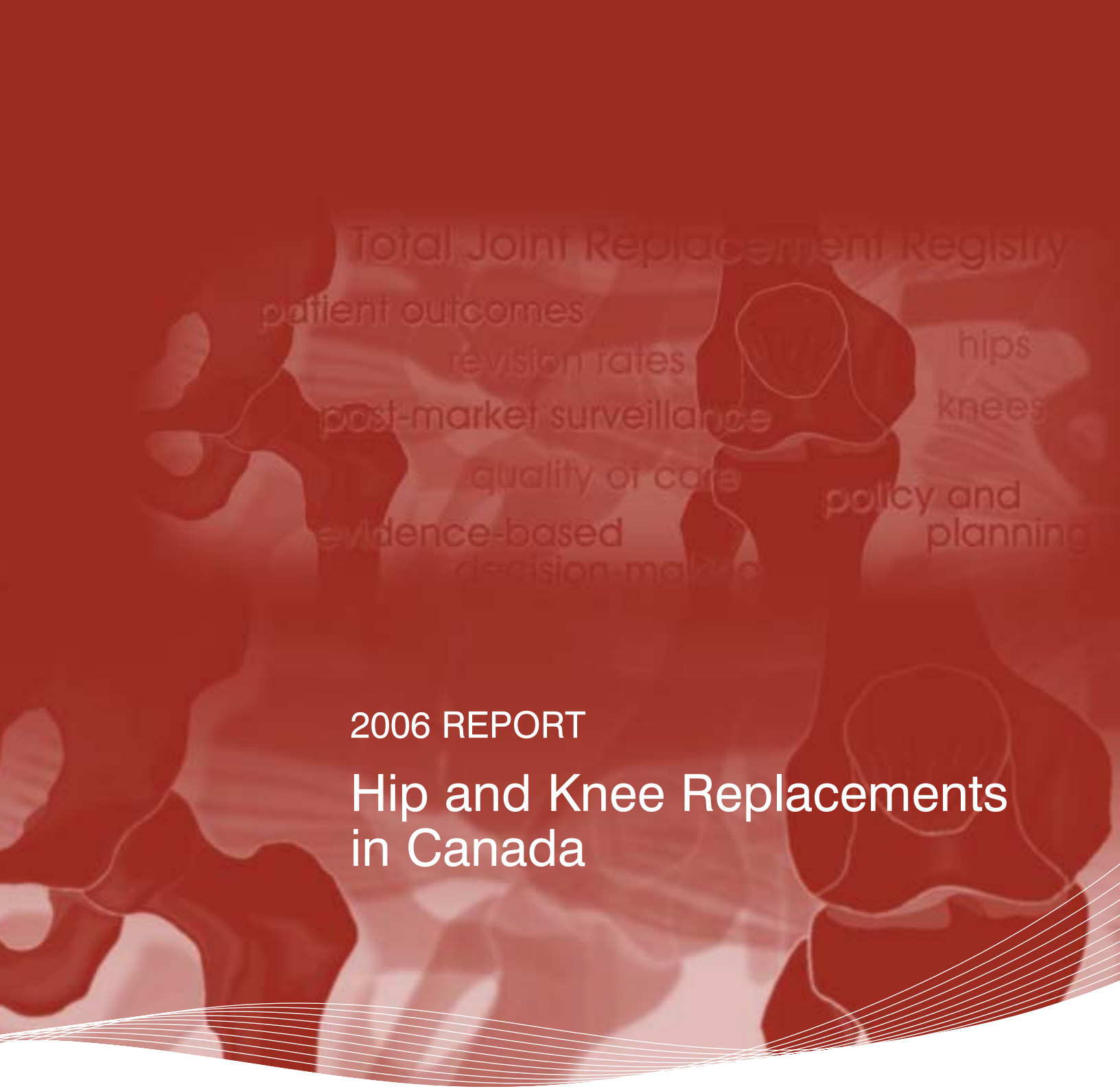

2006 REPORT

Hip and Knee Replacements in Canada

Canadian Joint Replacement Registry (CJRR)

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Canadian Joint Replacement Registry (CJRR)
2006 Annual Report
Hip and Knee Replacements in Canada

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- Dr. Michael Dunbar, Queen Elizabeth II Health Sciences Centre, Nova Scotia
- Dr. Olga L. Huk, Sir Mortimer B. Davis—The Jewish General Hospital, Quebec
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Executive Summary

The purpose of the *Canadian Joint Replacement Registry (CJRR) 2006 Annual Report on Hip and Knee Replacements in Canada* is to characterize hip and knee replacement procedures performed in Canada according to their epidemiology, and by selected clinical and surgical parameters.

Hip and knee replacement procedures are undertaken as a treatment when patients are experiencing severe pain and limited mobility, usually associated with arthritis or another joint disorder. During the procedure an artificial joint replaces the damaged joint. The surgery provides a successful, relatively low risk intervention that can provide significant pain and disability relief by enabling the new joint to move normally. This usually results in considerable improvement in a patient's functional status and quality of life. Arthritis and other joint disorders are correlated with advancing age and so an aging population contributes to an increase in hip and knee replacement procedures. In addition, new technologies are emerging in the surgical treatment of arthritis and arthritis-related disorders. These factors will likely increase the demand for surgery in the coming years.

About the Canadian Joint Replacement Registry (CJRR)

The CJRR is a national registry that collects information on hip and knee replacement surgeries performed in Canada and follows joint replacement patients over time, capturing revisions if they occur. In monitoring patient outcomes after replacement surgery, the CJRR identifies and explores the risk factors that may affect outcomes. The ultimate goal of the CJRR is to improve the quality of care and clinical outcomes of joint replacement recipients in Canada.

Participation in the CJRR has been steadily increasing since orthopaedic surgeons began submitting operative data in May 2001. As of April 2006, 70% of orthopaedic surgeons performing hip and knee replacement surgery in Canada were participating in the registry. On average, CJRR now receives approximately 1,800 forms on a monthly basis from all provinces in Canada.

Methodology

Findings in this report were obtained from two sources: the Hospital Morbidity Database (HMDB) and the CJRR database, both of which are managed by the Canadian Institute for Health Information (CIHI).

Surgical and orthopaedic implant data in this report are based on a total of 80,215 procedures that were submitted by surgeons participating in the CJRR for surgeries in fiscal years 2002–2003 through 2004–2005. The fiscal year encompasses data from April 1st through March 31st. Overall, data submissions have increased by 18% over the previous year.

All analyses were conducted using the SAS (version 9.1.3, Cary, NC, USA) statistical software package. A p value of <0.05 was used to assess statistical significance.

Hospitalization Statistics

Overall Trends

- There were 58,714 hospitalizations for hip and knee arthroplasty performed in Canada in 2004–2005 on Canadian residents. This represents a ten-year increase of 86.6% (from 31,463 hospitalizations for hip and knee arthroplasty in 1994–1995) and a 9.7% one-year increase (from 53,517 procedures in 2003–2004).
- In 2004–2005, there were 33,590 hospitalizations for knee and 25,124 hospitalizations for hip replacements. Since 1996–1997 the number of knee replacements has annually surpassed the number of hip replacements. This gap between the number of knee replacements over hip replacements has been increasing over time.
  - The number of knee replacements in 2004–2005 has more than doubled since 1994–1995 (an increase of 124.8%) with a 12.5% increase compared to the previous year.
  - The number of hip replacements, on the other hand, increased by 52% compared to 1994–1995, and by 6.1% compared to 2003–2004.

Provincial/Territorial Variations

- Provincial variations in joint replacement rates were observed across the country.
  - Prince Edward Island and Saskatchewan had the highest age-standardized rates of hip replacements (86.6 and 80.7 per 100,000 population, respectively), whereas Newfoundland and Labrador and Quebec had the lowest rates (50.1 and 44.4 per 100,000, respectively).
  - For knee replacements, Saskatchewan, Ontario and Prince Edward Island had the highest rates (120.9, 107.0 and 106.2 per 100,000 population, respectively), while Newfoundland and Labrador and Quebec had the lowest (66.7 and 55.6 per 100,000 population, respectively). Rates from the Territories are not reported due to small numbers.

Patient Demographics

- Females were more likely to undergo hip arthroplasty than males in 2004–2005 (the age-standardized rate for females was 69.7 per 100,000 compared to 62.5 for males). Females also had a higher rate of knee replacements (101.3) compared to males (90.8). Further, the majority of hip (57%) and knee (60%) replacement recipients were female.
- The age distributions of hip and knee replacement recipients were similar in 2004–2005, with the majority of patients being 65 years of age or older (65% of the hip and 68% of the knee replacement recipients). The mean age of patients who underwent hip replacements in Canada was 68 years (69.6 years for females and 65.6 years for males); for knee replacements, the mean age was 68.6 years (68.6 years for females and 68.5 years for males).

- Significant increases in age–sex specific rates for knee arthroplasty have occurred in the last decade (1994–1995 to 2004–2005). The most notable increases were observed in the 45 to 54 year age group, where the rate of knee replacements more than doubled for males (a 125% increase) and almost tripled for females (a 174% increase). However, the highest age–sex specific rate of knee replacements continues to be observed in the 75 to 84 year age group (rates of 510.5 per 100,000 for males and 590.4 per 100,000 for females). The number of knee replacements performed on people aged less than 45 years increased overall by 53% (up from 244 in 1994–1995 to 373 in 2004–2005) over the last 10 years.
- For hip replacement procedures, the highest age–sex specific rate in 2004–2005 was observed in the 75 to 84 year age group (405.2 per 100,000 for males and 532.7 per 100,000 for females). When compared to 1994–1995 age–sex specific rates, the largest increase occurred in the 45 to 54 year age group (53% for males and 41% for females).

Length of Stay in Hospital

- There has been a decrease in average length of stay for these procedures between 1994–1995 and 2004–2005. For hip replacements, the average length of stay decreased by 36% from 14 to 9 days, while for knee replacements, the average length of stay decreased by 42% from 12 to 7 days for the same period. The average length of stay includes both primary and revisions for hip and knee replacements.

Inter-Provincial/Territorial Movements

- With the exception of Yukon Territory and Nunavut, the majority of patients had their hip or knee arthroplasty procedures performed in their home province. Following Yukon Territory and Nunavut, residents of the Northwest Territories and Prince Edward Island were most likely to have their hip replacements performed in another province.

In-Hospital Mortality

- Post-operative in-hospital mortality is a relatively rare event among recipients of hip or knee replacements. Overall, the mortality rate of hip and knee replacement patients was 0.8% and 0.2%, respectively, with the highest mortality observed in the 85-year and older age group (4.9% after hip and 1.4% after knee arthroplasty).

Surgical and Clinical Characteristics (From the CJRR)

Overall Trends and Patient Demographics

- Of the 33,178 submissions to the CJRR for hip and knee replacement surgeries performed in 2004–2005, just over half (57%) were related to knee replacements and just under half were for hip replacements (43%). The last two years have seen significant increases in the number of submissions: a 49% increase between 2002–2003 and 2003–2004, and 18% from 2003–2004 to 2004–2005.
- In 2004–2005, females accounted for significantly ($p < 0.0001$) more hip and knee replacements than males (56% and 59%, respectively). The highest proportion of replacements was performed in the 65 to 74 year age group (30% of hip and 37% of knee replacements), followed by the 75 to 84 year age group (27% of hip and 28% of knee replacements, respectively).

Indications for Surgery and Previous Operations

Among all hip replacements in 2004–2005, 88% were primary surgeries and 12% were revisions. Among knee replacements, 94% were primary surgeries, while 6% were revision procedures.

- Degenerative osteoarthritis was the most common diagnosis indicated for both primary hip replacements (81%) and primary knee replacements (93%). The next most common diagnoses were osteonecrosis (6%) for hip and inflammatory arthritis (4%) for knee replacements.
- The leading reason recorded for revision of hip replacements was aseptic loosening (54%), followed by osteolysis (28%), poly wear (24%) and instability (16%). For the knee replacement revisions, the most common reason for revision reported was aseptic loosening (35%), followed by poly wear (30%), osteolysis (18%) and instability (13%).
- Of the primary hip and knee replacements recorded in 2004–2005, 94% and 74%, respectively, had no previous operation recorded. Among knee replacement recipients in which a previous operation was recorded, arthroscopic debridement was most commonly reported (16%), followed by arthroscopic menisectomy and open menisectomy (6% and 5% of all procedures, respectively).

Types of Surgery

- The vast majority of hip replacements in general (and primary hip replacements in particular) were total arthroplasty procedures (87% and 92%, respectively).
- Unicompartmental knee replacement (UKA) usage has remained consistent over the past three years (7%–8% of all knee replacements were unicompartmental procedures). UKA comprised 1% or less of revision knee replacements. At a provincial level, patients are twice as likely to undergo UKA in Western provinces than in the Eastern ones.

Surgical Approach

- Surgical approach patterns have remained largely unchanged over the past three years. In 2004–2005, the direct lateral was the most common approach (41%) used for hip replacements, followed by the posterolateral and the anterolateral approaches (28% and 25%, respectively). The Smith/Peterson and two-incision approaches were used in less than 1% of surgeries, respectively.
- The medial parapatellar approach was the surgical approach utilized in the vast majority (90%) of knee replacement procedures, with the intravastus, subvastus and lateral parapatellar approaches used in about 5%, 1% and <1% of cases, respectively.

Components Replaced

The term "components replaced" can refer to either components replacing the natural bone as in the case of primary procedures, or to components replacing existing artificial implants, as in the case of revision procedures.

- Regardless of joint, all components were significantly more likely to be replaced during primary procedures.
- For primary hip replacements, components were replaced over 90% of the time. For hip revisions, the femoral head was replaced 95% of the time, the acetabular insert 85%, acetabular component 78% and the femoral stem 69% of the time. Larger femoral heads were used significantly more for hip revisions than primary procedures.
- For primary knee replacements, the patellar component was replaced 73% of the time, while the femoral and tibial components were replaced in over 99% of cases. For knee revisions, the tibial component was most likely to be replaced (81%), followed by the femoral (76%) and patellar (51%) components.

Fixation Method

- Among all hip replacement procedures reported in the CJRR, the most common fixation method was cementless (62%), followed by hybrid (26%) and cemented (9%). Over the past three years, increases were seen in the proportion of procedures using a cementless fixation method (from 53% to 62%).
- For knees, the cemented technique was most commonly used (82%), followed by hybrid (12%) and cementless (4%). Over the past three years, increases were seen in the proportion of procedures using a cemented fixation method (from 75% to 82%).
- For both hip and knees, fixation methods used were similar for both primary and revision surgeries.

Bearing Surfaces

- Although various combinations of femoral head and acetabular liner materials were used in hip replacements, the most common bearing surface was metal-on-plastic (69%). The overall pattern of bearing surfaces has not changed over the past three years.

Bone Graft Use

- Overall, bone grafts were more frequently used for revision than for primary replacements, regardless of joint (40% versus 8% for hip and 22% versus 7% for knee replacements).

Body Mass Index (BMI)

- BMI distributions were found to be significantly different ($p < 0.0001$) between patients having hip replacements versus those having knee replacements. Patients with knee replacements were more likely to be overweight or obese compared to hip replacement patients (87% versus 74% combined). Both hip and knee replacement patients were rarely underweight.

Deep Vein Thrombosis (DVT) Prevention

- DVT prevention therapy was utilized in 97% of cases of hip and knee replacement in the CJRR.

Minimally Invasive Surgery (MIS)

- The use of a MIS approach increased from the previous fiscal year, being recorded in 12% of hip replacements and 8% of the knee replacements. The highest increase was in the use of MIS for hip replacements (an increase of more than 33%), while for the knee replacements the increase was smaller (7%).
- The vast majority of joint replacements for which MIS was used were primary procedures, with only about 1% of MIS performed for both hip and knee being used for revision joint replacements.
- Male patients were more likely to undergo MIS than females (for hip—OR of 1.12 and CI of 1.02–1.24; for knee—OR of 1.16 and CI of 1.04–1.3).
- The use of MIS for hip replacements did not vary much with age; for knee replacements, the MIS use decreases steadily in age groups older than 55 years.
- After adjusting for sex and age differences, for each hip and knee replacements, overweight and obese patients were less likely to undergo MIS.

Copies of the 2006 report can be purchased through the CIHI Order Desk at www.cihi.ca. Copies of the annual report, media release and recent bulletins can be downloaded free of charge from the CJRR website (www.cihi.ca/cjrr). Queries regarding this report may be addressed to cjrr@cihi.ca.

Introduction

The purpose of this report is to characterize the epidemiologic characteristics of hip and knee replacement procedures performed in Canada, and to describe them according to person (patient demographics), place (provincial and national level data) and time, and by using selected clinical and surgical parameters.

About the Canadian Joint Replacement Registry

The CJRR is a national registry that collects information on hip and knee replacement surgeries performed in Canada and follows joint replacement recipients over time to capture revisions, if and when they occur. The ultimate goal of the CJRR is to improve the quality of care and clinical outcomes of joint replacement recipients through studying the factors potentially affecting outcomes, such as surgical practices and analysis of orthopaedic implants.

The CJRR was developed through a joint effort between CIHI and the orthopaedic surgeons of Canada. CIHI and orthopaedic surgeons from each province who were working under the auspices of the Canadian Orthopaedic Association and the Canadian Orthopaedic Foundation upheld this initiative. A number of other key partners have contributed to the successful development and implementation of the CJRR—including orthopaedic patients; The Arthritis Society; federal, provincial/territorial ministries of health, as well as provincial joint replacement registries.[1]

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

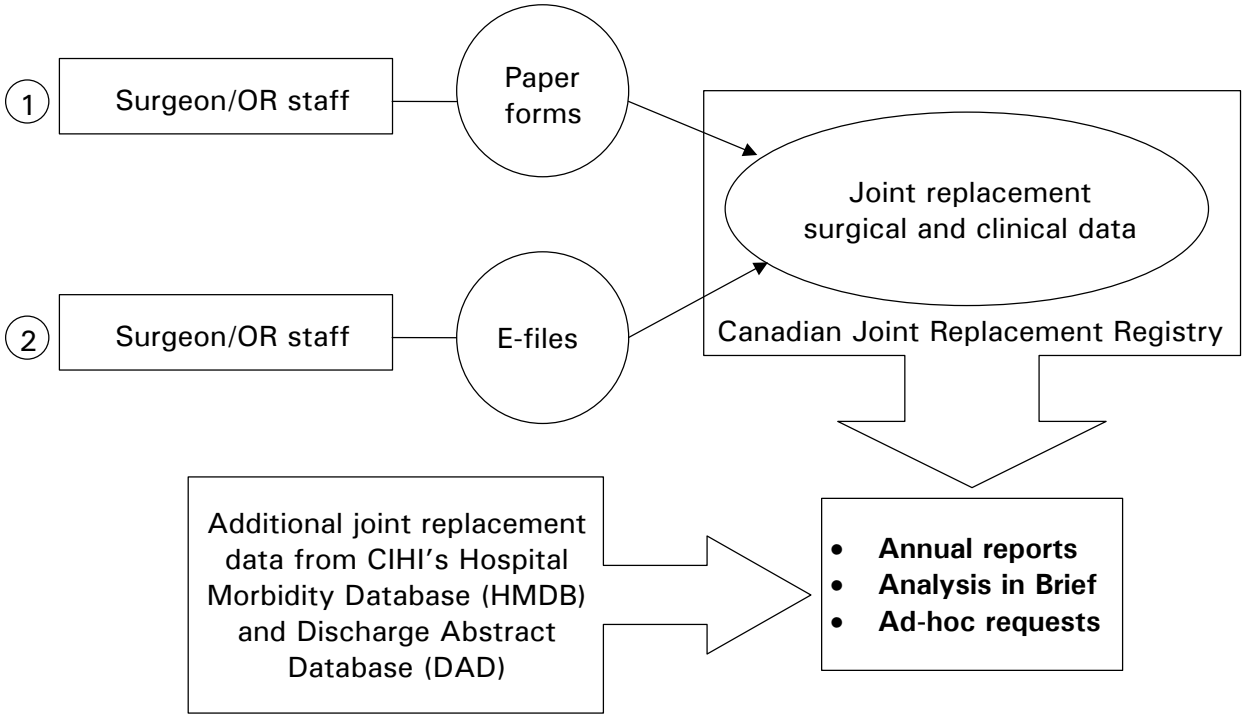


Figure 1. Canadian Joint Replacement Registry (CJRR) Data Flow Diagram

A number of orthopaedic surgeons and offices submit data directly to CJRR via paper data collection forms. Prior to surgery, patients are asked to provide consent to have their surgical information included in the CJRR. Once written patient consent is obtained, the surgeon and/or operating room staff fills out a two-page data collection form. The data collection form captures information such as patient demographics, the type of replacement, reason for replacement, surgical approach, fixation mode, implant types, antibiotic use, deep vein thrombosis prophylaxis and operating room environment. The data collection forms are sent directly to CIHI in pre-paid and labeled envelopes, where data verification, data entry, analyses and reporting are undertaken.

Electronic data submission files have been received from one provincial registry and one large facility in British Columbia and incorporated into the CJRR. Until March 2006 the province of Ontario had an operational provincial joint replacement registry, the Ontario Joint Replacement Registry (OJRR).[2] Each year, data were submitted by surgeons in Ontario to the OJRR, and then sent annually to the CJRR via the Ontario Ministry of Health and Long-Term Care (MOHLTC). Since October 2005, CJRR has been actively enrolling orthopaedic surgeons in Ontario in order to have their data submitted directly to CJRR.

For the purposes of producing annual reports, bulletins, and providing data for research and other data requests, CJRR analyzes data from the HMDB, which is also managed by CIHI. The two data sources together (CJRR and HMDB) provide a more complete profile of hip and knee replacement procedures performed in Canada.

In all instances, privacy and confidentiality of patients and surgeons are assured. 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 Participation

CJRR participation is tracked and reported as the percent of eligible surgeons who have agreed to submit data to the CJRR and as the estimated percent of surgeries for which data have been submitted. Surgeons performing hip and knee replacements during the reporting period are considered eligible to participate in the CJRR. The CJRR project team works with orthopaedic surgeons across the country to identify and recruit eligible surgeons.

Participating surgeons can earn Continuing Professional Development (CPD) credits by submitting operative data to the CJRR and reviewing regular CJRR feedback reports. Submission of six completed data collection forms to CIHI will earn 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. The CJRR team at CIHI provides surgeons with regular updates on the number of CPD credits earned through their participation in the CJRR.

Surgeon Participation Over Time

Data collection from surgeons began in May 2001. Between fiscal years 2001 and 2005, the number of participating surgeons has increased from 189 to 496 respectively, an increase of 162% (Figure 2). A major component of this increase is the first transfer of Ontario data to CJRR via the Ontario MOHLTC, which occurred in July 2003, accounting for the dramatic increase in CJRR participation shown in the graph (Figure 2).

Beginning in October 2005, CJRR has been actively enrolling orthopaedic surgeons in Ontario in order to have their data submitted directly to CJRR.

Note that the participation data shown in Figure 2 may differ somewhat from previous years due to two methodological changes. First, unlike previous reports, participation data in the current report are based on the fiscal year rather than the calendar year. This corresponds to how all the surgical data in the report are shown and gives a better depiction of participation during that time interval. Second, beginning with 2004–2005 data, surgeons were considered to be participating if they had submitted data or signed up during the previous three years. Previously the definition of participation only captured those who signed up, regardless of whether data was submitted. The revised definition more accurately captures actual participation.

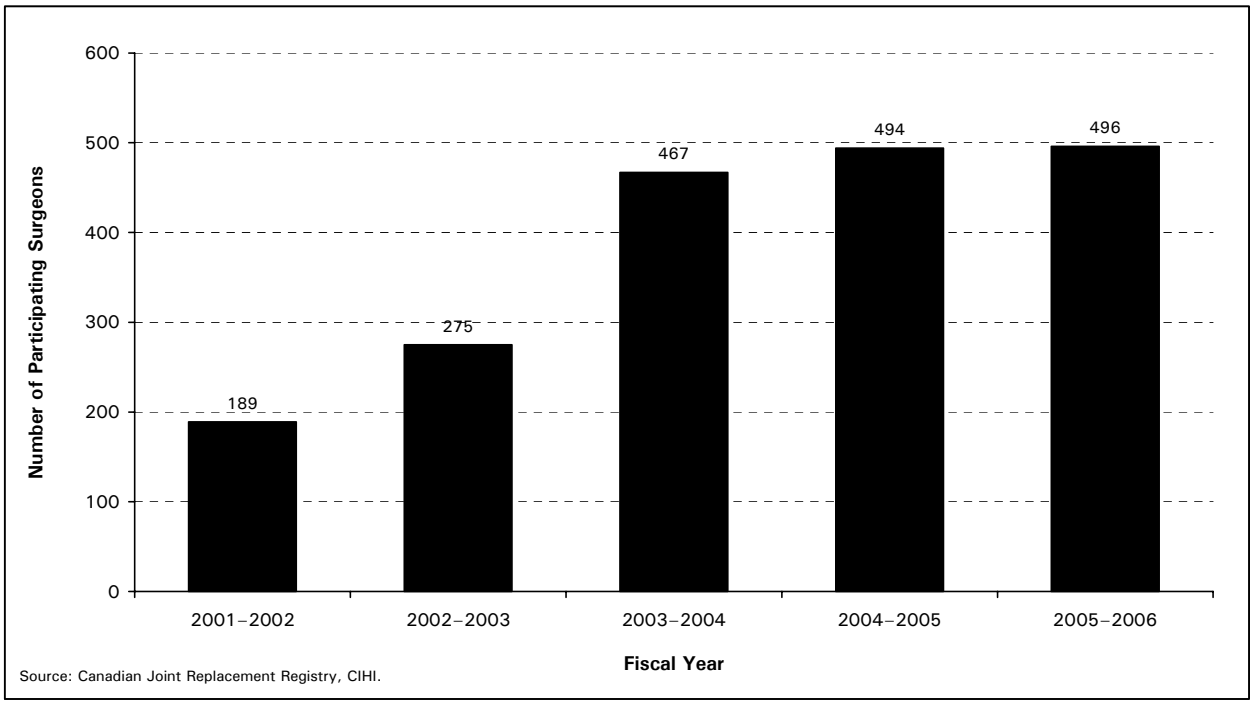


Figure 2. Number of Participating Surgeons in CJRR Since Inception

Surgeon Participation by Province

Table 1 shows participation statistics by province, compared to the estimated number of surgeons performing hip and knee replacement procedures as of March 31 2005. CJRR's overall participation rate was estimated at 69%, and was heavily weighted by the provinces that have the largest number of surgeons (Ontario, Quebec, British Columbia and Alberta, respectively). Together, these provinces accounted for approximately 83% of orthopaedic surgeons performing hip and knee replacements in Canada and 78% of all CJRR participating surgeons. Participation rates by province and territory ranged from 44% in Quebec to 100% in New Brunswick, Nova Scotia and Northwest Territories.

CJRR provincial representatives and numerous site leaders have been instrumental in promoting the benefits of the registry and, by extension, increasing surgeon participation and commitment for submitting operative data to the CJRR in their respective provinces.

Table 1. CJRR Surgeon Participation by Province as of March 31, 2005

Hospital Province	Number of Participating Surgeons	Number of Eligible* Surgeons	% Participation
British Columbia	62	99	63%
Alberta	48	55	87%
Saskatchewan	23	25	92%
Manitoba	21	22	91%
Ontario	191	252	76%
Quebec	84	189	44%
New Brunswick	26	26	100%
Nova Scotia	27	27	100%
Prince Edward Island	0	3	0%
Newfoundland and Labrador	10	15	67%
Northwest Territories	2	2	100%
Nunavut	0	0	N/A
Yukon	0	0	N/A
Total	**494**	**715**	**69%**

* To be eligible, the orthopaedic surgeon must be actively performing hip or knee replacement surgery. Surgeons are deemed to be participating if they have submitted in 2002–2005 or signed up within the period. The number of eligible surgeons is based on reports from CJRR provincial representatives, which may not be exact.

Important Methodological Notes

- Data submission by orthopaedic surgeons to the CJRR is voluntary. Not all eligible surgeons have submitted data to the CJRR. Furthermore, it is not known whether each participating surgeon has submitted all procedures. Response bias is possible, but is not quantifiable.
- Both hospitalization data from the Hospital Morbidity Database (HMDB) and clinical and surgical data from CJRR are based on year 2004–2005 unless otherwise specified. Data are reported by fiscal year (i.e. from April 1st 2004 to March 31st 2005).
- Hospitalization data prior to 2004–2005 are collected in a mixture of coding classifications (ICD-10-CA/CCI, ICD-9-CM, ICD-9/CCP). In 2004–2005, all provinces and territories reported their hip and knee replacements using ICD-10-CA/CCI classification system, with the exception of Quebec, which codes using ICD-9/CCP.
- HMDB data used to analyze knee replacement procedures include partial and total knee replacement procedures, as the latter cannot be separated out in the CCP classification system. Note, however, that only data on total hip replacements are shown. Partial hip replacements are not included in the analyses.
- Provincial analyses are based on patient's province of residence, not where the procedure was performed. Counts by province of residence may have been artificially increased due to a revised methodology adopted beginning with the 2004 annual report. Using this methodology, patients were assigned to a province using the first three digits of the postal code, when the postal code was incomplete. The number of counts reported in the "Unknown" category has therefore decreased.
- Patients with unknown residence were included in the overall counts for Canada and the overall age-standardized rates.
- Cases are counted by number of hospitalizations. If a person has more than one hip or knee replacement (i.e. bilateral) procedure coded for the same hospital visit, only one procedure is counted.
- Quebec counts and age-standardized rates for knee replacements in 2003–2004 are estimated by incorporating revision records for knee replacements from the raw Med-Écho file because Quebec knee revision codes are not identifiable in the 2003 HMDB data. Knee replacement revisions have been captured in Quebec by Med-Écho, using CCP code 93.471, while other provinces coding in CCP used the code 93.40.
- Quebec counts for hip and knee replacements prior to 2003–2004 may have been underestimated since revision codes were not identifiable in the HMDB at that time.
- The calculation of age-standardized rates for New Brunswick in 2004–2005 excluded one region due to missing data submission. This region was included in the overall national age-standardized rates and national counts reported.
- All analyses were conducted using the SAS (version 9.1.3, Cary, NC, USA) statistical software package.
- Appendices A and B provide additional details regarding the methodology and data sources for the HMDB and the CJRR, respectively.

Hospitalization Statistics

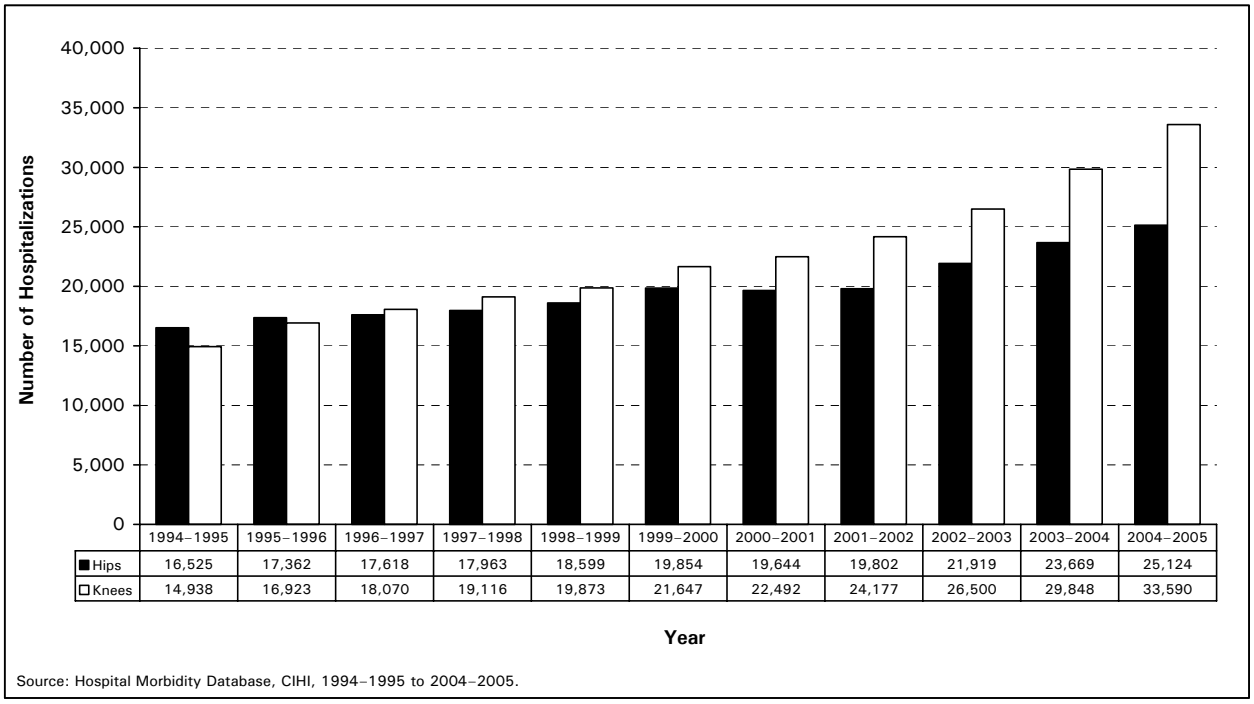
Important Note: Analyses for this section are based on the HMDB and report on fiscal year data (April 1st to March 31st). Please refer to Appendix A for methodological detail pertaining to this database.

Overall Trends and Statistics

There were 58,714 hip and knee replacements performed in Canada on Canadian residents in 2004–2005, representing a 10-year increase of 87% from 31,463 procedures in 1994–1995 and a one-year increase of 9.7% from 53,517 procedures in 2003–2004.

In 1994–1995, the number of hip replacements exceeded the number of knee replacements in Canada (16,525 versus 14,938 surgeries, respectively). However, since then, knee replacements have annually surpassed the number of hip replacements, and the gap has been steadily widening (Figure 3).

In 2004–2005, there were 33,590 hospitalizations for knee and 25,124 hospitalizations for hip replacements. The number of knee replacements in 2004–2005 has more than doubled since 1994–1995 (an increase of 124.8%) with a 12.5% increase compared to the previous year. The number of hip replacements, on the other hand, increased by 52% compared to 1994–1995, and by 6.1% compared to the previous year (2003–2004).



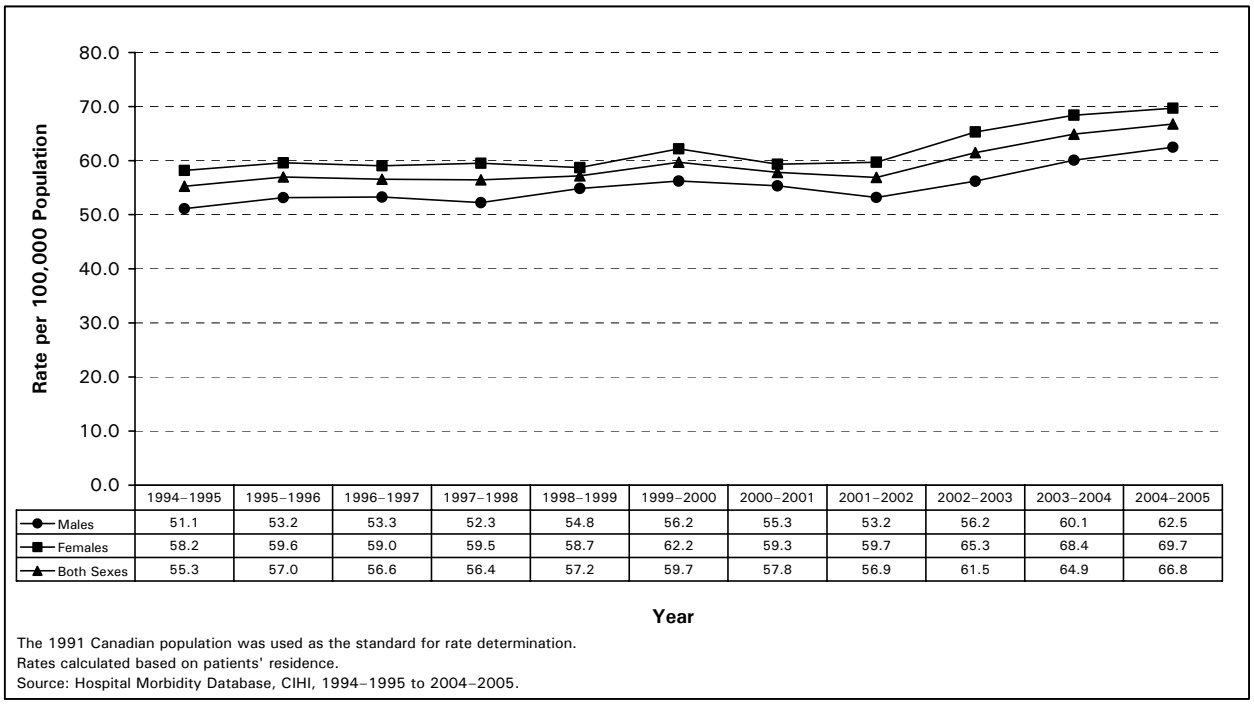
	1994–1995	1995–1996	1996–1997	1997–1998	1998–1999	1999–2000	2000–2001	2001–2002	2002–2003	2003–2004	2004–2005
■Hips	16,525	17,362	17,618	17,963	18,599	19,854	19,644	19,802	21,919	23,669	25,124
□Knees	14,938	16,923	18,070	19,116	19,873	21,647	22,492	24,177	26,500	29,848	33,590

Source: Hospital Morbidity Database, CIHI, 1994–1995 to 2004–2005.

Figure 3. Number of Hospitalizations for Hip and Knee Replacement Procedures Performed in Canada, 1994–1995 to 2004–2005

Age-standardization is a common analytical technique used to compare rates over time, as it takes into account changes in age structure across populations and time. The age-standardized rates are reported per 100,000 of the population.

Figure 4 shows the age-standardized rate of the hospitalizations for hip replacements by sex. The rate was 11.5% higher for females than for males (69.7 versus 62.5). The hip replacement rate, regardless of sex, increased by 21%, from 55.3 per 100,000 in 1994–1995 to 66.8 in 2004–2005. For males, the increase over the ten-year period was 22% (from 51.1 to 62.5 per 100,000). For females, the ten-year increase was 20% (58.2 to 69.7 per 100,000).

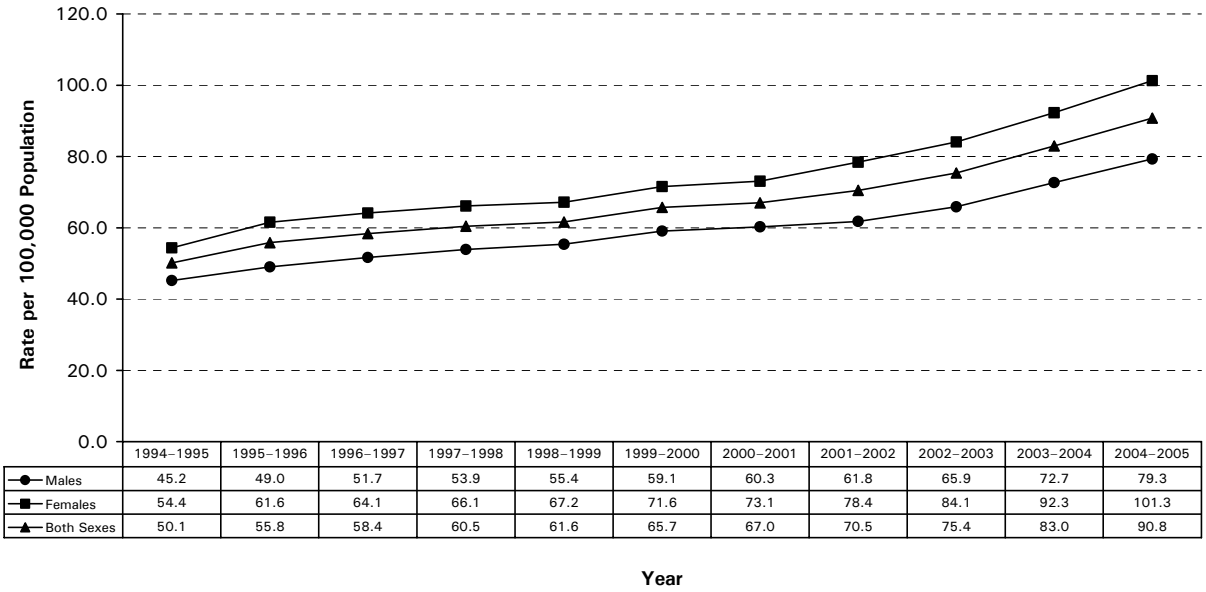


	1994–1995	1995–1996	1996–1997	1997–1998	1998–1999	1999–2000	2000–2001	2001–2002	2002–2003	2003–2004	2004–2005
Males	51.1	53.2	53.3	52.3	54.8	56.2	55.3	53.2	56.2	60.1	62.5
Females	58.2	59.6	59.0	59.5	58.7	62.2	59.3	59.7	65.3	68.4	69.7
Both Sexes	55.3	57.0	56.6	56.4	57.2	59.7	57.8	56.9	61.5	64.9	66.8

The 1991 Canadian population was used as the standard for rate determination.
Rates calculated based on patients' residence.
Source: Hospital Morbidity Database, CIHI, 1994–1995 to 2004–2005.

Figure 4. Age-Standardized Hospitalization Rates (per 100,000 Population) by Sex for Hip Replacement, in Canada, 1994–1995 to 2004–2005

Larger differences, both between the sexes and over time, were observed for knee replacement rates (Figure 5). In 2004–2005, the age-standardized knee replacement rate was 101.3 for females compared to 79.3 for males, a difference of 28%. The overall age-standardized rate has almost doubled over the ten-year period from 50.1 in 1994–1995 to 90.8 in 2004–2005. During this time period, a 75% increase was noted for males (from 45.2 to 79.3 per 100,000), while for females the corresponding increase was 86% (from 54.4 to 101.3 per 100,000).



	1994–1995	1995–1996	1996–1997	1997–1998	1998–1999	1999–2000	2000–2001	2001–2002	2002–2003	2003–2004	2004–2005
Males	45.2	49.0	51.7	53.9	55.4	59.1	60.3	61.8	65.9	72.7	79.3
Females	54.4	61.6	64.1	66.1	67.2	71.6	73.1	78.4	84.1	92.3	101.3
Both Sexes	50.1	55.8	58.4	60.5	61.6	65.7	67.0	70.5	75.4	83.0	90.8

The 1991 Canadian population was used as the standard for rate determination.
Rates calculated based on patients' residence.
Source: Hospital Morbidity Database, CIHI, 1994–1995 to 2004–2005.

Figure 5. Age-Standardized Hospitalization Rates (per 100,000 Population) by Sex for Knee Replacements, in Canada, 1994–1995 to 2004–2005

International Comparisons

Crude rates of hip and knee replacements for selected countries are presented in Tables 2 and 3. These rates have not been adjusted for age or sex. The rates help to roughly estimate the incidence of joint replacement procedures for primary and revision surgeries, for countries where this information was available. The reporting year is not uniform for all countries and ranges from 2003 to 2004 based on the most recent data available. The Canadian crude rate for knee replacements includes partial knee replacements, which cannot be identified and separated from total knee replacements in the ICD-9/CCP coding classification system.

New Zealand had the highest crude rate for primary and revision hip replacements (150 and 22 per 100,000, respectively); for knee replacements, the United States had the highest rates (144 and 11 per 100,000, respectively).

Table 2. International Comparison of Hip Replacement Crude Rates (per 100,000 Population)

Country	Crude Rate per 100,000		Year	Reference
	Primary	Revisions		
Australia	96.4	19.4	2003–2004	Australian Orthopaedic Association National Joint Replacement Registry, *Annual Report* (Adelaide: AOA, 2004)
New Zealand	150	22	2004	New Zealand National Joint Register
Norway	133.8	20	2004	Norwegian Arthroplasty Register, *Annual Report* (June 2004)
Canada*	**70**	**9**	**Fiscal 2004**	**Canadian Joint Replacement Registry**
United States	122.8	12.4	2003	American Academy of Orthopaedic Surgeons 1. National Hospital Discharge Survey, 1991–2003. Data obtained from U.S. Department of Health and Human Services; Centers for Disease Control and Prevention; National Centre for Health Statistics 2. Annual Estimates of the Population for the United States, Regions and Divisions: April 1, 2000 to July 1, 2005 (NST-EST2005-08). Source: Population Division, U.S. Census Bureau. Release Date: December 22, 2005

* Crude rate calculations are based on counts from the HMDB, CIHI, 2004–2005. Counts are reported for all provinces and territories in Canada.

Table 3. International Comparison of Knee Replacement Crude Rates (per 100,000 Population)

Country	Crude Rate per 100,000		Year	Reference
	Primary	Revisions		
Australia	116.7	13	2003–2004	Australian Orthopaedic Association National Joint Replacement Registry, *Annual Report* (Adelaide: AOA, 2004)
New Zealand	102	8	2004	New Zealand National Joint Register
Norway	62.6	6.9	2004	Norwegian Arthroplasty Register, *Annual Report* (June 2004)
Sweden	101.9	6.7	2004	The Swedish Knee Arthroplasty Register
Canada*	**97**	**8**	**Fiscal 2004**	**Canadian Joint Replacement Registry**
United States	143.7	11.3	2003	American Academy of Orthopaedic Surgeons 1. National Hospital Discharge Survey, 1991–2003. Data obtained from U.S. Department of Health and Human Services; Centers for Disease Control and Prevention; National Centre for Health Statistics 2. Annual Estimates of the Population for the United States, Regions and Divisions: April 1, 2000 to July 1, 2005 (NST-EST2005-08). Source: Population Division, U.S. Census Bureau. Release Date: December 22, 2005

* Crude rate calculations are based on counts from the HMDB, CIHI, 2004–2005. Counts are reported for all provinces and territories in Canada.

Table 4 indicates the changes in crude rates (per 100,000 population) over time. Crude rates for both hip and knee replacements appear to have increased in these countries. It is important, however, to note that these are "crude" rates with no adjustments made for age or sex, or for changes occurring within the population over time in these countries.

Table 4. International Comparisons—Changes Over Time in Crude Rates for Primary Hip and Knee Replacements

Country	Primary Hip Replacements					Primary Knee Replacements				
	CJRR 2005 Report		Latest Statistics		% Change	CJRR 2005 Report		Latest Statistics		% Change
	Year	Crude Rate††	Year	Crude Rate††		Year	Crude Rate††	Year	Crude Rate††	
Australia*	1999–2000	74	2003–2004	96	30%	1999–2000	81	2003–2004	117	44%
Canada†	**2001–2002**	**57**	**2004–2005**	**70**	**23%**	**2001–2002**	**74**	**2003–2004**	**97**	**31%**
New Zealand‡	2000	119	2004	150	26%	2000	75	2004	102	36%
Norway§	2000	124	2004	134	8%	2000	35	2004	63	79%
Sweden**						1996–1997	63	2004	102	62%

* Australian Orthopaedic Association National Joint Replacement Registry, *Annual Report* (Adelaide: AOA, 2004).
† HMDB, CIHI (2001–2002, 2004–2005).
‡ New Zealand National Joint Register, New Zealand, January–December 2001, 2004.
§ Norwegian Arthroplasty Register, *Annual Report 2003* (Norway: 2004).
** Swedish Knee Arthroplasty Register, Annual Reports 2002, 2003 (cumulative counts), 2004.
†† Crude rate per 100,000 population.

Unilateral vs. Bilateral Procedures

Table 5 shows the number and percentages of unilateral and bilateral hip and knee replacement procedures performed in Canada in 2004–2005. The information on laterality is available in the Canadian Classification of Health Interventions (CCI—corresponding to ICD-10-CA). This information was not available in the Canadian Classification of Procedures (CCP corresponding to ICD-9) used earlier. Therefore the information is not available for the Canadian provinces that continued to report using ICD-9/CM and CCP during 2004–2005.

The vast majority of hip (99.5%) and knee (96.4%) replacements were performed as unilateral procedures.

Table 5. Number of Hospitalizations for Hip and Knee Replacements by Laterality, CCI Coded Cases Only, Canada, 2004–2005

Laterality in CCI	Hip Replacement Hospitalizations	%	Knee Replacement Hospitalizations	%
Unilateral	20,919	99.5%	27,621	96.9%
Bilateral	97	0.5%	890	3.1%
Not Stated*	0	0.0%	2	0.0%
Total	21,016	100.0%	28,513	100.0%

Notes
* "Not stated" includes not populated laterality field, as well as unacceptable formats.
Information on laterality is not available for the provinces reporting in ICD-9/CCP system.
There were 4,108 hip and 5,077 knee replacement procedures reported using the ICD-9/CCP system.

Source: HMDB, CIHI, 2004–2005.

Provincial/Territorial Variations

Most hospitalizations for hip and knee replacements in Canada were for primary procedures (89% for hip; 92% for knee) as shown in Tables 6 and 7. Though Ontario reported the highest number of primary procedures and revisions for hip and knee replacements, the percent revisions were among the lowest (11.2% for hip; 7.6% for knee). On the other hand, though the Territories had fewer counts reported for revisions, they had the highest percentage of revisions for hips (21.6%). For knee replacement procedures, Prince Edward Island reported the highest proportion of revisions (13.1% of a total number of 176 procedures). Saskatchewan had the lowest percentage of revisions (8.9%) for hip replacement procedures, while British and Columbia and Saskatchewan reported the lowest proportion (6.3%) of knee revision procedures.

Table 6. Number of Hospitalizations by Type of Hip Replacements, Canada by Province of Residence, 2004–2005

Province	Number of Primary Replacements	Number of Revision Replacements	Total Number of Replacements	Percent Revisions
Newfoundland and Labrador	284	35	319	11.0%
Prince Edward Island	124	24	148	16.2%
Nova Scotia	816	91	907	10.0%
New Brunswick*	436	101	537	18.8%
Quebec	3,667	462	4,129	11.2%
Ontario	9,591	1,120	10,711	10.5%
Manitoba	770	158	928	17.0%
Saskatchewan	890	86	976	8.8%
Alberta	2,222	259	2,481	10.4%
British Columbia	3,447	459	3,906	11.8%
Territories†	40	11	51	21.6%
Canada‡	**22,305**	**2,819**	**25,124**	**11.2%**

Notes
Counts includes patients of all ages.
* One region in NB was excluded due to missing data submission.
† Territories include Northwest Territories, Yukon and Nunavut.
‡ National counts include the procedures excluded from NB.

Table 7. Number of Hospitalizations by Type of Knee Replacements, Canada, 2004–2005

Province	Number of Primary Replacements	Number of Revision Replacements	Total Number of Replacements	Percent Revisions
Newfoundland and Labrador	375	35	410	8.5%
Prince Edward Island	153	23	176	13.1%
Nova Scotia	1,092	122	1,214	10.0%
New Brunswick*	721	99	820	12.1%
Quebec	4,783	340	5,123	6.6%
Ontario	13,962	1,123	15,085	7.4%
Manitoba	1,124	147	1,271	11.6%
Saskatchewan	1,345	90	1,435	6.3%
Alberta	2,875	244	3,119	7.8%
British Columbia	4,522	306	4,828	6.3%
Territories†	69	7	76	9.2%
Canada‡	**31,052**	**2,538**	**33,590**	**7.6%**

Notes
Counts includes patients of all ages.
* One region in NB was excluded due to missing data submission.
† Territories include Northwest Territories, Yukon and Nunavut.
‡ National counts include the procedures excluded from NB.

Table 8 presents the number of hip replacement procedures by province of patient residence for 2004–2005 compared to 1994–1995 and the associated percent change. Over a ten-year period, British Columbia had the highest increase in number of hospitalizations for hip replacements (67%) followed closely by Quebec (66%), Newfoundland and Labrador (55%), and Ontario (55%). For knee replacements, the number of hospitalizations in the ten-year period increased by more than 70% across all provinces. The greatest increase occurred in British Columbia (162%), followed by Quebec (145%), Newfoundland and Labrador (132%) and Ontario (128%).

Table 8. Number of Hospitalizations for Hip and Knee Replacement Procedures, Canada, 1994–1995 and 2004–2005

Province	Hip Arthroplasty			Knee Arthroplasty		
	Fiscal Year 1994–1995	Fiscal Year 2004–2005	10-Year Increase %	Fiscal Year 1994–1995	Fiscal Year 2004–2005	10-Year Change %
Newfoundland and Labrador*	206	319	55%	177	410	132%
Prince Edward Island	107	148	38%	84	176	110%
Nova Scotia	729	907	24%	674	1,214	80%
New Brunswick†	417	537	29%	403	82	103%
Quebec	2,480	4,129	66%	2,094	5,123	148%
Ontario	6,932	10,711	55%	6,628	15,085	128%
Manitoba	659	928	41%	574	1,271	121%
Saskatchewan	812	976	20%	833	1,435	72%
Alberta	1,801	2,481	38%	1,568	3,119	99%
British Columbia	2,342	3,906	67%	1,845	4,828	162%
Territories‡	11	51	364%	11	76	591%
Unknown†, §	234	<5	N/A	222	<5	N/A
Canada**	**16,524**	**25,124**	**52%**	**14,938**	**33,590**	**125%**

* For Newfoundland and Labrador, counts pertain to 1995–1996 since counts based on patient's residence were incomplete for 1994–1995.
† One region in NB was excluded due to missing data submission.
‡ Territories include counts for Nunavut (for 2003 and 2004 only), Yukon and Northwest Territories.
§ Excludes non-Canadian residents.
** Total for 1994–1995 does not add up as 1995–1996 counts were used for Newfoundland residents. For 2004–2005, national counts include the procedures excluded from NB.

Source: HMDB, CIHI, 1994–1995 and 2004–2005.

As shown in Table 9, the age-standardized rates of hip and knee replacement procedures varied greatly across Canada, with Prince Edward Island and Saskatchewan reaching the highest hip replacement rates (87 and 81 per 100,000 population, respectively). Conversely Newfoundland and Labrador and Quebec had the lowest hospitalization rates for hip replacements (50 and 44 per 100,000 population, respectively).

The highest rate of knee replacement occurred in Saskatchewan (121 per 100,000), while Newfoundland and Labrador and Quebec had the lowest (67 and 56 per 100,000 population, respectively).

Since 1994–1995, the hip replacement rate increased in all the provinces with the exception of Alberta. The greatest percent increase was seen in Quebec (33%) followed by Newfoundland and Labrador and British Columbia (28% each). The age-standardized rate of knee replacement increased in all provinces, with the greatest percent increases in British Columbia (105%) and Manitoba (103%), while Nova Scotia and Alberta recorded the lowest increases (55% and 46%, respectively).

Table 9. Age Standardized Rate per 100,000 Population of Hospitalizations for Hip and Knee Replacements, 1994–1995 and 2004–2005

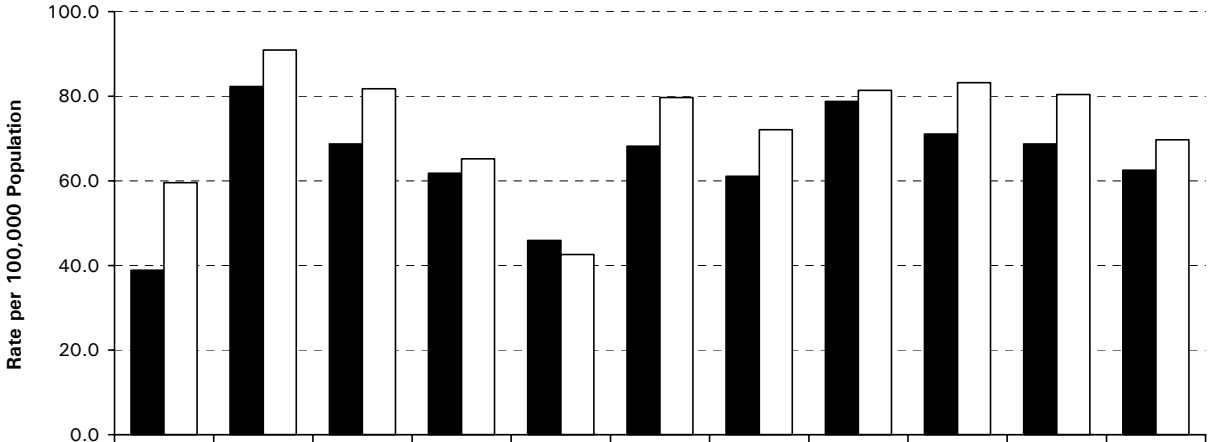
Province	Hip Arthroplasty			Knee Arthroplasty		
	Fiscal Year 1994–1995	Fiscal Year 2004–2005	10-Year Change %	Fiscal Year 1994–1995	Fiscal Year 2004–2005	10-Year Change %
Newfoundland and Labrador*	39.1	50.1	28%	34.0	66.7	96%
Prince Edward Island	73.2	86.6	18%	58.8	106.2	83%
Nova Scotia	72.3	76.4	6%	67.2	103.9	55%
New Brunswick†	52.2	64.4	23%	51.0	100.1	96%
Quebec	33.4	44.4	33%	28.3	55.6	97%
Ontario	61.6	74.8	21%	59.0	107.0	81%
Manitoba	53.4	67.3	26%	46.0	93.2	103%
Saskatchewan	68.8	80.7	17%	69.4	120.9	74%
Alberta	78.2	77.9	0%	69.2	101.3	46%
British Columbia	58.7	75.1	28%	46.2	94.9	105%
Canada‡	**55.3**	**66.8**	**21%**	**50.1**	**90.8**	**81%**

* For Newfoundland and Labrador, rates pertain to 1995–1996 since data on patient's residence were incomplete for 1994–1995.
† One region in NB was excluded due to missing data submission.
‡ Excludes non-Canadian residents.
The 1991 Canadian population is used to standardize rates

Source: HMDB, CIHI, 1994–1995 and 2004–2005.

The age-standardized rates by sex and province for hip replacements (Figure 6) were similar for both males and females. The rates were highest in Prince Edward Island for both females (90 per 100,000) and males (82 per 100,000 population).

Saskatchewan had the highest knee replacement age standardized rate for females (135 per 100,000), followed by Ontario (122 per 100,000) (Figure 7). The highest rate of knee replacements for males was also recorded in Saskatchewan (105 per 100,000). The lowest rates for both females and males were recorded in Quebec (61.9 and 48.0 per 100,000 respectively) and Newfoundland and Labrador (69.3 and 63.6 per 100,000 respectively).

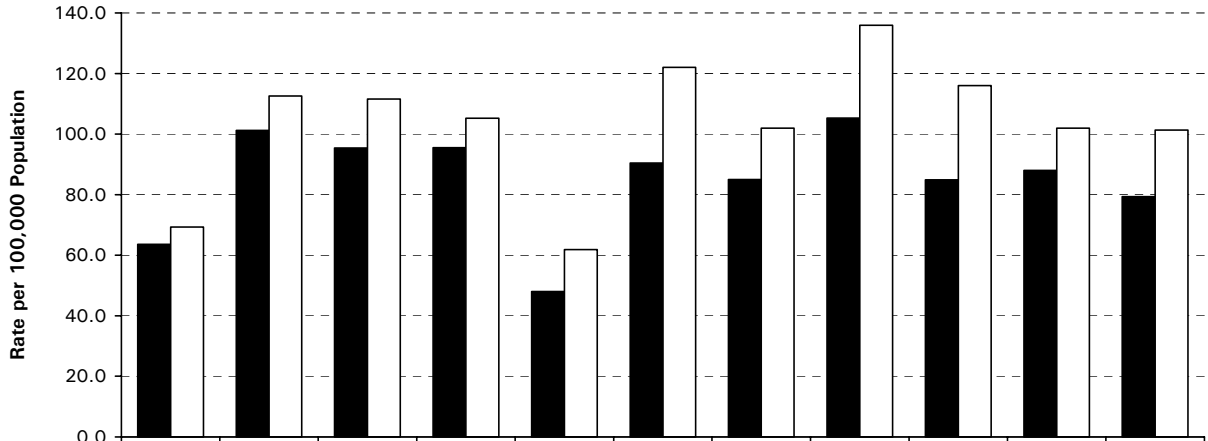


	N.L.	P.E.I.	N.S.	N.B.*	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Canada
■ Males	38.9	82.3	68.7	61.8	45.9	68.2	61.1	78.8	71.1	68.7	62.5
□ Females	59.6	90.9	81.8	65.2	42.6	79.7	72.1	81.4	83.2	80.4	69.7

Province

Rates calculated based on patients residence. Yukon, Northwest Territories and Nunavut rates suppressed due to small numbers but included in national calculation.
* One region in NB was exluded from the calculation of provincial rate due to missing data submission, but was included for the calculation of the national rate.
The 1991 Canadian population was to standardize rates.
Source: Hospital Morbidity Database, CIHI, 2004–2005.

Figure 6. Age-Standardized Rates (per 100,000 Population) of Hip Replacement Procedures for Males and Females, 2004–2005



	N.L.	P.E.I.	N.S.	N.B.*	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Canada
■ Males	63.6	101.2	95.4	95.5	48.0	90.4	85.0	105.3	84.9	88.0	79.3
□ Females	69.3	112.6	111.6	105.2	61.9	122.0	101.9	135.9	116.0	101.9	101.3

Province

Rates calculated based on patients residence. Yukon, Northwest Territories and Nunavut rates suppressed due to small numbers but included in national calculation.
* One region in NB was exluded from the calculation of provincial rate due to missing data submission, but was included for the calculation of the national rate.
The 1991 Canadian population was to standardize rates.
Source: Hospital Morbidity Database, CIHI, 2004–2005.

Figure 7. Age-Standardized Rates (per 100,000 Population) of Knee Replacement Procedures for Males and Females, 2004–2005

Inter-Provincial/Territorial Movements

Most patients had their joint replacement surgeries performed in their province of residence, with the exception of Yukon Territory and Nunavut. However, a small proportion of patients had their joint replacements performed in other provinces. Possible reasons for undergoing joint replacement in a province other than the home province include the potential for a shorter wait time, access to a sub-specialty, or other services not available in their home province. As hip replacements are not performed in Yukon Territory, and neither hip nor knee replacements are performed in Nunavut, residents of these two territories must travel to other provinces to have hip and knee replacements performed.

The provincial/territorial movements of hip replacement patients are presented in Table 10. Residents of Prince Edward Island, Saskatchewan, Nova Scotia, Northwest Territories and Manitoba were most likely to have their hip replacement surgery performed in another province. On the other hand, residents of Ontario and Alberta (0.2% each) and Newfoundland and Labrador (0.3%) were least likely to travel to another province for their hip replacement surgery. For the most part, the movements seen across provinces were similar to the previous years' (2001–2002 to 2003–2004) patterns.

With respect to the flow of patients into provinces for hip replacement surgery, New Brunswick (6.5%), Manitoba and Alberta (3.4% each) and Nova Scotia (3.1%) had the highest proportion of out-of-province patients coming to their province for surgery. In absolute numbers, however, Alberta (n = 86), New Brunswick (n = 39), Ontario (n = 34) and Manitoba (n = 32) received the highest number of patients from out-of-province for hip replacement procedures.

Table 10. Movement of Hip Replacements Patients Across Provinces, 2004–2005

Patient's Province of Residence	Province Where the Procedure Was Performed*										
	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	N.W.T.
N.L.	318		<5								
P.E.I.		137	11								
N.S.			870	35		<5					
N.B.			<5	563		<5					
Que			<5	<5	4,108	17					
Ont.						10,685	23		<5	<5	
Man.			<5			<5	916	7		<5	
Sask.			<5			<5	5	930	36	<5	
Alta.						<5		<5	2,474	5	
B.C.	<5			<5		6		<5	46	3,851	
Y.T.									<5	14	
N.W.T.									<5		26
Nun.						<5	<5				<5

* No joint replacements (hip) performed in Nunavut and Yukon Territory.
Cells with counts less than five are suppressed in order to minimize the risk of residual disclosure.

Source: HMDB, CIHI, 2004–2005.

Table 11 shows the inter-provincial movement of patients who underwent knee replacements in Canada in 2004–2005. Residents of Northwest Territories, Prince Edward Island, Nova Scotia and Saskatchewan were most likely to have their knee replacement surgery in another province. Similar to the pattern seen for hip replacement recipients, only a small proportion of residents of Alberta (0.4%), Ontario, New Brunswick and Newfoundland and Labrador (0.2% each) had their knee replacement surgeries in a province other than their province of residence. New Brunswick (6.5%), Manitoba (3.5%) and Alberta (3.3%) had the highest proportion of out-of-province residents coming to have joint replacement surgery. Of note, 41% of the knee replacement surgeries performed on patients from Nunavut were performed in Northwest Territories, raising the proportion of out-of-province patients treated in the latter province to above 30%.

Table 11. Movement of Knee Replacements Patients Across Provinces, 2004–2005

Patient's Province of Residence	Province Where the Procedure Was Performed*											
	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	N.W.T.	Y.T.
N.L.	409		<5									
P.E.I.		168	5	<5		<5						
N.S.			1,170	44								
N.B.			<5	851								
Que				11	5,077	35						
Ont.	<5					15,051	31			<5		
Man.						<5	1,264	4	<5	<5		
Sask.			<5			<5	7	1,385	40	<5		
Alta.						<5		<5	3,106	5		
B.C.						5	<5	<5	63	4,757		
Y.T.									<5	5		6
N.W.T.									<5		30	
Nun.						12	7				13	

* No joint replacements (knee) performed in Nunavut.
Cells with counts less than five are suppressed in order to minimize the risk of residual disclosure.

Source: HMDB, CIHI, 2004–2005.

Patient Demographics

The age distribution of hip and knee replacement recipients was similar, with the majority of patients being 65 years of age or older (65% of hip and 68% of knee replacement recipients). Only small proportions of patients for both procedures were younger than 45 years (5% of the hip and 1% of the knee replacement recipients) (Figure 8).

In 2004–2005, the mean age of patients who underwent hip replacements in Canada was 68 years (69.6 years for females and 65.6 years for males). The mean age of knee replacement patients was 68.6 years (68.6 years for females and 68.5 years for males). Overall, patients undergoing knee replacements were significantly older then their hip replacement counterparts.

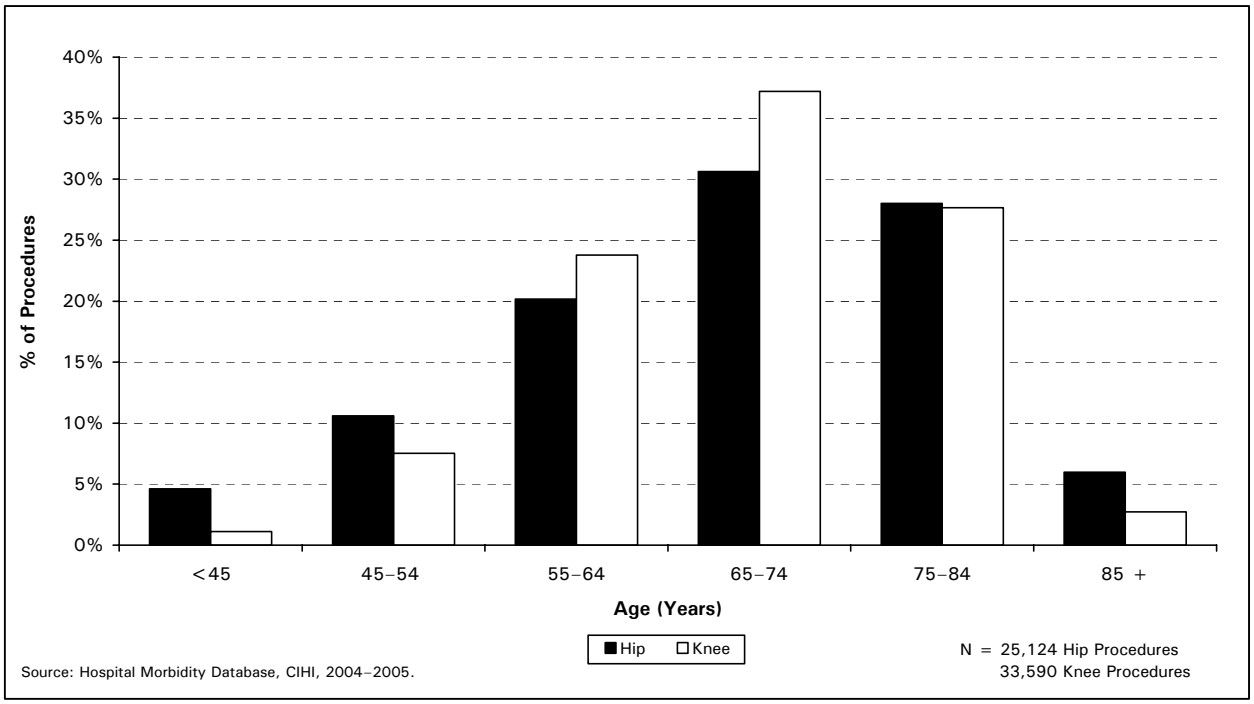


Figure 8. Age Distribution of Hip and Knee Replacement Recipients, Canada, 2004–2005

Females were more likely to undergo hip arthroplasty as compared to men in 2004–2005 (the age-standardized rate for females was 69.7 per 100,000 compared to 62.5 for men). Females also had a higher rate of knee replacement (101.3) as compared to males (90.8). In 2004–2005, 57% of the hip replacement recipients were female and 43% were male; of the knee replacement recipients, 60% were female, and 40% were male.

Table 12 shows the number of hip and knee replacements by age group and sex for 2004–2005, compared to 1994–1995. For hip replacement procedures, the largest increases for both males and females were seen in the 85-year and older age group (116% and 109%, respectively), followed by the 45 to 54 year age group (110% for males and 95% for females).

For knee replacement procedures, the largest increases were noted in the 45 to 54 year age group (229% for males and 327% for females), followed by the 85-year and older age group for males (181%) and the 55 to 64 year age group for females (189%).

Table 12. Number of Hip and Knee Arthroplasties by Age and Sex, Canada, 1994–1995 and 2004–2005

Hip Arthroplasty						
	Males			Females		
Age Group (Years)	Fiscal Year 1994–1995	Fiscal Year 2004–2005	10-Year Change %	Fiscal Year 1994–1995	Fiscal Year 2004–2005	10-Year Change %
<45	471	640	36%	455	519	14%
45–54	693	1,452	110%	620	1,212	95%
55–64	1,585	2,471	56%	1,634	2,595	59%
65–74	2,444	3,346	37%	3,704	4,350	17%
75–84	1,454	2,448	68%	2,754	4,591	67%
85 +	190	410	116%	521	1,090	109%
Total	**6,837**	**10,767**	**57%**	**9,688**	**14,357**	**48%**
Knee Arthroplasty						
	Males			Females		
Age Group (Years)	Fiscal Year 1994–1995	Fiscal Year 2004–2005	10-Year Change %	Fiscal Year 1994–1995	Fiscal Year 2004–2005	10-Year Change %
<45	100	15	56%	144	217	51%
45–54	275	905	229%	380	1,624	327%
55–64	1,265	3,238	156%	1,642	4,751	189%
65–74	2,675	5,259	97%	4,058	7,229	78%
75–84	1,517	3,506	131%	2,529	5,786	129%
85 +	115	323	181%	238	596	150%
Total	**5,947**	**13,387**	**125%**	**8,991**	**20,203**	**125%**

Source: HMDB, CIHI, 1994–1995 and 2004–2005.

Table 13 shows the age-specific rates for hip and knee replacements, by sex for 2004–2005, as compared to 1994–1995. For hip replacement procedures, the highest age-specific rates in 2004–2005 were noted in the 75 to 84 year age group for both males and females (405 and 533 per 100,000, respectively), followed by the 65 to 74 year age group (317 and 373 per 100,000, for males and females respectively). For males, the largest ten-year increases were seen among the 45 to 54 year age group (53%), followed by the 85-year and older age group (43%). For females the highest rates were observed in the 85-year and older age group followed by the 45 to 54 year age group (42% and 41%, respectively).

Substantial increases in age–sex specific rates for knee arthroplasty have occurred in the last decade (1994–1995 to 2004–2005). The most notable increases are observed in the 45 to 54 year age group, where the rate of knee replacements has more than doubled for males (a 125% increase) and almost tripled for females (a 174% increase). However, the highest age–sex specific rate of knee replacements is consistently observed in the 75 to 84 year age group (rates of 510.5 per 100,000 for males and 590.4 per 100,000 population for females). It is important to note that the Canadian population in 40 to 59 year age group has increased by 32% over decade between 1994–1995 and 2004–2005, while the Canadian population 60 years of age and older has increased by 17%.

Table 13. Age-Specific Rates (per 100,000 Population) of Hip and Knee Arthroplasty by Sex and Age Group, Canada, 1994–1995, 2004–2005

Hip Arthroplasty						
Age Group (Years)	Males			Females		
	Fiscal Year 1994–1995	Fiscal Year 2004–2005	10-Year Change %	Fiscal Year 1994–1995	Fiscal Year 2004–2005	10-Year Change %
<45	4.7	6.4	36%	4.7	5.4	14%
45–54	39.5	60.6	53%	35.4	49.8	41%
55–64	129.2	147.4	14%	129.8	150.7	16%
65–74	264.1	316.9	20%	332.0	372.8	12%
75–84	349.4	405.2	16%	427.2	532.7	25%
85 +	200.8	286.3	43%	234.4	334.0	42%
Total	**47.4**	**67.8**	**43%**	**65.9**	**88.6**	**35%**
Knee Arthroplasty						
Age Group (Years)	Males			Females		
	Fiscal Year 1994–1995	Fiscal Year 2004–2005	10-Year Change %	Fiscal Year 1994–1995	Fiscal Year 2004–2005	10-Year Change %
<45	1.0	1.8	82%	1.5	2.4	63%
45–54	15.7	35.3	125%	21.7	59.5	174%
55–64	103.1	162.5	58%	130.5	242.1	86%
65–74	289.1	456.1	58%	363.7	555.5	53%
75–84	364.5	510.5	40%	392.3	590.4	51%
85 +	121.5	172.5	42%	107.1	172.5	61%
Total	**41.2**	**74.9**	**82%**	**61.1**	**111.1**	**82%**

The 1991 Canadian population was used to standardize rates.

Source: HMDB, CIHI, 1994–1995 and 2004–2005.

Length of Hospital Stay

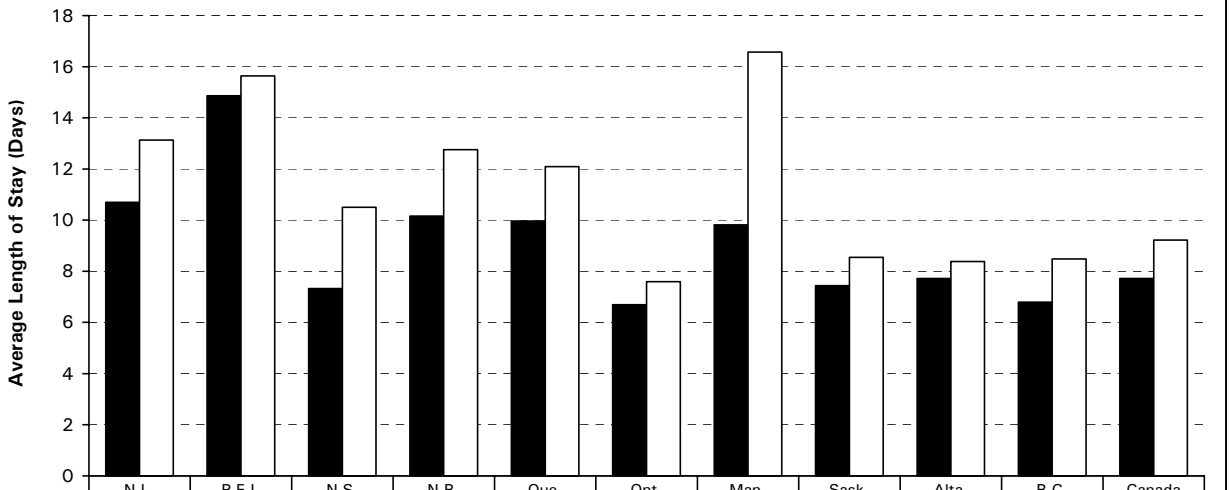
Methodological Note:

Analyses presented in this section 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 residence are included in this analysis.

Provincial average lengths of stay in hospital for hip and knee replacement patients in 2004–2005 by sex are shown in Figures 9 and 10. Generally, patients undergoing hip replacement procedures had longer hospital stays than those undergoing knee replacement.

On average, patients undergoing a hip replacement remained in hospital for 9 days compared to 7 days for those receiving a knee replacement. Ontario, British Columbia and Alberta had lower average lengths of stay than the national average for both hip and knee replacements. In contrast, Manitoba, Prince Edward Island, Newfoundland and Labrador, New Brunswick and Quebec had higher than the national average lengths of stay for both hip and knee procedures.

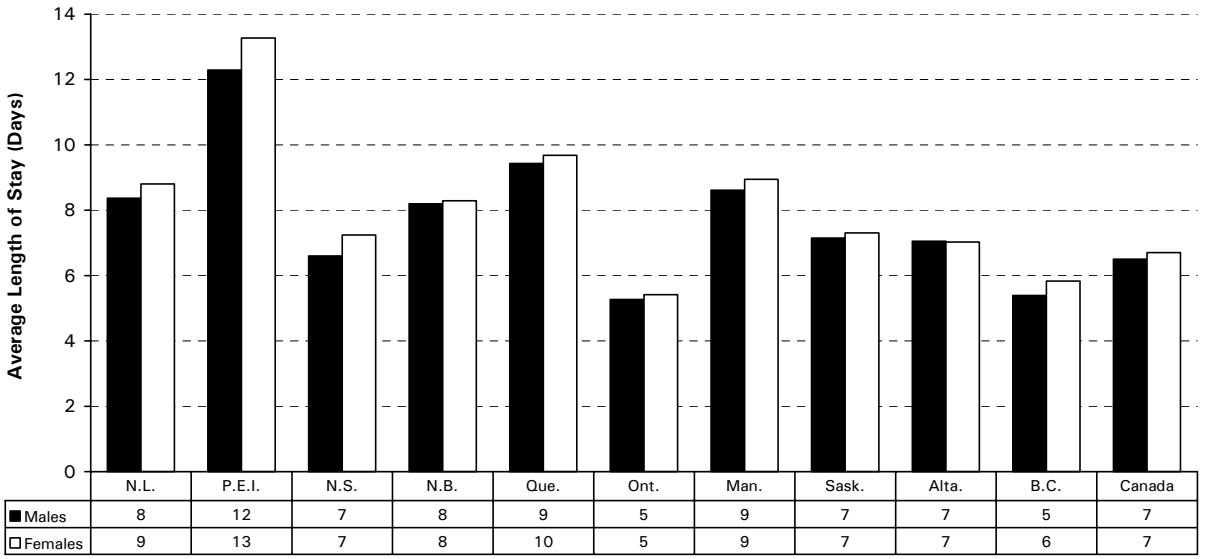
On average, females undergoing a hip or knee replacement procedure remained in hospital longer than their male counterparts.



	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Canada
■Males	11	15	7	10	10	7	10	7	8	7	8
□Females	13	16	11	13	12	8	17	9	8	8	9

Northwest Territories, Nunavut and Yukon numbers suppressed, but included in overall national average.
Source: Hospital Morbidity Database, CIHI, 2004–2005.

Figure 9. Average Length of Hospital Stay for Hip Replacement Patients by Sex and Province, 2004–2005



	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Canada
■ Males	8	12	7	8	9	5	9	7	7	5	7
□ Females	9	13	7	8	10	5	9	7	7	6	7

Northwest Territories, Nunavut and Yukon numbers suppressed, but included in overall national average.
Source: Hospital Morbidity Database, CIHI, 2004–2005.

Figure 10. Average Length of Hospital Stay for Knee Replacement Patients by Sex and Province, 2004–2005

Over the decade of study beginning in 1994–1995, there has been a noticeable decrease in the length of stay for both hip and knee replacements in all provinces. Nationally, the average length of stay for individuals undergoing a hip replacement decreased by 36% from 14 days in 1994–1995 to 9 days in 2004–2005. Similarly, knee replacement recipients now spend an average of 7 days in hospital compared to 12 days in 1994–1995, a decrease of 42%.

In-Hospital Mortality

Post-operative in-hospital mortality is a relatively rare event among patients receiving both hip and knee replacement surgery (Table 14). Overall, in 2004–2005, less than 1% of patients undergoing hip or knee replacement surgery died in hospital (0.8% and 0.2%, respectively).

The risk of post-operative in-hospital death increases with age (Table 14). 80% of the deaths occurring among hip replacement recipients and 70% of the deaths after knee replacement procedures occurred in patients 75 years or older. This age related pattern is maintained for both males and females. The association between age and in-hospital death, however, seems to be more prominent for hip replacement recipients compared to knee replacement patients.

Table 14. Number of In-Hospital Deaths after Hip and Knee Arthroplasty by Patient's Sex and Age Group, Canada, 2004–2005

Hip Arthroplasty					
Age Group (Years)	Number of Deaths			Number of Patients	% of Deaths
	Males	Females	Total		
<75	19	21	40	16,585	0.2%
75–84	44	44	88	7,039	1.3%
85 +	33	40	73	1,500	4.9%
All Ages	96	105	201	25,124	0.8%
Knee Arthroplasty					
Age Group (Years)	Number of Deaths			Number of Patients	% of Deaths
	Males	Females	Total		
<75	8	12	20	23,379	0.1%
75–84	18	15	33	9,292	0.4%
85 +	5	8	13	919	1.4%
All Ages	31	35	66	33,590	0.2%

Source: HMDB, CIHI, 2004–2005.

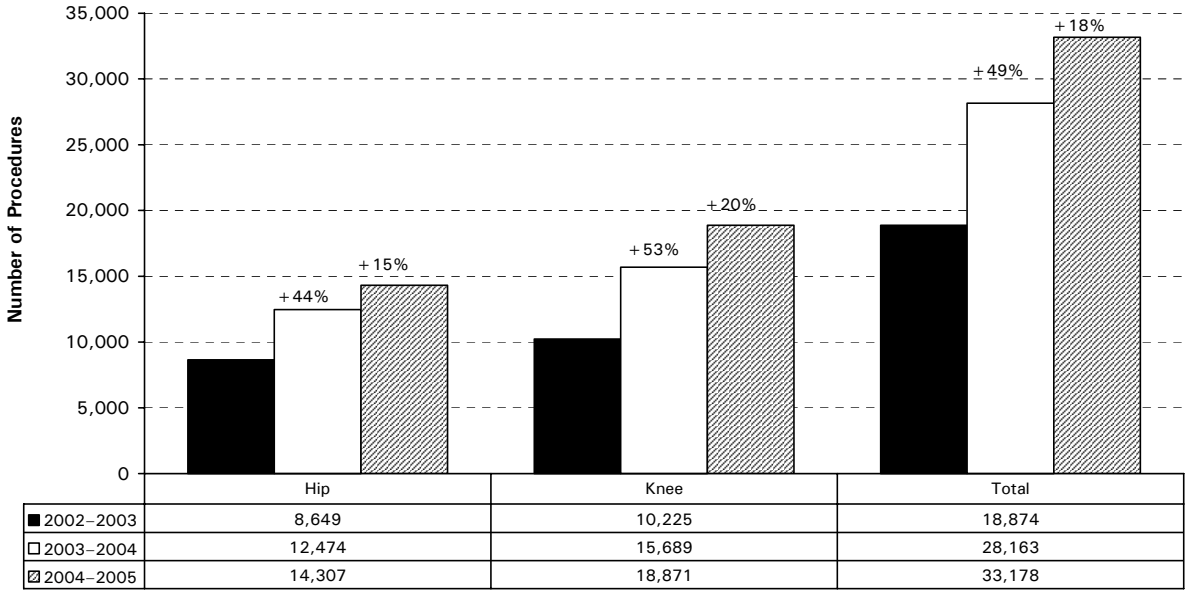
Surgical and Clinical Characteristics

Methodological Notes:

- **Analyses in this section are based on the CJRR data for fiscal years 2002–2003 to 2004–2005.**
- **Data submission by orthopaedic surgeons to the CJRR is voluntary and not all eligible surgeons are participating. Each surgeon may not have submitted all procedures performed.**
- **Wherever the term "significant" is used in this report, a two-sided statistical test (Chi-square or Fisher Exact, as appropriate) was performed and the result was statistically significant at the 0.05 level.**
- **Through this report, the term "components replaced" can refer to either components replacing the natural bone, as in the case of primary procedures, or to components replacing existing artificial implants, as in the case of revision procedures.**
- **Additional methodological details are presented in Appendix A.**

Overall Trends

Among all hip and knee replacement surgeries performed in 2004–2005 and submitted to the CJRR (33,178), just over half (57%) were knee replacements and just under half were hip replacements (43%). The last two years have seen significant increases in the number of submissions: a 49% increase between 2002–2003 and 2003–2004, and 18% from 2003–2004 to 2004–2005 (Figure 11).



	Hip	Knee	Total
2002–2003	8,649	10,225	18,874
2003–2004	12,474	15,689	28,163
2004–2005	14,307	18,871	33,178

Percent change refers to change from previous year.
Source: Canadian Joint Replacement Registry, CIHI, 2002–2003 to 2004–2005.

Figure 11. Submissions to CJRR by Joint, 2002–2003 to 2004–2005

Patient Demographics

There were observed differences in demographics among patients receiving hip and knee replacements. In 2004—2005, females accounted for significantly ($p < 0.0001$) more hip and knee replacements than males (56% and 59%, respectively). The highest proportions of replacements were performed in the 65 to 74 year age group (30% and 37%, respectively), followed by the 75 to 84 year age group (27% and 28%, respectively). The younger (under age 45 years) and the older (85 years and older) patients comprised the lowest proportion of hip and knee replacements in the CJRR (Figure 12).

Overall, Canadians receiving knee replacements were significantly older than those receiving hip replacements ($p < 0.0001$).

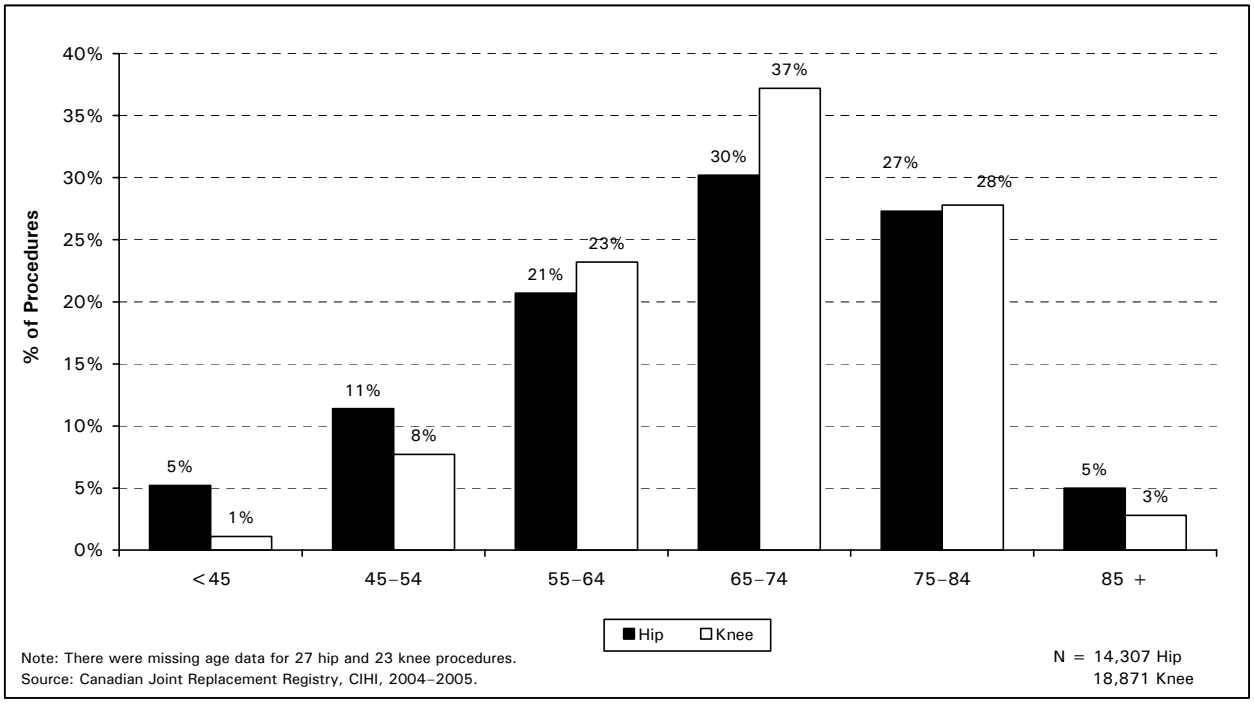


Figure 12. Hip and Knee Replacements by Age Group, CJRR, 2004–2005

Purpose of Surgery (Primary vs. Revision)

Among all hip replacements reported in 2004–2005, 88% were primary surgeries and 12% were revisions (Table 15). Among knee replacements, 94% were primary surgeries, while 6% were revisions (Table 16).

Increases in each of hip and knee replacement procedures in the CJRR between 2002–2003 and 2004–2005 were mainly driven by an increase in primary procedures (primary vs. revisions increase: 67% vs. 49% for hip, and 85% vs. 81% for knee respectively).

Table 15. Hip Replacements by Type of Surgery, 2002–2003 to 2004–2005

Type of Replacement	2002–2003		2003–2004		2004–2005		2-Year Increase
	N	%	N	%	N	%	%
Primary	7,520	87%	10,781	86%	12,595	88%	67%
Revision	1,111	13%	1,672	13%	1,659	12%	49%
First Revision	804	9%	1,207	10%	1,226	9%	52%
Second Revision	224	3%	327	3%	306	2%	37%
Third Revision	65	1%	86	1%	79	1%	22%
>3 Revisions	18	0%	52	0%	48	0%	167%
Excision	4	0%	3	0%	10	0%	150%
Not Stated	14	0%	18	0%	43	0%	207%
Total	**8,649**	**100%**	**12,474**	**100%**	**14,307**	**100%**	**65%**

Source: Canadian Joint Replacement Registry, CIHI, 2002–2003 to 2004–2005.

Table 16. Knee Replacements by Type of Surgery, 2002–2003 to 2004–2005

Type of Replacement	2002–2003		2003–2004		2004–2005		2-Year Increase
	N	%	N	%	N	%	%
Primary	9,589	94%	14,698	94%	17,728	94%	85%
Revision	615	6%	968	6%	1,115	6%	81%
First Revision	502	5%	799	5%	94	5%	80%
Second Revision	94	1%	136	1%	164	1%	74%
Third Revision	13	0%	21	0%	30	0%	131%
>3 Revisions	6	0%	12	0%	17	0%	183%
Excision	5	0%	5	0%	8	0%	60%
Not Stated	16	0%	18	0%	20	0%	25%
Total	**10,225**	**100%**	**15,689**	**100%**	**18,871**	**100%**	**85%**

Source: Canadian Joint Replacement Registry, CIHI, 2002–2003 to 2004–2005.

Indications for Surgery

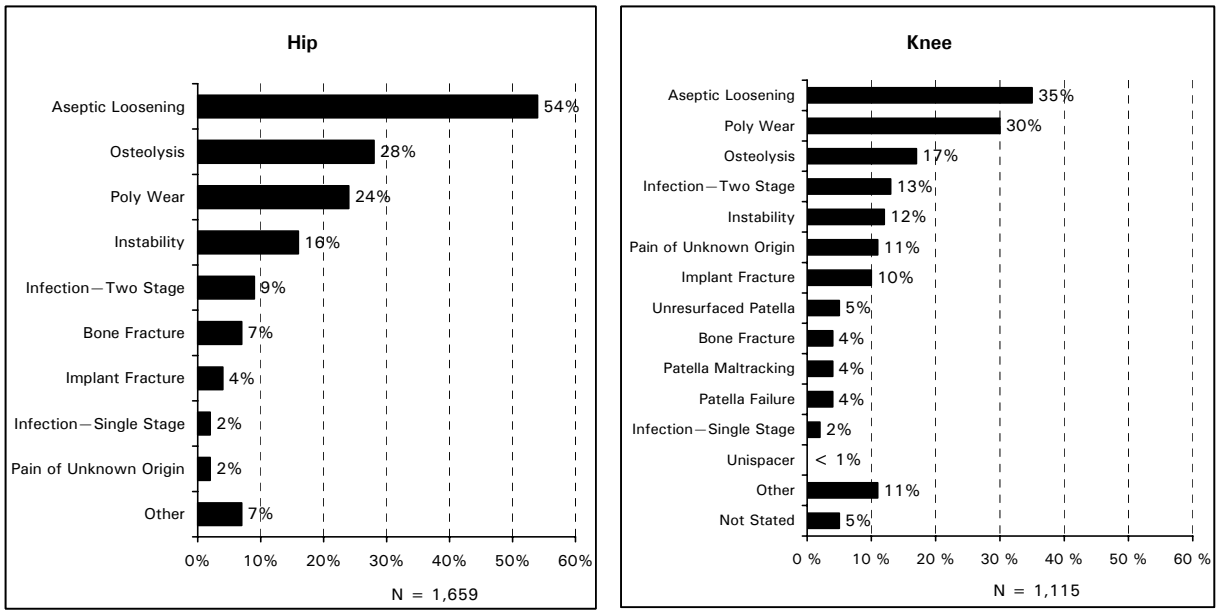
For primary replacements only, surgeons were asked to record *only the most responsible* diagnosis groupings that were applicable to the patients. Degenerative osteoarthritis was the most common diagnosis indicated for both primary hip replacements (81%) and primary knee replacements (93%).

For primary hip replacements, the second most commonly reported diagnosis grouping was osteonecrosis (6%), followed by acute fracture and inflammatory arthritis (4% each). For primary knee replacements, the second most commonly reported grouping was inflammatory arthritis (4%), followed by post-traumatic osteoarthritis (2%).

Reasons for Revision

For revision joint replacement procedures only, surgeons were asked to record *one or more* reasons for revision from a specified list of categories. The most common reason for revision among hip replacements was aseptic loosening (54%), followed by osteolysis (28%), poly wear (24%) and instability (16%) (Figure 13).

Among the knee replacement revisions, the most common reason for revision reported was aseptic loosening (35%), followed by poly wear (30%), osteolysis (18%) and instability (13%) (Figure 13).



Note: Percentages do not add up to 100% as more than one reason for revision can be recorded.
Source: Canadian Joint Replacement Registry, CIHI, 2004–2005.

Figure 13. Reasons Reported for Revising Hip and Knee Replacements, 2004–2005

Previous Operations

For primary joint replacement procedures, surgeons were asked to record *one or more* previous operations from a specified list of categories. Of the primary hip and knee replacement procedures recorded in 2004–2005, 94% and 74%, respectively, had no previous operation recorded. Among knee replacements in which a previous operation was recorded, arthroscopic debridement was most commonly reported (16%), followed by arthroscopic menisectomy and open menisectomy (6% and 5% of all procedures, respectively).

Types of Surgery

Hip

For primary hip replacements and hip replacements including revision procedures, the vast majority were total arthroplasty procedures (92% and 87%, respectively) (Table 17).

See *Appendix B* for the method used to define these types of surgeries.

Table 17. Hip Replacements by Type of Surgery, 2004–2005

Hip Replacements	Total Arthroplasty	Hemi Arthroplasty		Resurfacing Arthroplasty		Not Stated	Hip Replacements
		Monopolar	Bipolar	Full	Hemi		
All	87%	2%	5%	1%	<1%	5%	100%
Primary	92%	2%	4%	1%	<1%	<1%	100%

Source: Canadian Joint Replacement Registry, CIHI, 2004–2005.

Knee

According to CJRR data, unicompartmental knee replacement (UKA) usage has remained fairly consistent over the past three years (unicompartmental vs. total knee replacements accounted for 7%–8% vs. 92%–93% of all knee replacements). There has been a consistent incremental increase in primary UKA from 2002–2003 through 2004–2005 (Figure 14).

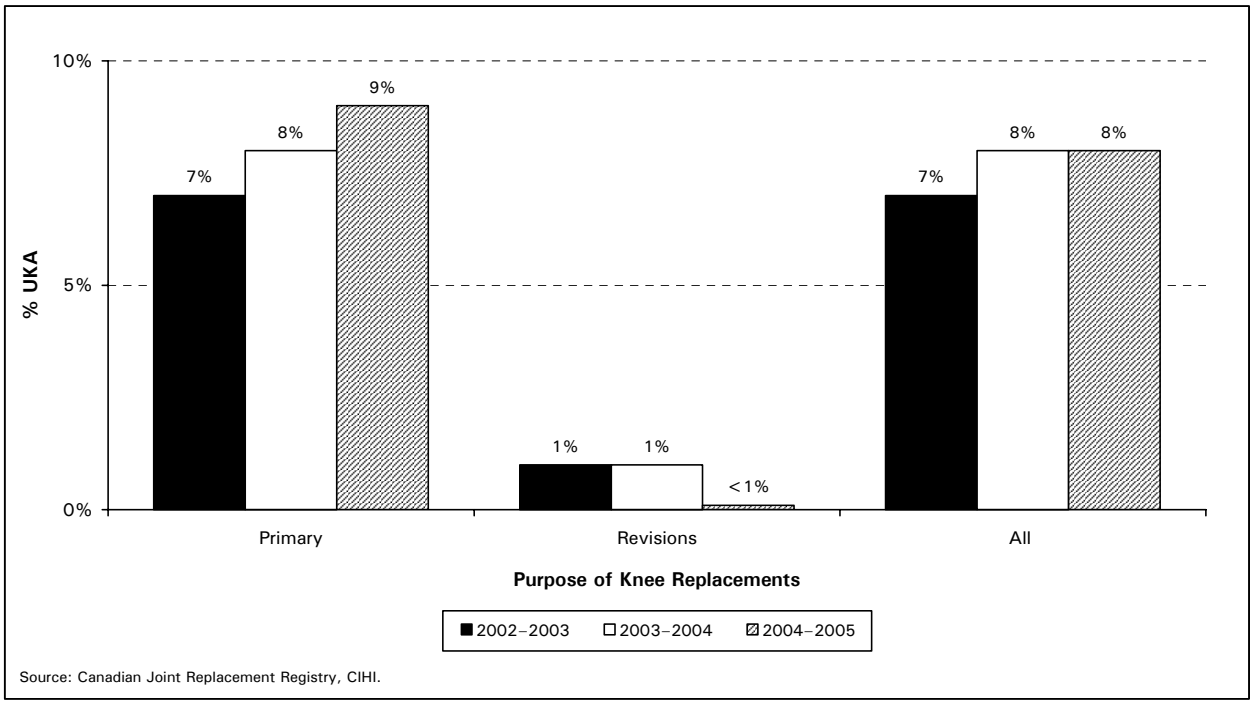
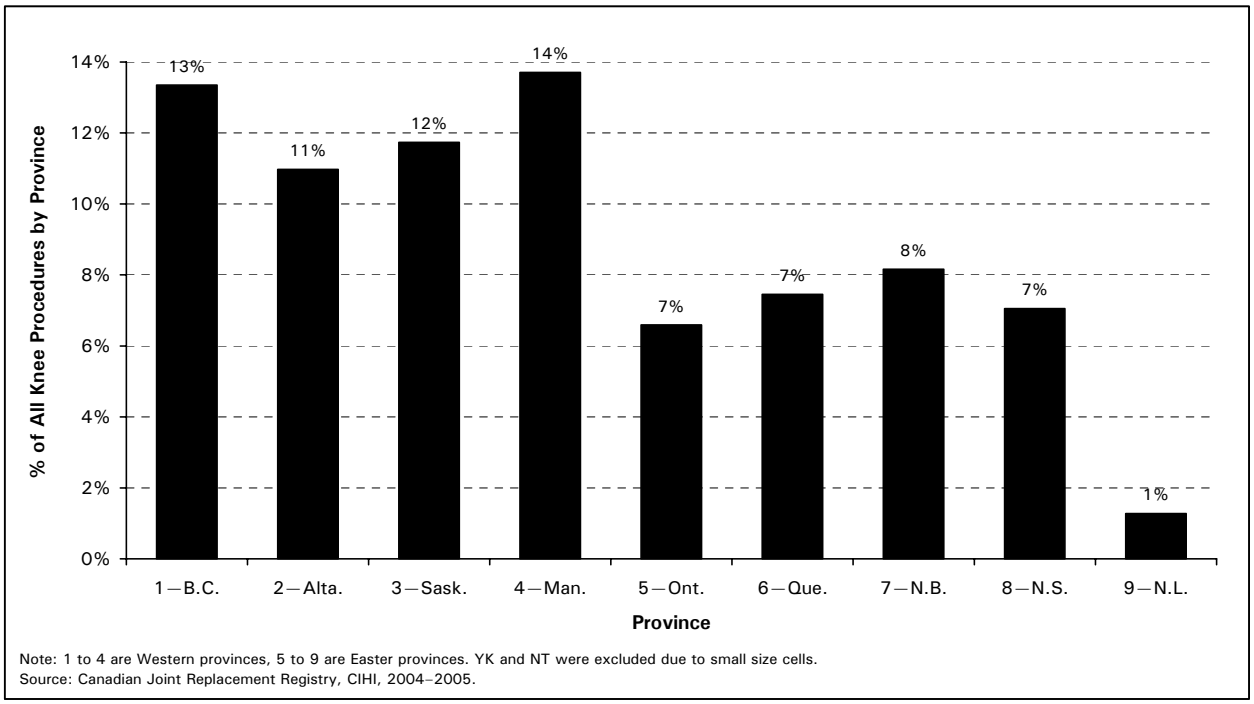


Figure 14. Unicompartmental Knee Replacements—All, Primary and Revisions, 2002–2003 to 2004–2005

UKA procedures involve smaller incisions, and are reported to result in less bleeding, quicker recovery, and less bone loss than a total knee replacement. UKA may be performed in patients with only limited knee arthritis; the procedure consists of replacing only one side of the knee joint. In knees that are otherwise healthy, a unicompartmental approach allows the other compartment and all ligaments to remain intact. By retaining the remaining normal compartments of the knee, it is thought that the joint may function more naturally.[3, 4]



Note: 1 to 4 are Western provinces, 5 to 9 are Easter provinces. YK and NT were excluded due to small size cells.
Source: Canadian Joint Replacement Registry, CIHI, 2004–2005.

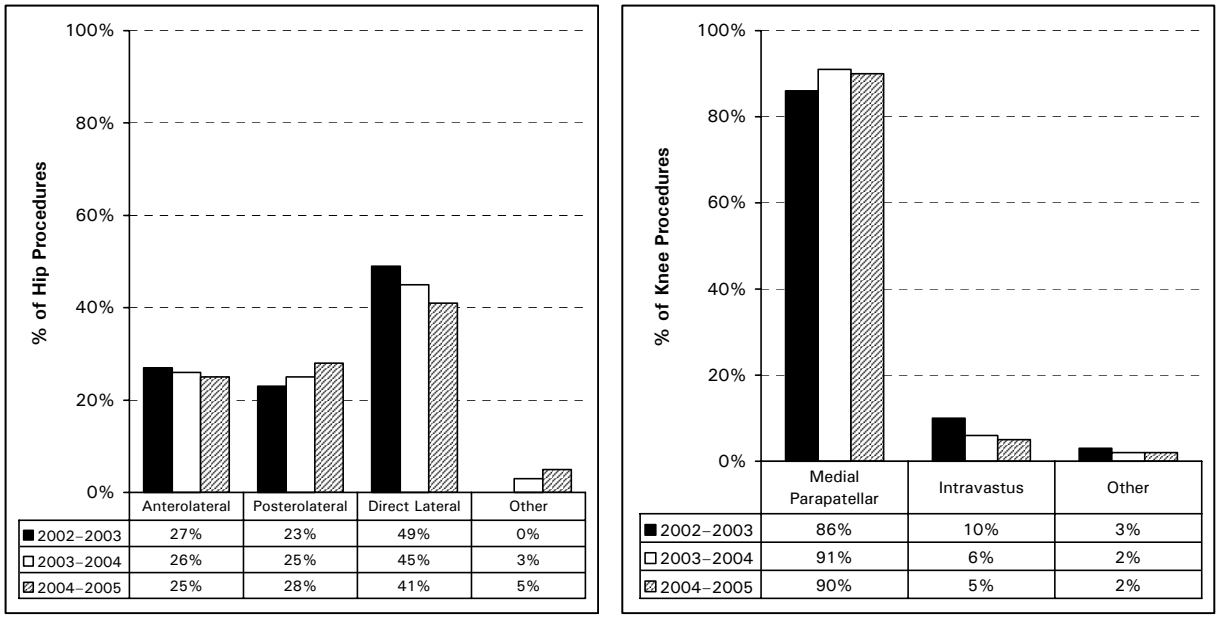
Figure 15. Primary Unicompartmental Knee Replacements—by Province, 2004–2005

The distribution of primary UKA across Canada (Figure 15) shows significant differences between Western and Eastern provinces ($p = 0.004$). The patients in the Western provinces are twice as likely as the Eastern ones (OR 1.94) to undergo UKA than TKA.

Surgical Approach

Surgical approach by joint shows clear patterns that have not changed appreciably over the past three years (Figure 16). Among hip replacements in 2004–2005, the direct lateral approach was the most common approach (41%), followed by the posterolateral and the anterolateral approaches (28% and 25%, respectively). The Smith/Peterson and two-incision approaches were used in less than 1% of surgeries, respectively.

Among knee replacements, the medial parapatellar approach was the approach utilized in the vast majority (90%) of procedures, with the intravastus, subvastus and lateral parapatellar approaches used in about 5%, 1% and <1% of cases, respectively.

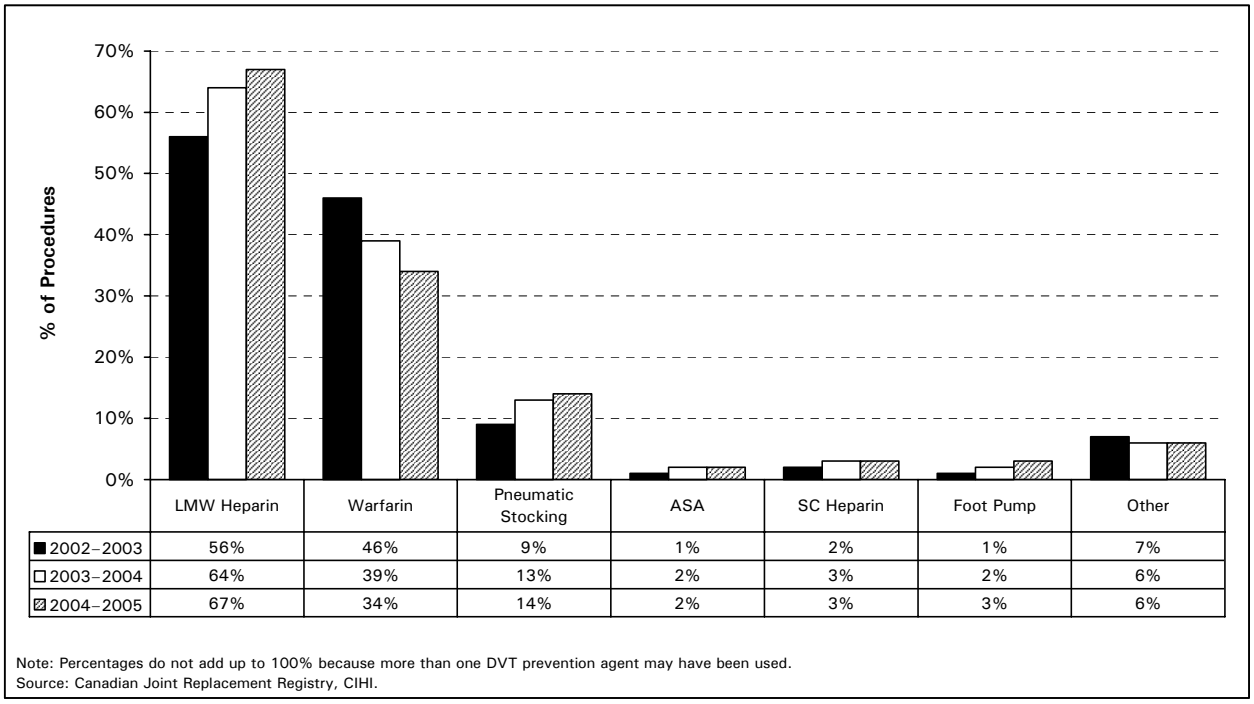


Note: There were missing surgical approach data for 160 procedures in 2002–2003, 317 procedures in 2003–2004 and 707 procedures in 2004–2005.
Source: Canadian Joint Replacement Registry, CIHI.

Figure 16. Surgical Approach for Hip and Knee Replacements, 2002–2003 to 2004–2005

Deep Vein Thrombosis (DVT) Prevention

Joint replacement surgery is associated with a high risk of deep venous thrombosis (DVT), and as such DVT prevention therapy was used in almost all (97%) cases of hip and knee replacements reported to the CJRR in 2004–2005. The types of DVT agent used remained consistent over the past three years, with low molecular weight (LMW) heparin being the most common (67% in 2004–2005, up from 56% in 2002–2003), followed by Warfarin (34% in 2004–2005, down from 46% in 2002–2003) (Figure 17).



	LMW Heparin	Warfarin	Pneumatic Stocking	ASA	SC Heparin	Foot Pump	Other
2002–2003	56%	46%	9%	1%	2%	1%	7%
2003–2004	64%	39%	13%	2%	3%	2%	6%
2004–2005	67%	34%	14%	2%	3%	3%	6%

Note: Percentages do not add up to 100% because more than one DVT prevention agent may have been used.
Source: Canadian Joint Replacement Registry, CIHI.

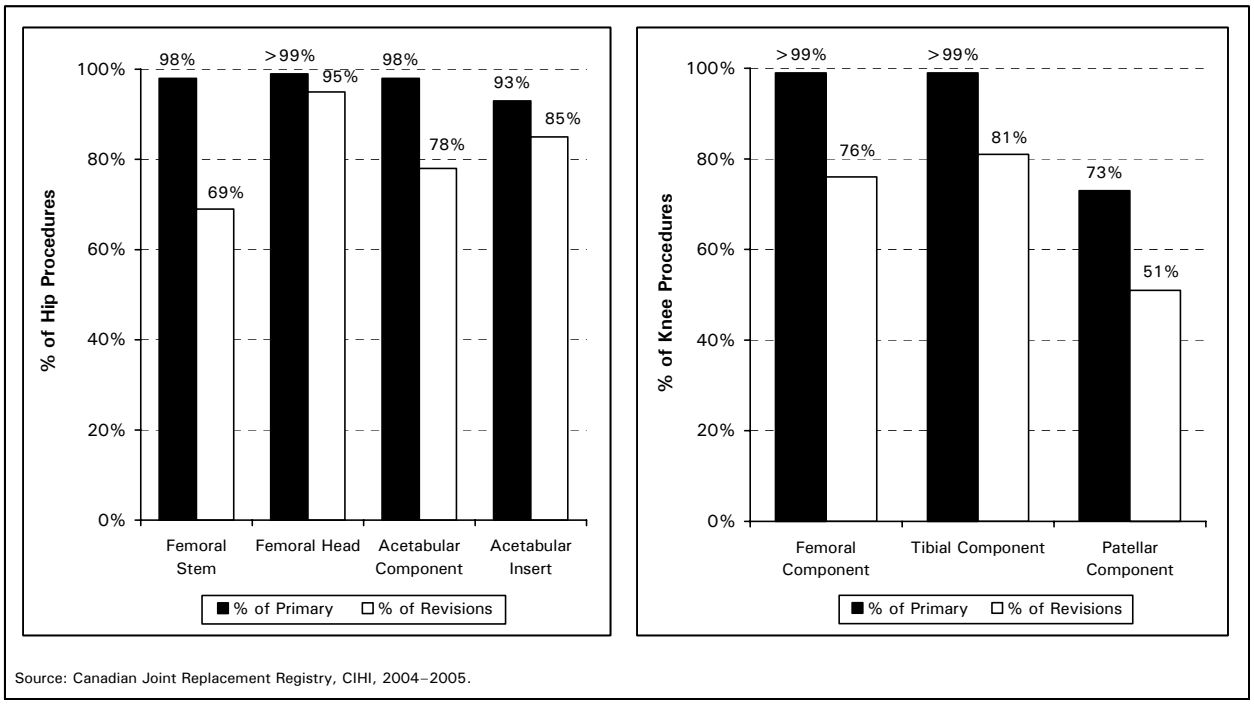
Figure 17. DVT Prevention Agents Used For Hip and Knee Replacements, 2002–2003 to 2004–2005

Component Characteristics

Type of Components Replaced

As expected, regardless of joint, all components were significantly more likely to be replaced during primary procedures than revision procedures (Figure 18). Among primary hip replacements, most components were replaced over 90% of the time. Among hip revision procedures, however, the femoral head was most likely to be replaced (95%), and the femoral stem least likely (69%).

Among primary knee replacements the patellar component was replaced only 73% of the time. Among knee revision procedures, the tibial component was most likely to be replaced (81%), followed by the femoral component (76%). The patella was resurfaced only half of the time (51%).



Source: Canadian Joint Replacement Registry, CIHI, 2004–2005.

Figure 18. Components Replaced by Joint, 2004–2005

Patella Resurfacing

Research has suggested that there is no significant outcome difference between the groups of patients having patella resurfaced compared to those did not have it resurfaced.[5] In the CJRR for 2004–2005, 78% of the replacement procedures were undertaken with patella resurfacing, and this proportion has been consistent over the past three years (Figure 19). Note that patellar resurfacing, as part of knee arthroplasty, is not applicable to unicompartmental knee replacement procedures.

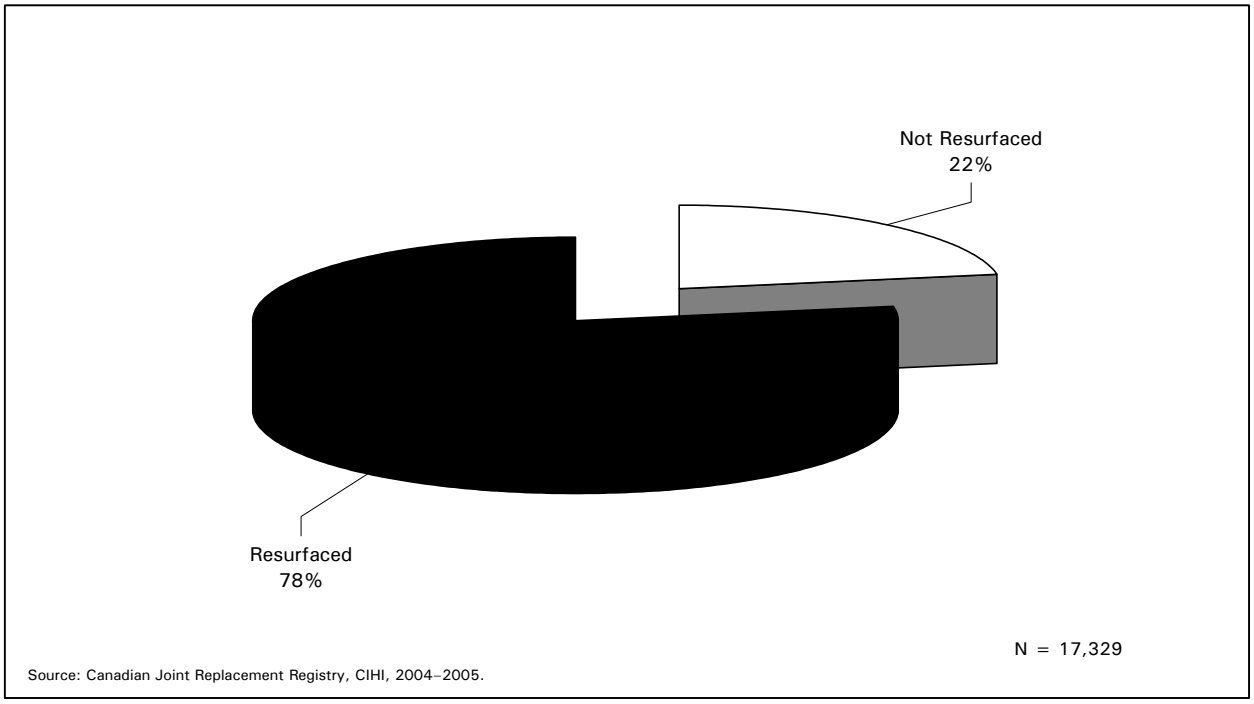


Figure 19. Patella Resurfacing, Non-Unicompartmental Knee Replacements, 2004–2005

Size of Components Replaced

The stability and durability of hip reconstruction is dependent on many factors that include the design and size of prosthetic components. The literature suggests that the use of larger femoral heads may result in improved joint stability when associated with the appropriate type of acetabular component.[6, 7]

The CJRR data demonstrates that larger femoral head sizes (32 mm or larger) for hip replacements were significantly more common among revisions than primary replacements ($p < 0.001$). The most commonly used femoral head size was 28 mm (primary and revision: 70% and 41%), followed by 32 mm (primary and revision: 19% and 35%) (Figure 20).

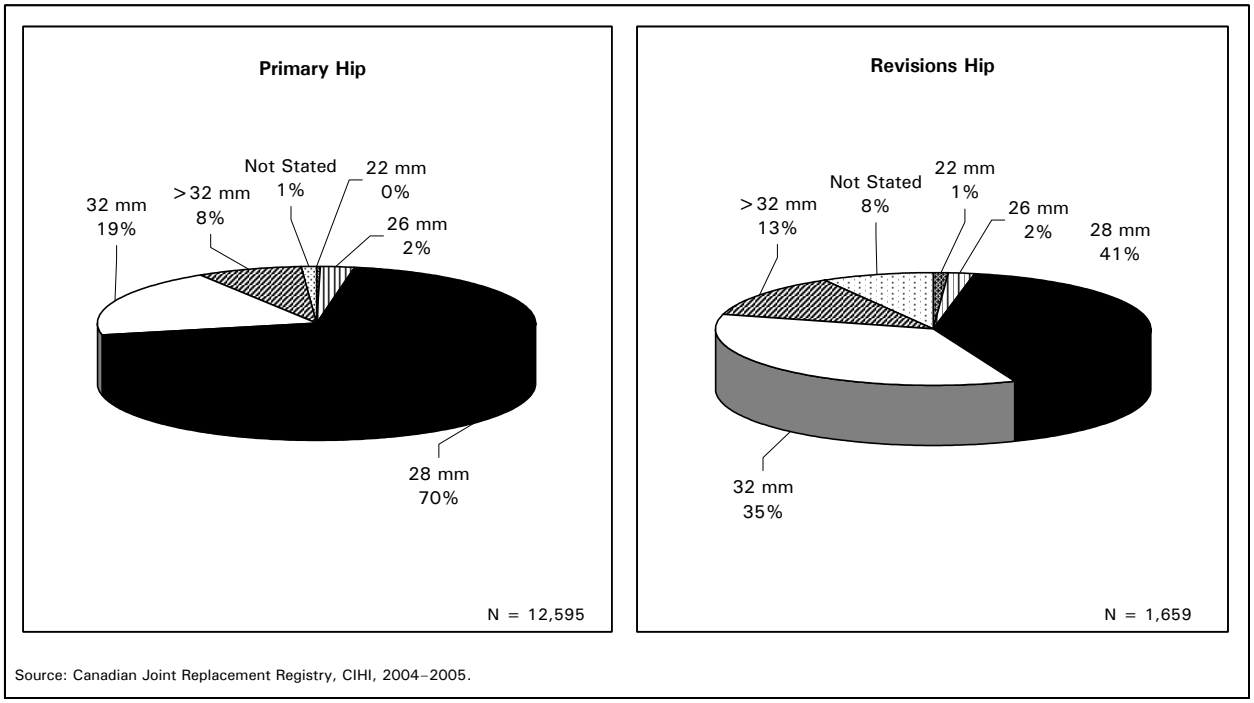


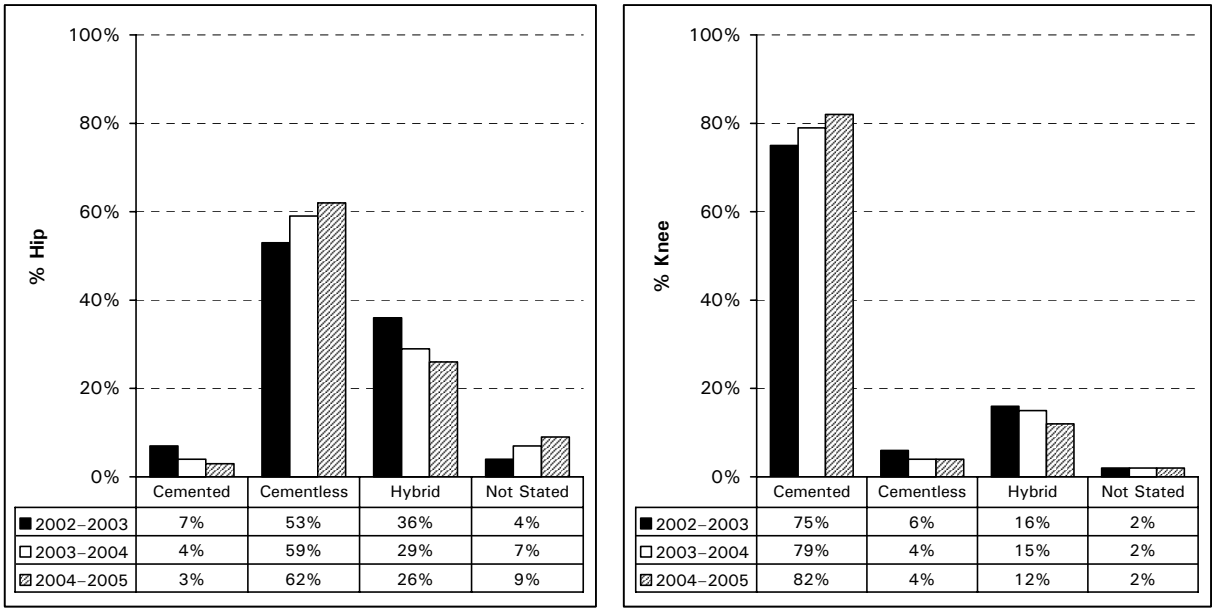
Figure 20. Primary and Revision Hip Replacements by Size of Femoral Head, 2004–2005

Fixation Method

Among all hip replacements, the most common fixation method was cementless (62%), followed by hybrid (26%) and cemented (3%) (Figure 21). Over the past three years, increases were seen in the percentage of procedures using a cementless fixation method (from 53% to 62%).

For knees, the cemented technique was most commonly used (82%), followed by hybrid (12%) and cementless (4%) (Figure 20). Over the past three years, increases were seen in the percentage of procedures using a cemented fixation method (from 75% to 82%).

For both hip and knee replacement procedures, fixation methods used were similar for both primary and revision surgeries.



	Cemented	Cementless	Hybrid	Not Stated
2002–2003	7%	53%	36%	4%
2003–2004	4%	59%	29%	7%
2004–2005	3%	62%	26%	9%

	Cemented	Cementless	Hybrid	Not Stated
2002–2003	75%	6%	16%	2%
2003–2004	79%	4%	15%	2%
2004–2005	82%	4%	12%	2%

Source: Canadian Joint Replacement Registry, CIHI, 2002–2003 to 2004–2005.

Figure 21. Fixation Method for Hip and Knee Replacement Procedures, 2002–2003 to 2004–2005

Bearing Surfaces for Hip Replacements

Although various combinations of femoral head and acetabular liner materials were used in hip replacement procedures, the most common bearing surface was metal-on-plastic (69%), primarily cobalt chrome/cross-linked polyethylene (Figure 22). The overall pattern of bearing surface used has not changed over the past three years. However, there is a trend towards an increase in the use of cobalt chrome/cross-linked polyethylene (Figure 23).

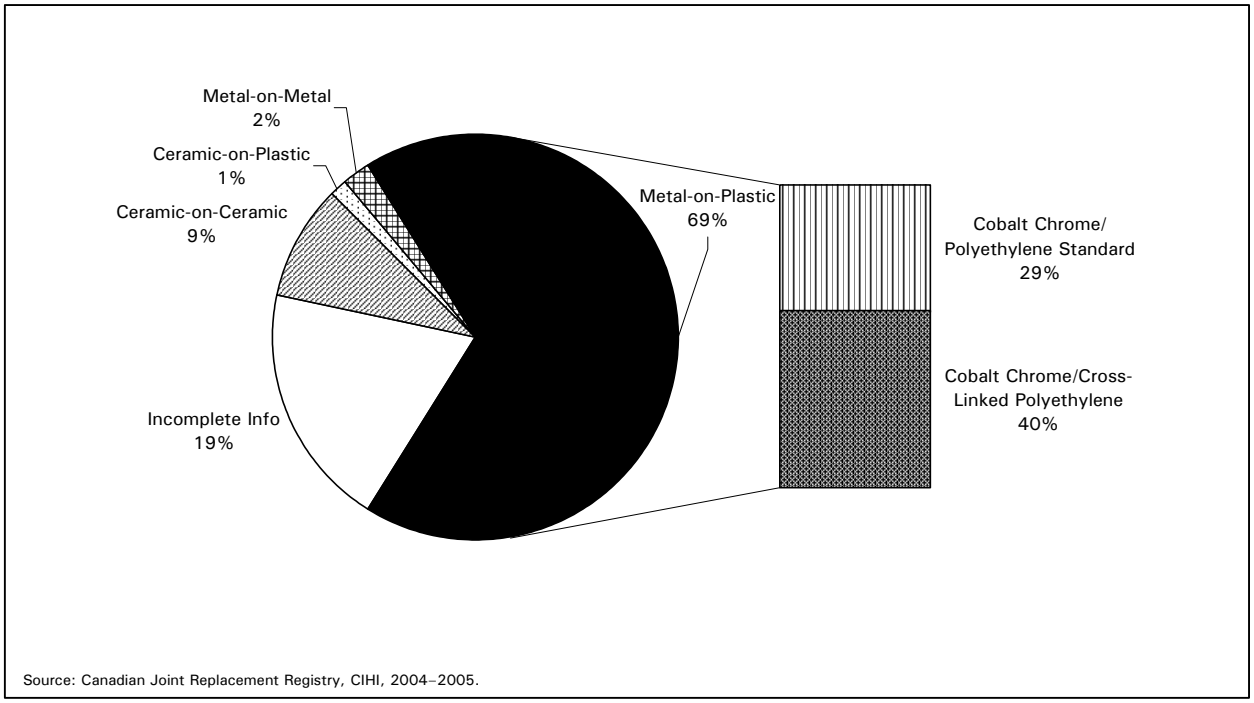


Figure 22. Bearing Surfaces for Hip Replacements, 2004–2005

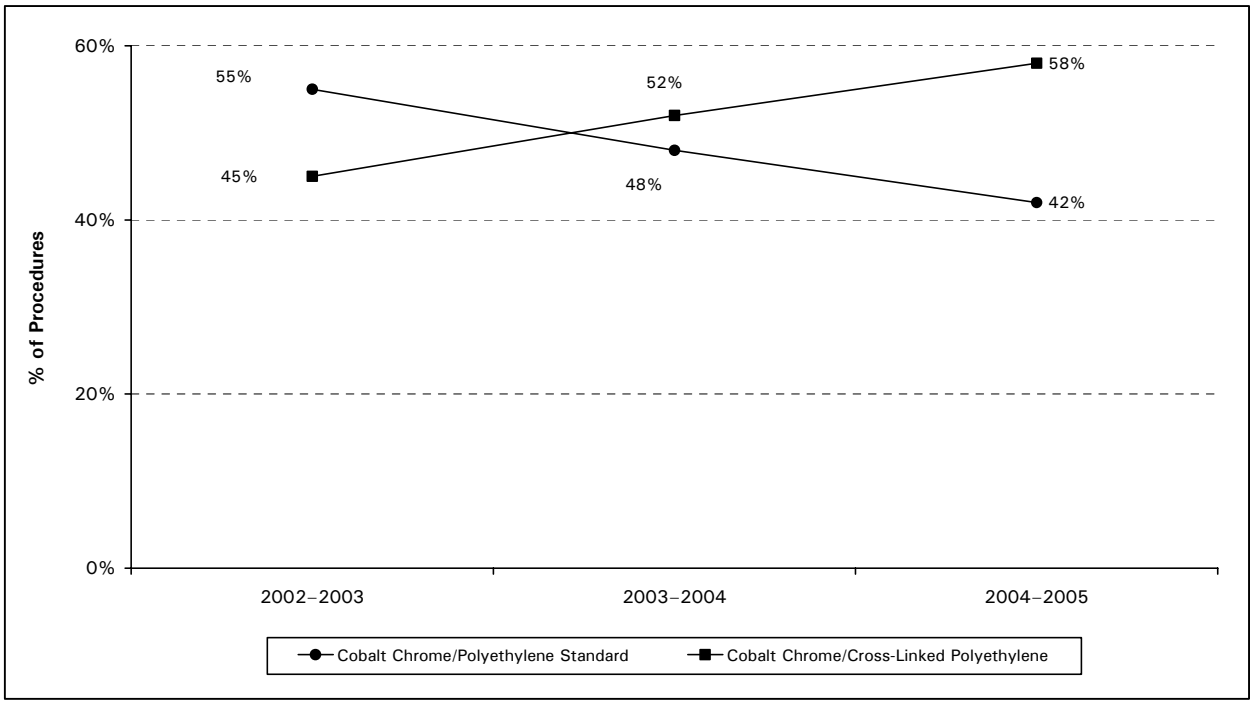


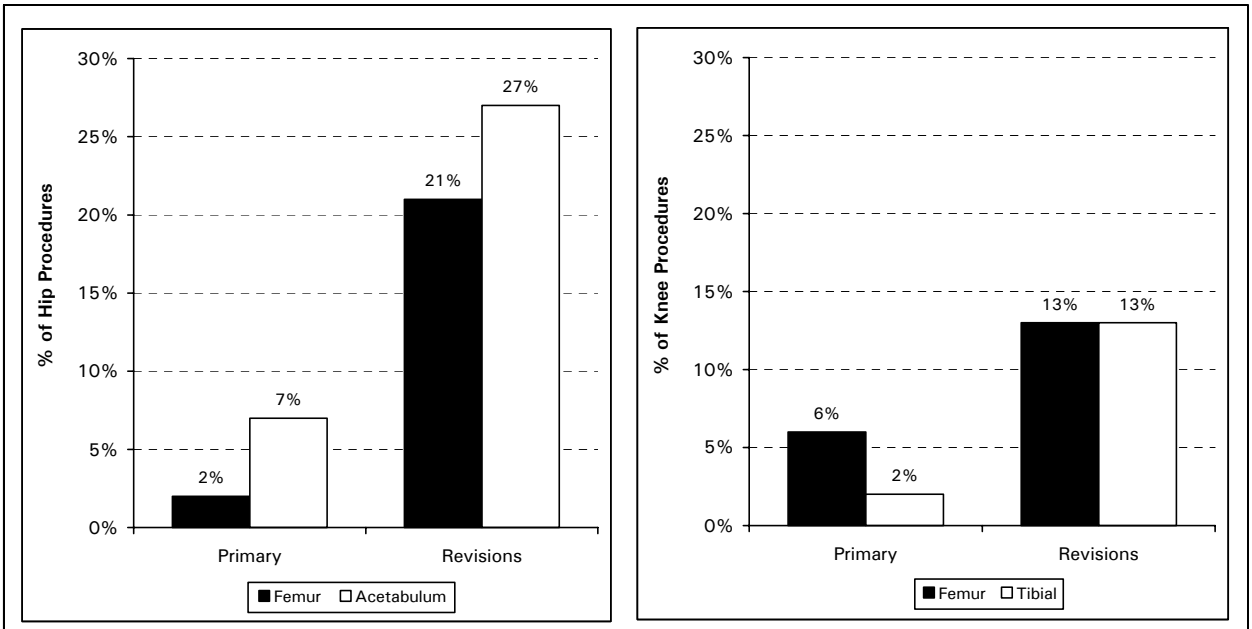
Figure 23. Types of Metal-on-Plastic Bearing Surfaces, Hip Replacements, 2002–2003 to 2004–2005

Bone Graft Use

Collection of information on bone graft use began in 2003–2004 for the CJRR with information captured regarding bone graft use on the femur and acetabulum among hip replacements, as well as on the femur and tibia among knee replacements. As in the previous year, in 2004–2005, overall, bone grafts were used more frequently for revision procedures than for primary replacements, regardless of joint (40% versus 8% for hip replacements; 22% versus 7% for knee replacements).

For revision hip replacements, 21% used bone grafts on the femur compared to 2% in primary replacement procedures. For revision procedures reported, 27% used bones grafts on the acetabulum as compared to 7% for primary procedures.

For revision knee replacements, 13% used bone grafts on the femoral component as compared to 6% for primary procedures. Of the cases reported, 13% used bone grafts for the tibial component compared to 2% for primary knee replacement procedures (Figure 24).



Note: Bone graft information was not available for 536 hip and 269 knee procedures.
Source: Canadian Joint Replacement Registry, CIHI, 2004–2005.

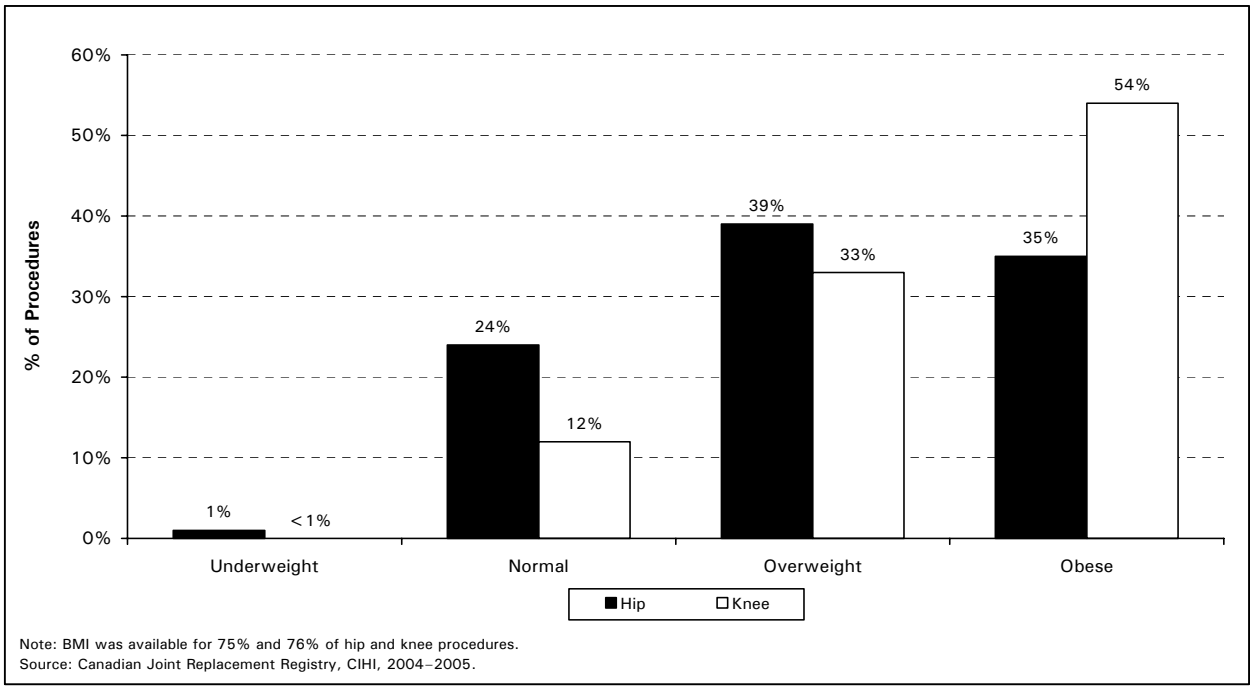
Figure 24. Bone Graft Use for Hip and Knee Replacements, 2004–2005

Body Mass Index

Obesity is one of the known factors associated with osteoarthritis.[8, 9] Since osteoarthritis is a primary reason for joint replacement procedures, it is of interest to examine body mass index (BMI) distributions among hip and knee replacement patients. BMI is calculated as: weight (in kilograms) divided by the height (in metres) squared. Patients were assigned to the following internationally accepted BMI categories: under 18.5 (underweight); 18.5–24.9 (normal weight); 25.0–29.9 (overweight); 30.0 or higher (obese).[10, 11]

BMI data were available for 75% (n = 10,696) hip and 76% (n = 14,364) knee replacement patients with valid height and weight measurements in 2004–2005 recorded in CJRR.

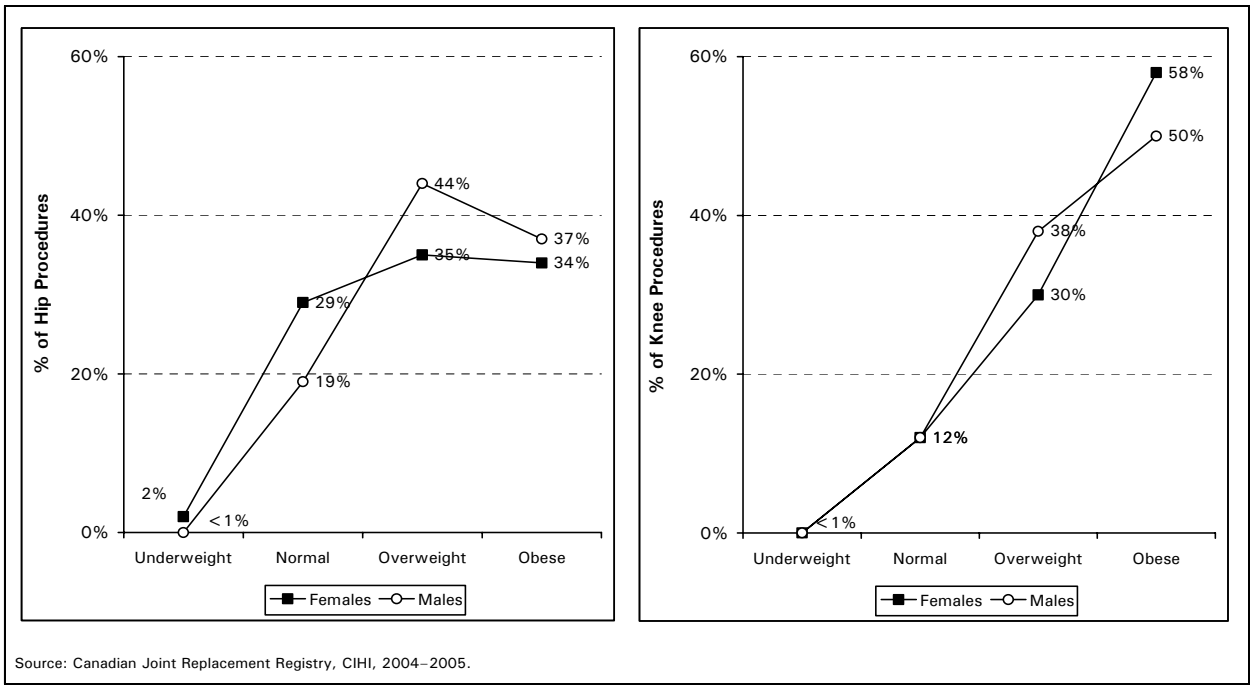
Patients with knee replacements were significantly more likely to be overweight or obese compared to hip replacement patients (87% versus 74% combined, $p < 0.0001$) (Figure 25). Both hip and knee replacement patients were rarely underweight ($\leq 1\%$).



Note: BMI was available for 75% and 76% of hip and knee procedures.
Source: Canadian Joint Replacement Registry, CIHI, 2004–2005.

Figure 25. Hip and Knee Replacement Patients by Body Mass Index Category, 2004–2005

There were also significant differences in BMI when analyzed by sex for hip, but not for knee patients. A higher proportion of males undergoing hip replacement procedures were overweight or obese than their female counterparts ($p < 0.001$) (Figure 26), but no significant difference in BMI between males and females was found for patients undergoing knee replacement surgery.



Source: Canadian Joint Replacement Registry, CIHI, 2004–2005.

Figure 26. Relationship Between Sex and BMI, by Joint, 2004–2005

Of note, a threshold effect appeared to be evident with BMI and age. For both hip and knee patients BMI increases with age, up to 55 years, then begins to decrease (Figure 27).

The findings suggest that, at least in the joint replacement recipients' population, patients are heavier with age until around 55 years, and then their weight decreases.

For both hip and knee replacement the peak number of procedures are performed on patients in the 65 to 74 year age group. There is an established association between obesity and the development of osteoarthritis, and there is a window of time during which arthritis causes damage to joints requiring intervention. Those who are at an unhealthy weight at, or approaching, age 55 years can be expected then to form the predominant group of patients who will undergo joint replacements 10 years later, at or around, age 65 years. This is consistent with the long-time observed association between overweight and obesity and the need for joint replacement.[9]

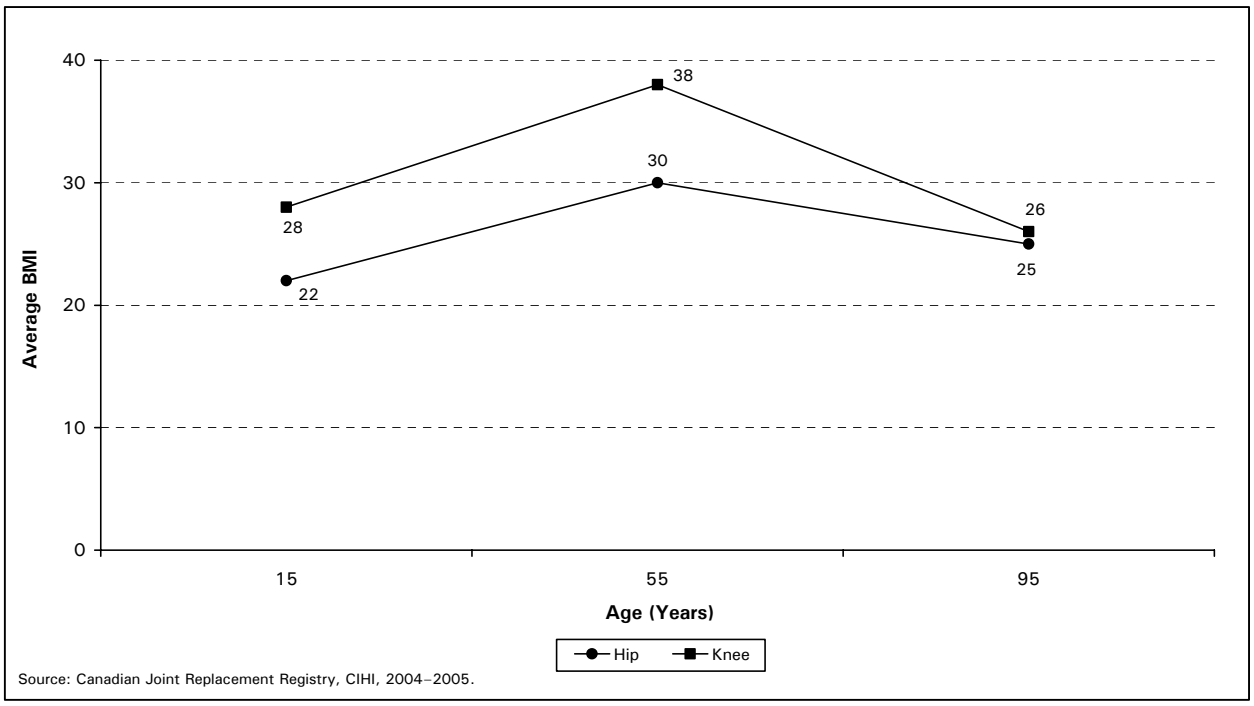


Figure 27. Average BMI by Age, by Joint, 2004–2005

Special Surgical Techniques

Minimally Invasive Surgery (MIS)

MIS is an emerging surgical technique used for hip and knee replacement procedures. The purported benefits of this approach include: smaller dissections, reduction in blood loss, shorter length of stay in hospital, improved outcomes, and quicker rehabilitation process, however these benefits are not always consistent.[12, 13, 14, 15, 16, 17, 18] CJRR began collecting MIS information in 2003–2004.

In 2004–2005, use of MIS was reported in 12% of hip and 8% of knee replacement procedures, representing increases of 33% and 7%, respectively, compared to the previous year. MIS information was available from 94% (n = 13,513) of hip and 96% (n = 18,093) of knee replacement records that year. Almost all (99%) of MIS procedures were primary procedures, as opposed to revisions. Significant differences in MIS use were found by sex, age (hip only), and BMI. Surgical approach did not vary significantly with MIS use. Although the proportions of MIS use by sex were similar by joint, males were significantly more likely to undergo a MIS procedure compared to females ($p<0.001$). Further, MIS use decreased significantly by age for knee replacements, particularly in the 55 years and older age group ($p<0.001$), but did not vary for hip replacements (Figure 28).

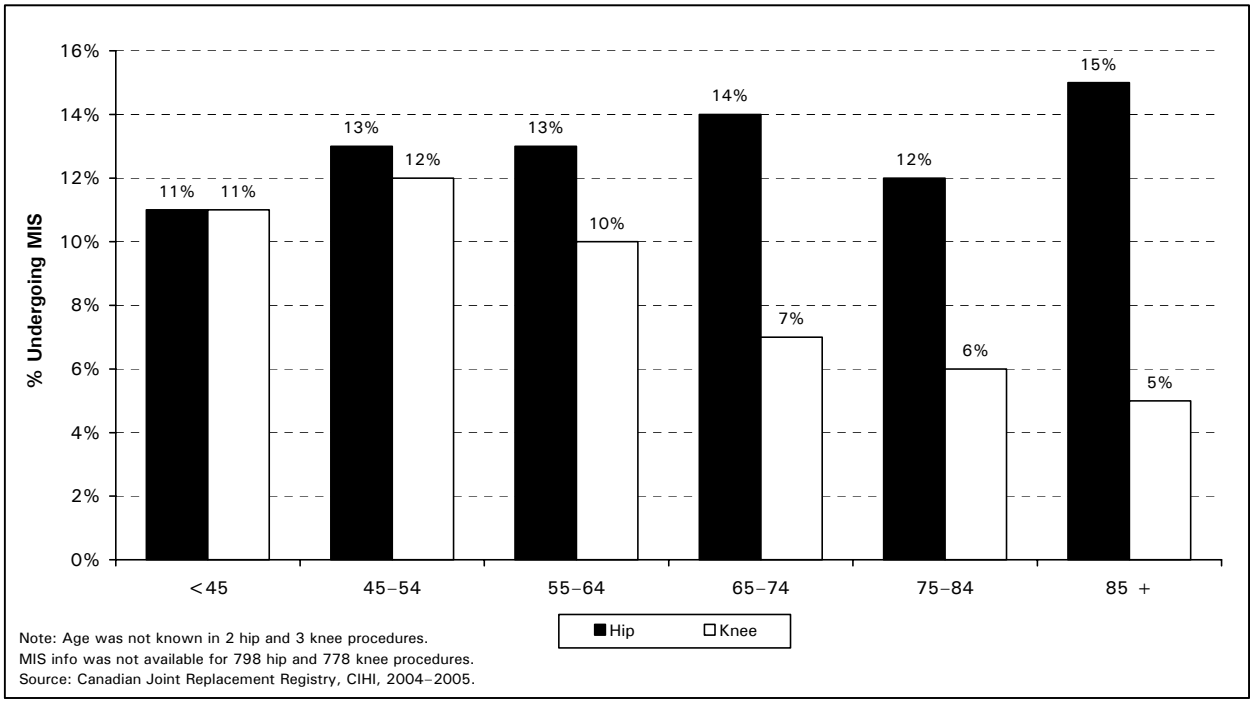


Figure 28. MIS Use by Age Group and Joint, 2004—2005

MIS use varied significantly according to BMI for both hip and knee replacements, but in opposite directions (Figure 29). Among hip replacements, MIS use decreased with increasing BMI; 34% of patients who were underweight or of normal weight underwent MIS compared to 22% of overweight or obese patients. Among knee replacements, MIS use increased with increasing BMI up to the overweight category.

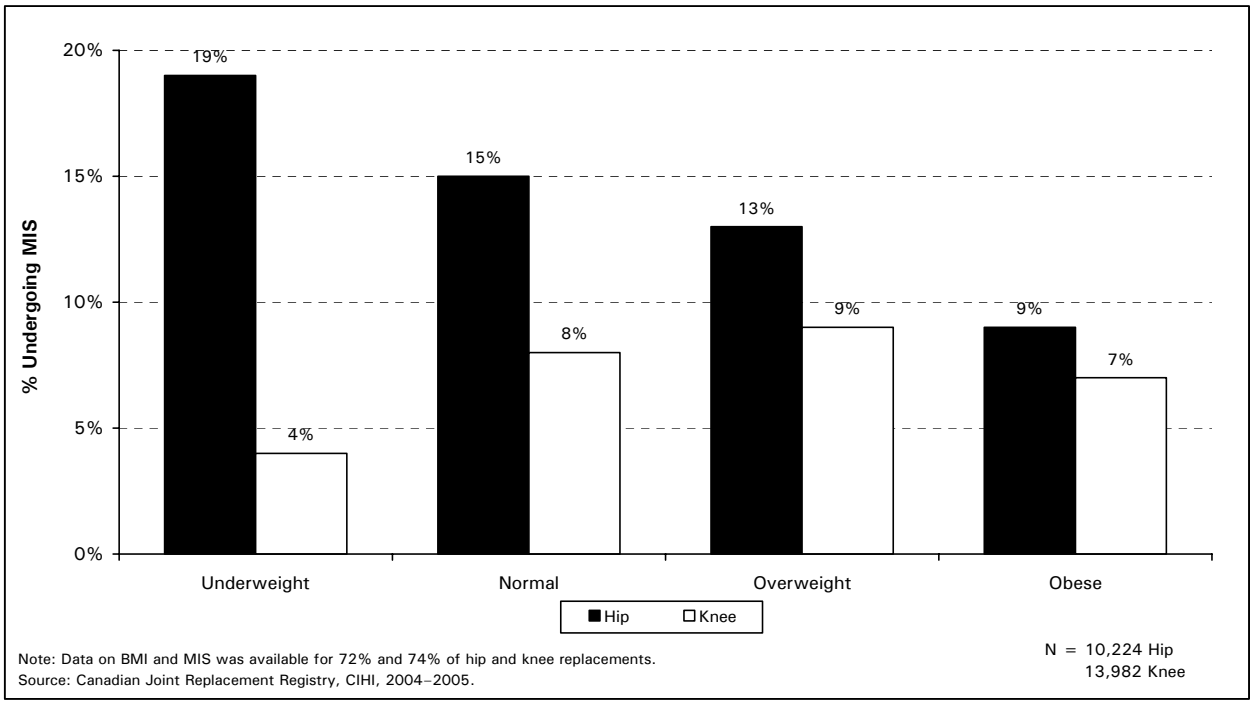


Figure 29. MIS Use by BMI Category and Joint, 2004–2005

It must be noted that after adjusting for BMI category and age, males were still significantly more likely than females to undergo MIS for joint replacement surgery ($p < 0.001$).

Discussion and Future Directions

The *Canadian Joint Replacement Registry (CJRR) 2006 Annual Report on Hip and Knee Replacements in Canada* uses data collected from several sources (including CJRR database, HMDB—both maintained at CIHI) to highlight trends and regional variations for hip and knee replacement procedures in Canada. As well the report provides detail on the nature and types of hip and knee replacement surgeries and surgical techniques utilized by Canadian orthopaedic surgeons. This information is intended for use by decision-makers involved in managing health care systems, by orthopaedic surgeons and related care providers, researchers, as well as the general public.

This year, in addition to continuing to present results of analyses in established areas, we present trends over time in the surgical and clinical section, and further explore clinical topics such as bearing surfaces (for hip replacements), bone graft use, MIS, the aging Canadian population, and BMI, as part of the need to provide national data on continually changing practices in the orthopaedic field.

The data reported shows a constantly increasing trend, for both hip and knee replacements, in both males and females—both in terms of counts and standardized rates. The most notable increases are observed in the 45 to 54 age groups, where the rate of knee replacements more than doubled for males and almost tripled for females. Analyses show that, overall, Canadians undergoing knee replacement procedures were significantly older than their hip replacement counterparts. This information is important as Canada's Ministers of Health plan for the provision of health care in the future.

While the incidence of joint replacement procedures increased constantly over the decade reported, the average length of stay in hospital has continued to decrease, for patients undergoing either hip or knee replacements.

The present report shows that there are significant differences in orthopedic practices with regards to choosing unicompartmental over total knee replacement procedures (patients in the Western provinces are twice as likely as the Eastern ones to undergo UKA). Further analysis on the potential determinant factors (age, sex, BMI distribution) will help improve the understanding of the phenomenon and contribute to orthopedic practices and adjustments to clinical guidelines.

In this report, patients who had knee replacements during 2004–2005 were found to be more likely to be overweight or obese as compared to hip replacement patients. A recently published paper by CIHI delineated similar findings for 2003–2004, and also found a strong cross-sectional relationship between rates of overweight and obesity and joint replacement surgery in general, using population body mass index (BMI) data from the Canadian Community Health Survey.[9] Obese persons were found to be over three times as likely to undergo joint replacement surgery, and persons in the overweight category were one and a half times were more likely, compared to those in the acceptable BMI category.

The relationship between BMI and MIS also found in this report warrants further research. For hip replacement procedures, the use of a MIS technique increased with lower BMI, whereas for knee replacements, MIS use increased with increasing BMI only up to the overweight category.

Joint replacement procedures are one of the five priority areas targeted federally for meaningful reductions in wait times by 2007.[19] A number of regional and national initiatives are underway to accomplish this goal. As a mechanism to inform these efforts, as of April 1st, 2005, CJRR began collecting data related to wait times as part of a broader CIHI initiative to collect and report on national wait time data. Preliminary data for 1,915 procedures captured in the CJRR were recently released in a CIHI report.[20] On average, CJRR patients spent 40% of the total wait between referral to an orthopedic specialist and the decision to proceed with surgery, and the remaining 60% of the time waiting for the surgery itself. As well as specific wait time information the CJRR provides information about trends in the growth of joint replacement surgery in Canada. It is important to know what the demand for joint replacement surgery currently is and what the trends indicate it will be in the future. To reduce wait times for hip and knee replacement procedures, the surgeries provided must meet the demand. The data collected and reported by the CJRR will continue to inform these issues for Canadians.

CJRR is currently expanding its data collection and recruitment efforts in order to allow it to become an increasingly relevant source of health information for decision-makers. CJRR is working to broaden its data collection options by developing a web-based data submission system, as an addition to current paper and electronic file options. More focused attention is being directed towards increasing CJRR participation in provinces such as Ontario and Quebec, which contribute a substantial proportion of national joint replacement data. CJRR began implementation in Ontario as of October 1st, 2005, with the winding down of operations of the Ontario Joint Replacement Registry.

For the 2004–2005 data presented in this report, CJRR participation at the orthopaedic surgeon level was at 69%, a slight increase from 67% from the previous year. Several regions had participation rates over 90%: New Brunswick, Nova Scotia, Northwest Territories, Manitoba and Saskatchewan. Compared to 2003–2004, the number of paper submissions to CJRR in 2004–2005 increased by 14% to over 1,500 monthly, and the total volume of data submissions (including electronic data) increased by 18%. Currently CJRR receives approximately 1,800 forms on a monthly basis.

Future directions for CJRR include further exploration of health outcomes that are reflective of the ever-changing hip and knee replacement surgery experience in Canada. For instance, in this report, we present trends in the use of MIS, and patellar resurfacing, which currently have mixed results reported in terms of outcomes.[5, 13, 21, 22] Outcome measurement at baseline, prior to replacement surgery, will allow the CJRR to explore the role that baseline severity plays in the hospital, postoperative, and longer term outcomes for Canadian joint replacement patients.

As the population ages and the "baby boomer" generation reaches the age when joint replacement surgery peaks (65 years and older), it will be important to have information available that will allow policy makers, clinicians and the public to make evidence based decisions. The economic burden, and the humanistic burden of pain and suffering associated with joint disease requiring surgical intervention is becoming increasingly prevalent in the literature[15–18, 23] and the CJRR will play a continuing and growing role in collecting and analyzing comprehensive national data to provide the evidence needed in the years ahead. As these and other new technologies and surgical techniques appear on the horizon for joint replacements, CJRR will be poised to explore new comprehensive analyses that will explore the spectrum of health outcomes in an effort to inform understanding of evolving implants and surgical techniques, both from a clinical and policy perspective.

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Appendix A: Report Methodology—Hospitalization Statistics

Introduction

The Hospital Morbidity Database (HMDB) is managed by CIHI and provides the number of discharges (including deaths) from a hospital by primary diagnosis and contains all acute care discharges in Canada. This database contains clinical and demographic data, such as primary diagnosis, operative procedures, admission date, discharge condition, total in-hospital stay and age and sex of the patient.

The Discharge Abstract Database (DAD) was developed by CIHI to collect acute inpatient data. Over time it has also been used to capture same day surgeries, long-term care, rehabilitation and other data. Starting in 2003–2004, Ontario and two facilities in Nova Scotia relocated their same day surgery submission to the National Ambulatory Care Reporting System (NACRS), another database maintained by CIHI.

In 2004–2005, discharge data were submitted directly to DAD by all provinces and territories with the exception of Quebec and facilities located outside the Winnipeg region in Manitoba. The Quebec Ministry of Health and Social Services and Manitoba Health submit data files to CIHI on an annual basis. These data files are then merged with the DAD to create the national Hospital Morbidity Database (HMDB).

Data received from general and allied special hospitals, including acute care, convalescence and chronic facilities (with the exception of Ontario) are downloaded from the Discharge Abstract Database (DAD) for those provinces participating in the DAD. Data from other hospitals are submitted separately to CIHI by the respective provinces and territories. The Hospital Morbidity Database captures almost 100% of acute care discharges in Canada.

Methodological Notes

To permit comparisons over time, all primary and revision surgeries based on acute inpatient discharges are included in the analyses for all years of data. The proportion of hip and knee replacements revisions is estimated at 11.2% and 7.6% in 2004–2005.

Population Reference Period

HMDB data reported in this document are hospitalizations for hip and knee replacements (including primary and revisions) performed in Canada, for patients discharged from all acute care facilities in Canada between April 1, 2004 and March 31, 2005. Additional years of data are also reported for trending purposes.

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

Analyses Based on Hospitalizations

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 where both are performed on the same day (i.e. same operative

episode). The current methodology counted the bilateral procedures as one, to be consistent with the reporting of procedures in the Canadian Classification of Health Interventions (CCI). Therefore comparisons with historical data should be made with care (current counts and rates may be higher, should the older methodology be applied).

Geographical Reporting

With the exception of the analyses on length of stay and in-hospital deaths, all HMDB analyses defined the reported province as where the patient resides, not where the procedure was performed. Patient geography was assigned based on postal code using the July 2005 Postal Code Conversion File, which is updated semi-annually by Statistics Canada. Patients with incomplete postal codes were included in the provincial and national counts and rate calculations, whereas out-of-Canada residents, or those with unknown or invalid province of residence codes, were excluded.

It must be noted that in the CJRR annual reports released prior to 2004, patients with unknown or invalid postal codes were reported in the "Unknown" category. The methodology was revised such that incomplete or unknown postal codes were mapped to provinces or territories using the first two digits or the Forward Sortation Area (FSA) of the postal code where possible. The impact 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 fiscal years 1994–2000.

Rate Reporting

Unless otherwise indicated, rates presented in this report are age-standardized. Sex-specific rates are reported, as there are considerable differences in rates of hip and knee replacements between males and females.

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

Inclusion of All Ages in Report

Similar inclusion criteria applied to the data used for the 2005 annual report were used for the present data. Patients in all age groups, including those less than 20 years were included in the analyses. The analysis of data on patients whose age was less than 20 years in 2003–2004 and 2004–2005 revealed similar findings as last year's report. For example, there were very few patients (<0.1%) in this age group for both hip and knee replacements. Most patients were 15 years and over. Also, the most responsible diagnosis for joint replacement surgery were specific to this patient population (e.g. malignant neoplasm, juvenile rheumatoid arthritis). Hence inclusion of patients less than 20 years of age does not impact overall analyses.

Codes Used to Identify Hip and Knee Replacements

In the Hospital Morbidity Database, for the fiscal period 1994 to 2000 period, 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 fiscal 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).

Based on the 2004–2005 data in the HMDB, nearly 84% of all hip replacements and 85% of all knee replacements were reported using the ICD-10-CA/CCI classification system, the remaining were reported using ICD-9-CM or ICD-9/CCP.

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

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

The mix of coding classifications and staggered implementation of the new classification across the country presents unique challenges in the interpretation of trends over time and geography. The CJRR will continue to monitor and investigate the impact of these coding changes over the coming years.

Hip Replacements

Table A–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 are 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 fiscal years 2001 and 2002, the coding of this attribute was optional and therefore the number of revision procedures may be underestimated. Coding of revisions is mandatory beginning from year 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 O*ther total hip replacements.* Prior to year 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 are 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 A–1. CCI and CCP Hip Replacement Codes*

Rubric	CCI Codes				
1.VA.53.^^ Implantation of internal device, hip joint	cemented	uncemented	using bone autograft [uncemented]	using bone homoograft [uncemented]	using 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 [e.g. telemanipulation 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

Note: (CCI Code)

1.VA.53.^^ Implantation of internal device, hip joint

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

Excludes: Implantation, prosthetic device to acetabulum alone

* 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, Discharge Abstract Database and National Ambulatory Reporting System in CIHI.

Knee Replacements

Table A–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 A–3 shows the split between true partial versus total knee replacements using the CCI coding system based on data of 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 fiscal years 2001 and 2002. Coding of revisions is mandatory beginning from year 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 A–2. CCI and CCP Codes for Total Knee Replacements*

Rubric	CCI Codes				
1.VG.53.^^ Implantation of internal device, knee joint	**cemented**	**uncemented**	**with bone autograft**	**with bone homoograft**	**with combined bone graft and cement or paste**
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)

Note: (CCI Code)

1.VG.53.^^ Implantation of internal device, knee joint

Includes: Arthroplasty with implantation of prosthetic device, knee
Hemiarthroplasty with implantation of prosthetic device, knee
Replacement, knee, using prosthetic device
Reduction with fixation and implantation of prosthetic device, knee

Excludes: Patellaplasty alone using prosthetic
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 Reporting System in CIHI.

Table A–3. Partial and Total Knee Replacement Hospitalizations by Submitting Hospital Province, ICD-10-CA/CCI Provinces Only, 2004–2005

Submitting Hospital Province	Extent of Knee Replacement Procedure					
	Partial* (CCI)		Total† (CCI)		All Knee Replacements (CCI)	
	Number	%	Number	%	Number	%
Newfoundland and Labrador	17	4.1%	394	95.9%	411	100.0%
Prince Edward Island	6	3.6%	162	96.4%	168	100.0%
Nova Scotia	90	7.6%	1,089	92.4%	1,179	100.0%
New Brunswick	110	12.6%	765	87.4%	875	100.0%
Ontario	1,675	11.1%	13,435	88.9%	15,110	100.0%
Manitoba	173	13.2%	1,137	86.8%	1,310	100.0%
Saskatchewan	163	11.7%	1,232	88.3%	1,395	100.0%
Alberta	271	8.4%	2,942	91.6%	3,213	100.0%
British Columbia	550	11.5%	4,220	88.5%	4,770	100.0%
Northwest Territories	4	9.3%	39	90.7%	43	100.0%
Yukon	0	0.0%	6	100.0%	6	100.0%
Total	**3,059**	**10.7%**	**25,421**	**89.3%**	**28,480**	**100.0%**

* CCI codes for partial knee arthroplasty: 1.VG.53.LA-PM, 1.VG.53.LA-SL.
† CCI codes for total knee arthroplasty: 1.VG.53.LA-PP, 1.VG.53.LA-PN.

Source: Hospital Morbidity Database, CIHI, 2004–2005.

Quebec Replacement Revision Counts Underestimated

Differences in the way revision knee replacements are coded in Quebec compared to other provinces has resulted in an underestimation of Quebec knee replacement revision procedures since 1998. In 1998, Quebec designated code 93.471 to indicate knee replacement revisions, which differs from the CCP code 93.40 that was implemented for knee replacement revisions as of April 1, 2000 for participating DAD provinces and territories (Quebec does not submit to the DAD, which is the parent database for HMDB). Code 93.471 is not part of the universe of codes reported by the CJRR. Also, it has not been previously identifiable in HMDB as the fifth digit was routinely truncated during HMDB data processing. As a result, CCP codes reported as 93.471 were incorrectly processed as 93.47 *Other repair of the knee*. CIHI is working with Quebec to resolve this data issue. As of 2004–2005 data, all instances of CCP code 93.471 on the raw Quebec data file from Med-Écho are converted to CCP code 93.40 prior to appending Québec data to HMDB at CIHI.

There were 340 knee replacement revision procedures performed in Quebec in 2004–2005, 311 in 2003–2004, 282 in 2002-2003, 255 in 2001–2002, 240 in 2000–2001, 171 in 1999–2000 and 184 in 1998–1999. The knee revision procedures performed in Quebec from 1998–1999 to 2002–2003 were provided by Med-Écho,[i] the counts for 2003–2004 were retrieved from the raw Med-Écho file, while the counts for 2004–2005 were retrieved from CIHI's HMDB. The data for 1998 to 2003 were not incorporated in the previous CJRR annual reports. The knee replacement revision counts reported for Quebec were therefore underestimated for those years.

In this report, the Quebec knee revision 2003–2004 data from Med-Écho were included in the reporting of the knee replacements which resulted in a1% increase for the national age-standardized rate (per 100,000 population) of the total knee replacements.

i. Med-Écho Quebec, December 2004.

Appendix B: Report Methodology—Surgical and Clinical Characteristics

Introduction

The CJRR is a national registry that collects information on hip and knee replacement surgeries performed in Canada and follows joint replacement recipients if and when revisions occur. The ultimate goal of the CJRR is to improve the quality of care and clinical outcomes of joint replacement recipients through studying the risk factors affecting outcomes, like surgical practices and post-market surveillance of orthopaedic implants.

The CJRR is the result of a joint effort between CIHI and the orthopaedic surgeons of Canada. CIHI and orthopaedic surgeons from each province who were working under the auspices of the Canadian Orthopaedic Association and the Canadian Orthopaedic Foundation upheld this initiative. A number of other key partners have contributed to the successful development and implementation of the CJRR—including orthopaedic patients; The Arthritis Society; federal, provincial/territorial ministries of health, as well as provincial joint replacement registries.

Collection of CJRR Data

Orthopaedic surgeons participating in the CJRR complete a two-page data collection form following a hip or a knee replacement surgery. Patients are required to provide consent prior to being included in the registry. During 2003 and 2004 an average of approximately 1,500 forms were submitted to the CJRR on a monthly basis; the numbers increased dramatically to an average of 2000 forms per month in 2005. Prior to October 2005, Ontario surgeons participated in the CJRR via the Ontario Joint Replacement Registry (see following section). Beginning October 2005, the information was no longer collected by OJRR, and Ontario surgeons were invited to submit their data directly to CJRR. Additionally, for the first time in 2004, data were submitted electronically to the CJRR from a major acute care facility in British Columbia.

Standardized edit checks are applied to submitted forms upon entry into the CJRR database and are also applied to data received electronically (i.e. OJRR, B.C.). These checks flag data elements, which do not meet criteria for logic, value range and completeness. Error comments and reports are automatically generated and records are then classified as draft, incomplete or complete according to which edit checks were passed or failed. A record is classified as complete only if it successfully passes all edit checks. For electronic data submissions, erroneous cases are referred back to their source for review and correction. For paper data submissions, all records (regardless of classification) are included in order to maximize the information available for this report.

Ontario Joint Replacement Registry (OJRR)

The analyses in this report were based on CJRR data from between April 1st, 2002 and March 31st, 2005. During this time, data from the Ontario orthopedic surgeons came into the CJRR database via the OJRR.

The OJRR was funded by the Ontario Ministry of Health and Long-Term Care (MOHLTC) and made possible by the support of the orthopaedic surgeons of Ontario under the Ontario Orthopaedic Association and Ontario Ministry of Health Long-Term Care. The OJRR was housed at the London Health Sciences Centre and was being implemented on a region-by-region basis, beginning in Southwestern Ontario in May 2001.

For the first time in July 2003, the CJRR received a subset of OJRR data via the Ontario Ministry of Health and Long-Term Care for inclusion in the CJRR. Surgical and clinical data elements collected by the OJRR were greater in both scope and specificity compared to those of the CJRR. Therefore, in several instances, data from OJRR had to be mapped to be comparable to CJRR fields and definitions. OJRR data were also subject to CIHI's edit checks intended to identify potential errors such as out-of-range values and problems with data logic.

Historical OJRR data included in the present report has been updated from the last report, thus numbers between the two reports may differ.

Methodological Notes

Population Reference Period

Surgical and clinical data presented in this report are based on hip and knee replacement surgeries and revisions performed in Canadian acute care hospitals. Data are presented on a fiscal year basis (2002–2003 to 2004–2005) with main focus on 2004–2005 data (patients undergoing surgery between April 1, 2004 and March 31, 2005). In instances in which surgery date was not available, admission date was used as a proxy.

Surgical data from orthopaedic surgeons presented in this report are subject to revision in future reports. The CJRR continues to accept data beyond the deadline for the reporting period; therefore, the information presented from this data source may be incomplete. Data from 2002–2003 and 2003–2004 shown in this report reflect updated numbers compared to the 2004 CJRR Annual Report.

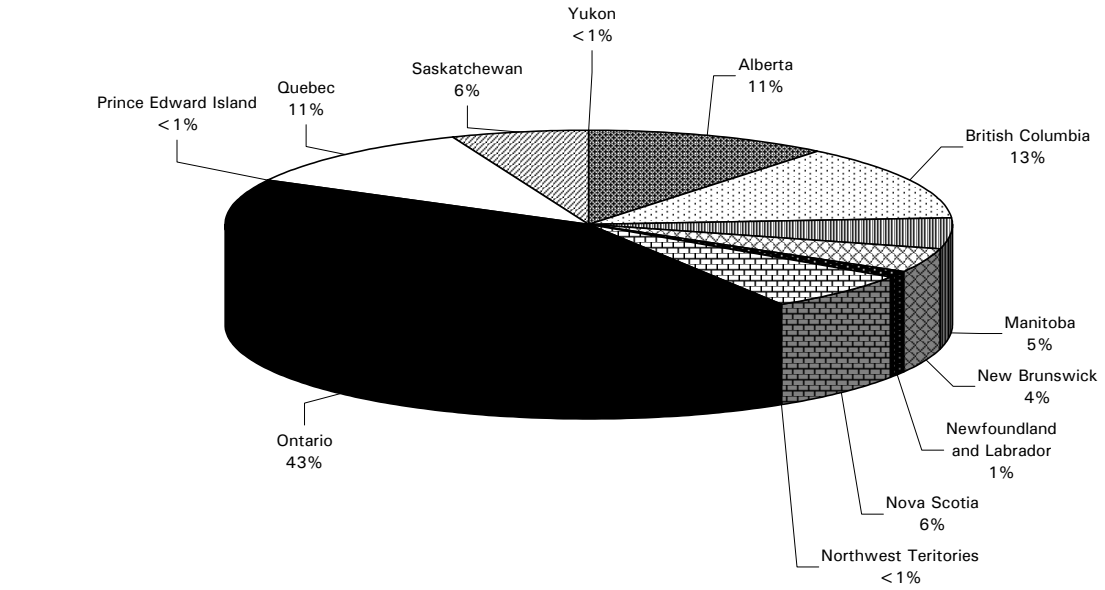
Geographical Reporting

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

A major data limitation of the CJRR is undercoverage, as participation in the CJRR is voluntary. The overall participation rate in CJRR as of April 2006 is 70%, with rates by province ranging from 48% in Quebec to 100% in New Brunswick, Nova Scotia, and Prince Edward Island. Surgeons' participation to CJRR has more than tripled since 2001, while the total data submissions have increased by 75% over the past three years. Data via OJRR contributed the greatest proportion (43%) of the total submissions in 2004–2005.

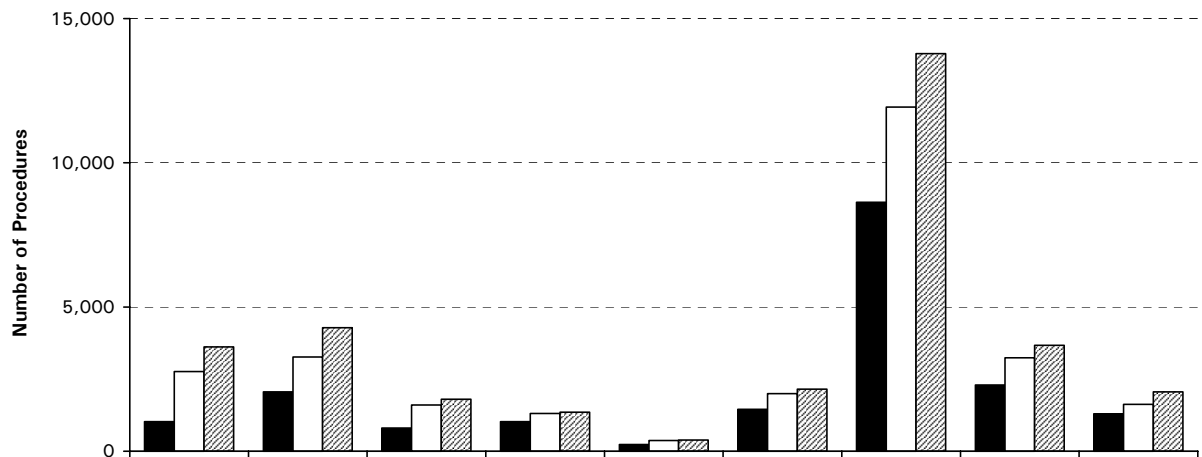
Figure B–1 shows the distribution of submissions by province for hip and knee replacement procedures received from orthopaedic surgeons in 2004–2005. Submission by orthopaedic surgeons from Ontario accounted for the greatest proportion of submissions (43%), followed by surgeons from British Columbia (13%), Quebec and Alberta (11% each) and Nova Scotia and Saskatchewan (6% each).



Note: Northwest Territories, Prince Edward Island and Yukon each had less than five surgeons submitting data.
Source: Canadian Joint Replacement Registry, CIHI, 2004–2005.

N = 33,178

Figure B–1. Percent of Joint Replacement Procedures Submitted to CJRR, by Province, 2004–2005



	Alta.	B.C.	Man.	N.B.	N.L.	N.S.	Ont.	Que.	Sask.
2002–2003	1026	2062	806	1030	237	1460	8636	2298	1300
2003–2004	2763	3270	1603	1315	374	2001	11930	3240	1624
2004–2005	3615	4286	1804	1354	388	2155	13784	3670	2061

Note: Northwest Territories, Prince Edward Island and Yukon each had less than five surgeons submitting data.
Source: Canadian Joint Replacement Registry, CIHI, 2002–2003, 2003–2004 and 2004–2005.

N = 80,215

Figure B–2. Hip and Knee Replacement Procedures Across Provinces, 2002–2003, 2003–2004 and 2004–2005

Figure B–2 shows the increases of joint replacements submissions to CJRR during the past two years across different provinces and territories. From fiscal 2002 to 2004, the data submissions increased dramatically for Alberta (+252%), Manitoba (+124%) and BC (+108%), followed by the rest of the provinces.

Hip Replacement (Arthroplasty)

The definition algorithm for the categories and subcategories of hip replacement (arthroplasty) procedures is based on combining information on replacing the four components involved (Table B–1).

Table B–1. Algorithm Used to Define Hip Arthroplasty Types

Type of Arthroplasty	Femoral Stern	Femoral Head	Acetabular Component	Acetabular Insert/Liner
Total Arthroplasty	Yes	Yes	Yes	Yes
Hemi-Arthroplasty				
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

Appendix C: Glossary

Glossary

Bearing surfaces

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

Body mass index (BMI)

Body mass index (BMI) is a relationship between weight and height that is associated with body fat and health risk. The equation is BMI = body weight in kilograms/height in meters squared.

Bone graft

A bone graft is 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 venous thrombosis is a condition where there is a blood clot in a deep vein (a vein that accompanies an artery). Deep venous thrombosis (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.

Fixation method

Hip and knee joint prostheses are replaced with or without cement as needed, to securely position the joint and allow for natural bone growth. Three major categories for fixation methods used were analyzed for both hip and knee replacements: cemented, cementless and hybrid techniques. These were defined as:

- cemented if the components involved (femoral and acetabular for hip and femoral and tibial for knee) were cemented;
- cementless if none of the components (femoral and acetabular for hip and femoral and tibial for knee) were cemented; and
- hybrid if one component was cemented and the other was not.

Hip arthroplasty

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. The cup is usually plastic, although some centers are trying other materials like 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 "hemi-arthroplasty" 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).

If only resurfacing of the hip joint is performed, it can be 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)

Surface replacement is a bone-conserving alternative to total hip replacement in order to restore normal joint movements and ensure joint stability.[14]

Knee arthroplasty

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 (MIS)

Minimally invasive surgery is a revolutionary surgical approach applied to most surgical specialties, including orthopaedic surgery. The technique allows for the reduction in the size of the incision and for minimizing trauma to the soft tissues; however MIS arthroplasty, or joint replacement, still involves cutting of 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 direct reason for patient's admission to the hospital. This helps to define the exact cause or reason for a patient's hip or knee replacement procedure.

Patella surfacing

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

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.

Unicompartmental knee arthroplasty (UKA)

A unicompartmental 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.