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Hip and Knee Replacements in Canada

2008–2009 Annual Report

Canadian Joint Replacement Registry (CJRR)



Canadian Institute
for Health Information

Institut canadien
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Hip and Knee Replacements in Canada Canadian Joint Replacement Registry (CJRR) 2008–2009 Annual Report

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Executive Summary

The purpose of the *Hip and Knee Replacements in Canada—Canadian Joint Replacement Registry 2008–2009 Annual Report* is to characterize hip and knee replacement procedures performed in Canada according to their epidemiology and by selected clinical and surgical parameters. The report also presents overall volumes and trends over time.

The information presented in this report is derived from three data holdings within the Canadian Institute for Health Information (CIHI): the Hospital Morbidity Database (HMDB) and the Discharge Abstract Database (DAD) (see Appendix B) and the Canadian Joint Replacement Registry (CJRR). HMDB and DAD are pan-Canadian databases that capture a finite set of administrative, clinical and demographic information on hospital inpatient events, including joint replacement procedures and revisions. They also provide national discharge statistics from Canadian health care facilities by diagnoses and procedures. CJRR is a pan-Canadian registry that collects additional and more detailed patient, clinical and surgical information on a subset of the hip and knee replacement procedures reported in HMDB and DAD.

HMDB and DAD, coupled with CJRR, help provide a comprehensive pan-Canadian overview of hip and knee replacements. Of the 72,469 (including Quebec data for 2005–2006) hip and knee replacements performed in hospital in 2006–2007, additional detailed information on 29,708 of them, or 41%, was captured in CJRR.

Hip and knee replacement procedures are undertaken as a treatment when patients are experiencing severe pain and limited mobility. The surgery provides a relatively low-risk intervention that can provide significant relief of pain and disability by enabling the new joint to move normally. This usually results in considerable improvement in a patient's functional status and quality of life.

For 2006–2007, there were 62,196 hospitalizations for hip (24,253) and knee (37,943) replacements performed across Canada; this figure does not include information from Quebec, as data were not available at the time of publication. The 2006–2007 figure represents a 10-year increase of 101% and a 6% annual increase. The median length of stay (LOS) was five days for patients undergoing hip replacements and four days for patients undergoing knee replacements. The length of stay for both procedures decreased considerably over the last decade.

The majority of Canadians receiving a joint replacement in 2006–2007 were 65 or older (63% for hip and 64% for knee). When age–sex-specific rates for joint replacements were examined, the most notable increases for knee replacement in the last decade occurred in the 45-to-54 age group (more than doubled for both males and females). The largest increase in the absolute number for males was noted in the 65-to-74 age group (2,644), followed by the 55-to-64 age group (2,595); the largest increase in the absolute number for females was observed in the 55-to-64 age group (4,581), followed by the 65-to-74 age group (3,707). For hip replacement procedures, the greatest age–sex-specific rate increase for males (76%) was seen in the 45-to-54 age group, while the greatest rate increase for females (36%) was seen in the 85 and older age group. The largest increase in the absolute number for males was noted in the

55-to-64 age group (1,233), and the largest increase for females was observed in the 75-to-84 age group (1,561), followed by the 55-to-64 age group (1,336). Osteoarthritis was the most prevalent diagnosis for hip/knee replacements.

Joint replacement procedures are one of the five priority areas targeted federally for meaningful reductions in wait times. As a mechanism to inform these efforts, as of April 1, 2005, CJRR began collecting data related to wait times as part of a broader CIHI initiative to collect and report on wait times for joint replacement based on patients who have already received the procedures. Wait times were submitted for 62% of the cases in CJRR in 2006–2007, up from 46% in 2005–2006. Analysis shows that wait times for patients who received hip replacements (median wait of 127 days) were significantly shorter than for those who received knee replacements (median wait of 169 days). Wait times for hip and knee replacement revisions were significantly shorter than those for primary hip and knee replacements. Compared to last year, the wait time for patients who underwent hip replacements did not change, while the wait time for patients who underwent knee replacements was 13 days shorter (median wait time of 169 days versus 182 days).

A high proportion of both hip and knee replacement patients in 2006–2007 were obese, as measured by body mass index (BMI), compared to the distribution of the Canadian population. Knee replacement recipients were found to be more overweight or obese than hip replacement recipients. The 2006–2007 findings are consistent with those from 2005–2006.

There is an increasing trend in the number of hip resurfacing replacements reported to CJRR and an increasing trend of minimally invasive surgery used for both hip and knee replacement procedures over the past four years. The use of larger femoral heads (≥ 32 millimetres) increased for both primary and revision hip replacement procedures since 2003–2004. The most common bearing surface was metal-on-plastic for hip replacements (78%). Cobalt chrome/cross-linked polyethylene was used more frequently than cobalt chrome/polyethylene standard, from 45% in 2002–2003 to 76% in 2006–2007. Bone graft femur use decreased from 28% in 2003–2004 to 14% in 2006–2007 for hip revision procedures, and from 17% in 2003–2004 to 8% in 2006–2007 for knee revision procedures.

Printed copies of the 2008–2009 report can be purchased through the CIHI Order Desk at www.cihi.ca. Electronic copies of the annual report, media advisory and recent bulletins can be downloaded free of charge from the CJRR website (www.cihi.ca/cjrr). Queries regarding this report may be sent by email to cjrr@cihi.ca.

Introduction

Osteoarthritis and related conditions comprise a large group of disorders affecting the joints, ligaments, tendons, bones and other components of the musculoskeletal system. These conditions are highly prevalent and are major causes of morbidity, disability (loss of productivity of persons with illness) and health care utilization.¹

Hip and knee replacements provide a viable treatment option for arthritis; the procedures are a means of improving quality of life by reducing chronic pain and increasing the ability to function independently.^{1,2} Successful replacement of deteriorated, arthritic and severely injured hips has contributed to enhanced mobility and comfortable, independent living for many people who would otherwise be substantially disabled.³

The purpose of this report is to characterize overall activity and epidemiologic characteristics of hip and knee replacement procedures performed in Canada, and to describe them according to person (patient demographics), place (by jurisdiction and pan-Canadian) and trends over time by using selected clinical and surgical parameters from the Hospital Morbidity Database (HMDB), Discharge Abstract Database (DAD) and Canadian Joint Replacement Registry (CJRR).

About the Canadian Joint Replacement Registry

CJRR is a pan-Canadian information system for hip and knee replacement operations with a mandate to record and analyze the level of activity, clinical parameters and outcomes of primary and revision hip and knee replacement operations over time. CJRR was developed through a joint effort between the Canadian Institute for Health Information (CIHI) and orthopedic surgeons in Canada.

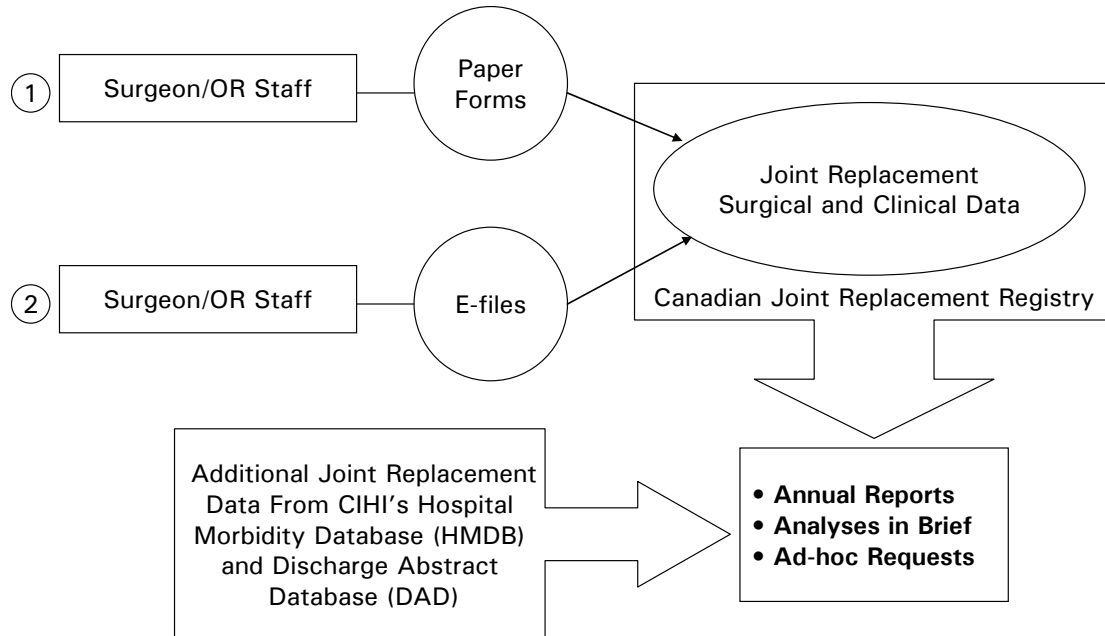
CIHI captures administrative and demographic information on all procedures performed in hospitals across Canada, including hip and knee joint replacements and revisions, through HMDB and DAD. HMDB and DAD also provide national discharge statistics from Canadian health care facilities by diagnoses and procedures. CJRR was developed to provide a rich set of additional patient, clinical and surgical information beyond what is captured in HMDB and DAD to enable more in-depth analysis of hip and knee replacements and revisions. The goal of CJRR is to provide information designed to help improve the quality of care and clinical outcomes of joint replacement recipients.

CIHI and orthopedic surgeons from each jurisdiction, who were working under the auspices of the Canadian Orthopedic Association and the Canadian Orthopedic Foundation, have upheld this initiative. A number of other key partners contributed to the successful development and implementation of CJRR, including orthopedic patients, the Arthritis Society and federal, provincial and territorial ministries of health.

Data Collection and Flow

The flow of data collection in CJRR is shown in Figure 1. Data are currently obtained from either paper data collection forms or electronic file submissions.

Figure 1 Canadian Joint Replacement Registry Data Flow Diagram



Surgeons who contribute data directly to CJRR submit standardized paper data collection forms. The surgeon and/or designated staff completes a two-page data collection form, which is submitted to CJRR. The data collection form captures patient demographics and clinical and surgical information.

Electronic data submission is another mode of transmitting data to CJRR. In 2006–2007, four facilities submitted data to CJRR electronically, which were then incorporated into the CJRR database. A web-based data capture application is being launched in 2009 to further increase the volume of CJRR data being submitted electronically.

Standardized edit checks are applied to all data submitted to CJRR. These checks flag data elements that do not meet criteria for logic, value range and/or completeness. A record is classified as complete only if it successfully passes all edit checks. Erroneous data are referred back to their source for review and correction.

Privacy and Confidentiality

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

CJRR Surgeon Participation

CJRR is a voluntary registry, with surgeons participating from across Canada. Surgeons are considered to be participating if they submitted data to or registered with CJRR.

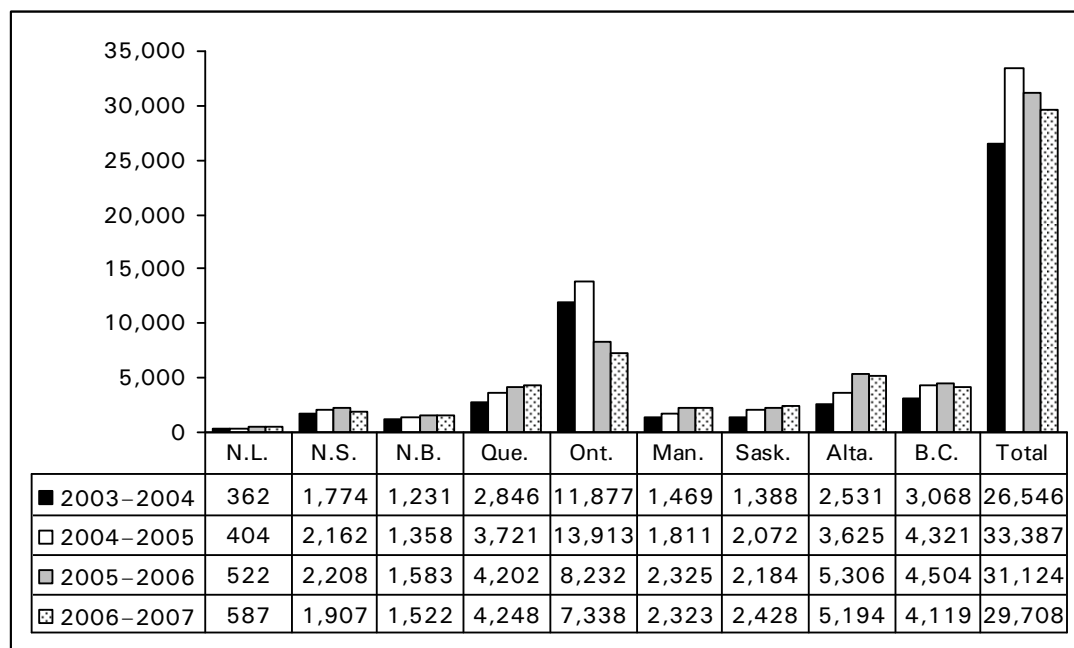
Participating surgeons earn continuing professional development (CPD) credits by submitting operative data to CJRR. Submission of six completed data collection forms to CIHI earns each surgeon one credit under activities outlined in Section 6 (Educational Development, Teaching and Research) of the CPD Framework of the Maintenance of Certification Program.

Joint Replacement Cases Reported to CJRR

As mentioned previously, HMDB and DAD capture administrative, clinical and demographic information on all joint replacement procedures performed in hospitals. CJRR, which is voluntary, provides a rich set of additional patient, clinical and surgical information to enable more in-depth analysis. Currently, CJRR captures additional information on 41% of the approximately 70,000 hip and knee replacements and revisions that were done in Canada in 2006–2007 (including Quebec).

Figure 2 summarizes CJRR participation by jurisdiction and shows how it changed over time. Overall, in 2006–2007, some 29,708 cases were submitted to CJRR, a 12% increase over 2003–2004. By jurisdiction, from 2003–2004 to 2006–2007, data submissions increased considerably for Alberta (+105%), Manitoba (+58%) and Quebec (+49%), followed by the rest of the jurisdictions. Over the same period, there was a 38% decrease for Ontario, largely related to a transition following the end of the Ontario Joint Replacement Registry in October 2005. Increased capture of hip and knee replacement procedures performed in Canada is a priority for CJRR.

Figure 2 Hip and Knee Replacement Procedures Submitted to CJRR Across Jurisdictions, 2003–2004 to 2006–2007



Note

The Northwest Territories and Prince Edward Island each had fewer than five surgeons submitting data to CJRR in 2006–2007.

Source

Canadian Joint Replacement Registry, 2006–2007, Canadian Institute for Health Information.

Methodological Notes

Data in the two main sections that make up this report arise from three sources. The use of these databases provides a unique opportunity to look at hip and knee replacement procedures in Canada from administrative and clinical perspectives.

The Hospitalization Statistics section contains data from HMDB and DAD, pan-Canadian databases that capture administrative, clinical and demographic information on hospital discharges, including all hip and knee replacements and revisions, from acute care Canadian facilities.

Data in the Surgical and Clinical Characteristics section come from CJRR, a pan-Canadian registry that collects and analyzes additional patient, clinical and surgical information on a subset of the primary and revision hip and knee replacement operations performed in Canada. As mentioned, additional information on some 41% of cases in HMDB and DAD were submitted to CJRR in 2006–2007.

Appendices B and D provide the methodology used and methodological notes for both the Hospitalization Statistics and Surgical and Clinical Characteristics sections of the annual report. Appendix C is an analysis of how well CJRR cases represent the overall population of hip and knee replacement patients in Canada, as captured in HMDB and DAD. Appendix E presents the definitions of hip and knee replacements as employed in CJRR. Appendix F provides a glossary of terms used throughout the report. All analyses were conducted using the SAS (version 9.1.3, Cary, North Carolina) statistical software package.

Hospitalization Statistics

Methodological Notes

- Analyses for this section are based on HMDB and DAD.
- Please refer to Appendix B for methodological detail pertaining to these databases and data.
- Quebec data were not included in this section due to a lack of availability to CIHI at time of publishing.

This section provides information on hospitalization rates of Canadians who underwent hip and knee replacements in 2006–2007, as well as information on historical trends at the pan-Canadian and provincial/territorial levels. It reports on patient jurisdiction of residence (not jurisdiction of treatment). Patient demographics, along with the hospitalization LOS, are also included.

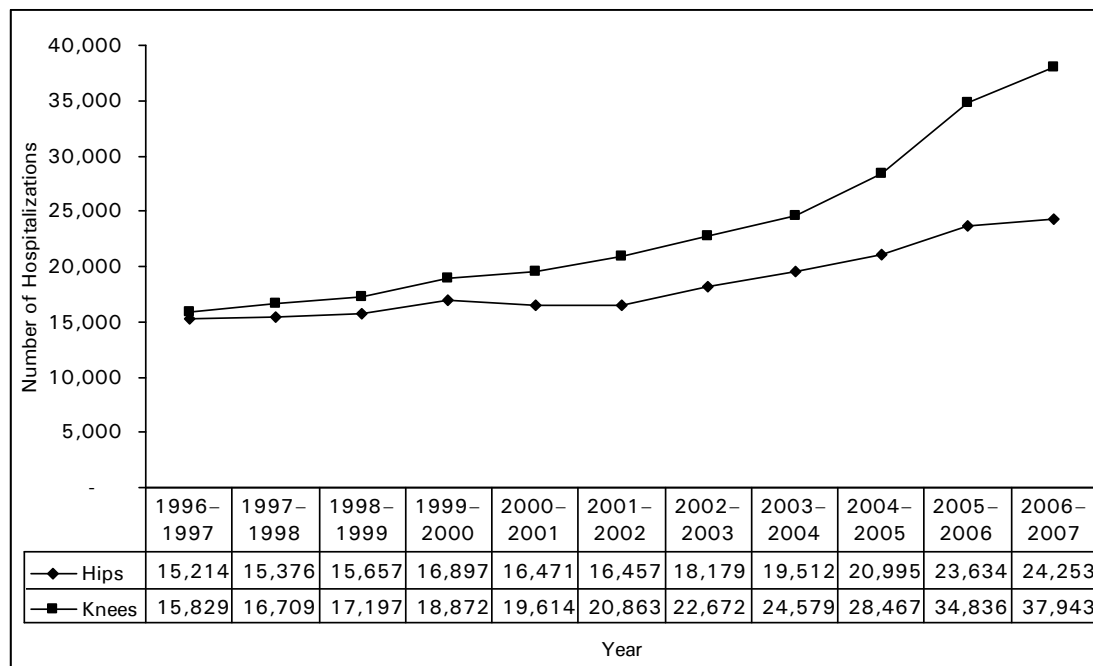
Pan-Canadian Overview of Hip and Knee Replacements

In 2006–2007, there were 62,196 hospitalizations for hip and knee replacements in Canada, not including Quebec. This figure represents a 10-year increase of 101%, from 31,043 procedures in 1996–1997, and a one-year increase of 6%, from 58,470 procedures in 2005–2006. This one-year increase is less than that observed in the previous year (2005–2006), where the one-year increase was 17%.

In 1996–1997, the number of knee replacements slightly exceeded the number of hip replacements in Canada, not including Quebec (15,829 versus 15,214 operations, respectively). Since then, the number of knee replacements has increased at a pace greater than that of hip replacements (Figure 3).

In 2006–2007, there were 37,943 hospitalizations for knee replacements and 24,253 hospitalizations for hip replacements. The number of knee replacements in 2006–2007 increased by 140% since 1996–1997 (15,829). There was a 9% increase in knee replacements compared to the previous year (2005–2006). In 2006–2007, the number of hip replacements was 59% higher than in 1996–1997. There was a 2.6% increase in hip replacements compared to the previous year (2005–2006).

Figure 3 Number of Hospitalizations for Hip and Knee Replacement Procedures in Canada, 1996–1997 to 2006–2007



Note

Quebec data were not included in this analysis.

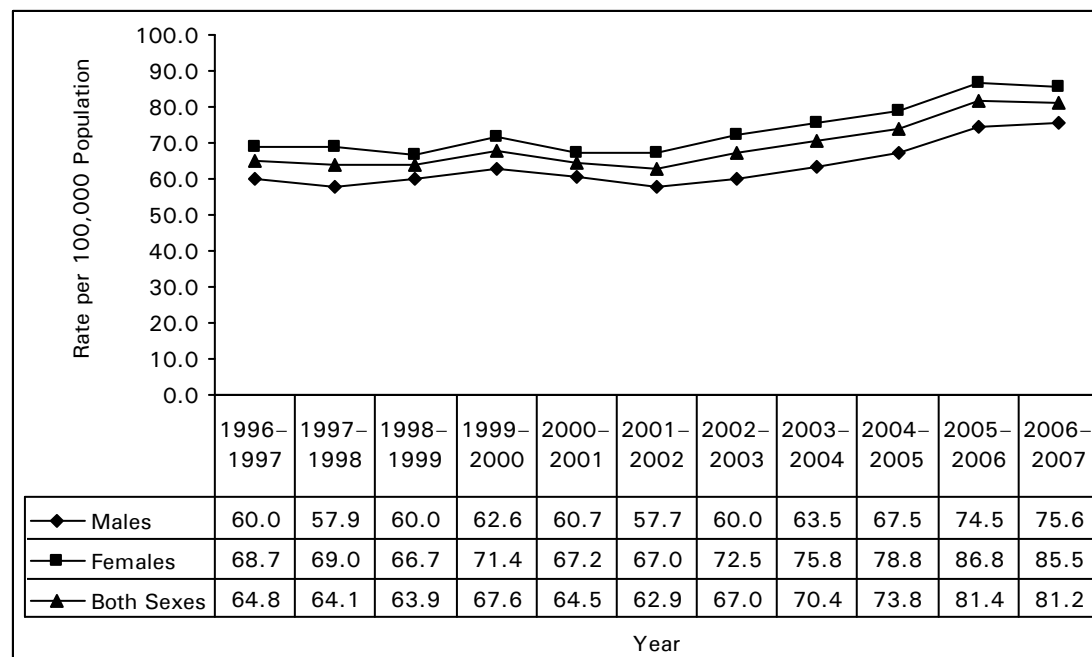
Sources

Hospital Morbidity Database, 1996–1997 to 2005–2006 and Discharge Abstract Database, 2006–2007, Canadian Institute for Health Information.

Pan-Canadian Age-Standardizedⁱ Hospitalization Rates

The overall pan-Canadian age-standardized hospitalization rate for hip replacement in 2006–2007 was 81.2, up 25.3% from 64.8 in 1996–1997 (Figure 4). The age-standardized rate for hip replacement was consistently higher for females than males over the 10-year period (Figure 4). For males, the increase over the 10-year period was 26% (from 60.0 to 75.6). For females, the 10-year increase was 24.4% (from 68.7 to 85.5).

Figure 4 Age-Standardized Hospitalization Rates (per 100,000 Population) by Sex for Hip Replacement, Canada, 1996–1997 to 2006–2007



Notes

Rates calculated based on the patients' jurisdiction of residence. Quebec data were not included in this analysis. The 1991 Canadian population was used as the standard for rate calculation.⁴

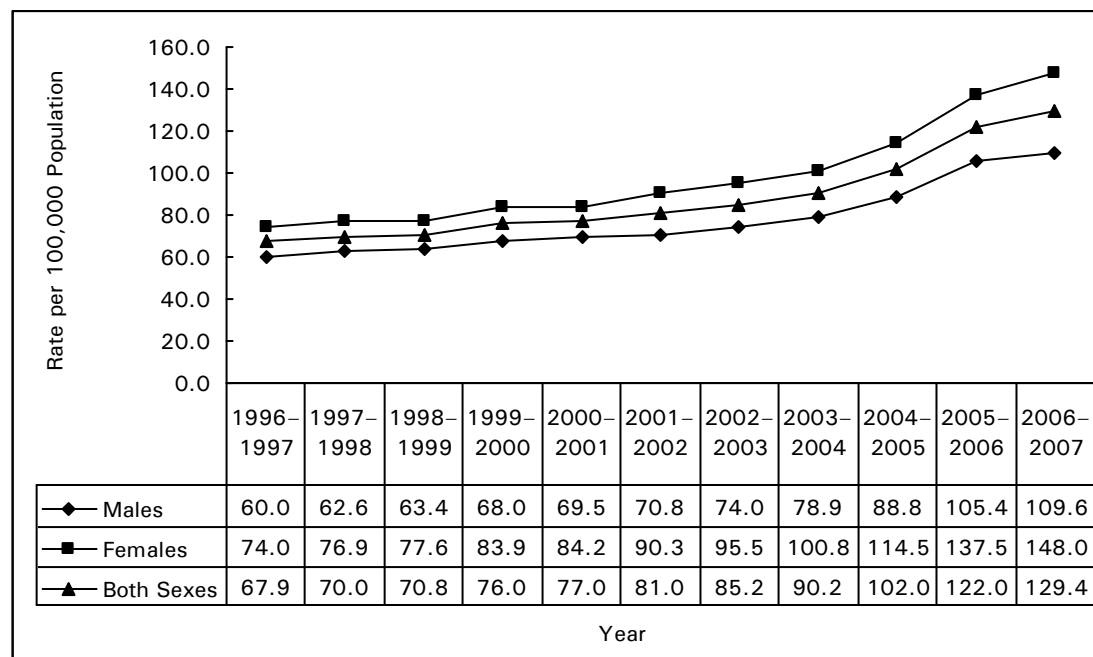
Sources

Hospital Morbidity Database, 1996–1997 to 2005–2006 and Discharge Abstract Database, 2006–2007, Canadian Institute for Health Information.

i. Age standardization is an analytical technique commonly used to compare rates over time, as it takes into account changes in age structure across populations and time. The age-standardized rates throughout this report are reported per 100,000 population unless otherwise specified.

Larger differences, both between the sexes and over time, were observed for the age-standardized knee hospitalization rates (Figure 5). In 2006–2007, the age-standardized knee hospitalization rate was 148.0 for females, compared to 109.6 for males, a difference of 38.4. The overall age-standardized rate increased 90% over the 10-year period, from 67.9 in 1996–1997 to 129.4 in 2006–2007. During this time period, an 82.7% increase was noted for males (from 60.0 to 109.6); for females the increase over the corresponding time period was 100% (from 74.0 to 148.0).

Figure 5 Age-Standardized Hospitalization Rates (per 100,000 Population) by Sex for Knee Replacements, Canada, 1996–1997 to 2006–2007



Notes

Rates calculated based on the patients’ jurisdiction of residence. Quebec data were not included in this analysis. The 1991 Canadian population was used as the standard for rate calculation.⁴

Sources

Hospital Morbidity Database, 1996–1997 to 2005–2006 and Discharge Abstract Database, 2006–2007, Canadian Institute for Health Information.

Jurisdictional Variations

Most hospitalizations for hip replacements in Canada were for primary procedures (89.4%). Table 1 presents the number of hip replacement procedures by jurisdiction of patient residence for 2006–2007 compared to 1996–1997 and the associated percent change. Over a 10-year period, Manitoba had the largest increase in the number of hospitalizations for hip replacements (77%).

Table 1 Number of Hospitalizations by Type of Hip Replacement by Jurisdiction

Jurisdiction	Total Number of Replacements 1996–1997	Total Number of Replacements 2006–2007	10-Year Increase (Percent)	Primary 2006	Revision 2006	Percent Revisions
Newfoundland and Labrador	207	336	62.3	302	34	10.1
Prince Edward Island	107	147	37.4	114	33	22.4
Nova Scotia	732	831	13.5	710	121	14.6
New Brunswick	486	651	34.0	561	90	13.8
Ontario	7,308	12,494	71.0	11,264	1,230	9.8
Manitoba	735	1,302	77.1	1,096	206	15.8
Saskatchewan	915	1,131	23.6	1,039	92	8.1
Alberta	1,950	2,649	35.8	2,359	290	10.9
British Columbia	2,680	4,656	73.7	4,186	470	10.1
Territories*	18	56	211.1	50	6	10.7
Total	15,138	24,253	60.2	21,681	2,572	10.6

Note

* Territories includes the Yukon, the Northwest Territories and Nunavut.

Sources

Hospital Morbidity Database, 1996–1997 and Discharge Abstract Database, 2006–2007, Canadian Institute for Health Information.

Most hospitalizations for knee replacements in Canada were for primary procedures (93%) in 2006–2007. Table 2 presents the number of knee replacement procedures by jurisdiction of patient residence for 2006–2007 compared to 1996–1997 and the associated percent change. As expected, Ontario reported the highest number of primary procedures and revisions for knee replacements compared to other jurisdictions. The number of hospitalizations in the 10-year period increased by more than 75% in most of the jurisdictions for knee replacement. The smallest increase occurred in Nova Scotia (24%). The greatest increase occurred in Prince Edward Island (222%).

As shown in Table 3, the age-standardized rates (per 100,000) of hip and knee replacement procedures varied greatly across Canada, with Saskatchewan and Manitoba having the highest rate of hip replacement, slightly above 90. Newfoundland and Labrador had the lowest hospitalization rates for hip replacements (50.5), followed by Nova Scotia with 66.5.

The highest age-standardized rate of knee replacement occurred in Manitoba (157.4), while Newfoundland and Labrador had the lowest (77.9).

Compared to 1996–1997, the age-standardized rate of hip replacement increased in most of the jurisdictions. The greatest percent increase was seen in Manitoba (56%). Nova Scotia and Alberta recorded slight decreases of 6% and 3%, respectively.

The age-standardized rate of knee replacement increased in all jurisdictions, with the greatest percent increase seen in Manitoba (172%), followed by Prince Edward Island (167%). Nova Scotia recorded the smallest increase over the time period (3%).

Table 2 Number of Hospitalizations by Type of Knee Replacements by Jurisdiction

Jurisdiction	Total Number of Replacements 1996–1997	Total Number of Replacements 2006–2007	10-Year Increase (Percent)	Primary 2006	Revision 2006	Percent Revisions
Newfoundland and Labrador	223	518	132.3	491	27	5.2
Prince Edward Island	72	232	222.2	217	15	6.5
Nova Scotia	905	1,126	24.4	1,023	103	9.1
New Brunswick	545	968	77.6	875	93	9.6
Ontario	8,002	20,742	159.2	19,247	1,495	7.2
Manitoba	723	2,202	204.6	2,059	143	6.5
Saskatchewan	899	1,620	80.2	1,536	84	5.2
Alberta	1,996	4,003	100.6	3,706	297	7.4
British Columbia	2,357	6,446	173.5	6,066	380	5.9
Territories*	29	86	196.6	82	<5	4.7
Total	15,751	37,943	140.9	35,302	2,641	7.0

Notes

* Territories include the Yukon, the Northwest Territories and Nunavut.

Absolute numbers less than five are represented by "<5" to ensure the protection of personal health information.

Sources

Hospital Morbidity Database, 1996–1997 and Discharge Abstract Database, 2006–2007, Canadian Institute for Health Information.

Table 3 Age-Standardized Rate (per 100,000) for Hip and Knee Hospitalizations by Jurisdiction, 1996–1997, 2006–2007

Jurisdiction	Hip Replacement			Knee Replacement		
	1996–1997	2006–2007	10-Year Increase (Percent)	1996–1997	2006–2007	10-Year Change (Percent)
Newfoundland and Labrador	37.7	50.5	34	42.0	77.9	86
Prince Edward Island	69.1	83.7	21	48.8	130.5	167
Nova Scotia	70.7	66.5	-6	88.7	91.6	3
New Brunswick	60.2	66.7	11	67.3	99.6	48
Ontario	62.2	82.5	33	68.3	139.4	104
Manitoba	58.4	91.1	56	57.8	157.4	172
Saskatchewan	76.1	91.7	21	74.6	133.1	78
Alberta	79.6	77.6	-3	83.3	120.6	45
British Columbia	63.7	85.1	34	56.1	119.6	113
Total	56.3	81.2	44	58.1	129.4	123

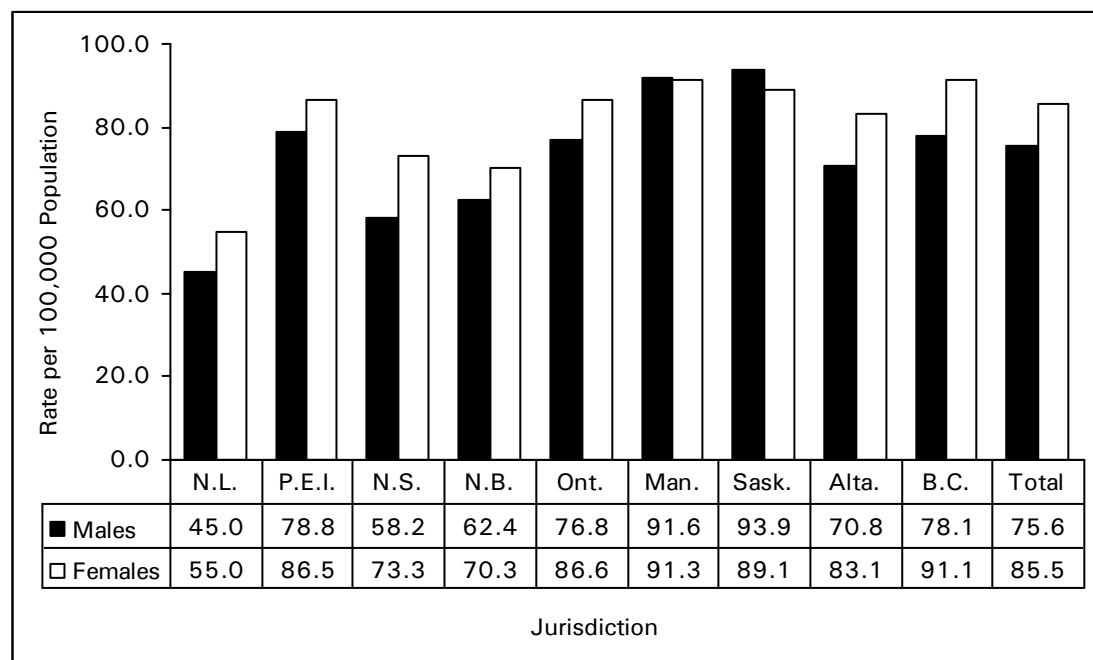
Sources

Hospital Morbidity Database, 1996–1997 and Discharge Abstract Database, 2006–2007, Canadian Institute for Health Information.

Age-Standardized Rates by Jurisdiction and Sex

The age-standardized rates by jurisdiction and sex for hip replacements (Figure 6) are generally higher for females than for their male counterparts. Manitoba and Saskatchewan are the exceptions. Saskatchewan had the highest age-standardized rate for males (93.9), followed by Manitoba with 91.3.

Figure 6 Age-Standardized Rates (per 100,000 Population) for Hip Replacement Procedures, by Jurisdiction and Sex, 2006–2007



Notes

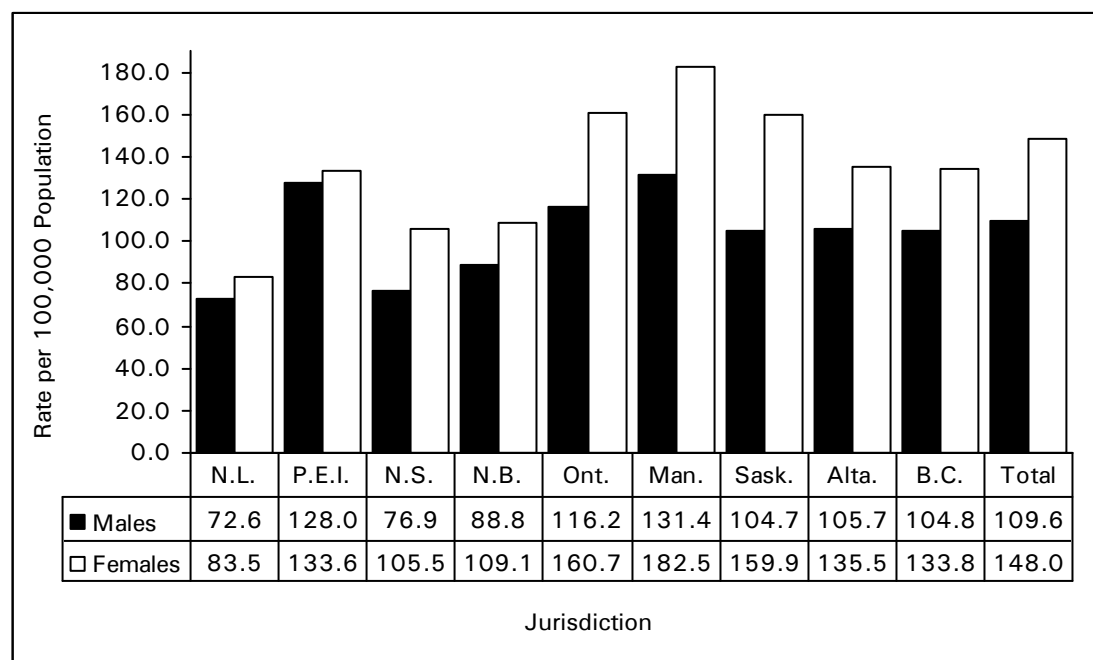
Rates calculated based on patients' jurisdiction of residence. Yukon, Northwest Territories and Nunavut rates are suppressed due to small numbers but are included in the total calculation. Quebec data were not available for this analysis. The 1991 Canadian population was used as the standard for rate calculation.⁴

Source

Discharge Abstract Database, 2006–2007, Canadian Institute for Health Information.

The age-standardized rates for knee replacement are higher for females than for males in all jurisdictions. Manitoba had the highest knee replacement age-standardized rate for females (182.5), followed by Ontario (160.7) (Figure 7). The highest age-standardized rate of knee replacements for males was recorded in Manitoba (131.4). The lowest rates for both females and males were recorded in Newfoundland and Labrador (83.5 and 72.6, respectively).

Figure 7 Age-Standardized Rates (per 100,000 Population) for Knee Replacement Procedures by Jurisdiction and Sex, 2006–2007



Notes

Rates calculated based on patients’ jurisdiction of residence. Yukon, Northwest Territories and Nunavut rates are suppressed due to small numbers but are included in the total calculation. Quebec data were not available for this analysis. The 1991 Canadian population was used as the standard for rate calculation.⁴

Source

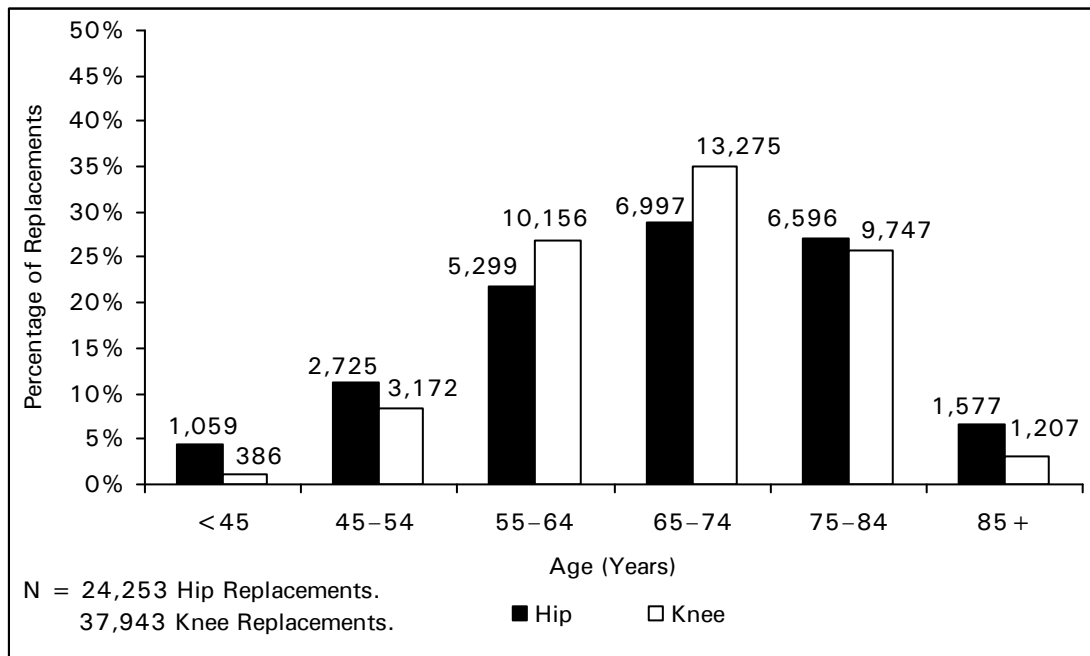
Discharge Abstract Database, 2006–2007, Canadian Institute for Health Information.

Patient Demographics

In 2006–2007, the mean age of patients who underwent hip replacements in Canada, excluding Quebec, was 67.6 (69.3 for females and 65.4 for males). The mean age of knee replacement patients was 68.0 (67.8 for females and 68.2 for males).

The age distributions of hip and knee replacement recipients were similar, with the majority of patients being 65 or older (63% of hip and 64% of knee replacement recipients). Only small proportions of patients for both procedures were younger than 45 (4% of hip and 1% of knee replacement recipients) (Figure 8).

Figure 8 Age Distribution of Hip and Knee Replacement Recipients, Canada, 2006–2007



Note

Quebec data were not available for the analysis.

Source

Discharge Abstract Database, 2006–2007, Canadian Institute for Health Information.

Females were more likely to undergo hip replacement than males in 2006–2007; the age-standardized rate for females was 85.5, compared to 75.6 for males (Figure 4). Females also had a higher rate of knee replacement (148.0) than males (109.6) (Figure 5). In 2006–2007, 57% of hip replacement recipients were female and 43% were male; of knee replacement recipients, 61% were female and 39% were male (Table 4).

Compared to 1996–1997, for hip replacement procedures the largest percent increase for males was seen in the 45-to-54 age group (140%), and the largest percent increase for females was seen in the 85 and older age group (105%). However, the largest increase in the absolute number for males was noted in the 55-to-64 age group (1,233), and the largest increase for females was observed in the 75-to-84 age group (1,561), followed by the 55-to-64 age group (1,336) (Table 4).

For knee replacement procedures, the largest percent increases were noted in the 45-to-54 age group for both males and females (271% and 337%, respectively), followed by the 85 and older age group for males (206%) and the 55-to-64 age group for females (260%). The largest increase in the absolute number for males was noted in the 65-to-74 age group (2,644), followed by the 55-to-64 age group (2,595), and the largest increase in the absolute number for females was observed in the 55-to-64 age group (4,581), followed by the 65-to-74 age group (3,707) (Table 4).

Table 4 **Number of Hip and Knee Replacements by Age and Sex, Canada, 1996–1997, 2006–2007**

Hip Replacements								
Age Group (Years)	Males				Females			
	1996–1997	2006–2007	10-Year Change (Counts)	10-Year Change (Percent)	1996–1997	2006–2007	10-Year Change (Counts)	10-Year Change (Percent)
< 45	399	592	193	48	431	467	36	8
45–54	640	1,537	897	140	664	1,188	524	79
55–64	1,311	2,544	1,233	94	1,419	2,755	1,336	94
65–74	2,209	3,013	804	36	3,199	3,984	785	25
75–84	1,517	2,421	904	60	2,614	4,175	1,561	60
85 +	240	407	167	70	571	1,170	599	105
Total	6,316	10,514	4,198	66	8,898	13,739	4,841	54
Knee Replacements								
Age Group (Years)	Males				Females			
	1996–1997	2006–2007	10-Year Change (Counts)	10-Year Change (Percent)	1996–1997	2006–2007	10-Year Change (Counts)	10-Year Change (Percent)
< 45	88	145	57	65	121	241	120	99
45–54	302	1,119	817	271	470	2,053	1,583	337
55–64	1,216	3,811	2,595	213	1,764	6,345	4,581	260
65–74	2,880	5,524	2,644	92	4,044	7,751	3,707	92
75–84	1,651	3,882	2,231	135	2,843	5,865	3,022	106
85 +	142	435	293	206	308	772	464	151
Total	6,279	14,916	8,637	138	9,550	23,027	13,477	141

Note

Quebec data were not available for the analysis.

Sources

Hospital Morbidity Database, 1996–1997 and Discharge Abstract Database, 2006–2007, Canadian Institute for Health Information.

Table 5 shows the age-specific rates for hip and knee replacements by sex for 2006–2007, compared to 1996–1997.

For hip replacement procedures, the highest age-specific rates in 2006–2007 were noted in the 75-to-84 age group for both males and females (490.7 and 634.2, respectively), followed by the 65-to-74 age group (368.5 and 448.9 for males and females, respectively). For males, the largest 10-year increase was seen among the 45-to-54 age group (76%), followed by the younger-than-45 age group (48%). For females, the largest increases were observed in the 85-and-older age group (36%), followed by the 55-to-64 and 45-to-54 age groups (32% and 30%, respectively).

Substantial increases in age–sex-specific rates for knee replacement occurred in 2006–2007, compared to 1996–1997. The most notable increases were observed in the 45-to-54 age group, where the rate of knee replacements more than doubled for males (171%) and more than tripled for females (217%). However, the highest age–sex-specific rate of knee replacements was consistently observed in the 75-to-84 age group (786.7 for males and 890.9 for females) (Table 5).

Table 5 Age-Specific Rates (per 100,000 Population) by Age Groups and Sex, Canada, 1996–1997, 2006–2007

Hip Arthroplasty						
Age Group (Years)	Males			Females		
	1996–1997	2006–2007	10-Year Change (Percent)	1996–1997	2006–2007	10-Year Change (Percent)
<45	5.2	7.7	48	5.8	6.2	7
45–54	45.7	80.4	76	47.5	61.6	30
55–64	140.6	186.6	33	149.8	197.4	32
65–74	304.4	368.5	21	380.8	448.9	18
75–84	429.7	490.7	14	497.0	634.2	28
85+	292.7	307.2	5	308.2	420.7	36
Total	56.9	84.5	49	78.8	108.6	38
Knee Arthroplasty						
Age Group (Years)	Males			Females		
	1996–1997	2006–2007	10-Year Change (Percent)	1996–1997	2006–2007	10-Year Change (Percent)
<45	1.2	1.9	57	1.6	3.2	101
45–54	21.6	58.6	171	33.6	106.4	217
55–64	130.4	279.5	114	186.2	454.6	144
65–74	396.9	675.6	70	481.4	873.3	81
75–84	467.6	786.7	68	540.6	890.9	65
85+	173.2	328.3	90	166.3	277.6	67
Total	56.5	119.9	112	84.6	182.0	115

Note

Quebec data were not available for the analysis.

Sources

Hospital Morbidity Database, 1996–1997 and Discharge Abstract Database, 2006–2007, Canadian Institute for Health Information.

Length of Stay and Outcomes for Hip and Knee Replacements in Canada

This section presents LOS using the mean, median and interquartile range (IQR).ⁱⁱ

For hip replacement hospitalizations, the median LOS decreased by 37.5%, from eight days in 1996–1997 to five days in 2006–2007. Over the 10-year period, since 1996–1997, the median LOS for knee replacement hospitalizations declined from eight to four days in 2006–2007, a decrease of 50% (Table 6).

Table 6 Median and Mean Length of Stay (Days) for Hip and Knee Replacements, Canada, 1996–1997 to 2006–2007

Fiscal Year	Hip			Knee		
	Mean	Median	IQR	Mean	Median	IQR
1996–1997	11	8	5	9	8	5
1997–1998	11	8	5	9	8	4
1998–1999	11	8	5	9	7	4
1999–2000	10	7	4	9	7	3
2000–2001	10	7	4	8	7	4
2001–2002	10	7	4	8	7	3
2002–2003	10	7	4	8	6	3
2003–2004	9	6	4	7	6	4
2004–2005	9	6	4	7	5	3
2005–2006	8	5	3	6	5	2
2006–2007	7	5	3	6	4	3

Note

Quebec data were not available for this analysis.

Sources

Hospital Morbidity Database, 1996–1997 to 2005–2006 and Discharge Abstract Database, 2006–2007, Canadian Institute for Health Information.

ii. 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 interquartile range (IQR) is a corresponding measure of variability, being equal to the difference between the third (Q3) and first (Q1) quartiles. Fifty percent of cases have an LOS within the IQR (Q3 to Q1). Median and IQR for LOS are reported throughout this section.

Hip replacement recipients (both male and female) in 2006–2007 spent a median of five days in hospital, compared to eight days in 1996–1997, a decrease of 37.5% (Table 7).

Table 7 Median and Mean Length of Stay (Days) for Hip Replacements by Sex, Canada, 1996–1997 to 2006–2007

Fiscal Year	Male			Female		
	Mean	Median	IQR	Mean	Median	IQR
1996–1997	10	8	5	12	8	5
1997–1998	10	7	4	11	8	5
1998–1999	10	7	4	11	8	5
1999–2000	9	7	3	11	8	5
2000–2001	9	7	4	11	7	4
2001–2002	9	7	4	10	7	4
2002–2003	9	6	4	10	7	5
2003–2004	8	6	3	9	7	4
2004–2005	7	6	4	9	6	4
2005–2006	7	5	3	8	5	4
2006–2007	6	5	3	7	5	3

Note

Quebec data were not available for this analysis.

Sources

Hospital Mobility Database, 1996–1997 to 2005–2006 and Discharge Abstract Database, 2006–2007, Canadian Institute for Health Information.

Knee replacement recipients in 2006–2007 spent a median of four to five days in hospital, compared to eight days in 1996–1997, a decrease of 50% for males and 37.5% for females (Table 8).

Table 8 Median and Mean Length of Stay for Knee Replacements by Sex, Canada, 1996–1997 to 2006–2007

Fiscal Year	Male			Female		
	Mean	Median	IQR	Mean	Median	IQR
1996–1997	9	8	4	10	8	4
1997–1998	9	7	4	9	8	4
1998–1999	9	7	3	9	7	4
1999–2000	8	7	4	9	7	3
2000–2001	8	7	4	9	7	4
2001–2002	8	6	3	8	7	3
2002–2003	7	6	4	8	6	3
2003–2004	7	6	4	7	6	3
2004–2005	7	5	3	7	6	3
2005–2006	6	5	3	6	5	2
2006–2007	6	4	3	6	5	3

Note

Quebec data were not available for this analysis.

Sources

Hospital Mobility Database, 1996–1997 to 2005–2006 and Discharge Abstract Database, 2006–2007, Canadian Institute for Health Information.

Jurisdictional median and mean lengths of stay in hospital for hip and knee replacement patients in 2006–2007 by sex are shown in tables 9 and 10.

Ontario and British Columbia had shorter median lengths of stay (four days) than other jurisdictions for both hip and knee replacements. In contrast, Prince Edward Island had longer median lengths of stay (11 days) than other jurisdictions for both hip and knee procedures.

Table 9 Median and Mean Length of Stay (Days) for Hip Replacement Patients by Jurisdiction and Sex, 2006–2007

Jurisdiction	Male			Female		
	Mean	Median	IQR	Mean	Median	IQR
Newfoundland and Labrador	9	7	4	9	7	3
Prince Edward Island	12	11	5	14	11	7
Nova Scotia	8	5	3	11	7	5
New Brunswick	9	7	4	10	7	4
Ontario	6	4	3	7	5	3
Manitoba	9	6	3	12	7	4
Saskatchewan	7	6	3	8	7	3
Alberta	7	5	2	8	5	3
British Columbia	6	4	2	7	4	3
Northwest Territories	5	6	4	7	7	1
Total	6	5	3	8	5	3

Note

Quebec data were not available for this analysis.

Source

Discharge Abstract Database, 2006–2007, Canadian Institute for Health Information.

Table 10 Median and Mean Length of Stay (Days) for Knee Replacement Patients by Jurisdiction and Sex, 2006–2007

Jurisdiction	Male			Female		
	Mean	Median	IQR	Mean	Median	IQR
Newfoundland and Labrador	9	7	4	8	7	3
Prince Edward Island	11	10	5	11	10	4
Nova Scotia	6	5	3	7	6	2
New Brunswick	9	7	3	8	7	3
Ontario	5	4	2	5	4	2
Manitoba	7	6	2	8	6	2
Saskatchewan	7	6	2	7	6	3
Alberta	6	5	2	6	5	2
British Columbia	5	4	2	5	4	2
Yukon	5	5	2	8	7	2
Northwest Territories	5	5	3	6	6	1
Total	6	4	3	6	5	3

Note

Quebec data were not available for this analysis.

Source

Discharge Abstract Database, 2006–2007, Canadian Institute for Health Information.

Summary of Findings

In 2006–2007, there were 37,943 hospitalizations for knee replacement procedures and 24,253 hospitalizations for hip replacement procedures, an increase of 101% over a 10-year period since 1996–1997 (Quebec data excluded). Hospitalizations for knee replacements increased by 140% in this period, while hospitalizations for hip replacements increased by 59%. Most hospitalizations for hip and knee replacements in Canada were for primary procedures (89.4% for hip; 93% for knee).

Consistent with this, the overall pan-Canadian age-standardized hospitalization rate for hip replacement increased by 25.3% (from 64.8 to 81.2) and the overall age-standardized rate for knee replacement increased by 90% (from 67.9 to 129.4) over the 10-year period. In general, age-standardized rates for females were higher than for males for both hip and knee replacements.

Substantial jurisdictional variation in the rate of hip and knee replacement was seen in 2006–2007, with Saskatchewan having the highest age-standardized rate of hip replacement (91.7) and Manitoba having the highest age-standardized rate of knee replacement (157.4). Newfoundland and Labrador had the lowest age-standardized rates of hip and knee replacement at 50.5 and 77.9, respectively.

The mean ages of hip and knee replacement recipients were 67.6 and 68.0, respectively, in 2006–2007. The highest age-specific rates for hip and knee replacements were noted in the 75-to-84 age group for both males and females (490.7 and 634.2, respectively), followed by the 65-to-74 age group (368.5 and 448.9 for males and females, respectively).

Canadians stayed in hospital for a shorter period of time after joint replacement surgery in 2006–2007 compared to previous years. Over the decade, median LOS decreased for both knee and hip replacements by 50% (from eight days to four days) and 37.5% (from eight days to five days), respectively.

Surgical and Clinical Characteristics of Joint Replacement Operations Reported in CJRR

Methodological Notes

- Analyses in this section are based on CJRR data for 2002–2003 through 2006–2007, unless otherwise stated.
- Quebec data are included in this section.
- Data submission by orthopedic surgeons to CJRR is voluntary and not all eligible surgeons are participating. Participating surgeons may not have submitted all procedures performed. Of the 72,469 hip and knee replacements performed in hospital in 2006–2007, 29,708 were captured in CJRR. This represents 41% of the total joint replacement procedures (45% of hip replacements and 38% of knee replacements).
- The data captured in CJRR were representative of the overall activity captured in HMDB in terms of patient sex, age, type of joint replacement and most responsible diagnosis. Ontario is considerably underrepresented in CJRR, while most other jurisdictions are somewhat overrepresented (see Appendix C).
- Sixty-two percent of CJRR cases contained wait time information in 2006–2007, up from 42% in 2005–2006.
- Where the term “significant” is used in this section, a two-sided statistical test (Chi-square, non-parametric or Wilcoxon test) was performed and the interpretation of the result was considered statistically significant at the 0.05 level.
- Throughout this section, the term “components replaced” is used to refer to components replacing natural bone, as in the case of primary procedures, or replacing existing artificial implants, as in the case of revision procedures.
- Additional methodological details are presented in Appendix D.

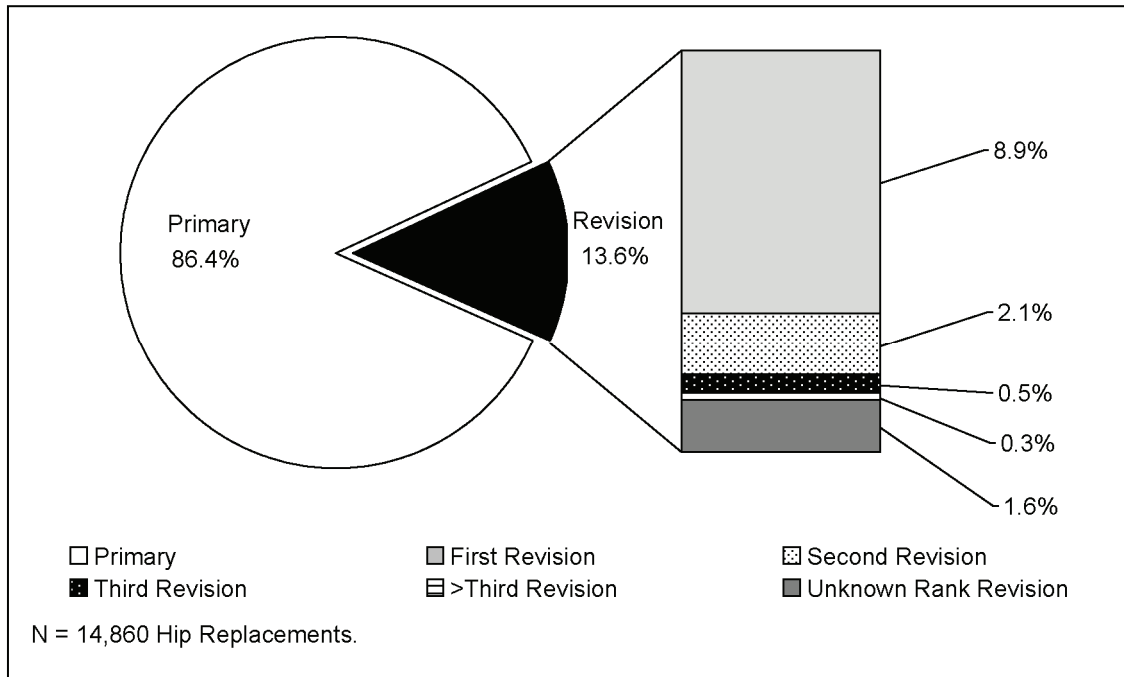
This section provides additional patient, clinical and surgical information about hip and knee replacement procedures performed in Canada and captured by CJRR. In addition, wait times for either a primary or revision replacement procedure are presented.

Type of Joint Replacement (Primary Versus Revision)

Primary Hip Replacement

Of hip replacements reported in CJRR for 2006–2007, 86.4% of operations involved primary replacements, while 13.6% involved revisions (Figure 9).

Figure 9 Type of Hip Replacements, CJRR, 2006–2007



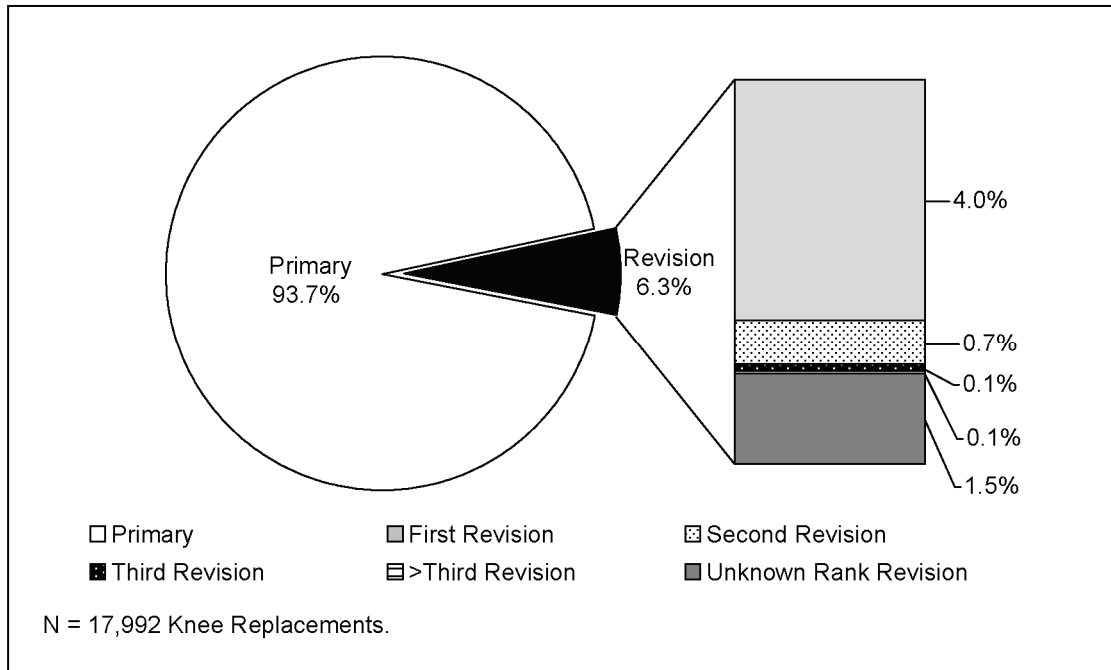
Source

Canadian Joint Replacement Registry, 2006–2007, Canadian Institute for Health Information.

Primary Knee Replacement

Among the knee replacements reported in CJRR for 2006–2007, 93.7% of them involved primary operations and 6.3% of them involved revisions (Figure 10).

Figure 10 Type of Knee Replacements, CJRR, 2006–2007



Source

Canadian Joint Replacement Registry, 2006–2007, Canadian Institute for Health Information.

Most Responsible Diagnosis for Primary Joint Replacement

For primary hip replacements, surgeons were asked to record *only the most responsible diagnosis* groupings applicable to patients. In 2006–2007, degenerative osteoarthritis (OA) was the most common responsible diagnosis indicated for primary hip replacements (81%) in CJRR, followed by osteonecrosis (5.2%) and acute fracture (4.5%).

For primary knee replacements, surgeons were asked to record *only the most responsible diagnosis* groupings applicable to patients. Among all primary knee replacements performed in 2006–2007, degenerative OA was the most commonly reported responsible diagnosis (94%), followed by inflammatory arthritis (3%) and post-traumatic OA (2%).

Body Mass Index

Studies have shown that obesity is one of the influencing factors associated with OA.^{5, 6} Since OA is the leading diagnosis for primary joint replacements,^{1, 7} examining body mass index (BMI) among hip and knee replacement patients is of importance. BMI is calculated as weight (in kilograms) divided by the square of height (in metres).⁸

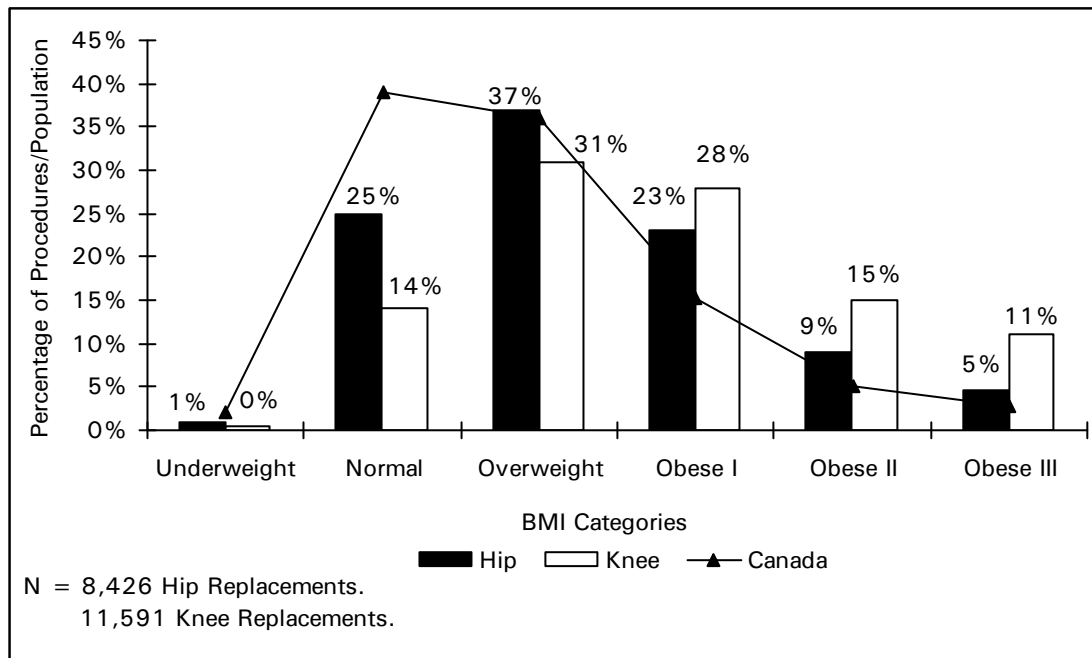
Based on international standards citing differentiation between subgroups within the obese category, patients reported to CJRR were assigned to the following BMI categories: less than 18.5 (underweight); 18.5 to 24.9 (normal weight); 25.0 to 29.9 (overweight); 30.0 to 34.9 (obese, class I); 35.0 to 39.9 (obese, class II); 40.0 and higher (obese, class III).^{9, 10, 11}

Calculations for BMI values for 2006–2007 were available for 63% (n = 8,246) of hip replacement patients and 69% (n = 11,591) of knee replacement patients in CJRR.

For hip replacements, patients classified as overweight represented the highest proportion of recipients in 2006–2007 (37%), followed closely by those classified as obese (36%). For knee replacements, patients classified as obese represented the highest proportion (55%) of recipients, followed by those classified as overweight (32%). Among obese patients, the obese class I category represented the highest proportion of recipients (23% for hip replacements and 28% for knee replacements).

Figure 11 shows that a high proportion of both hip and knee replacement patients in 2006–2007 were obese, compared to BMI distribution in the Canadian population.¹² Knee replacement recipients were found to be significantly more obese than hip replacement recipients (54% versus 37%, respectively [p<0.01]). The proportion of patients in the underweight category who underwent joint replacements was negligible (less than 1%).

Figure 11 Hip and Knee Replacement Recipients by Body Mass Index Category, CJRR, as Compared to Body Mass Index Distribution of Canadian Population, 2006–2007

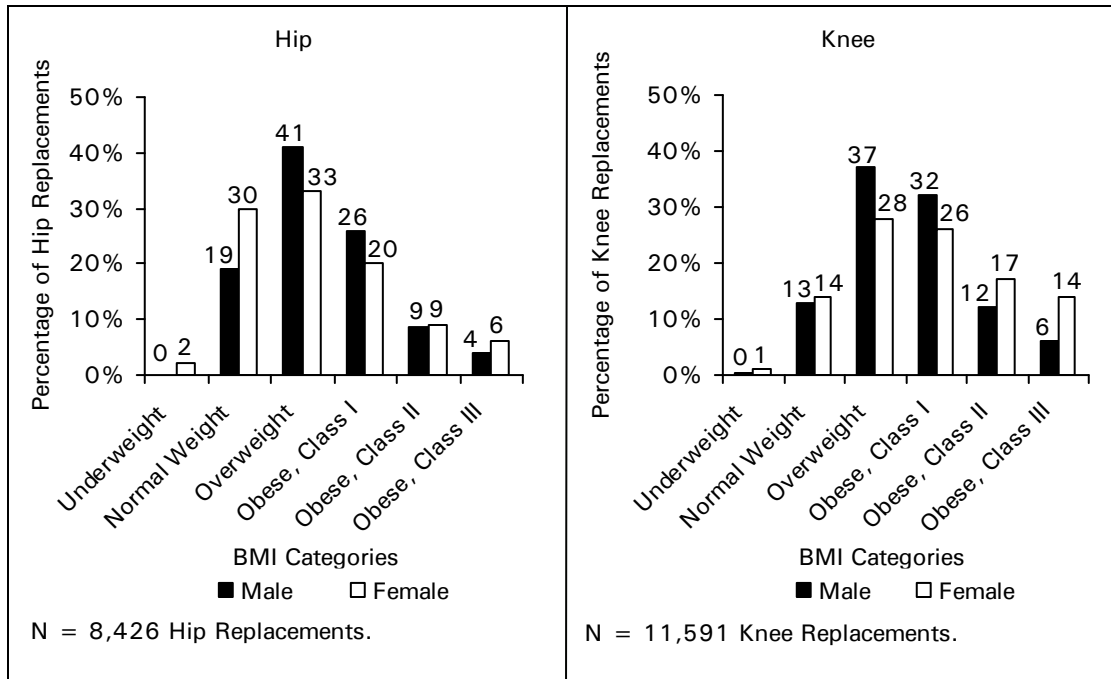


Sources

Canadian Joint Replacement Registry, 2006–2007, Canadian Institute for Health Information; Statistics Canada, 2004, Canadian Community Health Survey.

For hip replacements, significantly more males (80%) than females (68%) were observed to be overweight or obese ($p < 0.05$). For knee replacements, significantly more males (69%) than females (54%) were observed to be overweight and obese class I; the reverse was observed for the obese class II and III groups, where more females (31%) than males (18%) were in the class II and III subgroups ($p < 0.05$) (Figure 12).

Figure 12 Sex and Body Mass Index by Joint Replacement Type, CJRR, 2006–2007



Source

Canadian Joint Replacement Registry, 2006–2007, Canadian Institute for Health Information.

Wait Times

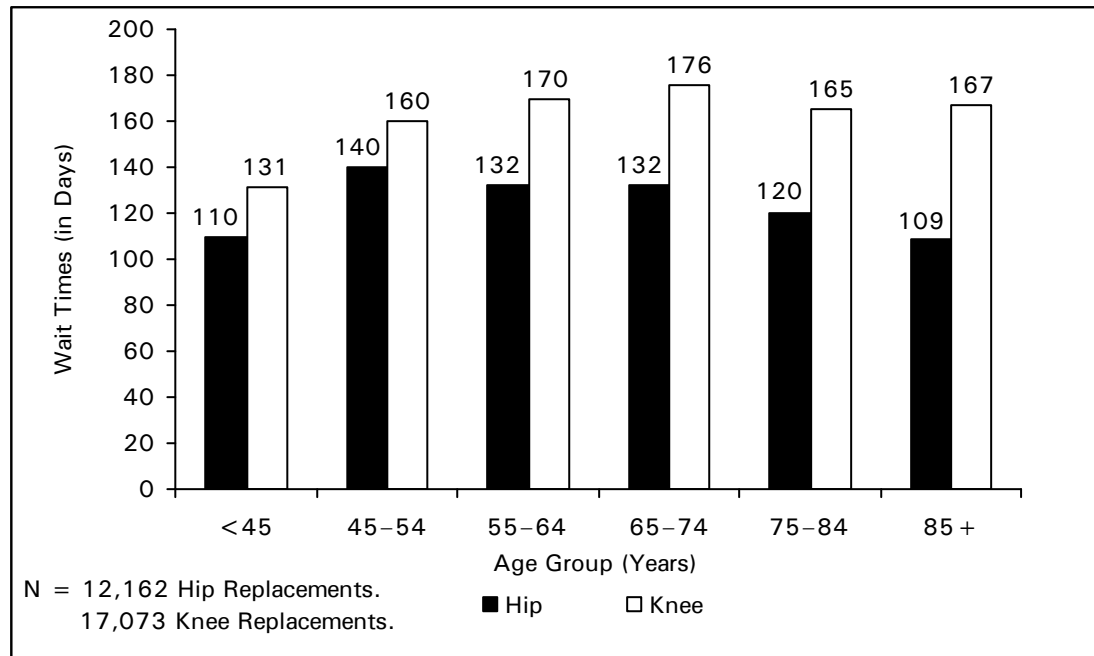
There is considerable interest in the amount of time that Canadians wait for various surgical procedures, including hip and knee replacement surgery. Wait times, as reported here, were measured from the time an orthopedic surgeon and patient made a decision for surgery to the time when the actual surgery occurred and are based on information provided voluntarily by participating surgeons for patients who have already received joint replacement surgery.

Over the course of 2006–2007, in CJRR, patients who were scheduled to undergo hip replacements waited significantly shorter lengths of time relative to those who were scheduled to undergo knee replacements (median wait times of 127 days [mean 182 days] versus 169 days [mean 237 days], respectively) ($p < 0.05$). Compared to last year, the wait time for patients who underwent hip replacement did not change, while the wait time for patients who underwent knee replacement was 13 days shorter (median wait time of 169 days versus 182 days).

Differences in median wait times between males and females were small, at eight days and six days for hip and knee replacement, respectively. The median wait time for males who underwent a hip replacement was 124 days (mean 175 days), while the median wait time for females was 132 days (mean 191 days). The median wait time for males who underwent a knee replacement was 173 days (mean 240 days), while the median wait time for females was 167 days (mean 234 days).

Figure 13 shows that there seems to be a decreased trend with age for hip replacements but not for knee replacements.

Figure 13 Median Wait Times (Days) by Age Groups for Hip and Knee Replacement Recipients, CJRR, 2006–2007



Note

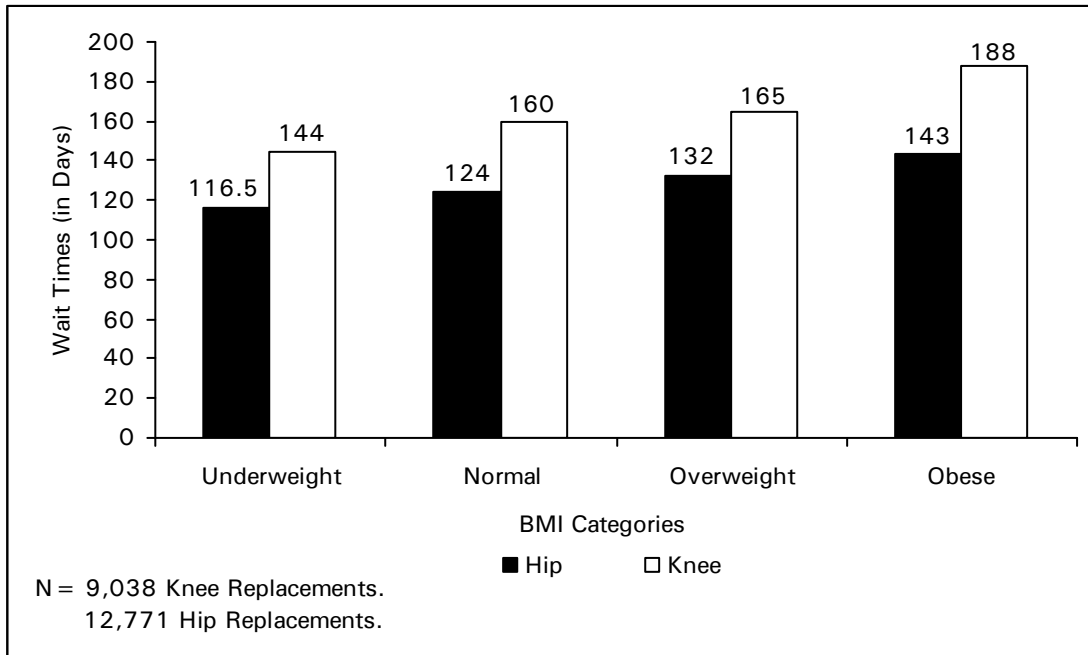
Wait time, as presented here, is from date of decision for surgery to date of surgery.

Source

Canadian Joint Replacement Registry, 2006–2007, Canadian Institute for Health Information.

Wait times for patients of various BMI categories were also found to be significantly different ($p < 0.0001$). Escalating BMI was associated with longer wait times regardless of the type of primary joint replacement (hip or knee) a patient underwent (Figure 14). One possible contributor to this longer wait time is that obese patients may be requested to lose weight prior to undergoing surgery in an effort to improve their health and the outcome of the procedure.

Figure 14 Relationship Between Median Wait Times (Days) and Body Mass Index, by Joint Replacement Type, CJRR, 2006–2007



Source

Canadian Joint Replacement Registry, 2006–2007, Canadian Institute for Health Information.

Wait Times for Hip Revision

There were 1,759 patients in CJRR who underwent hip revision procedures and had information on both surgery (revision) decision date and revision surgery date available. Among these patients, the dates when a decision for surgery was made were from 2003 to 2007, and the revisions were performed before March 31, 2007. The median wait time for hip revision was 92 days with an IQR of 147 days (mean 145 days).

Similar median wait times were observed for male and female patients who underwent hip revision (median 90 days with IQR 152 days [mean 147 days] and median 92 days with IQR 145 days [mean 144 days], respectively) ($p > 0.05$).

Patients 85 and older had a shorter median wait time, by at least 29 days, than younger patients (Table 11). Median wait times for hip revision among patients with normal BMI were at least 19 days less than patients in other BMI categories (Table 12).

Table 11 Wait Times for Hip Revision by Age Group

Age Group	N	Mean (Days)	Median (Days)	IQR
< 45	97	171	92	192
45–54	192	162	99	162
55–64	309	157	94	157
65–74	530	157	95	153
75–84	529	124	91	127
> 85	102	107	62	119

Source

Canadian Joint Replacement Registry, 2003–2004 to 2006–2007, Canadian Institute for Health Information.

Table 12 Wait Times for Hip Revision by Body Mass Index

BMI Categories	N	Mean (Days)	Median (Days)	IQR
Underweight	17	136	111	105
Normal	357	134	88	126
Overweight	501	162	111	173
Obese	414	176	107	167

Source

Canadian Joint Replacement Registry, 2003–2004 to 2006–2007, Canadian Institute for Health Information.

Wait Times for Knee Revision

There were 1,223 patients in CJRR who underwent a knee revision procedure and had information on both surgery (revision) decision date and revision surgery date available. Among these patients, the dates when a decision for surgery was made were from 2003 to 2007, and the revisions were performed before March 31, 2007. The median wait time for knee revision was 98 days with an IQR of 136 days (mean 147 days).

There was no significant difference in median wait time for knee revision between male patients (median 98 days with IQR 135 days [mean 142 days]) and female patients (median 97 days with IQR 136 days [mean 150 days]) ($p > 0.05$). Age was not a significant factor influencing the median wait time for knee revision ($p > 0.05$) (Table 13). BMI was not a factor in median wait times for knee revision ($p > 0.05$) (Table 14).

Table 13 Wait Times for Knee Revision by Age Group

Age Group	N	Mean (Days)	Median (Days)	IQR
<45	35	146	92	142
45–54	92	143	91	127
55–64	284	144	98	130
65–74	421	138	94	134
75–84	347	164	105	150
>85	44	125	74	144

Source

Canadian Joint Replacement Registry, 2003–2004 to 2006–2007, Canadian Institute for Health Information.

Table 14 Wait Times for Knee Revision by Body Mass Index

BMI Categories	N	Mean (Days)	Median (Days)	IQR
Underweight	6	73	51	139
Normal	126	154	89	163
Overweight	309	152	117	137
Obese	514	165	113	147

Source

Canadian Joint Replacement Registry, 2003–2004 to 2006–2007, Canadian Institute for Health Information.

Reasons for Hip Revision

Among the hip replacements reported in CJRR for 2006–2007, 13.6% were revisions. The most common reasons reported for hip replacement revisions in 2006–2007 were aseptic loosening (44%), osteolysis (22%), poly wear (21%) and instability (13%).

Reasons for Knee Revision

Among the knee replacements reported in CJRR for 2006–2007, 6.3% were revisions. The most common reasons reported for knee replacement revisions in 2006–2007 were aseptic loosening (25%), poly wear (17%), infection (16%) and instability (14%).

Classification of Surgical Types for Joint Replacements

Hip Replacement

A hip replacement may involve a total replacement, hemi-arthroplasty or resurfacing replacement. Total replacement entails replacing all three natural parts (ball, socket and bone shaft) with a prosthetic device. Hemi-arthroplasty entails a partial replacement, which may be monopolar (where only the femoral head and stem are replaced) or bipolar (where the femoral head and stem and the acetabular compartment, but not the acetabular insert/liner, are replaced). When resurfacing (bone-conservative method) of the hip joint is performed, it may involve full resurfacing (replacing the femoral head and acetabular compartment) or hemi-resurfacing (replacing only the femoral head). See Appendix E for the defining algorithm.

The vast majority of hip replacements reported in CJRR were total replacements (94%) in 2006–2007 (Table 15).

Table 15 Types of Hip Replacement, 2003–2004 to 2006–2007

Type of Hip Replacement	2003–2004	2004–2005	2005–2006	2006–2007
Hemi-Arthroplasty	341	364	413	303
Resurfacing Replacement	75	172	218	278
Total Hip Replacement	10,135	12,314	9,596	9,566
Total	10,551	12,850	10,227	10,147

Source

Canadian Joint Replacement Registry, 2003–2004 to 2006–2007, Canadian Institute for Health Information.

Knee Replacement

Knee replacement surgery may involve total knee replacement or uni-compartmental knee arthroplasty (UKA). A total knee replacement involves replacing all three components of the knee (femoral component, tibial component and patella).

UKA involves replacing only one side/compartment (medial, lateral or patellofemoral) of the knee. UKA may be performed in patients with only limited knee arthritis. A uni-compartmental approach allows the other compartment and all ligaments to remain intact. By retaining the remaining normal compartments of the knee, it is hypothesized that the joint may function more naturally.^{13, 14} Patellofemoral replacement involves replacing the patellofemoral component—the joint between the undersurface of the knee cap (patella) and the femur.

Table 16 shows the number of total knee replacement and uni-compartmental knee arthroplasty procedures over the past four years.

In CJRR, UKA procedure rates remained steady over the past four years (UKA procedures accounted for about 7.7% in 2006–2007 and 8.6% in 2004–2005 of primary replacements) (Figure 15).

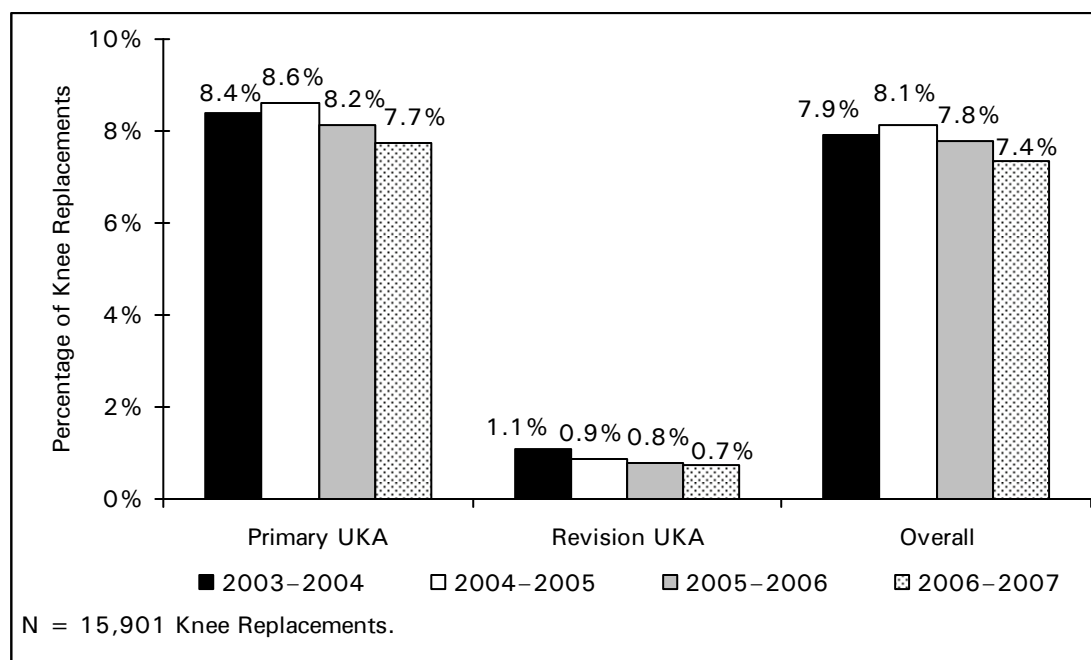
Table 16 Type of Knee Replacement, 2003–2004 to 2006–2007

Type of Knee Replacement	2003–2004	2004–2005	2005–2006	2006–2007
Uni-Compartmental Knee Arthroplasty	1,176	1,545	1,396	1,170
Total Knee Replacement	14,837	18,996	17,688	15,901
Total	16,013	20,541	19,084	17,071

Source

Canadian Joint Replacement Registry, 2003–2004 to 2006–2007, Canadian Institute for Health Information.

Figure 15 Uni-Compartmental Knee Arthroplasty—Primary and Revisions as a Proportion of All Knee Replacements, CJRR, 2003–2004 to 2006–2007



Source

Canadian Joint Replacement Registry, 2003–2004 to 2006–2007, Canadian Institute for Health Information.

Joint Replacement Surgical Approach

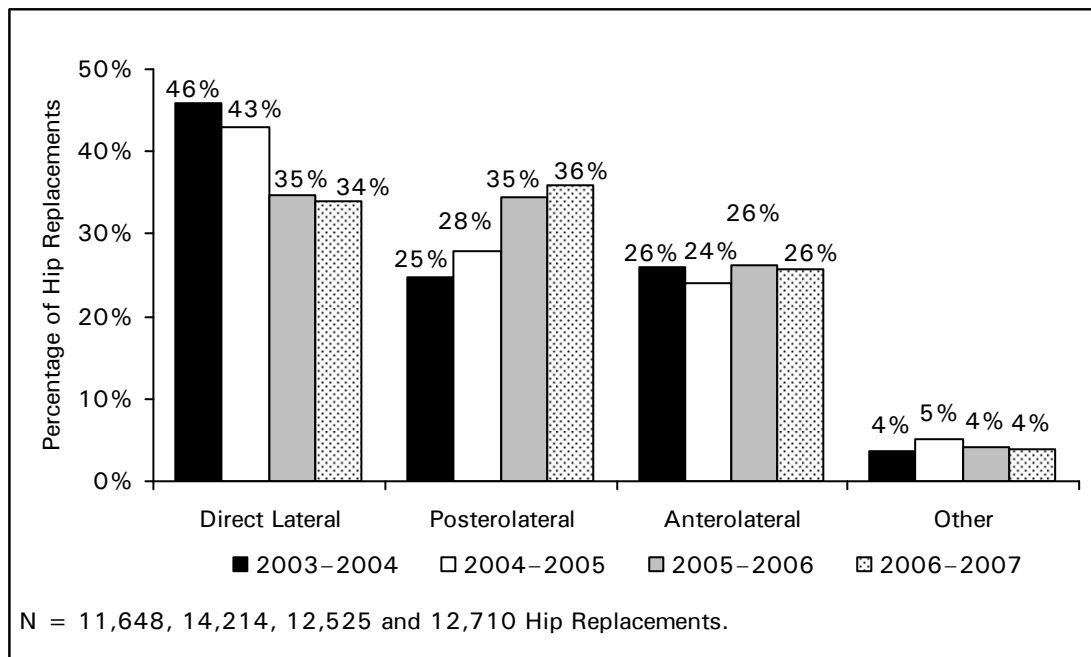
Hip and knee replacement surgery may be undertaken using either a conventional approach or a minimally invasive approach.

A conventional hip replacement involves a standard incision, 25 to 40 centimetres in length, while a minimally invasive hip replacement involves a shorter incision of less than 10 centimetres.¹⁵ Conventional hip surgical approaches include posterolateral, anterolateral, anterior (that is, Smith-Peterson), direct lateral or transgluteal (that is, Hardinge) and lateral transtrochanteric (that is, Charnley) approaches.^{16, 17, 18} A conventional knee replacement involves a standard incision, 20 to 30 centimetres in length, while a minimally invasive knee replacement involves a shorter incision, 10 to 12 centimetres in length.¹⁹

Conventional Surgical Approach

Changes were noted among the type of conventional surgical approaches used for hip replacements over the four years studied (Figure 16). Over this time, the use of a posterolateral surgical approach for hip replacement rose by 11%, while the use of a direct lateral approach for hip replacement declined (from 46% to 34%).

Figure 16 Surgical Approach for Hip Replacements, 2003–2004 to 2006–2007



Source

Canadian Joint Replacement Registry, 2003–2004 to 2006–2007, Canadian Institute for Health Information.

The use of conventional approaches in knee replacement operations remained consistent over the past four years. Among the knee replacements reported in CJRR, for 2006–2007, 92% of the procedures were performed with a medial parapatellar approach, 4% with an intravastus approach, 2% with a subvastus and 1% with a lateral parapatellar.

Minimally Invasive Surgical Approach

Minimally invasive surgery is an emerging surgical technique used for both hip and knee replacement procedures. In 2006–2007, 13% of the hip replacement and 11% of the knee replacement procedures reported in CJRR indicated the use of minimally invasive surgery (Table 17).

Table 17 Joint Replacements by Surgical Approach, 2003–2004 to 2006–2007

Fiscal Year	Hip Replacements				Knee Replacements			
	Minimally Invasive Approach		Conventional Approach		Minimally Invasive Approach		Conventional Approach	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
2003–2004	946	9	9,427	91	944	7	12,401	93
2004–2005	1,763	13	11,954	87	1,439	8	16,935	92
2005–2006	1,725	15	9,752	85	1,602	11	12,829	89
2006–2007	1,532	13	10,489	87	1,585	11	13,497	89

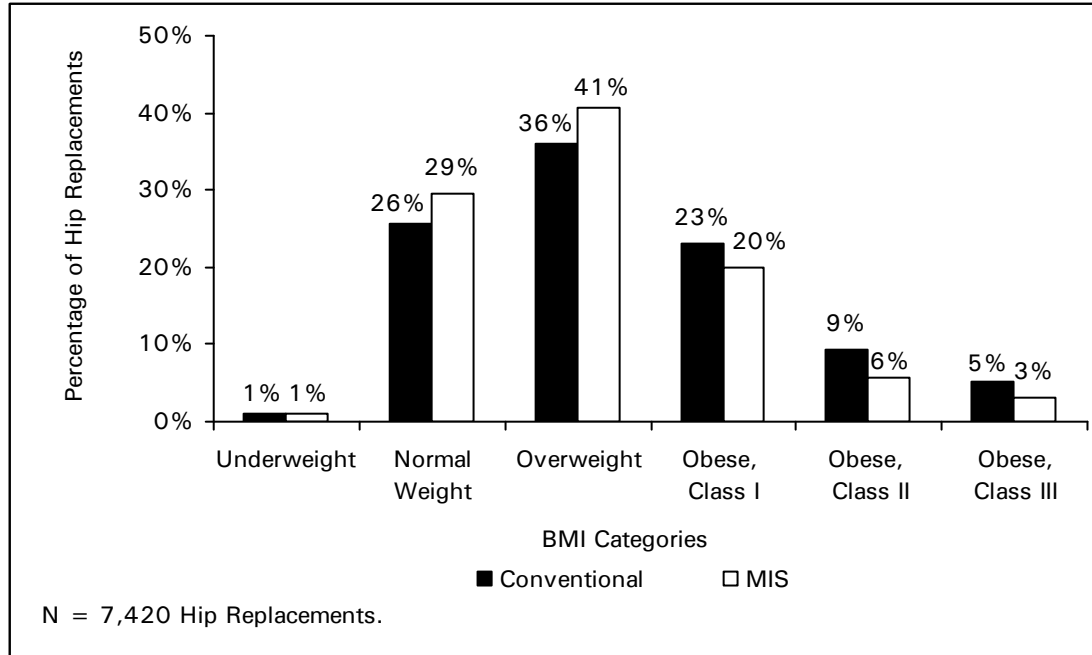
Source

Canadian Joint Replacement Registry, 2003–2004 to 2006–2007, Canadian Institute for Health Information.

There were 1,532 hip replacement procedures utilizing a minimally invasive approach in 2006–2007. Of the minimally invasive hip replacement procedures analyzed in 2006–2007, 98.4% were primary replacements and 1.6% were revisions. Among hip replacements using a minimally invasive approach, 69% were patients younger than 75. The proportion of patients undergoing a minimally invasive hip replacement was 12.5% for females and 13.0% for males.

Patients undergoing minimally invasive hip replacement had significantly lower BMIs than those undergoing conventional hip replacement ($p < 0.01$) (Figure 17).

Figure 17 Body Mass Index Categories for Conventional and Minimally Invasive Hip Replacements, 2006–2007



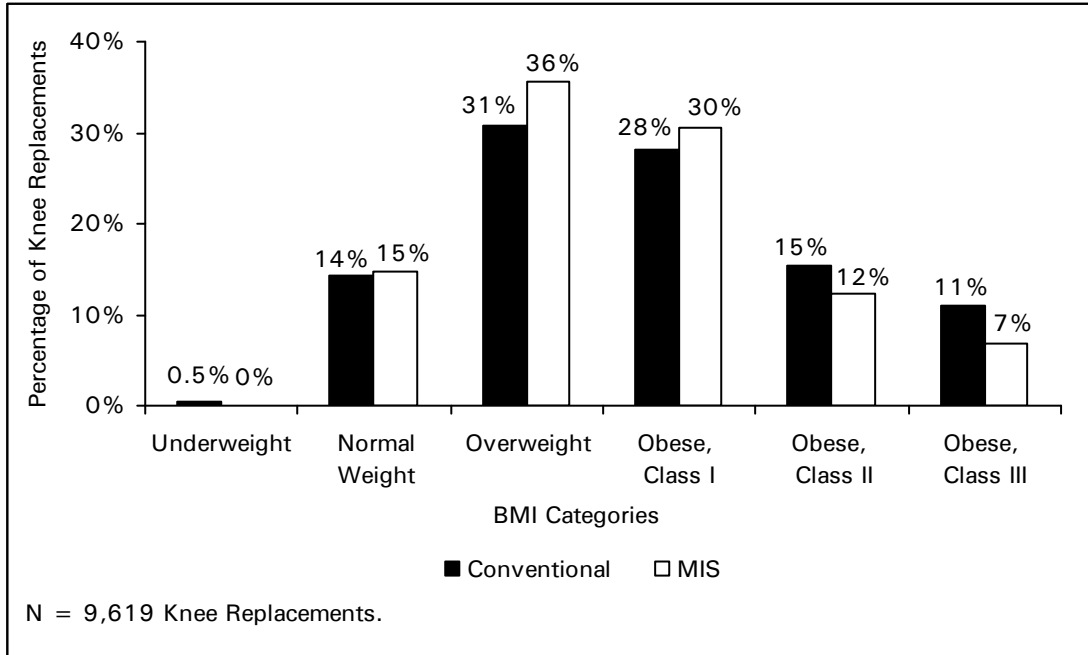
Source

Canadian Joint Replacement Registry, 2006–2007, Canadian Institute for Health Information.

There were 1,585 knee replacement procedures utilizing a minimally invasive technique in 2006–2007. Of the minimally invasive knee replacement procedures analyzed for 2006–2007, 98.8% were primary replacements and 1.2% were revisions. Among knee replacements with a minimally invasive approach, 71% of patients were younger than 75. The proportion of female patients undergoing a minimally invasive knee replacement was 10.4%, compared to 2.0% for males.

Patients undergoing minimally invasive knee replacement had significantly lower BMIs than those undergoing conventional knee replacement ($p < 0.05$) (Figure 18).

Figure 18 Body Mass Index Categories for Conventional and Minimally Invasive Knee Replacements, 2006–2007



Source

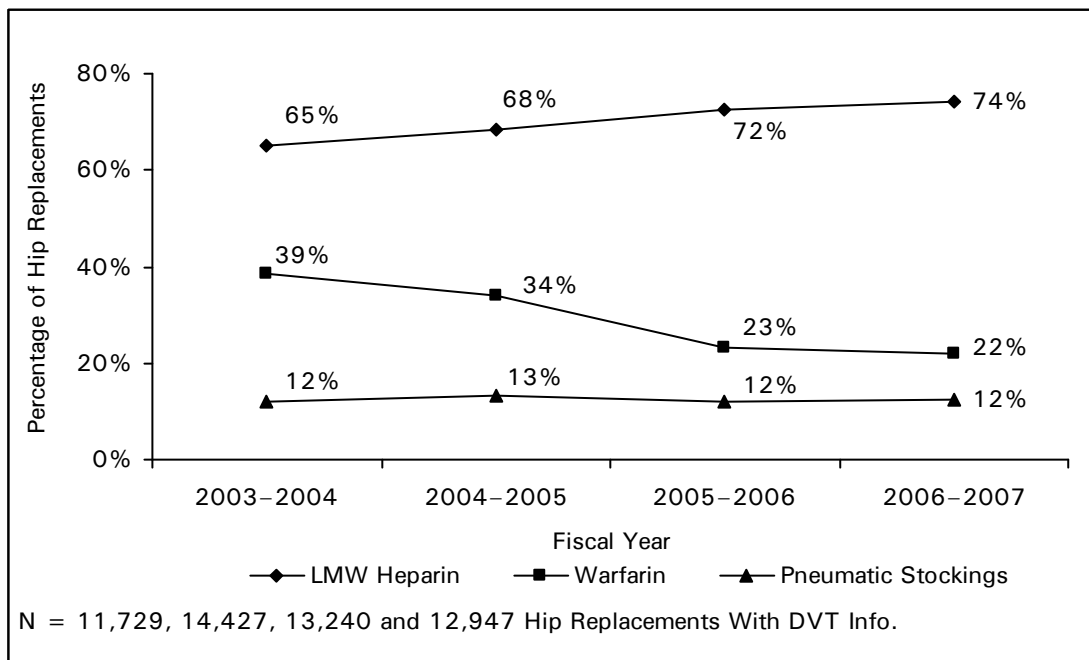
Canadian Joint Replacement Registry, 2006–2007, Canadian Institute for Health Information.

Joint Replacements and Deep Vein Thrombosis

One of the major risks facing patients who undergo orthopedic surgery in the lower extremities is 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 are used as DVT prophylactic (prevention) therapy.

In 2006–2007, more than 99% of joint replacement patients in CJRR received DVT prophylactic treatment. Low-molecular weight heparin was the most commonly used agent among hip and knee replacement recipients (74% and 73%, respectively), and its use increased since 2003–2004. Use of warfarin, the second most commonly used agent (22% and 25% for hip and knee replacement recipients, respectively) decreased since 2003–2004. One possible reason for this decrease is that warfarin often requires post-operation blood monitoring, whereas new DVT preventive agents have been developed that do not require daily blood monitoring. The decrease in length of stay in the hospital over the same time period means less post-operation blood monitoring may have even more appeal.

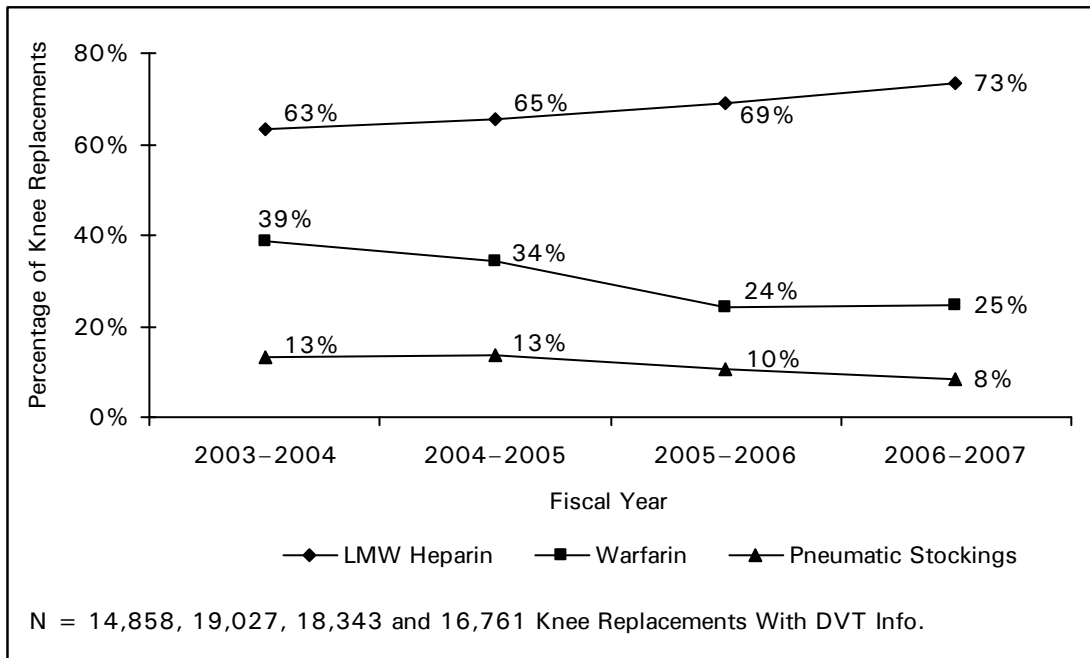
Figure 19 Deep Vein Thrombosis Preventive Agents Used in Hip Replacements, 2003–2004 to 2006–2007



Source

Canadian Joint Replacement Registry, 2003–2004 to 2006–2007, Canadian Institute for Health Information.

Figure 20 Deep Vein Thrombosis Preventive Agents Used in Knee Replacements, 2003–2004 to 2006–2007



Source

Canadian Joint Replacement Registry, 2003–2004 to 2006–2007, Canadian Institute for Health Information.

Joint Replacement Prosthesis Characteristics

Component Types Implanted for Hip Replacement Operations

There are four basic components used for hip replacement operations: acetabular component, acetabular insert/liner, femoral component and femoral head. All components of the naturally occurring bone joint were significantly more likely to be replaced during primary hip replacements than during revisions ($p < 0.01$) (Table 18). With hip replacement revisions, replacement of the femoral head was most common (83%) and replacement of the femoral stem/component was least common (47.9%) in 2006–2007 (Table 18).

Table 18 Compartments Replaced by Primary and Revision Hip Replacement, CJRR, 2003–2004 to 2006–2007

Primary Hip Replacement Performed								
Type of Component Implanted	2003–2004		2004–2005		2005–2006		2006–2007	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Acetabular Component	10,033	98.8	12,517	98.6	10,740	95.7	10,493	96.1
Acetabular Insert/Liner	9,685	95.4	11,950	94.2	10,029	89.4	9,687	88.7
Femoral Component (Hip)	10,130	99.8	12,670	99.8	11,127	99.2	10,864	99.5
Femoral Head	10,142	99.9	12,678	99.9	11,088	98.8	10,760	98.5
Total Primary HR	10,155		12,690		11,217		10,921	
Revision Hip Replacement Performed								
Type of Component Implanted	2003–2004		2004–2005		2005–2006		2006–2007	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Acetabular Component	1,273	81.9	1,338	78.4	1,073	64.8	1,082	63.2
Acetabular Insert/Liner	1,440	92.6	1,537	90.0	1,326	80.0	1,330	77.7
Femoral Component (Hip)	1,185	76.2	1,166	68.3	834	50.3	820	47.9
Femoral Head	1,497	96.3	1,608	94.2	1,434	86.5	1,424	83.2
Revision HR Performed	1,555		1,707		1,657		1,712	

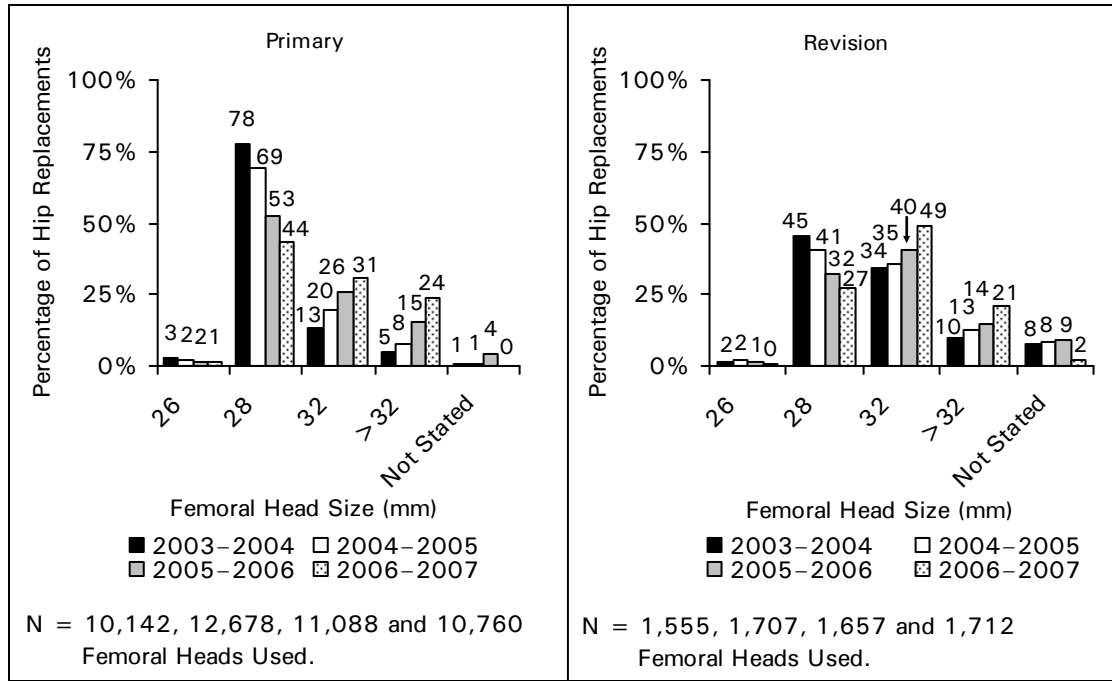
Source

Canadian Joint Replacement Registry, 2003–2004 to 2006–2007, Canadian Institute for Health Information.

Size of Femoral Head Implanted for Hip Replacement Surgery

The stability and durability of hip reconstruction is dependent on many factors, such as the design and size of the prosthetic components. In CJRR, a femoral head size of 28 millimetres was most commonly used for primary hip replacement (44%), followed by a femoral head size of 32 millimetres (31%). A femoral head size of 32 millimetres was most commonly used for revision hip replacement (49%), followed by a femoral head size of 28 millimetres (27%). Of note, there is an increasing trend (from 2003–2004 to 2006–2007) towards the use of 32-millimetre femoral heads and a decreasing trend in the use of 28-millimetre femoral heads. Similar patterns are noted for both primary and revision hip replacement procedures (Figure 21). This trend is related to the increasing use of new bearing surfaces, such as cross-linked polyethylene, metal-on-metal and ceramic-on-ceramic, which allow surgeons to take advantage of the benefits of larger femoral heads, that is, lower dislocation rates and enhanced range of motion without the risk of bearing failure.

Figure 21 Size of Femoral Head Used for Primary and Revision Hip Replacements, CJRR, 2003–2004 to 2006–2007



Source

Canadian Joint Replacement Registry, 2006–2007, Canadian Institute for Health Information.

Component Types Implanted for Knee Replacement Operations

There are three basic components used for knee replacement operations: femoral component, tibial component and patellar component. Among primary knee replacements reported in 2006–2007, 100% of the cases involved replacement of femoral and tibial components. With knee replacement revisions, replacement of the tibial component was most common (71%), followed by the femoral component (60%) in 2006–2007 (Table 19).

Table 19 Knee Replacement Components by Primary and Revision Knee Replacements, CJRR, 2003–2004 to 2006–2007

Primary Knee Replacement Performed								
Type of Component Implanted	2003–2004		2004–2005		2005–2006		2006–2007	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Femoral Component	13,901	100.0	17,860	100.0	16,722	99.87	15,059	99.9
Tibial Component	13,900	100.0	17,851	99.9	16,695	99.71	15,016	99.6
Patellar Component	12,063	86.8	14,950	83.7	11,958	71.42	9,833	65.2
Total Primary Knee Replacement	13,905		17,864		16,744		15,076	
Revision Knee Replacement Performed								
Type of Component Implanted	2003–2004		2004–2005		2005–2006		2006–2007	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Femoral Component	793	85.1	937	81.8	696	65.5	601	59.7
Tibial Component	879	94.3	1,056	92.1	836	78.7	716	71.2
Patellar Component	665	71.4	751	65.5	466	43.9	358	35.6
Total Revision Knee Replacement	932		1,146		1,062		1,006	

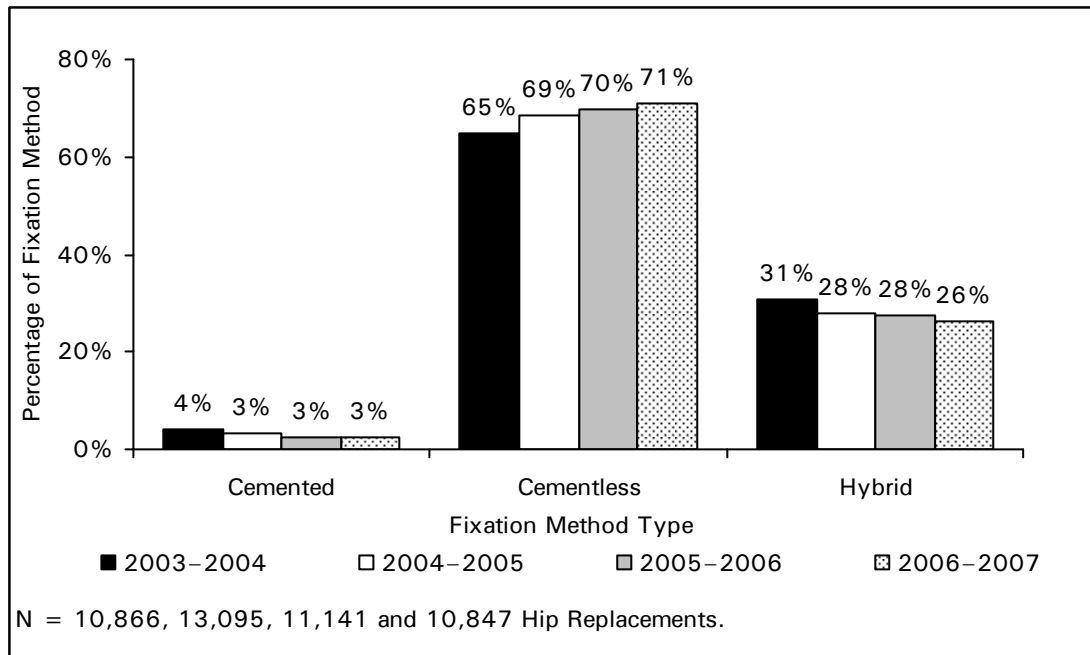
Source

Canadian Joint Replacement Registry, 2003–2004 to 2006–2007, Canadian Institute for Health Information.

Fixation Method in Joint Replacement Surgery

In 2006–2007, cementless (71%) was the most common fixation method used for hip replacement (primary and revision) procedures. Hybrid was the second most frequently used fixation method (26%). Hybrid refers to the use of a combination of cementless (screws) and cemented in a procedure. The use of the cementless method increased 6% between 2003–2004 and 2006–2007, while use of the hybrid method decreased 5% during the same period of time (Figure 22).

Figure 22 Fixation Method for Hip Replacement Procedures, CJRR, 2003–2004 to 2006–2007

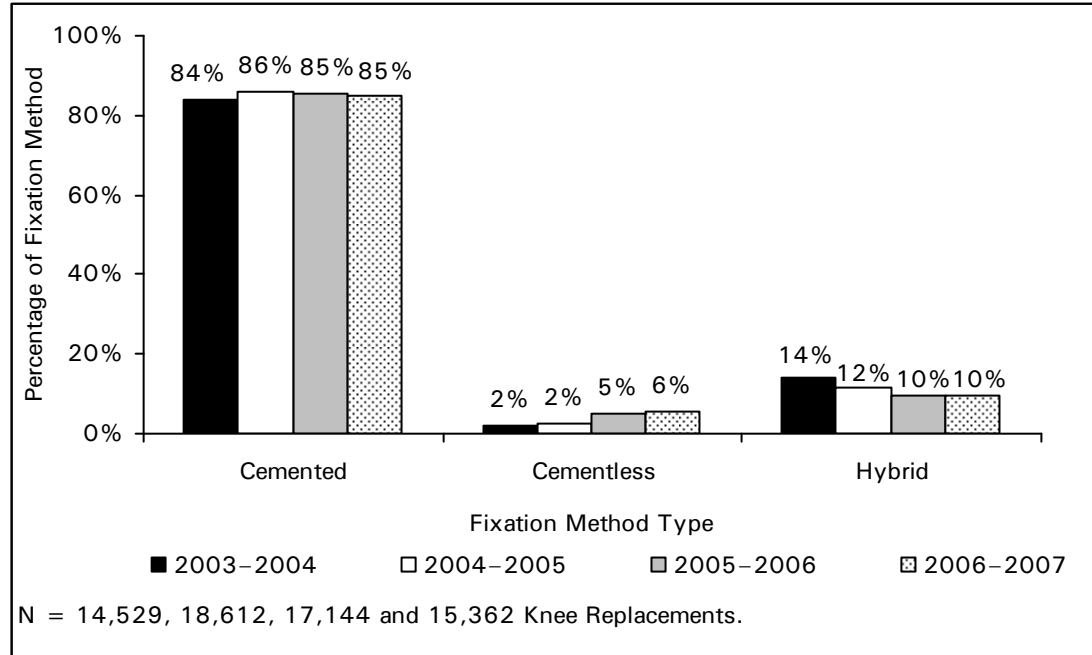


Source

Canadian Joint Replacement Registry, 2003–2004 to 2006–2007, Canadian Institute for Health Information.

Among all knee replacements reported to CJRR in 2006–2007, cemented (85%) was the most common fixation method used, followed by hybrid (10%) (Figure 23).

Figure 23 Fixation Methods for Knee Replacement Procedures, CJRR, 2003–2004 to 2006–2007



Source

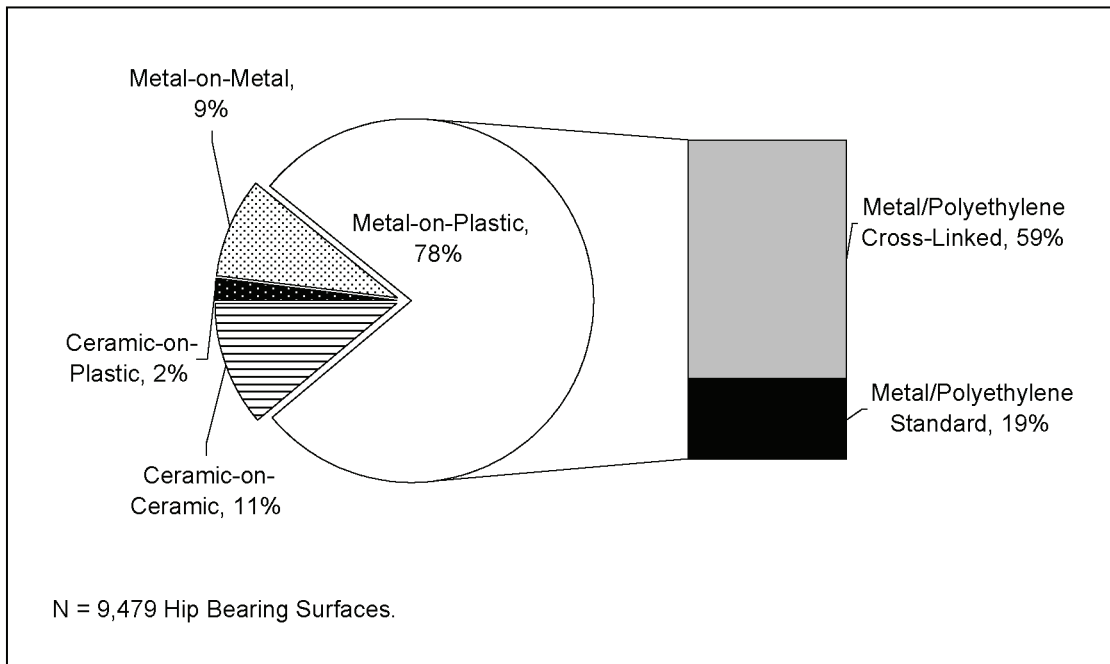
Canadian Joint Replacement Registry, 2003–2004 to 2006–2007, Canadian Institute for Health Information.

Cementless fixation method is used in hip replacements more often than cemented, while an opposite pattern is noted for knee replacements. The selection of fixation method depends on the type of replacement and the range of joint motion involved.

Bearing Surfaces for Hip Replacements

Although various combinations of femoral head and acetabular liner materials were used in performing hip replacement procedures, the most common bearing surface was metal-on-plastic (78%), primarily cobalt chrome/cross-linked polyethylene (Figure 24). There is an increasing trend in the use of cobalt chrome/cross-linked polyethylene, from 45% in 2002–2003 to 76% in 2006–2007 (Figure 25).

Figure 24 Bearing Surfaces for Hip Replacements, 2006–2007



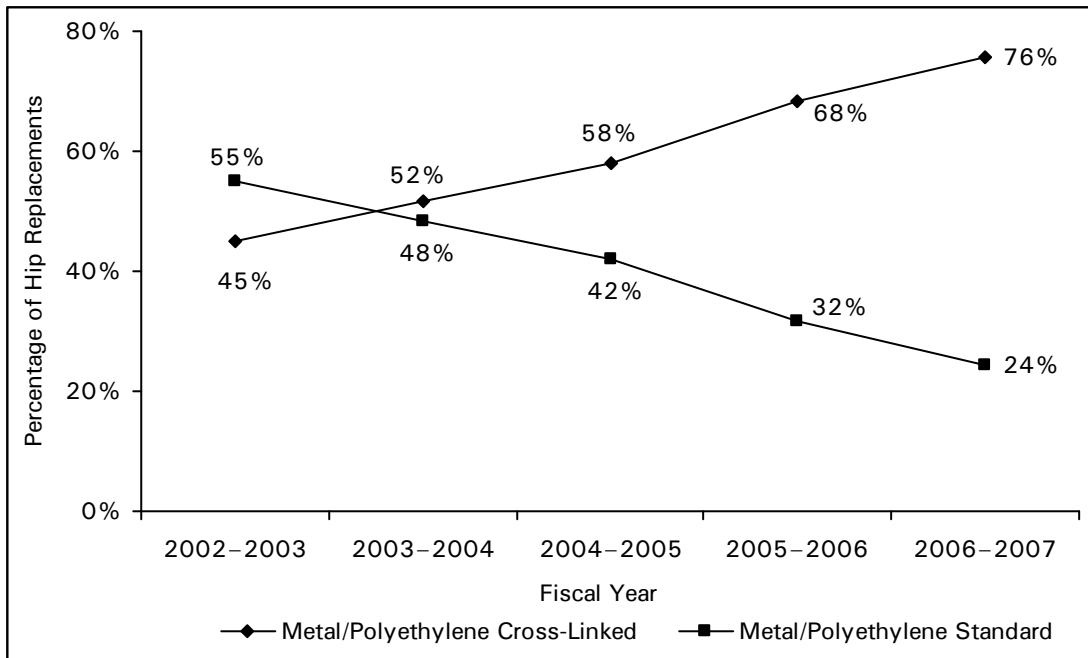
Note

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

Source

Canadian Joint Replacement Registry, 2006–2007, Canadian Institute for Health Information.

Figure 25 Types of Metal-on-Plastic Bearing Surfaces, Hip Replacements, 2002–2003 to 2006–2007



Note

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

Source

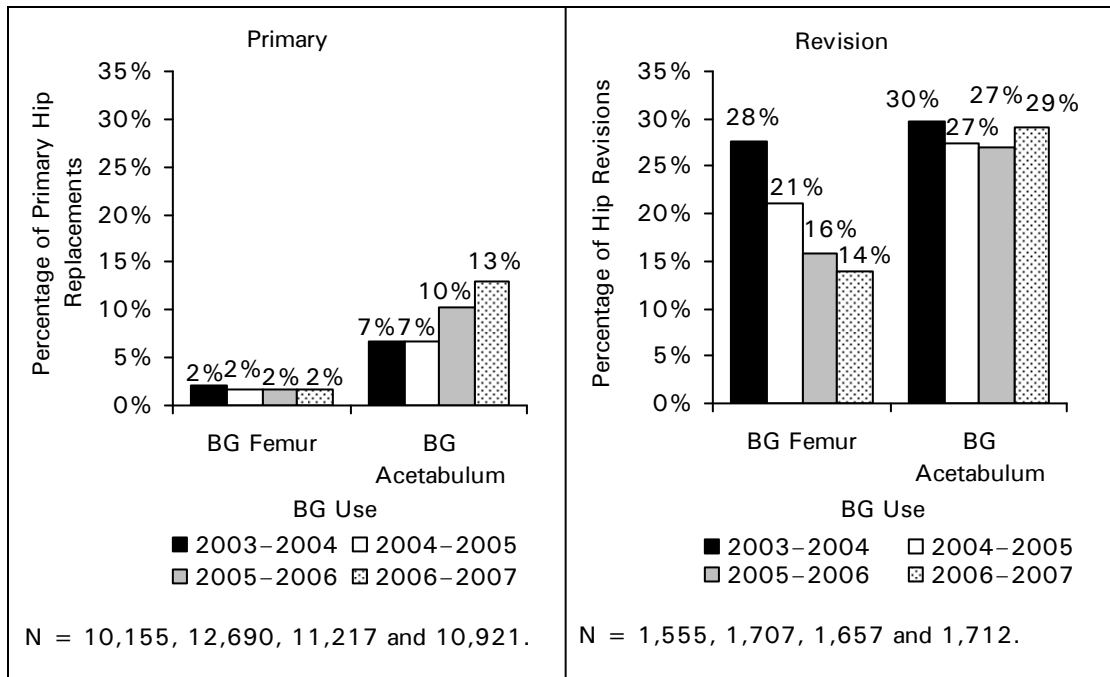
Canadian Joint Replacement Registry, 2002–2003 to 2006–2007, Canadian Institute for Health Information.

Bone Graft Use in Joint Replacement Surgery

Collection of information on bone graft (BG) use began in 2003–2004, with data captured regarding BG use on the femur and acetabulum for hip replacements. As in previous years, in 2006–2007, grafts were used more frequently for revision procedures than for primary replacement procedures.

For hip replacement revisions, BG transplantation on the femur was higher for revisions (14%) than for primary procedures (2%). For revision procedures reported, 29% used grafts on the acetabulum, compared to 13% for primary procedures. BG femur use decreased from 28% in 2003–2004 to 14% in 2006–2007 for hip revision procedures (Figure 26).

Figure 26 Bone Graft Use for Hip Replacements, 2003–2004 to 2006–2007

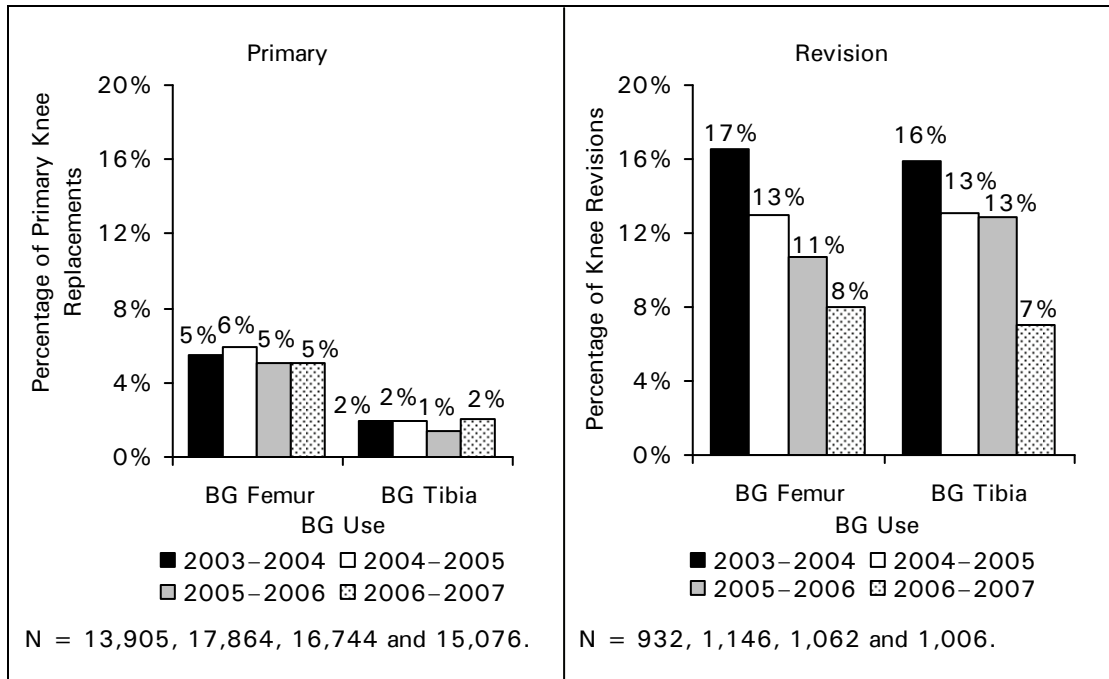


Source

Canadian Joint Replacement Registry, 2003–2004 to 2006–2007, Canadian Institute for Health Information.

For knee replacement procedures, in 2006–2007, BG use on the femur and tibia were also more frequently used among revisions (15%) than primary replacements (7%). Femur bone grafts were transplanted in 8% of the revisions and in 5% of the primary knee replacements; tibia bone grafts were transplanted in 7% of the revisions and in 2% of the primary knee replacements (Figure 27).

Figure 27 Bone Graft Use for Knee Replacements, 2003–2004 to 2006–2007



Source

Canadian Joint Replacement Registry, 2003–2004 to 2006–2007, Canadian Institute for Health Information.

Summary of Findings

Of hip replacements reported in CJRR for 2006–2007, 86.4% of operations involved primary replacements, while 13.6% involved revisions. Among the knee replacements reported in CJRR for 2006–2007, 93.7% of them involved primary operations and 6.3% of them involved revisions.

Degenerative OA was indicated as the most common responsible diagnosis for primary hip (81%) and knee (94%) replacements. The most common reason reported for both hip and knee replacement revisions in 2006–2007 was aseptic loosening (44% for hip; 25% for knee).

Hip and knee replacement tends to be disproportionately required for overweight or obese persons, in particular for knee replacements. Among the hip replacement recipients, BMI in the overweight (BMI 25.0 to 29.9) category represented the largest proportion (37%) in 2006–2007. Among the knee replacement recipients, BMI in the obese (BMI 30.0 to 39.9 and higher) category represented the largest proportion (55%) in 2006–2007.

Overall in 2006–2007, Canadians waited a significantly shorter period of time for primary hip replacement operations (median 127 days) than for primary knee replacements (median 169 days). Furthermore, wait times for hip and knee replacement revisions were shorter (median 92 days [mean 145 days] and median 98 days [mean 147 days], respectively) than for primary hip and knee replacements. Compared to last year, the wait time for patients who underwent hip replacements did not change, while the wait time for patients who underwent knee replacement was 13 days shorter in 2006–2007 (median wait time of 169 days versus 182 days). Escalating BMI was associated with longer wait times regardless of the type of primary joint replacement (hip or knee) a patient underwent.

There is an increasing trend in the number of hip resurfacing replacements reported to CJRR over the past four years, from 75 procedures (0.7% of all hip replacement procedures) in 2003–2004 to 278 procedures (2.7% of all hip replacement procedures) in 2006–2007. For knee replacement, UKA procedure rates remained steady for the same time period.

An increasing trend is observed for minimally invasive surgery used both in hip and knee replacement procedures over the past four years. Of the minimally invasive hip and knee replacement procedures, about 98% were primary replacements. Patients undergoing minimally invasive hip and knee replacements were younger and had lower BMIs than those undergoing conventional hip and knee replacement procedures.

Low-molecular weight heparin was the most commonly used agent for DVT prevention among hip and knee replacement recipients in 2006–2007 (74% and 73%, respectively). Use of warfarin, the second most commonly used agent, decreased from 39% for hip and 39% for knee in 2003–2004, to 22% for hip and 25% for knee in 2006–2007.

The use of larger femoral heads (≥ 32 millimetres) increased for both primary and revision hip replacement procedures since 2003–2004. The most common bearing surface used in 2006–2007 was metal-on-plastic for hip replacements (78%). There is an increasing trend in using cobalt chrome/cross-linked polyethylene, from 45% in 2002–2003 to 76% in 2006–2007. Bone grafts were used more frequently for revision procedures than for primary replacement procedures. BG femur use decreased from 28% in 2003–2004 to 14% in 2006–2007 for hip revision procedures, and from 17% to 8% for knee revision procedures.

Discussion and Future Directions

Hip and Knee Replacements in Canada—Canadian Joint Replacement Registry 2008–2009 Annual Report uses data collected from several sources (including CJRR, HMDB and DAD, all maintained at CIHI) to highlight trends and regional variations for hip and knee replacement procedures in Canada. As well, the report provides details on the nature and types of hip and knee replacement operations and surgical techniques utilized by Canadian orthopedic surgeons. This information is intended for use by decision-makers involved in managing health care systems, orthopedic surgeons and related care providers and researchers, as well as the general public.

This year, in addition to continuing to present results of analyses in established areas, we present emerging information on the wait times for joint revision procedures. Joint replacement procedures are one of the five priority areas targeted federally for meaningful reductions in wait times by 2007. As a mechanism to inform these efforts, as of April 1, 2005, CJRR began collecting data related to retrospective wait times as part of a broader CIHI initiative to collect and report on national wait time data. This year's report finds that wait times for patients who received hip replacements (median wait of 127 days) were significantly shorter than those for patients who received knee replacements (median wait of 169 days). The data collected and reported by CJRR will continue to retrospectively inform these issues.

In this report, patients in CJRR who had knee replacements during 2006–2007 were again more likely to be overweight or obese compared to hip replacement patients, and obese individuals were more than three times as likely to undergo joint replacement surgery, compared to those in the normal-weight BMI category.

Minimally invasive techniques provide new approaches for hip and knee replacement surgery. In 2006–2007, 13% of the hip replacement and 11% of the knee replacement procedures reported in CJRR used minimally invasive techniques. Patients undergoing minimally invasive joint replacement tended to weigh significantly less and were younger than those undergoing conventional joint replacement.

CJRR is currently expanding its data collection and recruitment efforts to become an increasingly relevant source of health information for decision-makers. CJRR will be implementing a web-based data submission system in addition to current paper and electronic file submission options. Focused attention continues to be directed towards increasing CJRR coverage across Canada.

Future directions for CJRR include launching comparative reports in 2009–2010. The comparative reports will allow participating facilities to compare key indicators at a sub-national level. Such information will support clinical practice, system management and policy.

CJRR will play a continuing and growing role in collecting and analyzing comprehensive pan-Canadian data in the years ahead. As new technologies and surgical techniques appear on the horizon for joint replacements, comprehensive analyses of CJRR data will explore the spectrum of health outcomes in an effort to increase knowledge and understanding of evolving implants and surgical techniques from clinical, administrative and policy perspectives.

Appendix A: CJRR Advisory Committee and Research and Development Subcommittee

CJRR Advisory Committee

- Dr. Robert Bourne (Co-Chair), London Health Sciences Centre, Ontario
- Dr. Eric R. Bohm (Co-Chair), University of Manitoba Joint Replacement Group, Manitoba
- Dr. Michael Dunbar (Co-Chair), Queen Elizabeth II Health Sciences Centre, Nova Scotia
- Dr. Olga L. Huk, The Sir Mortimer B. Davis—Jewish General Hospital, Quebec
- Dr. Darren Kerr, Saint John Regional Hospital, New Brunswick
- Dr. Hans Kreder, Sunnybrook and Women’s College Health Sciences Centre, Ontario
- Dr. Paul Kim, Ottawa Hospital, Ontario
- Dr. Martin Lavigne, Hôpital Maisonneuve-Rosemont, Quebec
- Dr. Brendan Lewis, Western Memorial Hospital, Newfoundland and Labrador
- Dr. James MacKenzie, Peter Lougheed Centre, Alberta
- Dr. Rod Martin, Health Care Corporation of St. John’s, Newfoundland and Labrador
- Dr. Bas Masri, Vancouver General Hospital, British Columbia
- Ms. Lynn Moore, The Arthritis Society of Canada, Ontario
- Mr. John Pipe, Patient Representative, Ontario
- Dr. James Waddell, St. Michael’s Hospital, Ontario
- Dr. Jason Werle, University of Calgary
- Dr. Allan Woo, St. Paul’s Hospital, Saskatchewan
- Ms. Alison Bartel, Concordia Hospital, Manitoba

CJRR Research and Development Subcommittee

- Dr. Michael Dunbar (Co-Chair), Queen Elizabeth II Health Sciences Centre, Nova Scotia
- Dr. Eric R. Bohm (Co-Chair), University of Manitoba Joint Replacement Group, Manitoba
- Dr. Robert Bourne, London Health Sciences Centre, Ontario
- Dr. Paul Kim, Ottawa Hospital, Ontario
- Dr. Hans Kreder, Sunnybrook and Women’s College Health Sciences Centre, Ontario
- Dr. Martin Lavigne, Hôpital Maisonneuve-Rosemont, Quebec
- Dr. Brendan Lewis, Western Memorial Hospital, Newfoundland and Labrador
- Ms. Lynn Moore, The Arthritis Society of Canada, Ontario
- Dr. Jason Werle, Rockyview Hospital, Alberta

Appendix B: Hip and Knee Replacement Coding Methodology, HMDB

Hospital Morbidity Database

Collection of HMDB Data

The Hospitalization Statistics chapter of the CJRR annual report contains data from the Hospital Morbidity Database (HMDB). HMDB, managed by CIHI, is a national data holding that captures administrative, clinical and demographic information on hospital discharges largely from Canadian acute care facilities. HMDB provides national information on diagnoses, operative procedures, admission dates, in-hospital lengths of stay and patient demographics.

HMDB is populated by two sources: 1) a subset of the Discharge Abstract Database (DAD) data, which consist largely of acute inpatient data from most provinces in Canada; and 2) data from provinces that do not participate in DAD. In 2006–2007, all provinces and territories submitted discharge data directly to DAD, with the exception of Quebec. The ministère de la Santé et des Services sociaux du Québec usually submits data files to CIHI on an annual basis. These data files are then merged with DAD to create the national HMDB. However, Quebec data for 2006–2007 were not available when this annual report was composed.

Population of Reference

DAD data reported in this document include hospitalizations for hip and knee replacements (including primary and revisions) performed in Canada, with the exception of Quebec, for all discharges from acute care hospitals during 2006–2007 (April 1, 2006, to March 31, 2007). Additional years of HMDB data are reported for trending purposes.

Patients in all age groups were included in the CJRR annual report. Patients younger than 20 comprised less than 0.1% of the total for hip and knee replacements for 2003–2004 through 2006–2007. Thus inclusion of this age group is unlikely to impact overall analyses.

Hip and knee replacements performed from 2004–2005 to 2006–2007 were identified according to ICD-10-CA/CCI codes, with the exception of Quebec, which reported using the ICD-9/CCP classification from 2004 to 2006. Hospitalization data prior to 2004–2005 were collected in a mixture of coding classifications (ICD-10-CA/CCI, ICD-9-CM, ICD-9/CCP). Analyses included partial and total knee replacement procedures, as the latter cannot be separated out in the CCP classification system. However, only data on total hip replacements are shown. Partial hip replacements are not included in the analyses. Counts for hip and knee replacements performed in Quebec prior to 2003–2004 may have been underestimated, since revision codes were not identifiable in HMDB at that time.

Operations coded as “previous” or “abandoned” were excluded from the analyses. Also, beginning with 2001–2002 data, operations coded as being performed out-of-province were excluded in order to avoid double-counting cases.

Hospitalization Counts

Beginning with the 2005 CJRR annual report, counts reported are based on the number of hospitalizations. In earlier reports, counts reported were based on the number of procedures performed. The main difference between the two methodologies occurs in the counting of bilateral procedures performed on the same day (that is, in the same operative episode). In the current methodology, if a person has more than one hip or knee replacement procedure (that is, bilateral) coded for the same hospital visit, only one hospitalization is counted. This is consistent with the reporting of procedures in the *Canadian Classification of Health Interventions* (CCI). Therefore, when comparisons with historical reports are made, this methodology should be kept in mind.

Geographical Reporting

With the exception of length of stay and in-hospital death analyses, provincial analyses are based on a patient's province of residence, not where the procedure was performed. Patient geography was assigned based on postal code using the July 2005 Postal Code Conversion File from Statistics Canada. Patients with incomplete postal codes were included in the provincial and national counts and rate calculations. Patients with unknown residence were excluded from the counts and the age-standardized rates of provincial analyses.

In CJRR annual reports released prior to 2004–2005, patients with unknown or invalid postal codes were reported in the "Unknown" province category. The methodology was revised such that incomplete postal codes were mapped to provinces/territories using the first three digits of the postal code. Therefore, there is a significant reduction in the number of patients with an "Unknown" province of residence and a corresponding increase in the counts for some provinces and territories compared to previously reported data in 1994–1995 through 2000–2001.

Converse to the rest of the report, length-of-stay analyses are based on the province where the procedure was performed as opposed to the province of patient residence. Non-Canadian residents and patients of unknown or invalid residence codes are included in this analysis.

Reporting of Age-Standardized Rates

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. Unless otherwise indicated, rates presented in this report are age standardized and are reported per 100,000 population.

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

Counts and rates of hip and knee replacements shown over time may vary in the current report compared to previous reports. This is due to the following:

- Historical counts for 1995–1996 through 2000–2001 have been updated in HMDB; and
- The calculations for age-standardized rates are based on updated fiscal population estimates from Statistics Canada.

Reporting Median and Interquartile Range of LOS

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

Codes Used to Identify Hip and Knee Replacements

In HMDB, for the period 1994 to 2000, hip or knee replacement procedures were coded using ICD-9-CM (*ICD-9-CM 9th Revision—Clinical Modification*) or CCP (*ICD-9-CCP 9th Revision—Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures*). ICD-9-CM codes were converted to CCP for the purpose of this report. Beginning in 2001, ICD-10-CA/CCI (*International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Canada and Canadian Classification of Health Interventions*) was introduced, replacing the previous classification systems in a staggered fashion across the country. CCI provides greater specificity in the classification of hip and knee replacement procedures compared to its predecessors. In addition to providing separate codes for cemented versus un-cemented procedures, it also permits separation of partial versus total replacements.

In 2003–2004, the ICD-10-CA/CCI classification systems were updated. New Brunswick started implementing the new version of ICD-10-CA/CCI. The provinces and territories already using ICD-10-CA/CCI for coding medical diagnoses and interventions began using the updated version of ICD-10-CA/CCI as well, while ICD-9-CM and ICD-9/CCP were still in use in Manitoba and Quebec, respectively, during this fiscal year. As a result, the 2003–2004 HMDB data file contains data in three different classification systems, namely, ICD-9/CCP, ICD-9-CM (enhanced ICD-9/CCP) and ICD-10-CA/CCI (version 2001 and version 2003).

In 2004–2005, Manitoba began adopting ICD-10-CA/CCI, thereby completing the implementation of the new classification system in all DAD-submitting provinces and territories. As a result, all provinces and territories reported their hip replacements and knee replacements in 2004–2005 and 2005–2006 using the ICD-10-CA/CCI classification system, except Quebec, which used the ICD-9/CCP coding system.

Of note, the ICD-10-CA/CCI classification system is considerably different from the previously used ICD-9/CCP and ICD-9-CM classification systems, which were relatively comparable.

Hip Replacements

Table B-1 presents the codes used to identify hip replacements in this report. In CCI, the rubric code of interest is 1.VA.53 *Implantation of internal device, hip joint*. This rubric code is broken down into more detailed subcategories: cement spacer, single component and dual component and, for each, whether the procedure was cemented or uncemented (even more detailed components in the latter). Only the dual-component prosthetic device code series is of interest to this report, as these capture total (as opposed to partial) hip replacements: 1.VA.53.LA-PN (open approach) and 1.VA.53.PN-PN (robotics-assisted approach). In CCI, revisions are identified using a supplementary code called a Status Attribute, in which Status Attribute = R identifies that the procedure is a revision. It must be noted that for 2001–2002 and 2002–2003, the coding of this attribute was optional; therefore, the number of revision procedures may be underestimated. Coding of revisions is mandatory beginning in 2003–2004.

For hip replacement procedures coded in the CCP classification, codes of interest are 93.51 *Total hip replacements with methyl methacrylate* and 93.59 *Other total hip replacements*. Prior to 2000–2001, these codes also included revisions. However, after April 1, 2000, revisions of a total hip replacement *cemented with methyl methacrylate* were assigned the CCP code of 93.52 and revision of a total hip replacement *uncemented* was coded 93.53. Therefore, when reporting total hip replacement procedures in this report, any of these four codes is used. It must be noted that partial hip replacement procedures are captured using the CCP code 93.69 *Other repair of hip*, which is not included in this report's analyses.

Table B-1 CCI and CCP Hip Replacement Codes*

Rubric	CCI Codes				
1.VA.53.^.^ Implantation of Internal Device, Hip Joint	Cemented	Uncemented	Bone Autograft (Uncemented)	Bone Homograft (Uncemented)	Combined Bone Graft and Cement or Paste
Open Approach					
Dual-Component Prosthetic Device (Femoral and Acetabular)	1.VA.53.LA-PN-N	1.VA.53.LA-PN	1.VA.53.LA-PN-A	1.VA.53.LA-PN-K	1.VA.53.LA-PN-Q
Single-Component Prosthetic Device (Femoral)	1.VA.53.LA-PM-N	1.VA.53.LA-PM	1.VA.53.LA-PM-A	1.VA.53.LA-PM-K	1.VA.53.LA-PM-Q
Robotics-Assisted Approach (for Example, Tele-Manipulation of Tools)					
Dual-Component Prosthetic Device (Femoral and Acetabular)	1.VA.53.PN-PN	1.VA.53.PN-PN-N	1.VA.53.PN-PN-A	1.VA.53.PN-PN-K	1.VA.53.PN-PN-Q
Single-Component Prosthetic Device (Femoral)	1.VA.53.PN-PM	1.VA.53.PN-PM-N	1.VA.53.PN-PM-A	1.VA.53.PN-PM-K	1.VA.53.PN-PM-Q
Rubric	CCP Code		CCP Description		
93.5 Total Hip Replacement	93.51		Total Hip Replacement, Cemented		
	93.59		Other Total Hip Replacement		
	93.52		Revision of Total Hip Replacement, Cemented		
	93.53		Revision of Total Hip Replacement, Uncemented		

Notes

1.VA.53.^.^ Implantation of Internal Device, Hip Joint

Includes: Replacement with implantation prosthetic device, hip
Hemi-arthroplasty with implantation prosthetic device, hip
Replacement, hip, using prosthetic device
Reduction with fixation and implantation of prosthetic device, hip

Excludes: Implantation, prosthetic device to acetabulum alone (see 1.SQ.53.^.^)

* Only dual-component prosthetic device codes in CCI were considered as they refer to total, not partial, hip replacements while performing analysis of data from the Hospital Morbidity Database.

Knee Replacements

Table B-2 presents the codes of interest used to identify knee replacements for the purposes of this report. It must be noted that although CCI permits the separation of true total knee replacements from partial knee replacements, *all* codes in rubric 1.VG.53 were used to define total knee replacement. The decision to include partial replacements in the reporting was made to maintain comparability with provinces using the older classification systems, which do not distinguish between the two types of surgery. Table B-3 shows the split between true partial versus total knee replacements using the CCI coding system based on data from 2004–2005.

In CCP, the relevant knee replacement code was 93.41 *Geomedic and polycentric total knee replacement*, which captured primary and revision procedures together until April 2000. Afterwards, the code 93.40 was added to capture revisions of total knee replacements only, cemented or uncemented. In CCI, revisions are identified using the supplementary code Status Attribute = R, but it was optional to report this code in 2001–2002 and 2002–2003. Coding of revisions is mandatory beginning in 2003–2004. While the rest of Canada uses CCP code 93.40 to capture knee revision procedures (cemented and uncemented), CCP code 93.471 has been used in the Med-Écho since 1998 to capture knee revisions in Quebec.

Table B-2 CCI and CCP Codes for Total Knee Replacements*

Rubric	CCI Codes				
	Cemented	Uncemented	With Bone Autograft	With Bone Homograft	With Combined Bone Graft and Cement or Paste
1.VG.53.^ ^ Implantation of Internal Device, Knee Joint					
Cement Spacer (Temporary) (Impregnated With Antibiotics)	1.VG.53.LA-SL-N	–	–	–	–
Dual Component Prosthetic Device (Bicondylar)	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
Single Component Prosthetic Device (Unicondylar)	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
Tri-Component Prosthetic Device (Medial, Lateral and Patellofemoral)	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
Rubric	CCP Code		CCP Description		
93.4—Arthroplasty of the Knee and Ankle	93.41		Total Knee Replacement (Geomedic) (Polycentric)		
	93.40, 93.471		Revision of Total Knee Replacement (Geomedic) (Polycentric)		

Notes

1.VG.53.^ ^ Implantation of Internal Device, Knee Joint

Includes: Replacement with implantation of prosthetic device, knee
Hemi-arthroplasty with implantation of prosthetic device, knee
Replacement, knee, using prosthetic device

Excludes: Patellaplasty alone using prosthetic device
Replacement, patellofemoral alone

* All of these CCI codes were considered for analysis of data from the Hospital Morbidity Database, Discharge Abstract Database and National Ambulatory Care Reporting System at the Canadian Institute for Health Information.

Table B-3 Partial and Total Knee Replacement Hospitalizations by Reporting Hospital Province (Provinces Reporting in ICD-10-CA, CCI Only)

Submitting Hospital Province	Extent of Knee Replacement Procedure					
	Partial*		Total†		All Knee Replacements (CCI)	
	Counts	Percentage	Counts	Percentage	Counts	Percentage
Newfoundland and Labrador	23	4.5	489	95.5	512	100
Prince Edward Island	<5	0.4	224	99.6	225	100
Nova Scotia	54	4.9	1,049	95.1	1,103	100
New Brunswick	94	9.4	911	90.6	1,005	100
Ontario	953	4.6	19,823	95.4	20,776	100
Manitoba	65	2.9	2,192	97.1	2,257	100
Saskatchewan	64	4.1	1,500	95.9	1,564	100
Alberta	243	5.9	3,856	94.1	4,099	100
British Columbia	354	5.5	6,046	94.5	6,400	100
Northwest Territories	0	0.0	27	100.0	27	100
Yukon	0	0.0	12	100.0	12	100
Total	1,851	4.9	36,129	95.1	37,980	100

Notes

Counts with cell size less than five were suppressed due to privacy.

* CCI codes for partial knee replacement: 1.VG.53.LA-PM, 1.VG.53.LA-SL.

† CCI codes for total knee replacement: 1.VG.53.LA-PP, 1.VG.53.LA-PN.

Source

Discharge Abstract Database, 2006–2007, Canadian Institute for Health Information.

Appendix C: Patient Demographics in CJRR Compared to HMDB

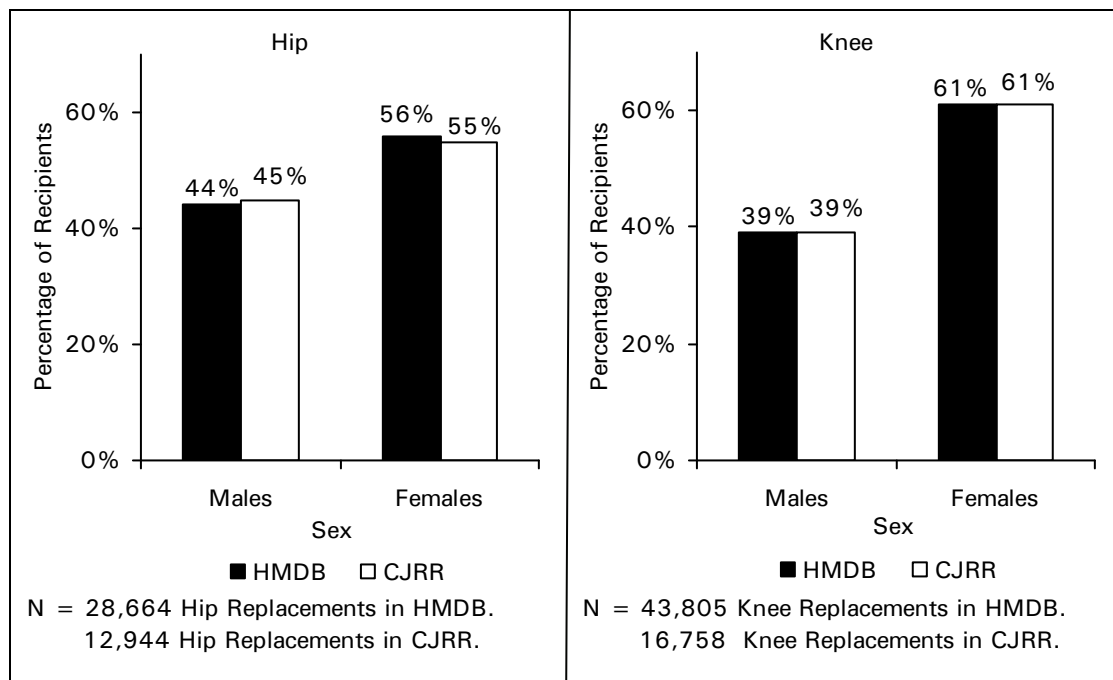
The data in the CJRR database are a subset of all patients who have received joint replacement procedures in Canadian hospitals as captured in HMDB. This section compares the patient demographics of the data captured in CJRR for 2006–2007 versus the data in HMDB for the same time period to provide insight into how representative CJRR data are of the overall HMDB population. For Quebec, 2005–2006 HMDB data were used in this section for the comparison due to a lack of availability of 2006–2007 data.

Overall, CJRR captured 45% of hip replacement procedures and 38% of knee replacement procedures captured in HMDB for 2006–2007.

Sex

The sex distribution of joint replacement recipients in CJRR is comparable to that in HMDB. Figure 28 shows that 55% of hip replacement recipients were female and 45% were male in CJRR, while in HMDB, 56% of the hip replacement recipients were female and 44% were male. Of the knee replacement recipients, 61% were female and 39% were male in both CJRR and HMDB.

Figure 28 Sex Distribution for Hip Replacement in CJRR and HMDB, 2006–2007



Note

Quebec data in 2005–2006 HMDB were used in this analysis.

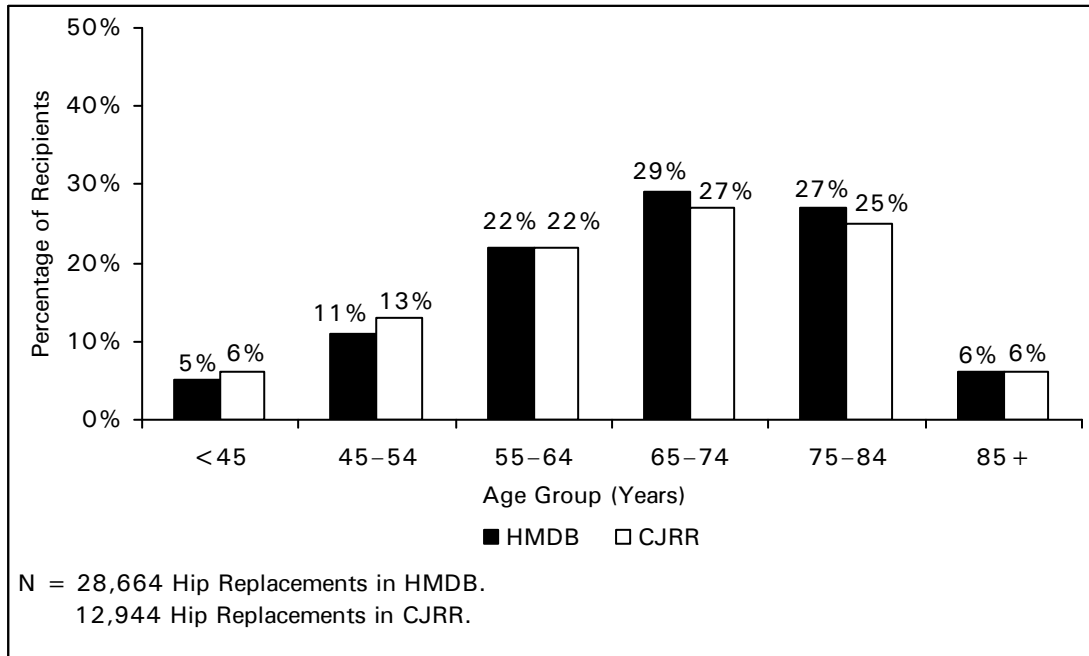
Sources

Canadian Joint Replacement Registry, 2006–2007 and Hospital Morbidity Database, 2006–2007, Canadian Institute for Health Information.

Age

Age distribution for joint replacement recipients in CJRR is also comparable to that of the population of joint replacement recipients in HMDB (figures 29 and 30).

Figure 29 Age Distribution of Hip Replacement Recipients in CJRR and HMDB, 2006–2007



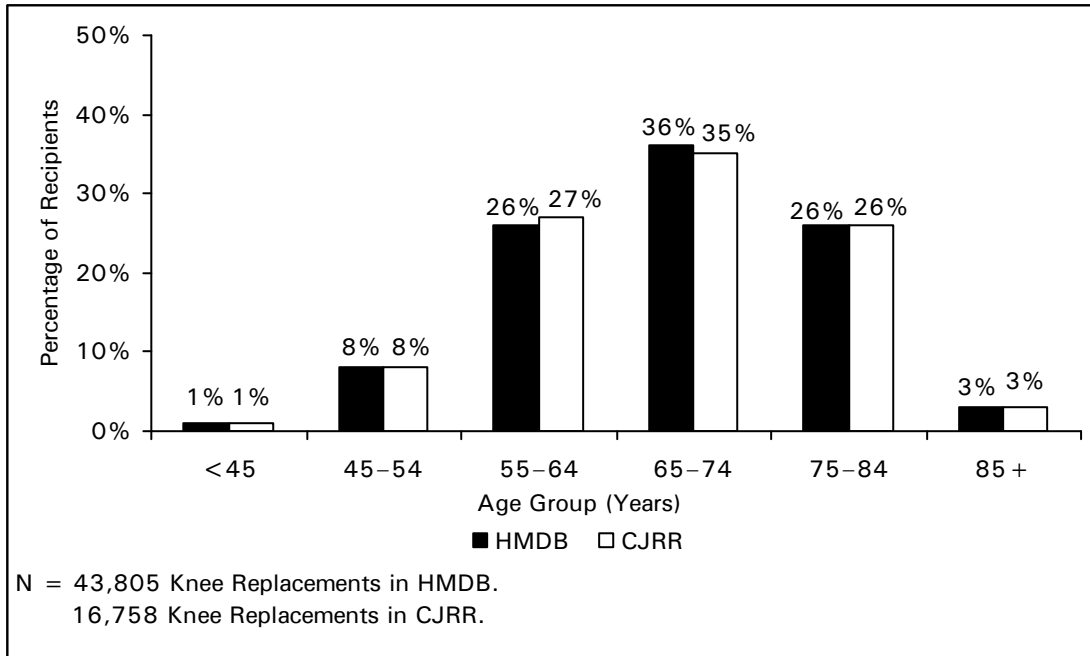
Note

Quebec data in 2005–2006 were used for this analysis.

Sources

Canadian Joint Replacement Registry, 2006–2007 and Hospital Morbidity Database, 2006–2007, Canadian Institute for Health Information.

Figure 30 Age Distribution of Knee Replacement Recipients in CJRR and HMDB, 2006–2007



Note

Quebec data in 2005–2006 HMDB were used for this analysis.

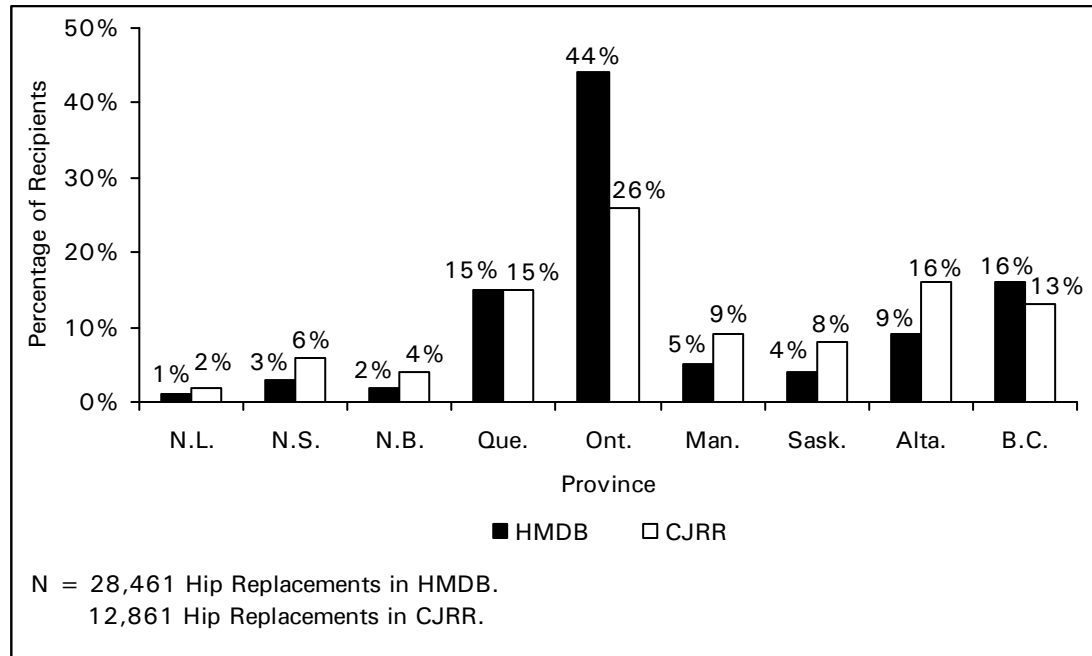
Sources

Canadian Joint Replacement Registry, 2006–2007 and Hospital Morbidity Database, 2006–2007, Canadian Institute for Health Information.

Patient Place of Residence Jurisdiction

Figures 31 and 32 show the distribution by jurisdiction of patient residence for hip and knee replacements in the CJRR and HMDB. Ontario is considerably underrepresented in the CJRR, with a corresponding overrepresentation of most other jurisdictions.

Figure 31 Distribution of Hip Replacement Recipients by Jurisdiction in CJRR and HMDB, 2006–2007



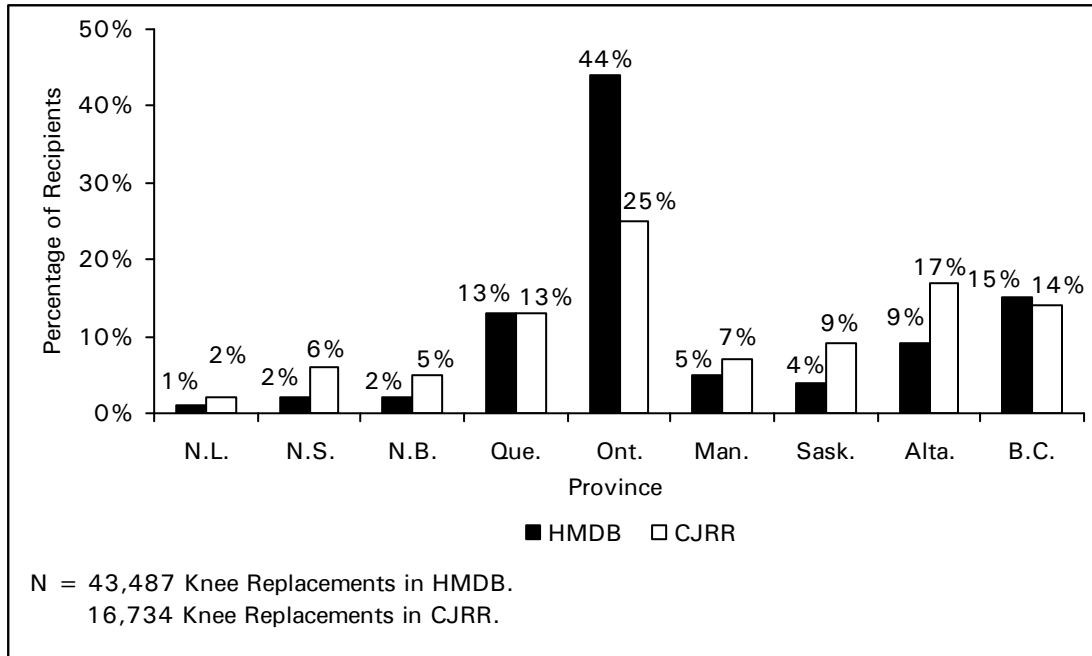
Note

Quebec data in 2005–2006 HMDB were used for this analysis.

Sources

Canadian Joint Replacement Registry, 2006–2007 and Hospital Morbidity Database, 2006–2007, Canadian Institute for Health Information.

Figure 32 Distribution of Knee Replacement Recipients by Jurisdiction in CJRR and HMDB, 2006–2007



Note

Quebec data in 2005–2006 HMDB were used for this analysis.

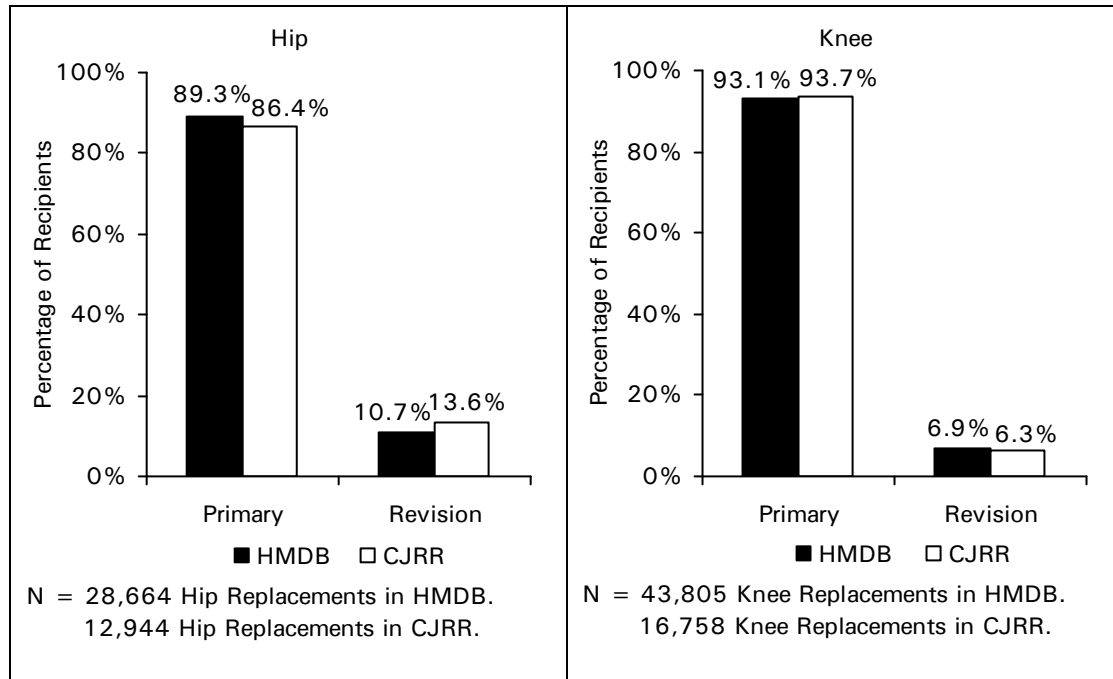
Sources

Canadian Joint Replacement Registry, 2006–2007 and Hospital Morbidity Database, 2006–2007, Canadian Institute for Health Information.

Primary Replacement and Revision

Figure 33 shows the proportion of primary joint replacements and revisions in CJRR compared to HMDB. Hip revisions are slightly overrepresented in the CJRR, with a corresponding slight underrepresentation of primary hip replacement procedures. The proportion of primary knee replacements and revisions is comparable in the CJRR and HMDB.

Figure 33 Type of Joint Replacement in CJRR and HMDB, 2006–2007



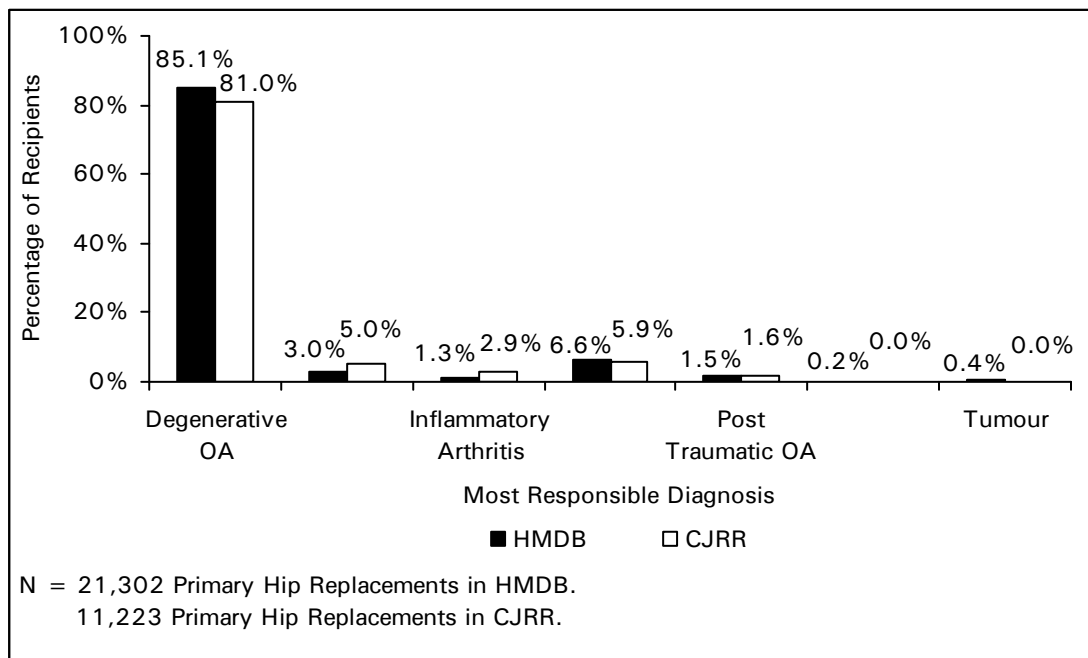
Note
 Quebec data in 2005–2006 HMDB were used for this analysis.

Sources
 Canadian Joint Replacement Registry, 2006–2007 and Hospital Morbidity Database, 2006–2007,
 Canadian Institute for Health Information.

Most Responsible Diagnosis

Figure 34, which compares CJRR and HMDB cases by most common responsible diagnosis, shows relatively similar distributions in 2006–2007.

Figure 34 Most Responsible Diagnosis for Hip Replacement in CJRR and HMDB, 2006–2007



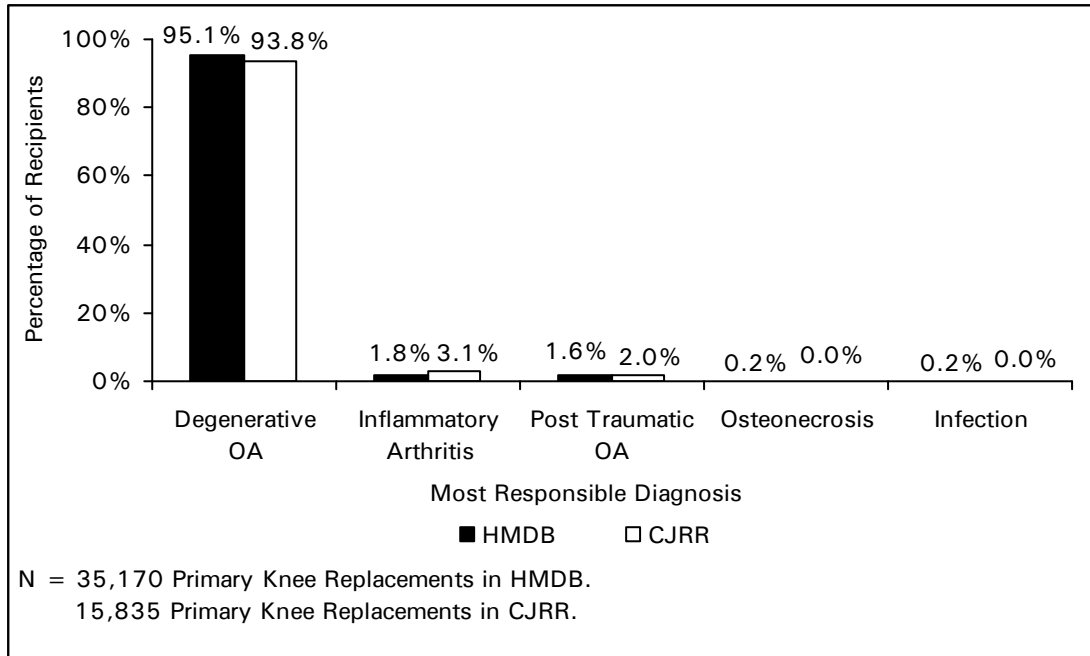
Note

Quebec data in 2005–2006 HMDB were used for this analysis.

Sources

Canadian Joint Replacement Registry, 2006–2007 and Hospital Morbidity Database, 2006–2007, Canadian Institute for Health Information.

Figure 35 Most Responsible Diagnosis for Knee Replacement in CJRR and HMDB, 2006–2007



Note
 Quebec data in 2005–2006 HMDB were used for this analysis.

Sources
 Canadian Joint Replacement Registry, 2006–2007 and Hospital Morbidity Database, 2006–2007, Canadian Institute for Health Information.

Appendix D: Hip and Knee Replacement Coding Methodology, CJRR

Canadian Joint Replacement Registry

The Surgical and Clinical Characteristics section of the report was based on data collected through CJRR. The methodology used in this section is presented below.

Collection of CJRR Data

CJRR is a national registry that collects information on primary and revision hip and knee replacement operations performed in Canada. Data are submitted to CJRR on a voluntary basis by participating surgeons from provinces across Canada through standardized data collection forms. Four facilities submitted data electronically in 2006–2007. From July 2003 through September 2005, data from Ontario were submitted through the Ontario Joint Replacement Registry. Beginning in October 2005, data from Ontario surgeons are submitted to CJRR.

All data undergo standardized edit checks to maximize data quality. For further information on CJRR data and coverage, please see the section About the Canadian Joint Replacement Registry.

Population Reference Period

Surgical and clinical data presented in this report are based on hip and knee replacement operations and revisions performed in Canadian acute care hospitals. Data are presented on a fiscal year basis (2002–2003 to 2006–2007), with the main focus on 2006–2007 data (April 1, 2006, to March 31, 2007). Fiscal year is defined by the date of surgery recorded on CJRR forms. In instances in which surgery date was not available, admission date was used as a proxy.

Surgical data from orthopedic surgeons presented in this report may be updated in future reports. CJRR continues to accept data beyond the deadline for the reporting period; thus the information presented from this data source may be incomplete. Data from 2002–2003 through 2005–2006 shown in this report reflect updated numbers compared to the 2005 CJRR annual report.

Geographical Reporting

For the clinical and surgical data presented in this report, the reported province is based on where the procedure was performed, not where the patient resides.

Undercoverage

Since 2002–2003, a steady increase in the number of primary hip replacements was observed over five years in CJRR. The cumulative increase was 50% for primary hip procedures, while for hip revision, the increase over the five years was 60%. The number of knee replacement procedures in CJRR between 2002–2003 and 2006–2007 increased by 65% for primary procedures and 74% for revision procedures.

A limitation of CJRR data reported is undercoverage, as not all eligible surgeons participate in CJRR. The overall surgeon participation rate in CJRR as of March 31, 2007, is 61%, with rates varying by province. Furthermore, it is not known whether each participating surgeon submitted all procedures. Response bias is possible but not quantifiable.

For further information on CJRR participation and coverage, please see the section About the Canadian Joint Replacement Registry.

Procedures

Cases are counted by number of procedures. If a patient had a bilateral procedure, it counts as two procedures in CJRR.

Data Element Notes

Minimally Invasive Surgery

CJRR began collecting minimally invasive surgery information in 2003–2004.

Revisions and DVT Prevention

When recording revision joint replacement procedures, surgeons were asked to indicate *one or more* reasons for revision from a list provided. Similarly, surgeons were asked to record one or more methods of DVT prevention. Since more than one option is possible for both elements, percents shown in the report for reasons for revision and DVT prevention may not sum to 100%.

Note that the data submitted by one facility indicated replacements by primary or revision procedure but provided no information on the type of revision (first revision, second revision). Thus, the counts for revision procedures are higher than the sum of counts for types of revisions.

Excisions

Information on excision procedures was not provided by two facilities for 2006–2007; thus there may be undercounting of excisions.

Components Replaced

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

Body Mass Index

BMI is calculated as weight (in kilograms) divided by the square of height (in metres).⁸

Based on international standards, patients were assigned to the following BMI categories: less than 18.5 (underweight); 18.5 to 24.9 (normal weight); 25.0 to 29.9 (overweight); 30.0 to 34.9 (obese, class I); 35.0 to 39.9 (obese, class II); 40.0 and higher (obese, class III).

Wait Times

Wait times are measured from the time an orthopedic surgeon made a decision, with a patient's consent, for surgery to the time when the actual surgery occurred. Based on the distribution of wait times, the median and IQR are presented for wait times in the report.

Statistical Analysis and Tests of Significance

The Wilcoxon test, a non-parametric method, was performed to test the association between sex and the time between the primary and the first revision, for both hips and knees.

Throughout the analyses presented in the report, statistical testing employed t-tests to compare the average between two groups, Chi-square correlation tests and Mantel-Haenszel tests for trends, as well as nonparametric methods to compare medians.

Wherever the term "significant" is used in this report, a two-sided statistical test (t-test, Chi-square, as appropriate) was performed and the result was statistically significant at the 0.05 level.

Appendix E: Definition of Hip and Knee Replacements in CJRR

Hip Replacement

The definition, or algorithm, for the categories and subcategories of hip replacement (arthroplasty) procedures is based on combining information on replacing the four compartments involved as shown below in Table E-1.

Table E-1 Algorithm Used to Define Hip Replacement Types

Type of Arthroplasty	Femoral Stem	Femoral Head	Acetabular Component	Acetabular Insert/Liner
Total Arthroplasty	Yes	Yes	Yes	Yes
Hemiarthroplasty				
1. Monopolar	Yes	Yes	No	No
2. Bipolar	Yes	Yes	Yes	No
Resurfacing Arthroplasty				
1. Full Resurfacing	No	Yes	Yes	No
2. Hemi-Resurfacing	No	Yes	No	No

Knee Replacement

There are two different types of knee replacements captured in this report. *Total knee replacement* involves replacing all three compartments of the knee (medial, lateral and patellofemoral compartment). *Uni-compartmental knee replacement* involves replacing one or both of the medial and lateral compartments.

Appendix F: Glossary

acetabulum

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.

anterolateral approach

A type of surgical approach used for hip replacement. This conventional surgical approach is carried out between the gluteus medius and tensor muscles.

aseptic loosening

A 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 acetabulum). Surface types include cobalt chrome, stainless steel, metal, ceramic alumina, polyethylene standard and polyethylene cross-linked.

body mass index (BMI)

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

bone graft

A bone graft is a surgery to place new bone into spaces around a broken bone or in between holes and defects in bone. The new bone can be taken from the patient’s own healthy bone (this is called an autograft) or from frozen, donated bone (allograft).

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 it may break off and travel through the blood stream (embolize). A resulting embolus can lodge in the brain, lungs, heart or other area, causing severe damage to that organ.

degenerative osteoarthritis

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

direct lateral approach

A type of surgical approach used for hip replacement or resurfacing. The approach requires elevation of the hip abductors in order to access the joint through a vertical split in the abductor muscles.

fixation method

As hip and knee joint prostheses are replaced they are fixated 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, cementless and hybrid techniques.

- **Cemented:** if the components involved (femoral and acetabular for hip and femoral and tibial for knee) were fixed by bone cement.
- **Cementless:** if none of the components (femoral and acetabular for hip and femoral and tibial for knee) was cemented (for example, a cementless method such as screws was employed).
- **Hybrid:** if one component was cemented and the other was not.

hemiarthroplasty (partial replacement)

A surgical procedure which replaces one half of the joint with an artificial surface and leaves the other part in its natural (preoperative) state.

hip replacement

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

The total hip prosthesis consists of three parts:

- A cup that replaces the hip socket. A plastic cup is commonly used, although other materials may be used, such as ceramic and metal.
- A metal or ceramic ball that replaces the head of the femur.
- A metal stem that is attached to the shaft of the bone to add stability to the prosthesis.

The hemiarthroplasty can be monopolar (where only the femoral head and stem are replaced) or bipolar (where the femoral head and stem and the acetabular component, but not the acetabular insert/liner, are replaced).

Resurfacing the hip joint is another surgical method that can involve either full resurfacing (both the femoral head and acetabular component are replaced) or hemi-resurfacing (where only the femoral head is replaced).

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 (rather than a conventional replacement which removes the femoral head and replaces it with a metal prosthesis) and the neck, stem and the acetabulum (socket) are relined with a metal cup-shaped implant.

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 undersurface of the knee cap is cut to allow for placement of an artificial component.

minimally invasive surgery

Minimally invasive surgery is an emerging surgical approach applied to most surgical specialties, including orthopedic surgery. The technique allows for the reduction in the size of the incision and for minimizing trauma to the soft tissues; however, minimally invasive replacement, or joint replacement, still involves cutting bone, realigning the soft tissue mechanism that supports the joint and placing the implant. A more accurate term describing the minimally invasive approach is considered to be “modification of standard approaches.”

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

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.

patella surfacing

As part of the knee joint replacement surgery, patella surfacing/resurfacing is not applicable to uni-compartmental knee replacement procedures.

poly wear

Polyethylene wear; the patterns of poly wear include deformation, delamination, breakage, pitting, abrasion and third-body wear.

posterolateral surgical approach

A type of surgical approach used for hip replacement or resurfacing in which a large incision is made on the side of the hip and upper thigh.

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 or replacements made to an existing hip or knee artificial 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 the removal of one or more hip or knee components as necessary.

uni-compartmental knee arthroplasty (UKA)

A uni-compartmental knee arthroplasty is used when only one side/compartment (medial, lateral or patellofemoral) of the knee is diseased or damaged and needs to be replaced with an artificial joint prosthesis.

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