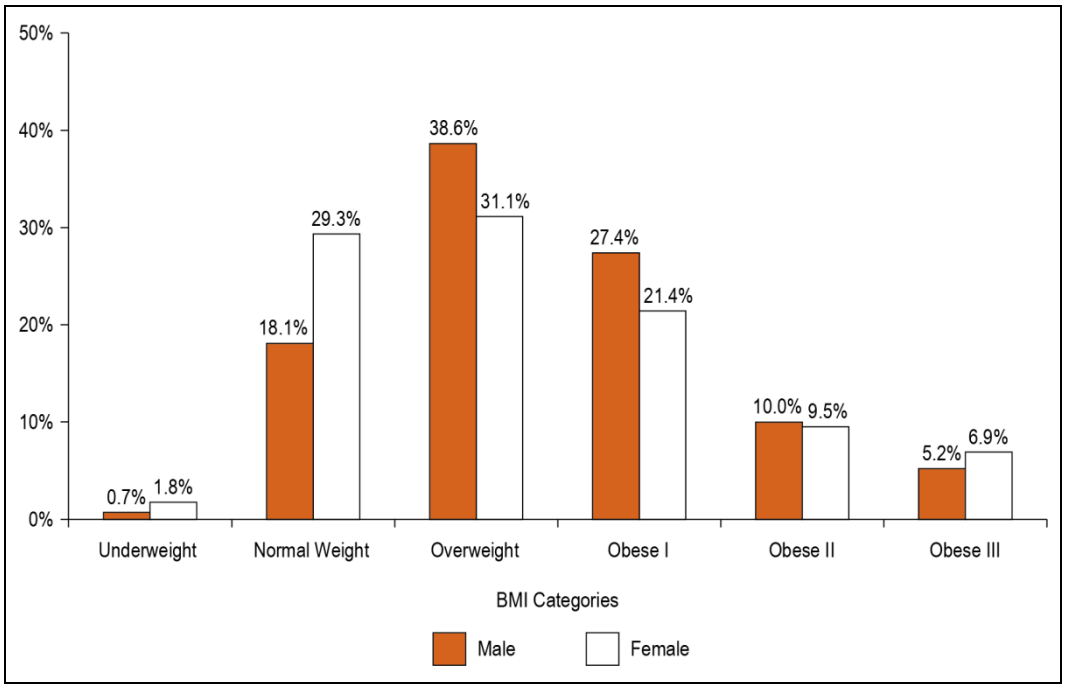
N = 17,467 knee replacements.

Sources

Canadian Joint Replacement Registry, 2011–2012, Canadian Institute for Health Information.

Looking at hip replacements only by sex (Figure 14), more males than females were categorized as overweight (38.6% versus 31.1%, respectively) and obese, class I (27.4% versus 21.4%, respectively). However, more females were categorized in the highest obesity category (obese, class III) than males (6.9% versus 5.2%, respectively).

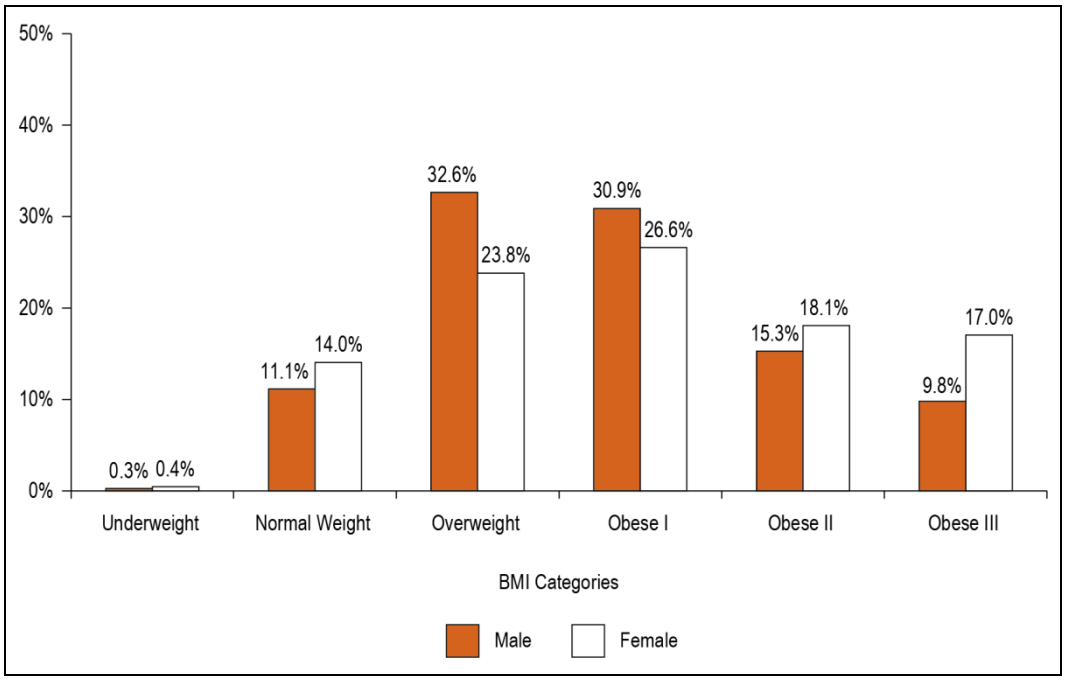
Figure 14: Sex and BMI Category for Hip Replacements, 2011–2012



Note
N = 11,208 hip replacements.
Source
Canadian Joint Replacement Registry, 2011–2012, Canadian Institute for Health Information.

Looking at knee replacements only by sex (Figure 15), again, more males than females were categorized as overweight (32.6% versus 23.8%, respectively) and obese, class I (30.9% versus 26.6%, 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 (17.0% versus 9.8%, respectively).

Figure 15: Sex and BMI Category for Knee Replacements, 2011–2012



Note
N = 17,467 knee replacements.
Source
Canadian Joint Replacement Registry, 2011–2012, Canadian Institute for Health Information.

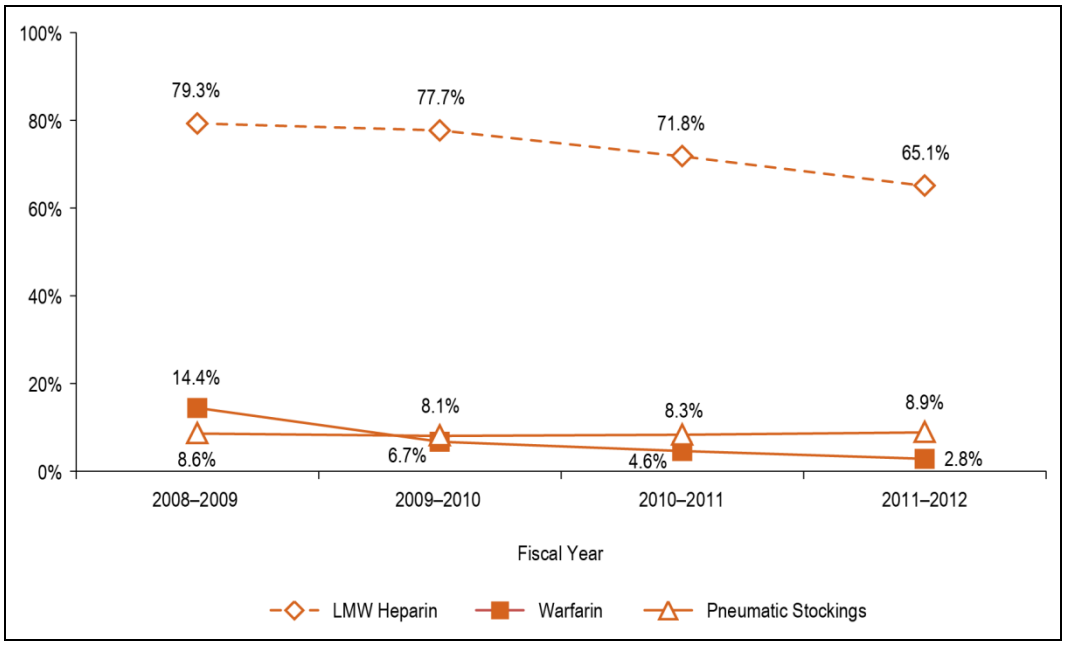
Deep Vein Thrombosis Preventive Agents Used

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 16 and 17 show the use of common DVT preventive agents in hip and knee replacements reported to CJRR between 2008–2009 and 2011–2012. This data element was dropped with the 2012–2013 implementation of the MDS.

Among hip replacements in 2011–2012, low-molecular-weight (LMW) heparin was the most commonly used DVT preventive agent (65.1%)—a decrease since 2008–2009 (79.3%). The use of warfarin has decreased as well over the four years, from 14.4% in 2008–2009 to 2.8% in 2011–2012. 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 16: Deep Vein Thrombosis Preventive Agents Used in Hip Replacements, 2008–2009 to 2011–2012



Notes

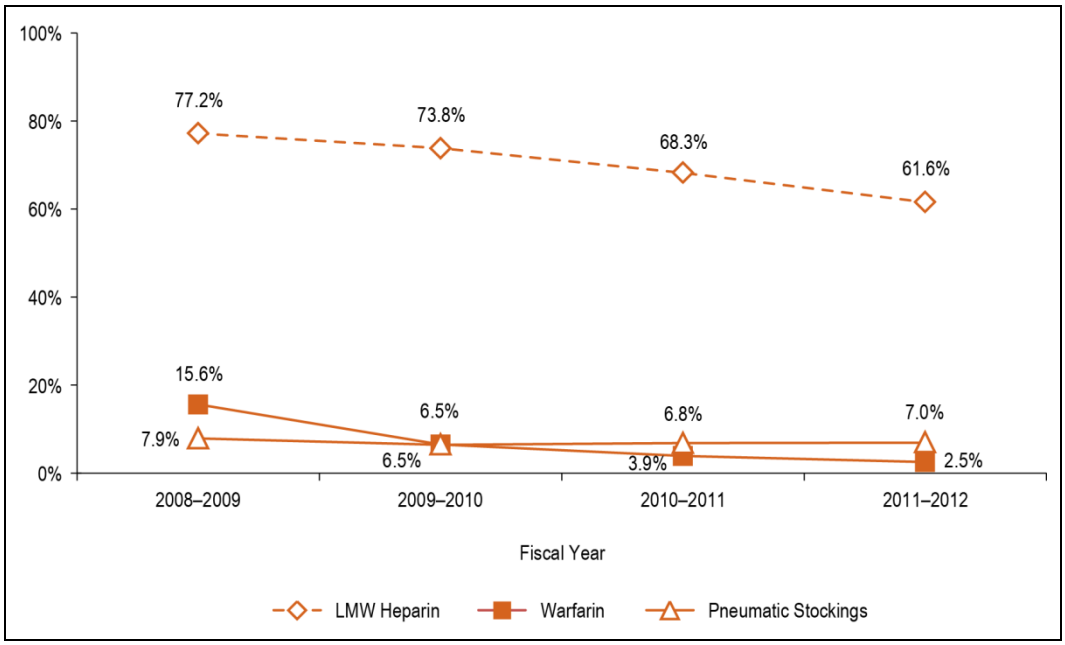
LMW: Low molecular weight.

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, 2008–2009 to 2011–2012, Canadian Institute for Health Information.

Figure 17: Deep Vein Thrombosis Preventive Agents Used in Knee Replacements, 2008–2009 to 2011–2012



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, 2008–2009 to 2011–2012, Canadian Institute for Health Information.

Similarly, among knee replacements, LMW heparin use has decreased from 77.2% in 2008–2009 to 61.6% in 2011–2012. As for hip replacements, the use of warfarin has decreased over the four years, from 15.6% in 2008–2009 to 2.5% in 2011–2012. 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

Components Replaced in Revision Procedures

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

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

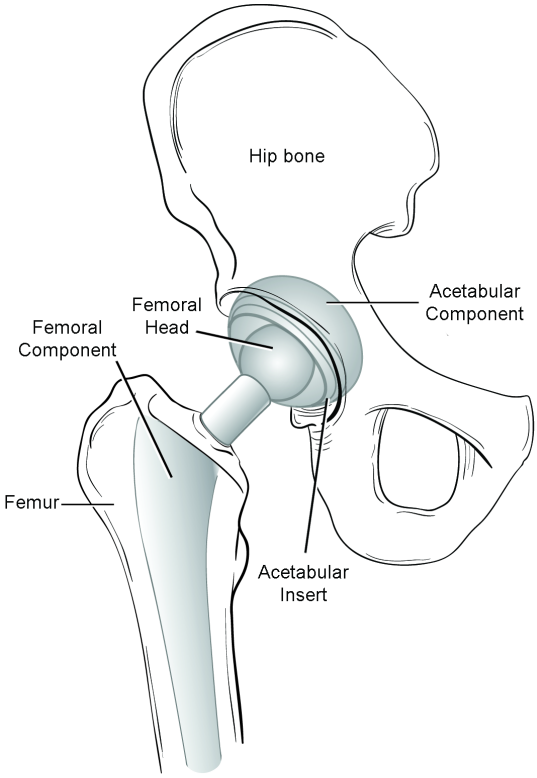


Image adapted; original image courtesy of the American Academy of Orthopaedic Surgeons.

For hip revisions reported in CJRR in 2012–2013, the femoral head was by far the most common component replaced (92.1%), while the femoral stem was the least common (50.6% of revision procedures). Acetabular components were replaced in 56.7% of reported revisions, while 76.6% of them required the acetabular liners to be changed.

Similarly, four basic components (or implant parts) are used for knee replacements: the femoral component, tibial component, tibial insert/liner and patellar component.

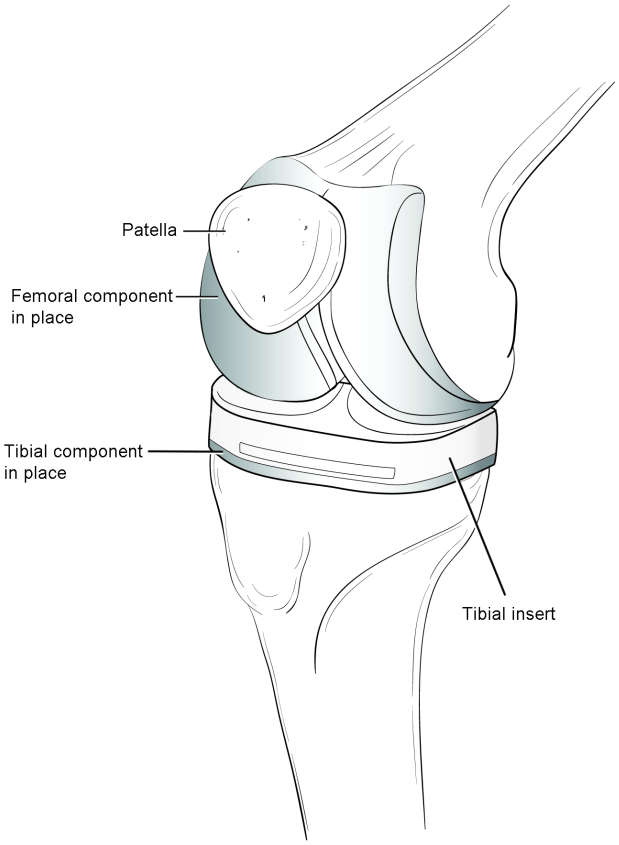


Image adapted; original image courtesy of the American Academy of Orthopaedic Surgeons.

For knee revisions reported to CJRR in 2012–2013, the tibial insert was the most common component replaced (85.7%), while the patellar component was the least common (30.4%). Also, 68.3% of femoral components and 65.7% of tibial components were replaced.

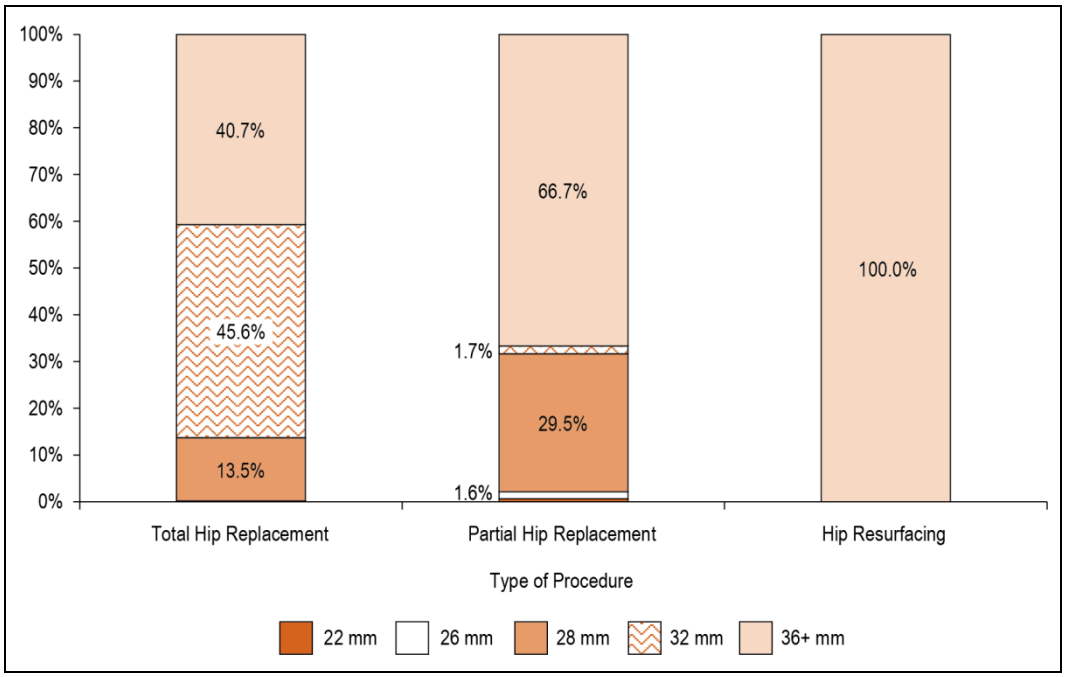
Femoral Head Size in Hip Replacements

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. In recent years a preference for use of larger-diameter heads to improve stability has been evident.[3]

Figure 18 shows the size of femoral heads used for primary hip replacements reported in 2011–2012 CJRR data; this data was not yet available for the 2012–2013 data year.

The use of various sizes differed among the types of primary hip replacement procedures (Figure 18). As expected, hip resurfacing procedures used large femoral heads. In fact, 100% of all hip resurfacing procedures in 2011–2012 reported femoral head sizes of 36+ mm. Most total hip replacements were performed using 32 mm femoral heads (45.6%), followed by 36+ mm (40.7%). Among partial hip replacements, there was more variation in femoral head size but still a tendency for larger sizes (36+ mm: 66.7%; 28 mm: 29.5%).

Figure 18: Femoral Head Size by Type of Primary Hip Replacement Procedure, 2011–2012



Source
Canadian Joint Replacement Registry, 2011–2012, Canadian Institute for Health Information.

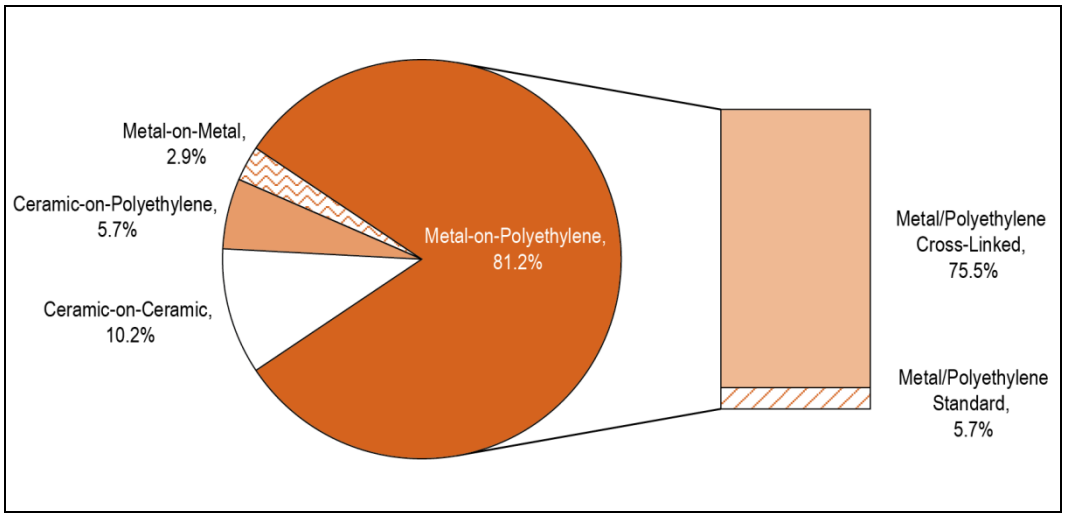
Bearing Surfaces for Hip Replacements

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.

Bearing surface materials were reported by data submitters. In 2011–2012, only 42% of procedures performed in Canada were submitted to the registry and, of these, only 73% reported information on bearing surfaces.

As seen in Figure 19, the most common bearing surface among hip replacements in 2011–2012 was metal-on-polyethylene (or plastic) (81.2%), with metal-on-cross-linked polyethylene being used in 75.5% of procedures. A metal-on-metal bearing surface combination was used in 2.9% of all hip replacements that reported bearing surface materials. The number of metal-on-metal total hip replacements increased from 2003–2004 to a peak in 2007–2008 but has since declined steadily.[4] Implant data for 2012–2013 and beyond will be reported in future annual reports, once a CJRR product information library has been fully established.

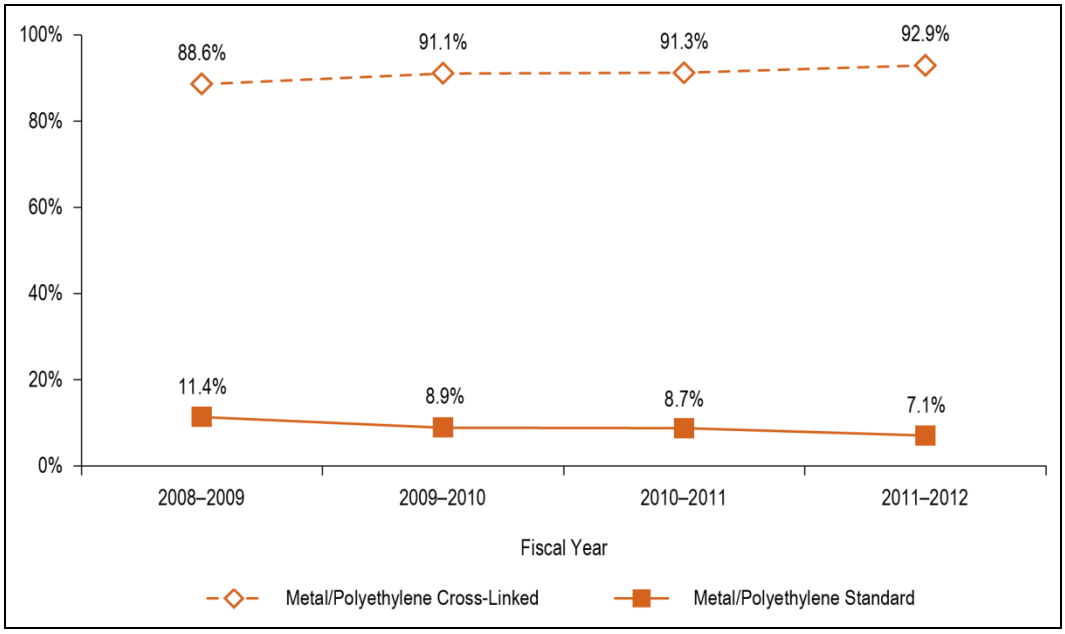
Figure 19: Bearing Surfaces for Hip Replacements, 2011–2012



Notes
N = 12,463 hip bearing surfaces.
In 2011–2012, 42% of procedures performed in Canada were submitted to the registry and, of these, 73% had information on bearing surfaces.
Bearing surfaces were as reported by data submitters.
Source
Canadian Joint Replacement Registry, 2011–2012, Canadian Institute for Health Information.

Figure 20 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 slightly, from 88.6% of all metal-on-polyethylene bearing surfaces for hip replacements in 2008–2009 to 92.9% in 2011–2012, while the use of metal-on-polyethylene standard decreased from 11.4% in 2008–2009 to 7.1% in 2011–2012.

Figure 20: Types of Metal-on-Polyethylene Bearing Surfaces for Hip Replacements, 2008–2009 to 2011–2012



Notes

The denominator for percentage calculations excludes records that have no information available on bearing surfaces. Bearing surfaces were as reported by data submitters.

Source

Canadian Joint Replacement Registry, 2008–2009 to 2011–2012, Canadian Institute for Health Information.

Table 17 presents the jurisdictional variation of the most common bearing surfaces used across Canada in 2011–2012 as reported to the registry. More than 90% of procedures from Ontario, B.C. and Saskatchewan used metal-on-polyethylene bearing surfaces. Ceramic-on-ceramic implants were reported mainly from Quebec (18.8%) and Manitoba (13.7%). Only 2.9% of 2011–2012 procedures with reported bearing surface were metal-on-metal, the majority of which were performed in Quebec.

Table 17: Bearing Surfaces for Hip Replacements, by Jurisdiction, 2011–2012

Jurisdiction	Metal-on-Polyethylene	Ceramic-on-Ceramic	Ceramic-on-Polyethylene	Metal-on-Metal
Newfoundland and Labrador	70.6%	10.5%	18.9%	0.0%
Nova Scotia	85.9%	10.7%	2.5%	0.9%
New Brunswick	77.5%	9.1%	10.2%	3.2%
Quebec	70.0%	18.8%	4.3%	7.0%
Ontario	92.9%	3.8%	3.2%	0.1%
Manitoba	72.9%	13.7%	10.2%	3.2%
Saskatchewan	91.5%	5.4%	2.8%	0.3%
Alberta	73.7%	12.9%	9.4%	4.1%
British Columbia	92.0%	3.2%	4.3%	0.5%

Notes
N = 12,463 hip bearing surfaces.
In 2011–2012, 42% of procedures performed in Canada were submitted to the registry and, of these, 73% had information on bearing surfaces.
Bearing surfaces were as reported by data submitters.
No bearing surface information was submitted for surgical procedures from Yukon or the Northwest Territories.
Calculations are based on jurisdiction where the procedure was performed.
Source
Canadian Joint Replacement Registry, 2011–2012, 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 (83.8%) in 2011–2012, followed by the hybrid method (14.8%). Use of the cementless fixation method has increased slightly over time, from 79.6% of all procedures in 2008–2009. The use of the hybrid fixation method has decreased from 19.0% in 2008–2009, while the cemented method has been fairly stable at around 1%.

For knee replacements, however, the cemented approach was by far the most common fixation method used, representing 89.1% of procedures in 2011–2012. Use of the cemented approach has been consistently high since 2008–2009. Year over year, the cementless fixation method has been the least favoured, ranging from 2.4% of all procedures in 2008–2009 to 2.9% in 2011–2012 and only 8.0% of procedures used a hybrid method.

Implant data for 2012–2013 and beyond will be reported in future annual reports, once a CJRR product information library has been fully established.

Summary of Clinical and Surgical Findings

Of the hip replacements reported to CJRR in 2012–2013, most (91.3%) were primary procedures (of which 83.6% were total hip replacements, 15.2% were partial hip replacements and 1.2% were hip resurfacing procedures), while 8.7% involved revision of the previously implanted hip joint. Among knee replacements reported to CJRR in the same year, 94.8% were primary procedures (of which 94.1% were total knee replacements) and 5.2% were revisions. This trend is similar to that seen in the HMDB data.

In 2012–2013, degenerative arthritis was indicated as the most common diagnosis grouping for both primary hip replacements (76.5%) and primary knee replacements (97.1%). The most common reason for hip and knee replacement revision was aseptic loosening, which accounted for 26.3% of hip revisions and 22.5% of knee revisions.

Just more than one-third (34.5%) of hip replacement patients fell in the overweight BMI category (BMI 25.0 to 29.9) in 2011–2012. Among knee replacement patients, almost equal proportions of patients were categorized as overweight and obese, class I (BMI 30.0 to 64.9), at 27.3% and 28.3% of all knee replacement patients, respectively.

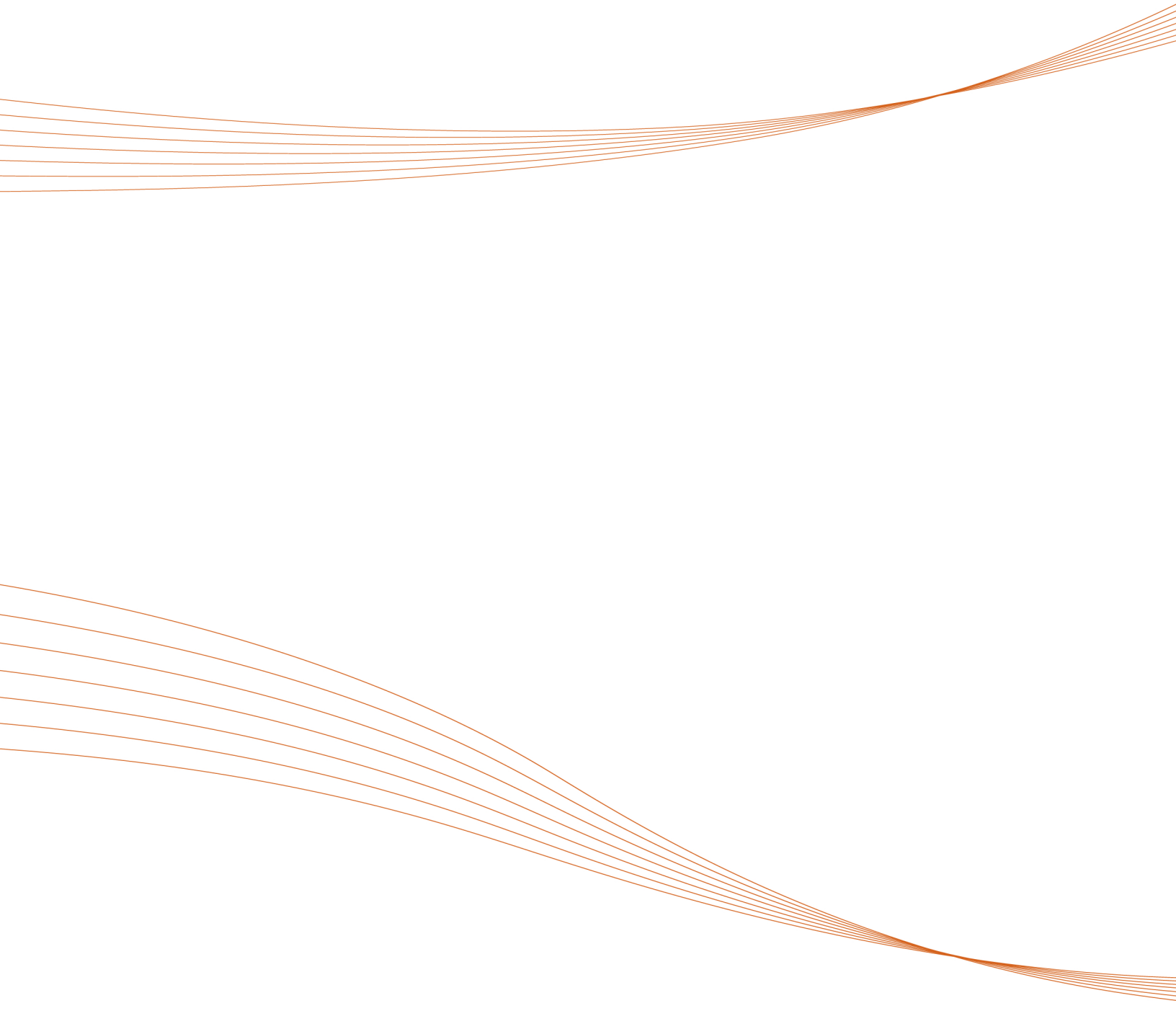
For both hip and knee replacements, LMW heparin was the most commonly used DVT preventive agent, with 65.1% of hip replacement recipients and 61.6% of knee replacement recipients receiving the agent in 2011–2012.

In 2012–2013, the most commonly replaced component in hip replacement revision procedures was the femoral head, contributing to more than 92.1% of revisions. The most commonly replaced component in revision knee replacements in 2012–2013 was the tibial insert, which was involved in 85.7% of procedures.

More than 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 2.9% of all hip replacements in CJRR in 2011–2012.

In 2011–2012, the use of various sizes of femoral heads differed among the types of primary hip replacements. The majority of total hip replacements were performed using 32 mm femoral heads (45.6%). Sizes 36 mm and larger were used in 100% of resurfacing procedures, in 66.7% of partial procedures and in 40.7% of total hip procedures.

Data from 2011–2012 shows that more than 80% of hip replacements used a cementless fixation method and that close to 90% of knee replacements were performed using a cemented fixation method.

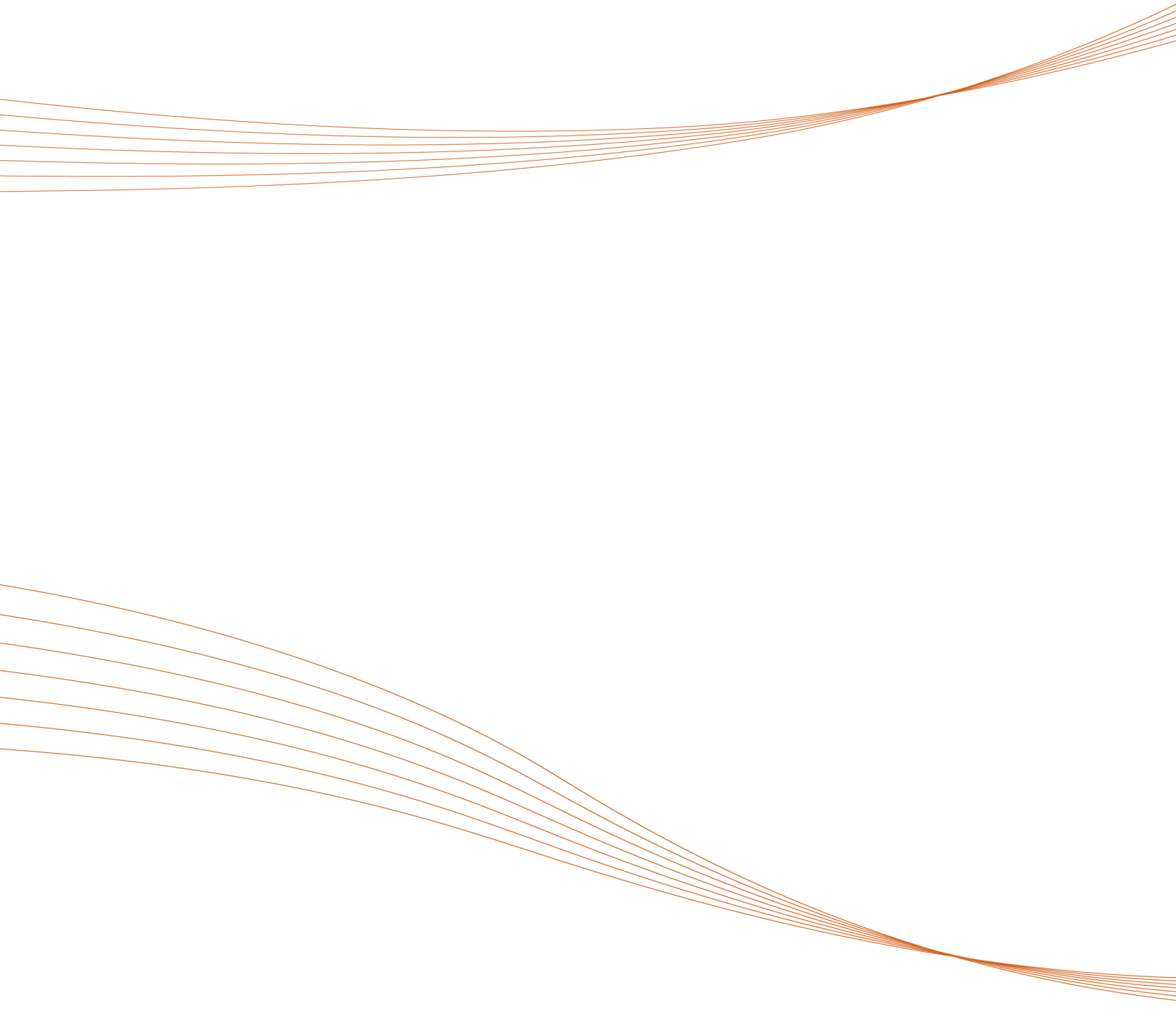


Chapter 4: Future Directions

CJRR continues to undergo significant changes to improve its ability to contribute to quality and outcome improvements for Canadians who have hip or knee replacements.

- CJRR continues to work in collaboration with key policy-makers and orthopedic surgeons in other jurisdictions to further encourage mandated reporting to CJRR.
- CJRR has adopted fully electronic data collection. As of 2013–2014, paper data collection forms are no longer accepted. CJRR can receive data one of two ways: via electronic files or through the CJRR's web-based data entry tool.
- As of 2013–2014, the registry is able to receive scanned implant barcodes. Barcode scanning is reducing the possible data entry errors as well as the effort needed to capture the medical device information.
- With product characteristics no longer being captured in the MDS, the CJRR program team is developing an internal product information library to enable efficient identification of implant characteristics from product number information collected based on product catalogue numbers. Accurate and timely product information from manufacturers is required to support this goal.

As the number of hip and knee replacement procedures continues to rise and the implants and surgical techniques used continue to evolve, CJRR data will be even more important for understanding related health outcomes from clinical, administrative and policy perspectives.



Appendices

Appendix A: CJRR Advisory Committee

- Dr. Eric Bohm (Chair), Concordia Joint Replacement Group, Department of Surgery, University of Manitoba
- Dr. Michael Dunbar (Co-Chair), Queen Elizabeth II Health Sciences Centre, Nova Scotia
- Ms. Alison Bartel, Nursing Representative, Concordia Hospital, Manitoba
- Mr. Dave Brar, British Columbia Ministry of Health
- Ms. Brie DeMone, Manitoba Health
- Ms. Kathryn Doresco, Ontario Ministry of Health and Long-Term Care
- Dr. Martin Lavigne, Hôpital Maisonneuve-Rosemont, Quebec
- Dr. Brendan Lewis, Western Memorial Regional Hospital, Newfoundland and Labrador
- Dr. Olga Huk, Hôpital général juif Sir Mortimer B. Davis, Quebec
- Dr. Darren Kerr, Saint John Regional Hospital, New Brunswick
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Appendix B: Methodological Notes, HMDB

Hospitalization Information

Chapter 2 of this report presents data from the HMDB. The figures and tables provide data on hospitalizations for hip and knee replacements (primary and revision, elective and urgent procedures) performed in acute care hospitals in Canada, based on discharges from April 1, 2008, to March 31, 2013.

Counts reported were based on the number of hospitalizations, not the number of procedures. A hospitalization may include more than one joint replacement procedure. Procedures coded as "abandoned" were excluded from the analyses. Procedures coded as being performed out of hospital were also excluded to avoid double-counting.

With the exception of length-of-stay analyses, provincial analyses in this chapter 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. Patients with invalid postal codes or unknown residence were excluded from provincial analyses as well as from national counts, where indicated.

For the calculation of age-standardized rates, national and provincial fiscal population estimates were used based on July 1 estimates of the given fiscal year, as provided by Statistics Canada. The 1991 Canadian population was used as the standard population. The number of hospitalizations used for rate calculations includes both total and partial replacements for patients age 20 and older. The age restriction is a methodological change from previously published CJRR reports. The new methodology was consistently applied across presented time trends; therefore, counts and rates will differ from previously published ones.

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

Hip and Knee Replacement Coding in HMDB

Canadian Classification of Health Interventions (CCI) codes were used to identify hip and knee replacements from 2008–2009 to 2012–2013.

As of 2006–2007, all provinces and territories have adopted the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Canada* and the *Canadian Classification of Health Interventions* (ICD-10-CA/CCI) as the coding standard for diagnoses and interventions. Data from 2008–2009 used version 2006 of ICD-10-CA/CCI, data from 2009–2010 to 2011–2012 used version 2009 of ICD-10-CA/CCI, and data from 2012–2013 onward uses version 2012.

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. Starting with version 2009, CCI codes allowed hip resurfacing procedures to be identified using the Extent Attribute code (Extent Attribute = 02 in version 2009 and Extent Attribute = RE in version 2012). 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
—	Cement spacer (temporary, impregnated with antibiotics)	—	—	—	1.VA.53.LA-SL-N	—
Robotics-Assisted Approach (e.g., Telemanipulation of Tools) [Discontinued as of version 2012]						
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.

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 [patella only]	1.VP.53.LA-PM-N	1.VP.53.LA-PM
[New as of version 2012] Dual component [patellofemoral]	1.VP.53.LA-PN-N	1.VP.53.LA-PN

Notes

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:

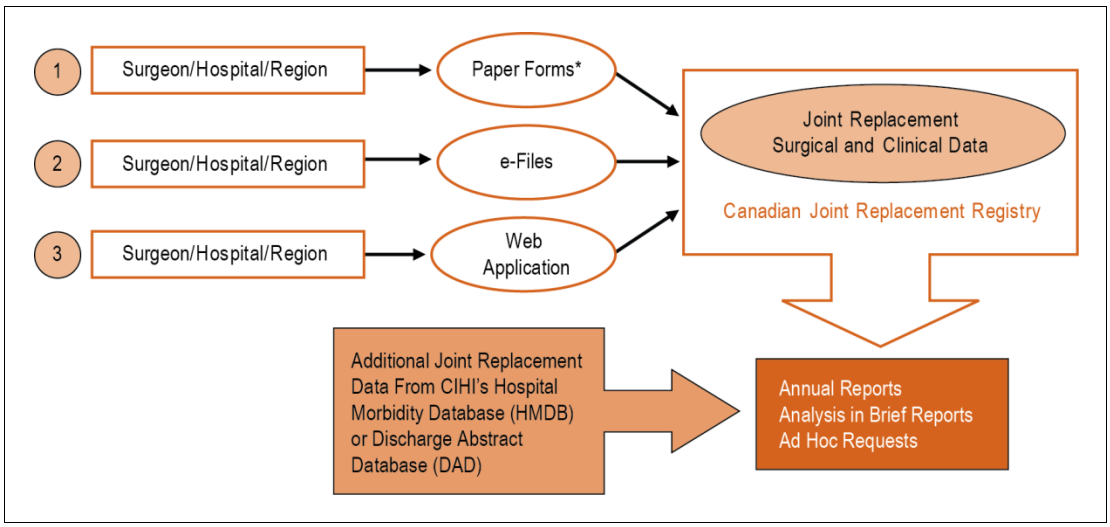
Patellaplasty, using prosthetic implant device
Replacement, patella (only), using prosthetic device
Replacement, patellofemoral (only), using prosthetic device

Appendix C: Methodological Notes, CJRR

Clinical and Surgical Information

Chapter 3 of this report presents data based on CJRR. The flow of data collection in CJRR is shown in Figure C-1. In 2012–2013, data was submitted to the database in one of three ways: electronic file submissions, web-based data submissions or paper data collection forms. As of 2013–2014, paper data collection forms are no longer accepted.

Figure C-1: Canadian Joint Replacement Registry Data Flow Diagram, 2012–2013



Note
*As of April 1, 2013, paper data collection forms are no longer accepted.
Source
Canadian Institute for Health Information.

The figures and tables in Chapter 3 provide data on clinical and surgical details for hip and knee replacements (primary and revision procedures), based on surgery dates from April 1, 2008, to March 31, 2013, with the main focus on the latter fiscal year (April 1, 2012, to March 31, 2013). However, for statistics where MDS 2012–2013 data was not available, 2011–2012 data was used instead.

Counts reported for CJRR are counted by the number of procedures. A bilateral procedure counts as two procedures in CJRR. In a few specified instances, records were excluded from analyses because of coding differences. The CJRR transitioned to a new MDS standard as of 2012–2013; with this transition, 846 records were submitted using the old standard, which could not be completely mapped to the MDS.

Table C-1 presents CJRR coverage estimates compared with the HMDB for 2011–2012 and 2012–2013. Note the following considerations:

- CJRR data is based on date of surgery, whereas HMDB data is based on discharge date. However, for comparative purposes, the impact is estimated to be minimal.
- CJRR accepts data from any participating facility, including ambulatory and privately funded institutions. Data from private facilities was excluded from the analysis. The HMDB reports on procedures from public acute care facilities only.

For more information, please see *Data Quality Documentation for Users: Canadian Joint Replacement Registry, 2012–2013* on CJRR's web page, at www.cihi.ca/cjrr.

Table C-1: Hip and Knee Replacements in CJRR as a Percentage of HMDB

Jurisdiction	Number of Procedures Submitted to CJRR* in 2012–2013	Number of Procedures Expected in CJRR† in 2012–2013	2012–2013 Coverage	2011–2012 Coverage
Newfoundland and Labrador	765	1,720	44.5%	30.9%
Prince Edward Island	0	562	0.0%	0.0%
Nova Scotia	2,182	3,405	64.1%	77.6%
New Brunswick	2,149	2,624	81.9%	76.7%
Quebec	8,422	19,473	43.2%	47.4%
Ontario‡	39,669	43,966	90.2%	21.8%
Manitoba‡	3,469	4,055	85.5%	88.3%
Saskatchewan	3,418	4,404	77.6%	78.0%
Alberta	7,428	11,452	64.9%	59.5%
British Columbia‡	10,449	14,363	72.7%	43.0%
Territories§	35	84	41.7%	19.4%
Canada	**77,986**	**106,108**	**73.5%**	**41.5%**

Notes

* Excludes procedures done in private facilities.

† Sourced from HMDB, reporting number of hospitalizations rather than procedures. Bilateral procedures were counted as two separate procedures to be consistent with CJRR.

‡ As of 2012–2013, Ontario and B.C. mandated CJRR data submission. Manitoba mandated CJRR submissions as of 2011–2012 but included paper submissions. As of 2013–2014, the province mandated submissions on an electronic basis.

§ Territories include Yukon and the Northwest Territories. No hip or knee procedures were performed in Nunavut.

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

Sources

Hospital Morbidity Database and Canadian Joint Replacement Registry, 2011–2012 and 2012–2013, Canadian Institute for Health Information.

Hip and Knee Replacement Coding in CJRR

Throughout Chapter 3, the type of joint replacement procedure was determined based on information provided by the data supplier and on whether specific components were used during the procedure. The coding methodology for each type of joint replacement is described in Table C-2.

Table C-2: CJRR Coding Methodology for Primary Hip and Knee Replacements

Joint Type	Procedure Type	CJRR Data Standard	
		Pre-MDS (Until 2011–2012)	MDS (2012–2013 Onward)
Hip	Partial Hip Replacement	Identified as hemiarthroplasty by the data submitter	Identified as such by the data submitter
	Hip Resurfacing	Identified through femoral head and acetabular component catalogue numbers	Identified as such by the data submitter
	Total Hip Replacement	Not otherwise identified as partial or resurfacing hip replacement AND At least one of the femoral components or femoral heads **and** at least one of the acetabular components or acetabular liner are used	Identified as such by the data submitter
Knee	Partial Knee Replacement	Identified as unicompartmental arthroplasty by the data submitter	Identified as such by the data submitter
	Total Knee Replacement	Not otherwise identified as partial replacement AND A femoral component, a tibial component and a patellar component are used	Identified as such by the data submitter

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 = body weight in kilograms ／ 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 arthritis

Degenerative arthritis 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 (e.g., 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 implant. 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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