

Total Joint Replacement Registry
patient outcomes
revision rates
post-market surveillance
quality of care
evidence-based
decision-making
hips
knees
policy and
planning

2005 REPORT

Total Hip and Total Knee Replacements in Canada

Canadian Joint Replacement Registry (CJRR)



Canadian Institute
for Health Information

Institut canadien
d'information sur la santé

All rights reserved.

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or by any information storage and retrieval system now known or to be invented, without the prior permission in writing from the owner of the copyright, except by a reviewer who wishes to quote brief passages in connection with a review written for inclusion in a magazine, newspaper or broadcast.

Requests for permission should be addressed to:

Canadian Institute for Health Information
495 Richmond Road
Suite 600
Ottawa, Ontario
K2A 4H6

Telephone: (613) 241-7860
Fax: (613) 241-8120
www.cihi.ca

Canadian Joint Replacement Registry (CJRR)
2005 Report—Total Hip and Total Knee Replacements in Canada
ISBN 1-55392-609-9 (PDF)

© 2005 Canadian Institute for Health Information

Cette publication est aussi disponible en français sous le titre :
*Registre canadien des remplacements articulaires (RCRA) —
Rapport de 2005, Arthroplasties totales de la hanche et du genou*
ISBN 1-55392-612-9 (PDF)

Acknowledgements

The CJRR team at CIHI would like to acknowledge the orthopaedic surgeons across Canada who contributed to the successful implementation of the CJRR through their diligent submission of surgical data to the registry. In particular, we wish to express our sincere thanks and appreciation to the members of the CJRR Advisory Committee, Research and Development Subcommittee, and Provincial Representatives for providing invaluable expert advice on the development of the registry and this report.

Dr. Eric R. Bohm

Provincial Representative
University of Manitoba Joint
Replacement Group
Manitoba

Dr. Martin Lavigne

Hôpital Maisonneuve-Rosemont
Quebec

Dr. Robert Bourne

Chair—CJRR Advisory Committee
London Health Sciences Centre
Ontario

Dr. Brendan Lewis

Western Memorial Hospital
Newfoundland and Labrador

Dr. Ken L. Brown

Provincial Representative
British Columbia's Children's Hospital

Dr. Barry Ling

Polyclinic
Prince Edward Island

Dr. Dalton Dickinson

Former Provincial Representative
Fredericton Medical Clinic
New Brunswick

Dr. James MacKenzie

Rockyview Hospital
Canadian Orthopaedic Foundation
Provincial Representative
Alberta

Dr. Michael Dunbar

Provincial Representative
Queen Elizabeth II Health Sciences Centre
Nova Scotia

Dr. Yang Mao

Centre for Chronic Disease
Prevention and Control
Health Canada

Dr. Olga L. Huk

Provincial Representative
Sir Mortimer B. Davis—
The Jewish General Hospital
Quebec

Dr. Rod Martin

Provincial Representative
Health Care Corporation of St. John's
Newfoundland and Labrador

Dr. Darren Kerr

Provincial Representative
Saint John Regional Hospital
New Brunswick

Dr. Bas Masri

Vancouver General Hospital
British Columbia

Dr. Hans Kreder

Sunnybrook and Women's College Health
Sciences Centre
Ontario

Dr. Timothy J. Pearce

Red Deer Regional Hospital
Alberta

Mr. John Pipe
Patient Representative
Ontario

Dr. Sandra Taylor
Director of Bioethics
Queen's University
Ontario

Dr. Cecil Rorabeck
Chair, CJRR Research and Development
Subcommittee
London Health Sciences Centre
Ontario

Dr. James Waddell
Provincial Representative
Canadian leader, Bone and Joint Decade
St. Michael's Hospital
Ontario

Dr. Robert Russell
James Paton Memorial Hospital
Newfoundland and Labrador

Ms. Susan Warner
Managing Director
The Ontario Joint Replacement Registry

Dr. William A. Silver
Former Provincial Representative
Saskatchewan

The 2005 CJRR report was developed at CIHI under the direction of Nizar Ladak, Director of Health Services Information, by:

Sukanya Gopinath, Senior Analyst, CJRR

Ellen Juqing Shi, Senior Analyst, CJRR

Nicole de Guia, Consultant, CJRR

Margaret Keresteci, Manager, Clinical Registries

We also acknowledge contributions from other members of the CJRR team, including Ann Baker, CJRR Quality Assurance Assistant and CJRR Data Entry Clerks Margaret Tom-Kun and Yoga Sivarajah. The CJRR data entry application and database were developed by a CIHI team led by Herbet Brasileiro, Consultant, Applications Development, Health Services under the direction of IT Services Manager-Toronto, Isabel Tsui.

The CJRR also thanks the CIHI Publication and Translation teams for assisting with formatting, layout and translation.

All questions regarding this report should be directed to:

Canadian Joint Replacement Registry
90 Eglinton Avenue East, Suite 300
Toronto, Ontario
M4P 2Y3

Telephone: (416) 481-2002

Fax: (416) 481-2950

Email: cjrr@cihi.ca

**Canadian Joint Replacement Registry (CJRR)
2005 Report
Total Hip and Total Knee Replacements in Canada**

Table of Contents

Acknowledgements	
Executive Summary	i
Introduction	1
Important Methodological Notes	5
Hospitalization Statistics.....	6
Overall Trends.....	6
Unilateral vs. Bilateral Procedures	8
International Comparisons.....	9
Provincial/Territorial Variations	11
Patient Demographics	20
Inter-Provincial/Territorial Movements.....	24
Length of Hospital Stay.....	27
In-Hospital Mortality.....	29
Surgical and Clinical Characteristics	32
Overall Trends.....	32
Patient Demographics	33
Purpose of Surgery (Primary vs. Revision)	34
Indications for Surgery	35
Reasons for Revision.....	37
Previous Operations	38
Surgical Approach	39
Deep Vein Thrombosis (DVT) Prevention.....	41
Component Characteristics	41
Fixation Method	44
Bearing Surfaces for Hip Replacements.....	47
Bone Graft Use.....	48
Body Mass Index	49
Special Surgical Techniques	50
Discussion and Future Directions	53
References	57
Appendix A—Report Methodology—Hospitalization Statistics	A-1
Appendix B—Report Methodology—Surgical and Clinical Characteristics	B-1
Appendix C—Glossary.....	C-1

Executive Summary

The purpose of the Canadian Joint Replacement Registry (CJRR) 2005 annual report is to characterize the basic epidemiology of total hip and total knee replacement surgeries performed in Canada according to person (patient demographics), place (provincial and national level data) and time, as well as selected surgical and clinical parameters.

Hip and knee replacement surgery can provide significant pain and disability relief and considerable improvement in a patient's functional status and quality of life. An aging population contributes to an increase in total hip and total 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.

About the Canadian Joint Replacement Registry (CJRR)

The CJRR is a national registry that collects information on total hip and total knee replacement surgeries performed in Canada and follows joint replacement recipients over time to monitor their outcomes, including revision rates. The ultimate goal of the CJRR is to improve the quality of care and clinical outcomes of joint replacement recipients through post-market surveillance of orthopaedic implants, improving the quality of surgical practices and the study of risk factors affecting outcomes.

Participation in the CJRR has been steadily increasing since orthopaedic surgeons began submitting operative data in May 2001. As of April 2005, 72% of orthopaedic surgeons performing total hip and total knee replacement surgery in Canada were participating in the registry. However, surgeon participation was 67% (as of June 2004) for the CJRR fiscal 2003 data set used in this report. Surgeons from outside Ontario submit their data directly to the CJRR. Orthopaedic surgeons in Ontario submit their data to the Ontario Joint Replacement Registry (OJRR), an initiative funded by the Ontario Ministry of Health and Long-Term Care (MOHLTC) that is based at London Health Sciences Centre.

Methodology

Findings in this report were obtained from two primary 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 presented in this report are based on the 44,997 submissions by surgeons participating in the CJRR for patients admitted for surgical procedures during both fiscal years 2002 and 2003 (from April 1, 2002 to March 31, 2004). Data from fiscal 2002 have been updated compared to last year's annual report. Overall, total data submissions have increased by 43% from fiscal 2002 to fiscal 2003. With the combined data of two fiscal years, the data set used for this report is over two and a half times the size of the data set in last year's CJRR report, reflecting the higher representation of CJRR data capture as well as the increase in CJRR participation.

Hospitalization Statistics

Overall Trends

- There were 48,475 hospitalizations for total hip and total knee replacements performed in Canada in 2002–2003, of which 48,419 were performed on Canadian residents. The latter number represents an eight-year increase of 53.9% from 31,463 hospitalizations for hip and knee replacement procedures in 1994–1995 and a one-year increase of 10.1% from 43,979 procedures in 2001–2002.
- In 2002–2003, there were 26,500 hospitalizations for total knee replacements compared to 21,919 hospitalizations for total hip replacements. Since 1996–1997, the number of total knee replacements has annually surpassed the number of total hip replacements, and the gap has been increasing over time. Compared to 1994–1995 numbers, the number of total knee replacements in 2002–2003 increased by 77.4%, with a 9.6% increase compared to the previous year. In contrast, the number of total hip replacements increased by 32.6% compared to 1994–1995, with a 10.7% increase compared to the previous year.

Provincial/Territorial Variations

- Provincial variations in joint replacement rates were observed across the country. Saskatchewan and Alberta residents had the highest age-standardized total hip replacement rates (80.8 and 75.1 per 100,000 population, respectively) as before, whereas Newfoundland and Labrador and Quebec residents had the lowest rates (50.3 and 42.3 per 100,000, respectively). For total knee replacement rates, Manitoba and Nova Scotia had the highest rates (97.9 and 97.5 per 100,000 population, respectively), while Newfoundland and Labrador and Quebec had the lowest (48.6 and 43.7 per 100,000 population, respectively). Rates from the Territories are not reported due to small numbers.

Patient Demographics

- Women were more likely to have a total hip replacement procedure compared to men in 2002–2003 (the age-standardized rate for women was 65.3 per 100,000 compared to 56.2 for men). Women (84.1) also had a higher rate of knee replacement compared to men (65.9). In 2002–2003, among total hip replacement recipients, 59% were female, and 41% were male. Among total knee replacement recipients, 61% were female, and 39% were male.
- The majority of total hip and total knee replacements were performed on patients aged 65 years of age and older (65% and 69%, respectively). The mean age of a patient who underwent a total hip replacement in Canada was 68 years (69.6 years for females and 65.7 years for males) in 2002–2003. In contrast, only 5% of patients who underwent a hip replacement were younger than 45 years of age. For total knee replacement patients, the mean age was 68.7 years (68.9 years for females and 68.5 years for males) in 2002–2003. Only 1% of patients who underwent a knee replacement were younger than 45 years of age.

- Since 1994–1995, significant increases in age-sex specific rates have occurred among total knee replacement procedures. Although the highest age-sex specific rate was in the age group of 75 to 84 (497.0 per 100,000 among men and 570.3 per 100,000 among women), the rate among persons aged 45 to 54 had almost doubled (99.4% increase) among men and more than doubled among women (132.7% increase). The number of total knee replacements performed on people aged less than 55 years overall increased by 149.0% (up from 899 to 2,239) between 1994–1995 and 2002–2003.
- For total hip replacement procedures, the highest age-sex specific rate was in the 75–84 age group (361.3 per 100,000 among men and 508.3 per 100,000 among women). Compared to 1994–1995 levels, the highest rate increase occurred in the age group of 85+ (33.4% and 40.5% for men and women, respectively).

Length of Stay

- There has been a decrease in average length of stay for these procedures since 1994–1995. For total hip replacements, the average length of stay decreased by 29.4% from 13.6 days in 1994–1995 to 9.6 days in 2002–2003. For total knee replacements, the average length of stay decreased by 39.3% from 12.2 to 7.4 days for the same period. Between 2001–2002 and 2002–2003, the average length of stay fell by 1.0% from 9.7 to 9.6 days for total hip replacements and fell by 3.9% from 7.7 days to 7.4 days for total knee replacements. The average length of stay pertains to 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 surgeries done in their home province. Residents of the Northwest Territories and Prince Edward Island were next most likely to have their hip replacements performed in another province. Next to Yukon Territory and Nunavut residents, residents of the Northwest Territories were most likely to have their knee replacements performed in another province.

In-Hospital Mortality

- Post-operative in-hospital mortality is still a relatively rare event among recipients of a total hip or total knee replacement. Overall, the mortality rate of total hip and total knee replacement patients was 0.8% and 0.2%, respectively.

Surgical and Clinical Characteristics

Indications for Surgery

- Degenerative osteoarthritis was the most common diagnosis resulting in the need for a primary total hip replacement (81%) and a primary total knee replacement (92%). Other common diagnoses were osteonecrosis, inflammatory arthritis, acute hip fracture, childhood hip problem, old hip fracture and post-traumatic osteoarthritis.
- The most common reasons for requiring a revision to a total hip replacement were aseptic loosening (57%), osteolysis (30%), poly wear (24%) and instability (15%). Among knee replacement revisions, the top four reasons were mostly similar: aseptic loosening (49%), poly wear (36%), osteolysis (22%) and instability (13%).

Surgical Approach

- The most common surgical approach among total hip replacement surgeries was the direct lateral approach. Approximately half (47%) of procedures involved the use of this technique. Other common approaches were the anterolateral (28%), and the posterolateral (24%) surgical approaches. The Smith/Peterson approach and 2-incision approach were used in less than 1% of surgeries, respectively. Among total knee replacement surgeries, the most common approach was by far the medial approach (90% of surgeries). The intravastus, subvastus and lateral approaches were used in only 8%, 1% and 1% of the procedures, respectively. By looking at fiscal 2003 data, only 8% of surgical approaches were minimally invasive (hip—9%; knee—7%).

Fixation Method

- For hip replacements, 37% of replaced femoral stems were cemented comparing to only 6% cemented for replaced acetabular components. For knee replacements, cement was more frequently used as fixation method for replaced femoral components (82%), tibial components (95%) and patella components (71%).

Body Mass Index

- Based on body mass index, patients with knee replacements were more likely to be overweight or obese (87%) compared to hip replacement patients (72%). Data were available for 65% of cases in fiscal 2003.

Copies of the 2005 report can be purchased through the CIHI Order Desk at www.cihi.ca. Copies of the Executive Summary, media release and recent bulletins can be downloaded free of charge from the CJRR Web site (www.cihi.ca/cjrr). Queries regarding this report may be addressed to cjrr@cihi.ca.

Introduction

This is the fourth annual report produced by the CJRR. The first annual report was published in January 2002.¹ The aim of this report is to characterize the basic epidemiology of total hip and total knee replacements performed in Canada according to person (patient demographics), place (provincial and national level data) and time, as well as selected surgical and clinical parameters.

About the Canadian Joint Replacement Registry

The CJRR is a national registry that collects information on total hip and total knee replacement surgeries performed in Canada and follows joint replacement recipients over time to monitor their outcomes (including revision rates). The ultimate goal of the CJRR is to improve the quality of care and clinical outcomes of joint replacement recipients through post-market surveillance of orthopaedic implants, improvement in the quality of surgical practices and the study of risk factors affecting outcomes.

The CJRR is a joint effort between CIHI and the orthopaedic surgeons of Canada. This initiative was championed by CIHI and orthopaedic surgeons from each province who were working under the auspices of the Canadian Orthopaedic Association and the Canadian Orthopaedic Foundation. A number of other key partners contributed to the successful development and implementation of the CJRR including the federal, provincial, and territorial ministries of health, the Arthritis Society, the Canadian Arthritis Network and the Ontario Joint Replacement Registry (OJRR).

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

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, a two-page data collection form is filled out by the surgeon and/or operating room staff. It 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 and data entry are completed.

At present, only the province of Ontario has an operational provincial joint replacement registry, the OJRR.² Orthopedic surgeons in Ontario participate in the CJRR through the OJRR. Surgical information in Ontario is collected electronically in the operating room using handheld computers or using a computer with web access. Data are submitted by surgeons in Ontario to the OJRR, and then sent to the CJRR via the Ontario Ministry of Health and Long-Term Care (MOHLTC).

Beginning in 2004, CJRR also began receiving electronic file submissions from a large acute care facility in British Columbia. This move from paper to electronic submission is expected to continue as institutions as well as regions are creating registries of their own.

For the purpose of producing annual reports, bulletins, and serving data requests, CJRR also analyzes data from the HMDB, which is also managed by CIHI. Appendix A provides additional methodological detail regarding this database.

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's Web site at www.cihi.ca. CJRR's Privacy Impact Assessment is also available on the Web site at www.cihi.ca/cjrr.

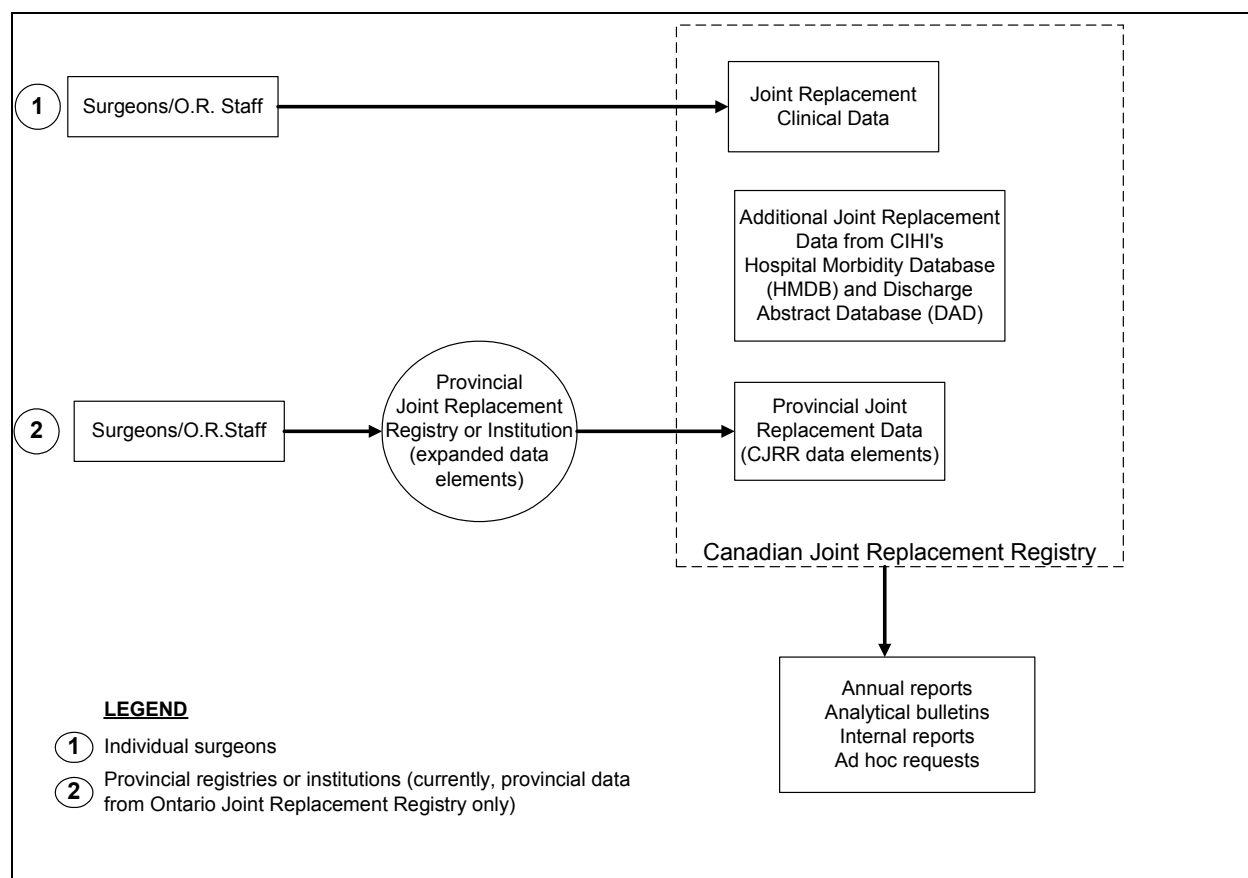


Figure 1. Canadian Joint Replacement Registry (CJRR) Data Flow Diagram

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 total hip and knee replacement 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 all eligible surgeons and records their agreement to participate.

Surgeons in Ontario participate in the CJRR through the OJRR, which is separately funded by the Ontario MOHLTC and hosted by the London Health Sciences Centre.

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.

As of April 2005, the participation rate is estimated at 72%.

Surgeon Participation Over Time

Data collection from surgeons began in May 2001. Since 2001, the number of participating surgeons has increased from 139 to 510, an increase of 267% (Figure 2). A major component of this increase is the first transfer of Ontario data to CJRR via the Ontario Ministry of Health and Long-Term Care, which occurred in July 2003, accounting for the dramatic increase in CJRR participation in the graph.

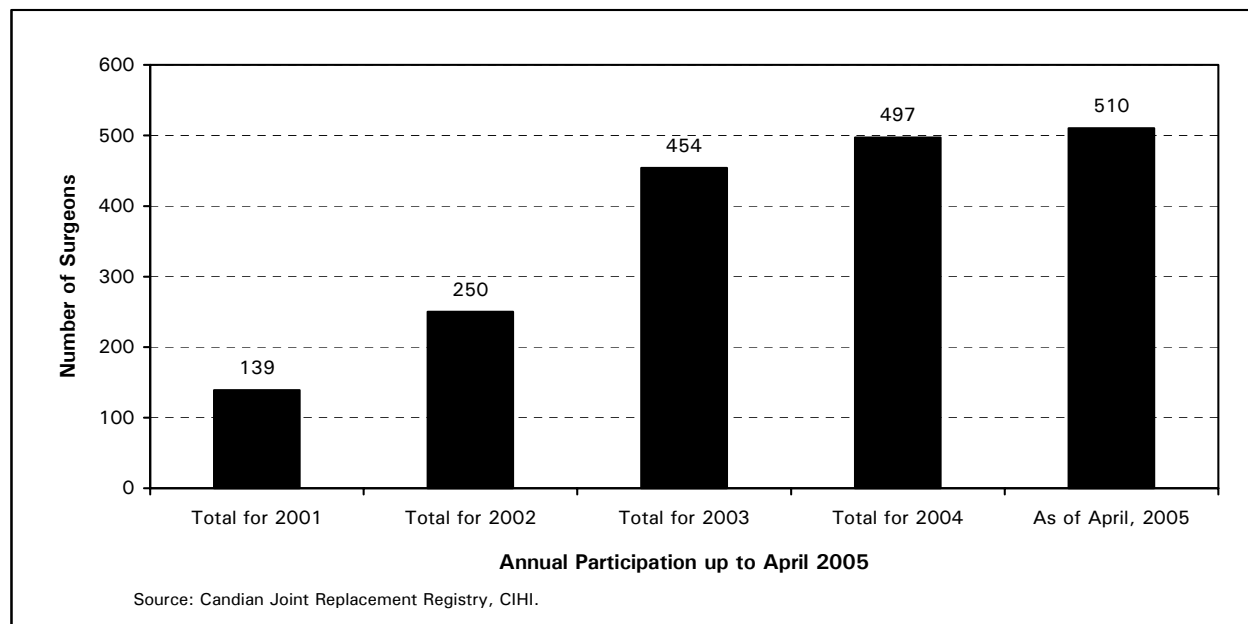


Figure 2. Number of Participating Surgeons in CJRR, 2001 to April 2005

Surgeon Participation for Fiscal 2003 Data by Province

As mentioned earlier, CJRR's participation rate is currently at 72% (as of April 2005). Table 1 shows participation statistics by province corresponding to the data year in this report. For fiscal 2003 data, CJRR's overall participation rate was 67% and 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 total hip and knee replacements in Canada and 79% of all CJRR participating surgeons. Participation rates by province and territory ranged from 47% in Quebec to 100% in New Brunswick and Nova Scotia.

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 for Fiscal 2003 Data

Hospital province	Surgeons signed up to participate	Estimated number of surgeons*	% participation
British Columbia	66	110	60%
Alberta	44	53	83%
Saskatchewan	19	29	66%
Manitoba	16	20	80%
Ontario	170	247	69%
Quebec	88	188	47%
New Brunswick	25	25	100%
Nova Scotia	23	23	100%
Prince Edward Island	3	4	75%
Newfoundland and Labrador	13	16	81%
Northwest Territories	1	1	100%
Total	468	716	67%

* Estimates based on information provided by CJRR provincial representatives as of June 8, 2004.

Notes:

- 1) There were no surgeons performing joint replacement surgeries in Yukon and Nunavut Territories at this time.
- 2) The participation statistics in the above table correspond to the data year presented in this report.

Important Methodological Notes

- Data submission by orthopaedic surgeons to the CJRR is voluntary. Not all participating surgeons have submitted data to the CJRR. Furthermore, it is not known whether all procedures have been submitted by each surgeon. Response bias is possible, but is not quantifiable.
- Hospital separation data presented in this report are collected in a mix of coding classifications (ICD-10-CA/CCI, ICD-9-CM, ICD-9/CCP). The 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.
- Analyses presented on total knee replacement procedures also include partial knee replacement procedures, as the latter cannot be separated out in the CCP classification system.
- Hospital separation data from the Hospital Morbidity Database (HMDB) are based on fiscal year 2002 discharges, whereas clinical and surgical data from CJRR are based on fiscal years 2002 and 2003. CJRR data submissions for fiscal 2002 have been updated since last year's annual report.
- Quebec counts for hip and knee replacements are underestimated since revision codes are not identifiable in the HMDB.
- Regional analyses in this report are primarily based on patient's region of residence, not where the procedure occurred. Counts by province of residence may have artificially increased due to a revised methodology adopted from the 2004 annual report, where patients were assigned to a province where possible 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. This is different from the methodology used for the 2004 CJRR Annual Report, which counted every procedure during a hospitalization.
- All analyses were conducted using the SAS version 8.0 statistical software package.

Note: Appendices A and B provide additional details regarding the methodology and data sources for the Hospital Morbidity Database and the CJRR, respectively.

Hospitalization Statistics

Important Note: Analyses for this section were based on the Hospital Morbidity Database and report on fiscal year data (i.e. from April 1st to March 31). Please refer to Appendix A for methodological detail pertaining to this database.

Overall Trends

There were 48,419 total hip and total knee replacements performed in Canada among Canadian residents in 2002–2003, representing a eight-year increase of 54% from 31,463 procedures in 1994–1995 and a one-year increase of 10% from 43,979 procedures in 2001–2002.

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

In 2002–2003, there were 26,500 total knee replacements compared to 21,919 total hip replacements. Compared to 1994–1995 numbers, the number of total knee replacements in 2002–2003 had increased by 77%, with a 10% increase over the previous year. The number of total hip replacements increased by 33% compared to 1994–1995, an increase of 11% over the previous year.

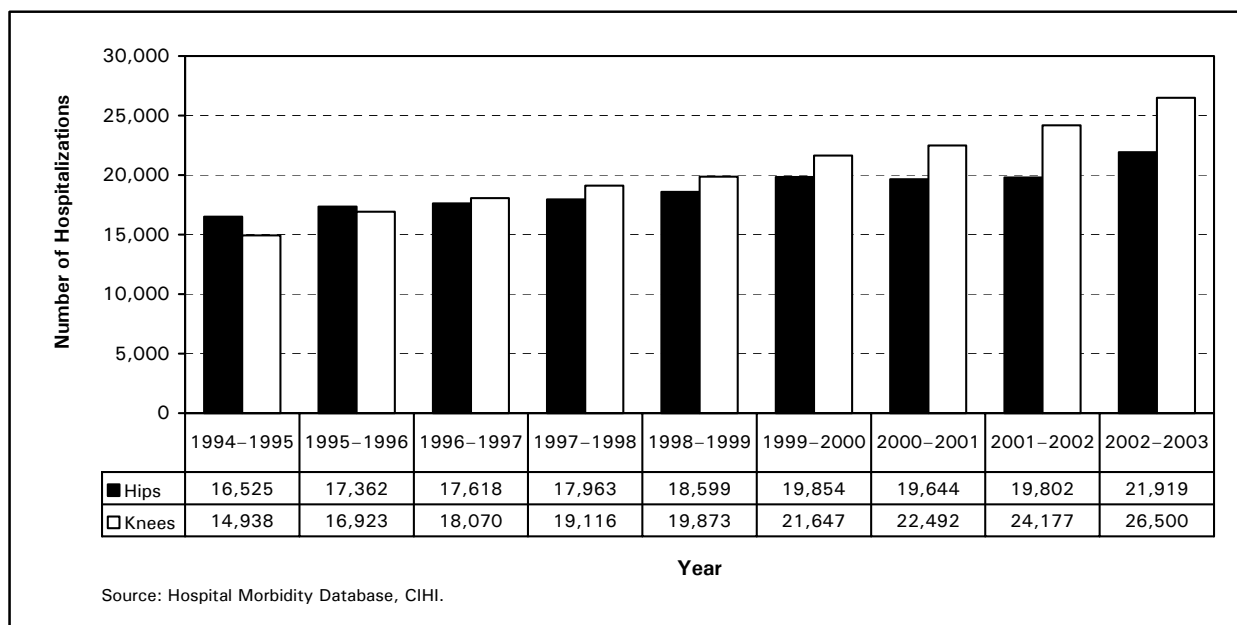


Figure 3. Number of Hospitalizations for Total Hip and Total Knee Replacement Procedures Performed in Canada, Fiscal 1994 to 2002

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

Figure 4 shows that the age-standardized rate of the hospitalizations for total hip replacements by sex. Among females in Canada the rate was 16% higher than that for males (65.3 versus 56.2). The total hip replacement procedure rate, regardless of sex, increased by 11% from 55.3 in 1994–1995 to 61.5 in 2002–2003. Among males, the eight-year increase was 10% (from 51.1 to 56.2). Among females, the eight-year increase was 12% (58.2 to 65.3 per 100,000).

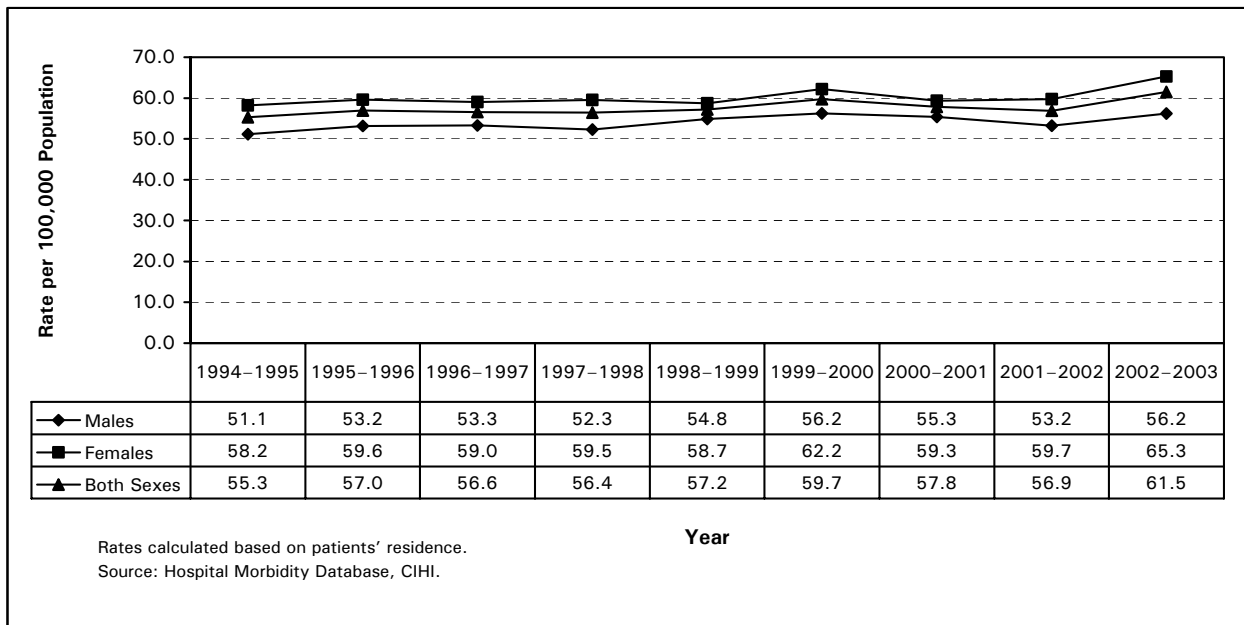


Figure 4. Age-Standardized Rates (per 100,000 population) by Sex for Total Hip Replacement Hospitalizations, Canada, Fiscal 1994 to 2002

For total knee replacement rates, the differences were much larger between the sexes and also over time (Figure 5). In 2002–2003, the age-standardized total knee replacement rate was 84.1 among females compared to 65.9 among males, a difference of 28% over males. The overall age-standardized rate increased by 50% in the eight-year period from 50.1 to 75.4. Among males, the increase was 46% (from 45.2 to 65.9). Among females, the corresponding increase was 55% (from 54.4 to 84.1).

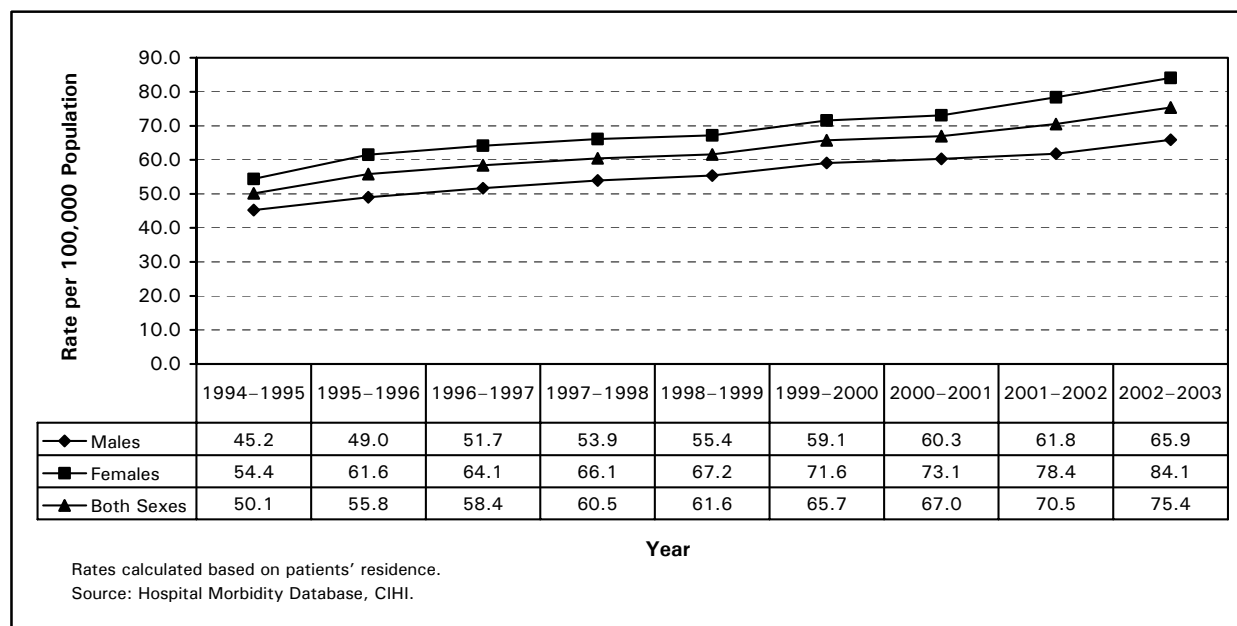


Figure 5. Age-Standardized Rates (per 100,000 population) by Sex for Total Knee Replacement Hospitalizations, Canada, Fiscal 1994 to 2002

Unilateral vs. Bilateral Procedures

Table 2 below shows the number of unilateral and bilateral hip and knee replacement procedures performed in Canada during fiscal 2002-2003. Information on laterality can now be identified in the Canadian Classification of Health Interventions (CCI—corresponding to ICD-10-CA). This was not possible in the Canadian Classification of Procedures (CCP—corresponding to ICD-9), which was being used earlier. For those Canadian provinces that continued to report in ICD-9/CM and CCP during fiscal 2002-2003, information on laterality is not available. Overall most hip and knee replacements were performed as unilateral (hip—99.5%; knee—96.4%) than bilateral procedures.

Table 2. Number of Hospitalizations for Hip and Knee Replacements by Laterality, CCI Coded Cases Only, Canada, Fiscal 2002

Laterality in CCI*	Hip replacement hospitalizations	%	Knee replacement hospitalizations	%
Unilaterals	16,627	99.5%	19,837	96.4%
Bilaterals	59	0.4%	709	3.4%
Not stated	26	0.2%	36	0.2%
Total	16,712	100.0%	20,582	100.0%

* Canadian Classification of Health Interventions

Note:

- Information on laterality is not available for provinces reporting in ICD-9, CCP classification system. There were 5,207 (hip) and 5,918 (knee) cases reported using ICD-9, CCP classification system.

Source: Hospital Morbidity Database, CIHI, Fiscal 2002.

International Comparisons

Crude rates of total hip and knee replacements for selected countries are presented in Tables 3 and 4. 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 revisions, for countries where this information was available. The reporting year is not uniform for all countries and ranges from 2000 to 2003 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.

While Norway had the highest crude rate for primary and revision (135 and 21 per 100,000, respectively) hip replacements, the knee replacement rates were among the lowest for primary and revision (50 and 5 per 100,000, respectively) procedures. The reverse is true for United States, which had the lowest crude rate for primary hip replacements (54 per 100,000) and among the highest rates for primary knee replacements (106 per 100,000).

Table 3. International Comparison of Crude Rates (per 100,000 population) of Primary Total Hip Replacements

Country	Crude rate per 100,000		Year	Reference
	Primary	Revisions		
Australia	93	18	Fiscal 2002	Australian Orthopaedic Association National Joint Replacement Registry. Annual Report. Adelaide: AOA; 2004.
New Zealand	124	19	2003	New Zealand National Joint Register
Norway	135	21	2002	Norwegian Arthroplasty Register, Annual Report June 2004
Canada*	64	6	Fiscal 2002	Canadian Institute for Health Information
United States	54	11	2000	American Academy of Orthopaedic Surgeons Source: National Center for Health Statistics; Centers for Disease Control and Prevention, 2002 National Hospital Discharge Survey

*Crude rate calculation based on counts from the Hospital Morbidity database, CIHI, Fiscal 2002.

Table 4. International Comparison of Crude Rates (per 100,000 population) of Primary Total Knee Replacements

Country	Crude rate per 100,000		Year	Reference
	Primary	Revisions		
Australia	108	13	Fiscal 2002	Australian Orthopaedic Association National Joint Replacement Registry. Annual Report. Adelaide: AOA; 2004.
New Zealand	72	9	2003	New Zealand National Joint Register
Norway	50	5	2002	Norwegian Arthroplasty Register, Annual Report June 2004
Sweden	81.5	7	2003	The Swedish Knee Arthroplasty Register
Canada*	79	5	Fiscal 2002	Canadian Institute for Health Information
United States	106	10	2000	American Academy of Orthopaedic Surgeons Source: National Center for Health Statistics; Centers for Disease Control and Prevention 2002 National Hospital Discharge Survey

*Crude rate calculation based on counts from the Hospital Morbidity database, CIHI, Fiscal 2002.

Table 5 indicates the changes in crude rates (per 100,000 population) over time, ranging between one to four years. Crude rates for hip replacements appear to have increased in these countries. The same is not true for knee replacements. While knee replacement rates increased for Australia, Norway, Sweden and Canada, there was a slight decrease (4%) reported in New Zealand. It is important, however, to note that these are "crude" rates with no adjustments made for age or gender or for changes occurring within the population over time in these countries.

Table 5. International Comparisons—Changes Over Time for Primary Hip and Knee Replacements

Country	Primary hip replacements					Primary knee replacements				
	CJRR 2004 report		Latest statistics		% increase	CJRR 2004 report		Latest statistics		% increase
	Year	Crude rate ⁶	Year	Crude rate ⁶		Year	Crude rate ⁶	Year	Crude rate ⁶	
Australia ¹	Fiscal 1999	74	Fiscal 2002	93	25.7%	Fiscal 1999	81	Fiscal 2002	108	33.3%
Canada ²	Fiscal 2001	57	Fiscal 2002	64	12%	Fiscal 2001	74	Fiscal 2002	79	6.8%
New Zealand ³	2000	119	2003	124	4.2%	2000	75	2003	72	-4.0%
Norway ⁴	2000	124	2003	135	8.9%	2000	35	2003	50	42.9%
Sweden ⁵						Fiscal 1996	63	2003	81.5	29.4%

1. Australian Orthopaedic Association National Joint Replacement Registry. Annual Report. Adelaide: AOA; 2003, 2004.
2. Hospital Morbidity Database, CIHI, Fiscal 2001, 2002. Counts for primary and revision hip and knee replacements are not reported by Quebec.
3. New Zealand National Joint Register, New Zealand, January–December 2001, 2004.
4. Norwegian Arthroplasty Register, Norway, Annual Report 2003, 2004.
5. Acta Orthop Scand 2000; 71(4):376–380; Swedish Knee Arthroplasty Register.
6. Crude rate per 100,000 population.

Provincial/Territorial Variations

Among the total number of hospitalizations for hip and knee replacements in Canada, most procedures were primary (91% for hip; 94% for knee) procedures 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 (9.6% for hip; 6.5% for knee). On the other hand, though Prince Edward Island had fewer counts reported for revisions among provinces, it had the highest percentage of revisions (23% for hips and 13% for knees). Saskatchewan had the lowest percentage of revisions (8.7%) for hip replacement and Newfoundland and Labrador reported the lowest percentage (5.6%) for knee revisions.

Table 6. Number of Hospitalizations by Type of Hip Replacement, Canada, Fiscal 2002

Province*	Number of primary replacements	Number of revision replacements	Total number of replacements	Percent revisions
Newfoundland and Labrador	262	35	297	11.8%
Prince Edward Island	89	27	116	23.3%
Nova Scotia	693	99	792	12.5%
New Brunswick	471	99	570	17.4%
Quebec ¹	3,733	7	3,740	N/A
Ontario	8,239	874	9,113	9.6%
Manitoba	786	112	898	12.5%
Saskatchewan	905	86	991	8.7%
Alberta	1,999	211	2,210	9.5%
British Columbia	2,772	388	3,160	12.3%
Territories ²	25	< 5	29	13.8%
Unknown ³	< 5	< 5	< 5	0.0%
Canada⁴	19,977	1,942	21,919	8.9%

1. Revision procedures are not coded separately from primary procedures in Quebec. Therefore, the revision count shown for this province is incomplete.

2. Includes Northwest Territories, Yukon Territory and Nunavut.

3. Excludes non-Canadian residents.

4. Total for Canada excludes counts for Quebec.

* Province represents province of patient residence.

N/A—Not applicable

Source: Hospital Morbidity Database, CIHI, Fiscal 2002.

Table 7. Number of Hospitalizations by Type of Knee Replacement, Canada, Fiscal 2002

Province*	Number of primary replacements	Number of revision replacements	Total number of replacements	Percent revisions
Newfoundland and Labrador	268	16	284	5.6%
Prince Edward Island	121	18	139	12.9%
Nova Scotia	978	101	1,079	9.4%
New Brunswick	718	90	808	11.1%
Quebec ¹	3,825	< 5	3,828	N/A
Ontario	11,262	780	12,042	6.5%
Manitoba	1,195	95	1,290	7.4%
Saskatchewan	1,005	67	1,072	6.3%
Alberta	2,501	200	2,701	7.4%
British Columbia	3,000	203	3,203	6.3%
Territories ²	43	< 5	44	2.3%
Unknown ³	9	< 5	10	10.0%
Canada⁴	24,925	1,575	26,500	5.9%

1. Total knee revision codes were not identified for Quebec in the Hospital Morbidity Database in 2002–2003. Therefore, the revision count shown for this province is incomplete.

2. Includes Northwest Territories, Yukon Territory and Nunavut.

3. Excludes non-Canadian residents.

4. Total for Canada excludes counts for Quebec.

*Province represents province of patient residence.

N/A—Not applicable

Note: Excluded from this table are 276 patient hospitalizations for total knee revisions performed in 2002–2003 in Quebec facilities and submitted separately by Med-Écho.³ These counts were not included because the province of patient residence was unknown.

Source: Hospital Morbidity Database, CIHI, Fiscal 2002.

Table 8 shows the number and percent change of total hip replacement procedures by province of patient residence for 2002–2003 compared to 1994–1995 and 2001–2002. For total hip replacements among provinces, Quebec had the highest number of hospitalizations (51%) followed by Newfoundland and Labrador (44%), New Brunswick (37%), Manitoba (36%) and British Columbia (35%) over an eight-year period. Newfoundland and Labrador recorded the highest change (30%) increase in hospitalizations over a one-year period (increased by 30%) followed by Saskatchewan (18%) and Prince Edward Island and British Columbia (15%). All other provinces showed an increase in the number of hospitalizations during the eight-year as well as the one-year periods.

Table 8. Number of Hospitalizations for Total Hip Replacement Procedures, Canada, Based on Patient Residence, Fiscal 1994, 2001, and 2002

Province	Total hip replacements 1994–1995	Total hip replacements 2001–2002	Total hip replacements 2002–2003	8-year % increase	1-year % increase
Newfoundland and Labrador ¹	206	229	297	44%	30%
Prince Edward Island	107	101	116	8%	15%
Nova Scotia	729	695	792	9%	14%
New Brunswick	417	519	570	37%	10%
Quebec	2,480	3,345	3,740	51%	12%
Ontario	6,932	8,382	9,113	31%	9%
Manitoba	659	857	898	36%	5%
Saskatchewan	812	842	991	22%	18%
Alberta	1,801	2,058	2,210	23%	7%
British Columbia	2,342	2,736	3,160	35%	15%
Territories ²	11	36	29	164%	-19%
Unknown ^{1, 3}	234	2	3	N/A	N/A
Canada⁴	16,525	19,802	21,919	33%	11%

1. For Newfoundland and Labrador and patients with unknown residence, 1995–1996 numbers are used for 1994–1995, as the latter data were incomplete.

2. Includes Northwest Territories, Yukon Territory and Nunavut.

3. Excludes non-Canadian residents.

4. Total for 1994–1995 does not add up because 1995–1996 numbers were used for Newfoundland and Labrador and patients with unknown residents.

5. Percentage change should be interpreted with caution as it is based on small numbers.

N/A—Not applicable

Source: Hospital Morbidity Database, CIHI.

As shown in Table 9, for total knee replacements, the number of hospitalizations in the eight-year period reflects an increase in all provinces. The greatest increase among provinces over the eight-year period was in Manitoba (125%), followed by New Brunswick (100%). For the one-year period, the increase was highest in Prince Edward Island (25%) followed by Nova Scotia (21%). There were no declines noticed among other provinces. However, among the territories there was a decline over the one-year period of 17%.

Table 9. Number of Hospitalizations for Total Knee Replacement Procedures Performed in Canada Based on Patient Residence, Fiscal 1994, 2001, and 2002

Province	Total knee replacements 1994–1995	Total knee replacements 2001–2002	Total knee replacements 2002–2003	8-year % increase	1-year % increase
Newfoundland and Labrador ¹	177	252	284	60%	13%
Prince Edward Island	84	111	139	65%	25%
Nova Scotia	674	893	1,079	60%	21%
New Brunswick	403	695	808	100%	16%
Quebec	2,094	3,314	3,828	83%	16%
Ontario	6,628	11,301	12,042	82%	7%
Manitoba	574	1,228	1,290	125%	5%
Saskatchewan	833	1,009	1,072	29%	6%
Alberta	1,568	2,413	2,701	72%	12%
British Columbia	1,845	2,903	3,203	74%	10%
Territories ²	11	53	44	300%	-17%
Unknown ^{1, 3}	222	5	10	N/A	N/A
Canada⁴	14,938	24,177	26,500	77%	10%

1. For Newfoundland and Labrador and patients with unknown residence, 1995–1996 numbers are used for 1994–1995, as the latter data were incomplete.

2. Includes Northwest Territories, Yukon Territory and Nunavut.

3. Excludes non-Canadian residents.

4. Total for 1994–1995 does not add up because 1995–1996 numbers were used for Newfoundland and Labrador and patients with unknown residents.

5. Percentage change should be interpreted with caution as it is based on small numbers.

N/A—Not applicable

Source: Hospital Morbidity Database, CIHI.

The age-standardized rates of total hip and total knee replacement procedures varied across Canada (Figure 6). Saskatchewan and Alberta residents had the highest total hip replacement rates (80.8 and 75.1 per 100,000 population, respectively), whereas Newfoundland and Labrador and Quebec (50.3 and 42.3 per 100,000 population, respectively) had the lowest hospitalization rates for hip replacements.

For total knee replacement rates, Manitoba and Nova Scotia had the highest rates (97.9 and 97.5 per 100,000 population, respectively), while Newfoundland and Labrador and Quebec had the lowest (48.6 and 43.7 per 100,000 population, respectively).

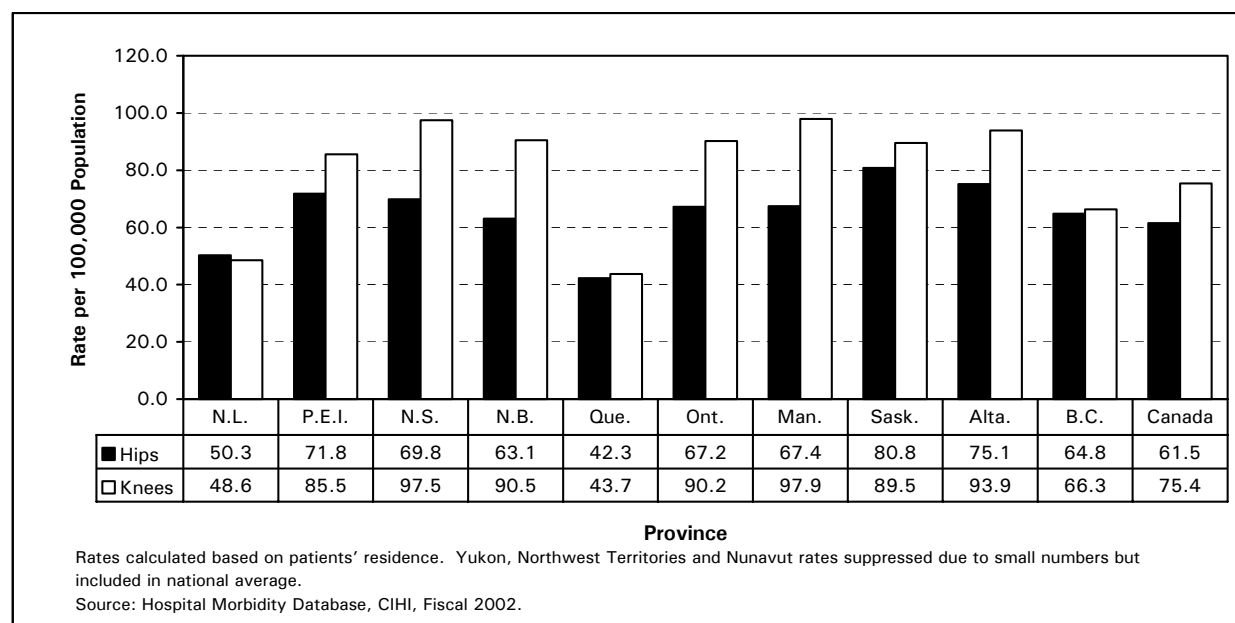


Figure 6. Age-Standardized Rates (per 100,000 population) of Total Hip and Total Knee Replacement Procedures by Province, Fiscal 2002

Table 10 shows the age-standardized hospitalization rate for total hip replacements and percent change by province of patient's residence for 2002–2003 compared to 1994–1995 and 2001–2002. Since 1994–1995, the rate increased in almost all the provinces except for Prince Edward Island, Nova Scotia and Alberta with the greatest percent increase in Newfoundland and Labrador (29%), followed by Quebec (27%). Newfoundland and Labrador (31%) and Saskatchewan (18%) registered the highest increases compared to 2001–2002.

Table 10. Age-Standardized Rates of Total Hip Replacement Hospitalizations in Canada Based on Patient Residence, Fiscal 1994, 2001, and 2002

Province	Total hip replacement 1994–1995	Total hip replacement 2001–2002	Total hip replacement 2002–2003	8-year % increase	1-year % increase
Newfoundland and Labrador ¹	39.1	38.5	50.3	29%	31%
Prince Edward Island	73.2	63.8	71.8	-2%	13%
Nova Scotia	72.3	61.5	69.8	-3%	13%
New Brunswick	52.2	59.4	63.1	21%	6%
Quebec	33.4	39.0	42.3	27%	8%
Ontario	61.6	63.3	67.2	9%	6%
Manitoba	53.4	65.6	67.4	26%	3%
Saskatchewan	68.8	68.4	80.8	17%	18%
Alberta	78.2	71.6	75.1	-4%	5%
British Columbia	58.7	57.5	64.8	10%	13%
Territories	**	**	**	N/A	N/A
Canada²	55.3	56.9	61.5	11%	8%

1. For Newfoundland and Labrador, 1995–1996 numbers are used, as 1994–1995 data are incomplete.

2. Patients with unknown residence are excluded.

** Yukon Territory, Northwest Territories and Nunavut rates are suppressed due to small numbers but included in national average.

N/A—Not applicable

Source: Hospital Morbidity Database, CIHI.

Table 11 shows the age-standardized total knee replacement rate and percent change by province of patient's residence for 2002–2003 compared to 1994–1995 and 2001–2002. Since 1994–1995, the rate increased among all provinces, with the greatest percent increases in Manitoba (113%), followed by New Brunswick (77%) and Quebec (54%). Compared to the previous year, the greatest percent increases were seen in Prince Edward Island (21%), followed by Nova Scotia (18%). There were no decreases seen among the provinces for both the eight-year as well as the one-year periods.

Table 11. Age-Standardized Rates of Total Knee Replacement Hospitalizations in Canada Based on Patient Residence, Fiscal 1994, 2001, and 2002

Province	Total knee replacement 1994–1995	Total knee replacement 2001–2002	Total knee replacement 2002–2003	8-year % increase	1-year % increase
Newfoundland and Labrador ¹	34.0	44.2	48.6	43%	10%
Prince Edward Island	58.0	70.7	85.5	47%	21%
Nova Scotia	67.2	82.5	97.5	45%	18%
New Brunswick	51.0	80.5	90.5	77%	12%
Quebec	28.3	39.1	43.7	54%	12%
Ontario	59.0	86.5	90.2	53%	4%
Manitoba	46.0	94.7	97.9	113%	3%
Saskatchewan	69.4	84.1	89.5	29%	6%
Alberta	69.2	86.6	93.9	36%	8%
British Columbia	46.2	61.8	66.3	44%	7%
Territories	**	**	**	N/A	N/A
Canada²	50.1	70.5	75.4	50%	7%

1. For Newfoundland and Labrador, 1995–1996 numbers are used, as 1994–1995 data are incomplete.

2. Patients with unknown residence are excluded.

** Yukon Territory, Northwest Territories and Nunavut rates are suppressed due to small numbers but included in national average.

N/A—Not applicable

Source: Hospital Morbidity Database, CIHI.

When age-standardized rates were examined by sex (Figure 7), the provincial trends for total hip replacement rates among males and females were similar to both sexes combined. The rate for females in Alberta, Prince Edward Island and Saskatchewan were noticeably among the highest (82 and 80 per 100,000 population, respectively). Saskatchewan also had the highest rate for hip replacement among males (80 per 100,000 population).

For total knee replacements (Figure 8), while Nova Scotia had the highest age-standardized rate (86 per 100,000 population) among males, Manitoba had the highest rate (113 per 100,000 population) among females. Quebec and Newfoundland and Labrador had the lowest rates for both males and females.

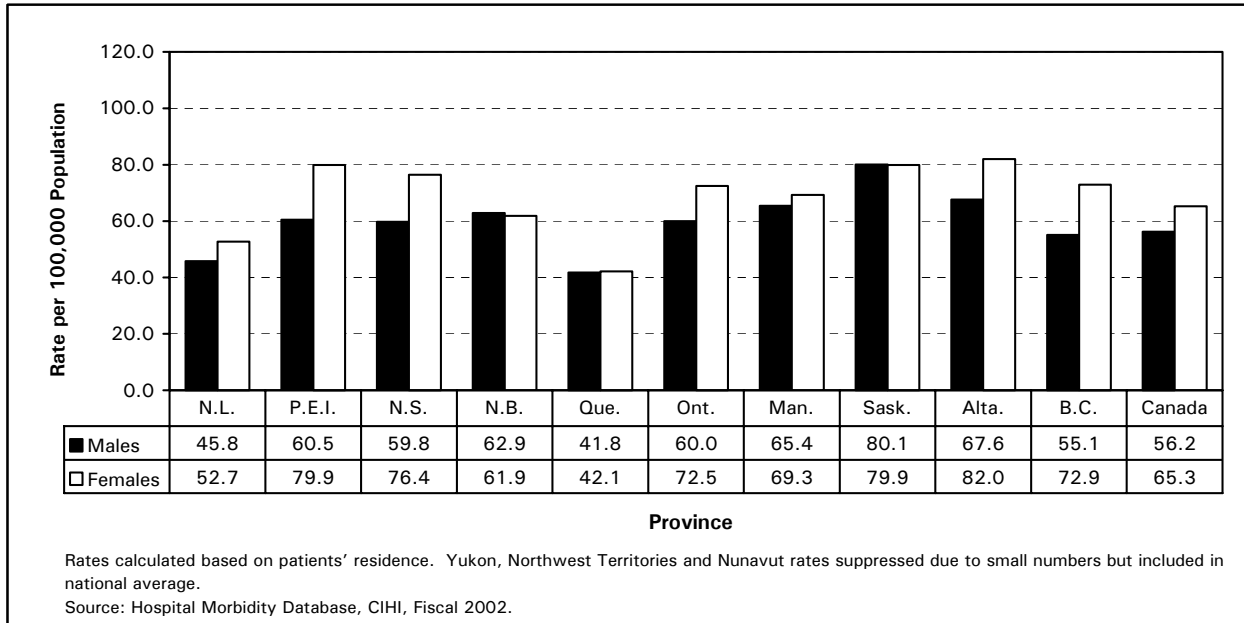


Figure 7. Age-Standardized Rates (per 100,000 population) of Total Hip Replacement Procedures for Males and Females, Fiscal 2002

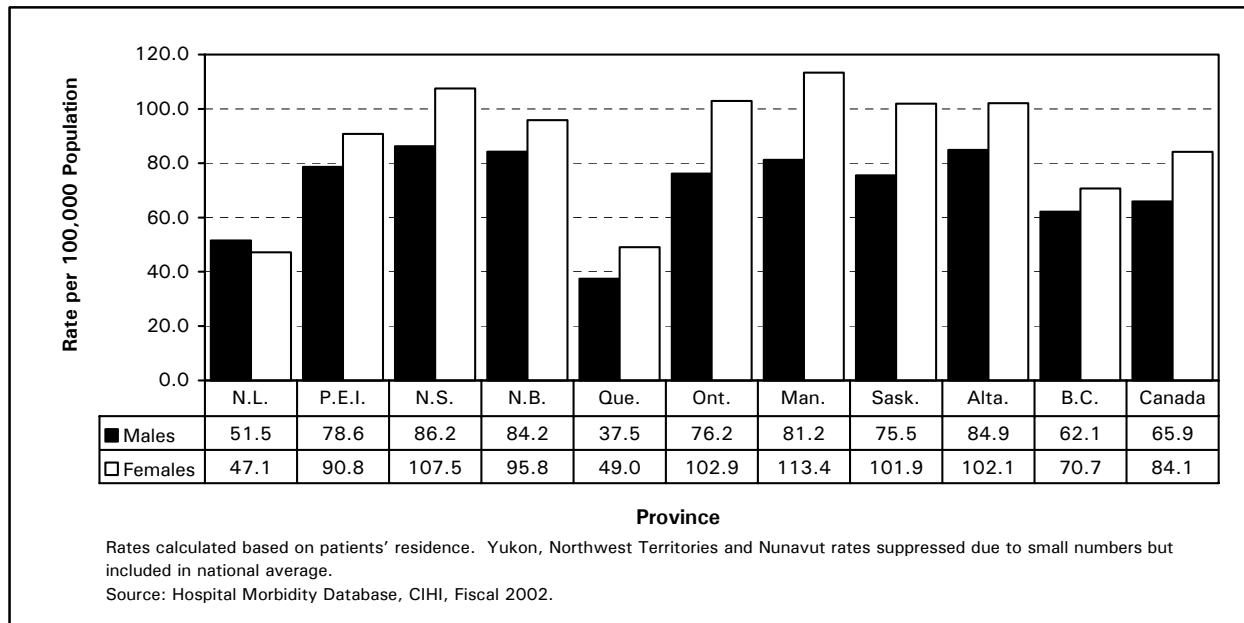


Figure 8. Age-Standardized Rates (per 100,000 population) of Total Knee Replacements for Males and Females, Fiscal 2002

Patient Demographics

The majority of total hip and knee replacements were performed on patients 65 years of age and older (65% and 69%, respectively). In 2002–2003, nearly a third (31%) of Canadian hip replacement recipients and 38% of knee replacement recipients were between the ages 65 and 74 years (Figures 9 and 10). In contrast, only 5% of patients who underwent a hip replacement, and 1% of those who underwent a knee replacement, were younger than 45 years of age. This age distribution of the patient population was similar to that seen in 2001-2002 and did not change appreciably.

Among total hip replacement patients, 59% were female, and 41% were male in 2002–2003. Among total knee replacement recipients, 61% were female, and 39% were male.

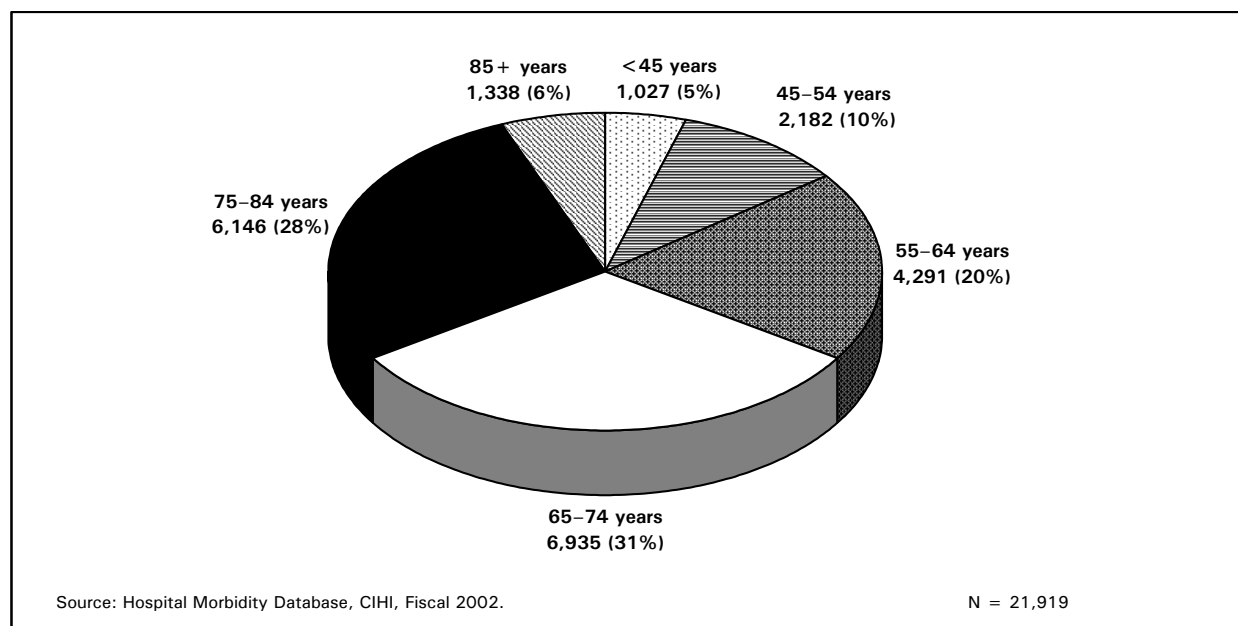


Figure 9. Distribution of Total Hip Replacement Procedures by Patient Age, Canada, Fiscal 2002

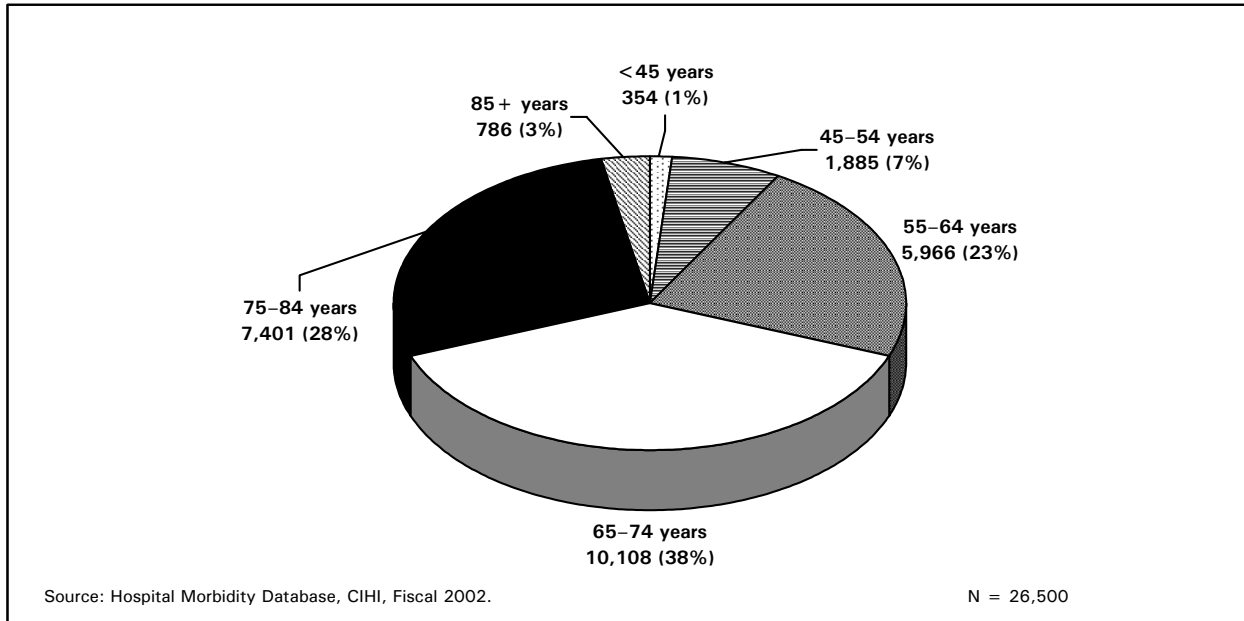


Figure 10. Distribution of Total Knee Replacement Procedures by Patient Age, Canada, Fiscal 2002

Tables 12 and 13 show the number of total hip and knee replacements by age group and sex for 2002–2003, compared to 1994–1995. For total hip replacement procedures, the largest increases were seen in the 85+ age groups (83% for men and 90% for women), followed by the 45 to 54 age groups (63% for men and 70% for women).

Among total knee replacement procedures, the order was reversed. The largest increases were noticed in the 45 to 54 age groups (160% for men and 208% for women), followed by the 85+ age groups (137% for men and 116% for women).

Table 12. Number and Distribution of Total Hip Replacement Hospitalizations by Age Group and Sex, Canada, Fiscal 2002 Compared to Fiscal 1994

Age group	Males			Females		
	1994–1995	2002–2003	8-year % increase	1994–1995	2002–2003	8-year % increase
<45 years	471	548	16.3%	455	479	5.3%
45–54 years	693	1,126	62.5%	620	1,056	70.3%
55–64 years	1,585	2,077	31.0%	1,634	2,214	35.5%
65–74 years	2,444	2,981	22.0%	3,704	3,954	6.7%
75–84 years	1,454	1,994	37.1%	2,754	4,152	50.8%
85+ years	190	347	82.6%	521	991	90.2%
Total	6,837	9,073	32.7%	9,688	12,846	32.6%

Source: Hospital Morbidity Database, CIHI.

Table 13. Number and Distribution of Total Knee Replacement Hospitalizations by Age Group and Sex, Canada, Fiscal 2002 Compared to Fiscal 1994

Age group	Males			Females		
	1994–1995	2002–2003	8-year % increase	1994–1995	2002–2003	8-year % increase
<45 years	100	144	44.0%	144	210	45.8%
45–54 years	275	716	160.4%	380	1,169	207.6%
55–64 years	1,265	2,379	88.1%	1,642	3,587	118.5%
65–74 years	2,675	4,212	57.5%	4,058	5,896	45.3%
75–84 years	1,517	2,743	80.8%	2,529	4,658	84.2%
85+ years	115	272	136.5%	238	514	116.0%
Total	5,947	10,466	76.0%	8,991	16,034	78.3%

Source: Hospital Morbidity Database, CIHI.

Tables 14 and 15 show the age-specific rates for total hip replacement and total knee replacement, by sex for 2002–2003 as compared to 1994–1995. For total hip replacement procedures, the highest age-specific rates in 2002-2003 were noticed among the 75 to 84 age groups (361 and 508 per 100,000 for men and women, respectively), followed by the 65 to 74 age groups (291 and 345 per 100,000, for men and women respectively). The largest eight-year increases were seen among the 85+ age groups (33% for men and 40% for women), followed by the 45 to 54 age groups (25% for men and 29% for women).

For total knee replacement procedures, the highest age-specific rate in 2002–2003 was in the 75 to 84 age groups among men (497 per 100,000) and women (570 per 100,000). The largest eight-year increases were in the age group of 45 to 54 for both men and women (99% and 133% increase), followed by the age group of 85+ (73% and 59%).

It is important to note that a substantial rate increase (from 36% to 133%) was seen across all age groups and both sexes for total knee replacement procedures from 1994–1995 to 2002–2003.

Table 14. Age-Specific Rates (per 100,000 population) of Total Hip Replacement Procedures by Sex, Canada, Fiscal 2002 Compared to Fiscal 1994

Age group	Males			Females		
	1994–1995	2002–2003	8-year % increase	1994–1995	2002–2003	8-year % increase
<45 years	4.7	5.4	14.9%	4.7	4.9	4.3%
45–54 years	39.5	49.3	24.8%	35.4	45.6	28.8%
55–64 years	129.2	136.3	5.5%	129.8	141.5	9.0%
65–74 years	264.1	291.1	10.2%	332.0	345.5	4.1%
75–84 years	349.4	361.3	3.4%	427.2	508.3	19.0%
85+ years	200.8	267.9	33.4%	234.4	329.3	40.5%
Total	47.4	58.3	23.0%	65.9	80.9	22.8%

Source: Hospital Morbidity Database, CIHI.

Table 15. Age-Specific Rates (per 100,000 population) of Total Knee Replacement Hospitalizations by Sex, Canada, Fiscal 2002 Compared to Fiscal 1994

Age group	Males			Females		
	1994–1995	2002–2003	8-year % increase	1994–1995	2002–2003	8-year % increase
<45 years	1.0	1.4	40.0%	1.5	2.2	46.7%
45–54 years	15.7	31.3	99.4%	21.7	50.5	132.7%
55–64 years	103.1	156.2	51.5%	130.5	229.3	75.7%
65–74 years	289.1	411.3	42.3%	363.7	515.2	41.7%
75–84 years	364.5	497.0	36.4%	392.3	570.3	45.4%
85+ years	121.5	210.0	72.8%	107.1	170.8	59.5%
Total	41.2	67.2	63.1%	61.1	101.0	65.3%

Source: Hospital Morbidity Database, CIHI.

Inter-Provincial/Territorial Movements

With the exception of Yukon Territory and Nunavut, most patients had their joint replacement surgeries done in their home province. However, a small proportion of patients had their replacements done in another province. Possible reasons include shorter wait time, or access to a sub-specialty not available locally in their home province. As total joint replacements are not performed in Yukon Territory and Nunavut, residents of these two territories must travel to neighboring provinces of Alberta or British Columbia to have hip and knee replacements performed.

The provincial/territorial movements of total hip replacement patients are depicted in Table 16. Residents of Northwest Territories and Prince Edward Island were most likely to have their total hip replacement surgery in another province. While some residents of Northwest Territories (27.3%) had their hip replacements done in Alberta, nearly 15% of residents of Prince Edward Island had their hip replacements done in Nova Scotia or in New Brunswick. In contrast, residents of Ontario (0.1%) and Alberta (0.5%) 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 last year's (fiscal 2001–2002) patterns.

When considering the absolute number of patients traveling to another province to undergo joint replacement surgery, residents of British Columbia (n=49) and Nova Scotia (n=31) traveled to another province to have their hip replaced more than residents of any other province. 42 of the 49 patients from British Columbia traveled to Alberta and, 26 of the 31 patients from Nova Scotia traveled to New Brunswick. Almost all patients (20 of 23) who were treated out of province from Quebec went to Ontario, while 28 of 30 residents from Saskatchewan went to Alberta.

With respect to the flow of patients into provinces for hip replacement surgery, New Brunswick and Alberta (5.2% and 3.5% respectively) had the highest proportion of out-of-province patients. In absolute numbers, however, Alberta (n = 79) and Ontario (n = 38) received the highest number of patients from out-of-province for a total hip replacement.

Table 16. Movement of Total Hip Replacement Patients Across Provinces, Fiscal 2002

Province	Number (%) of patients residing in this province who had their total hip replacement done in another province	Number (%) out-of-province patients who had their total hip replacement performed in this province
Newfoundland and Labrador	0 (0%)	0 (0%)
Prince Edward Island	18 (15.5%)	1 (1.0%)
Nova Scotia	31 (3.9%)	22 (2.8%)
New Brunswick	6 (1.0%)	31 (5.2%)
Quebec	23 (0.6%)	0 (0%)
Ontario	9 (0.1%)	38 (0.4%)
Manitoba	12 (1.3%)	6 (0.7%)
Saskatchewan	30 (3.0%)	18 (1.8%)
Alberta	12 (0.5%)	79 (3.5%)
British Columbia	49 (1.6%)	16 (0.5%)
Northwest Territories	3 (27.3%)	0 (0%)
Yukon Territory	12 (100%)*	0 (0%)
Nunavut	6 (100%)*	0 (0%)

*No joint replacements performed in Nunavut and Yukon Territory.

Notes: There were 3 total hip replacement procedures performed in Manitoba for which the patients' home province was unknown. Denominator for percentages is number of patients (Canadian residents only) treated in that province.

Source: Hospital Morbidity Database, CIHI, Fiscal 2002.

Table 17 shows the movement of patients who underwent a total knee replacement in Canada in 2002–2003. Residents of Northwest Territories (13.3%), Prince Edward Island (7.2%) and Saskatchewan (3.2%) were most likely to have their total knee replacement surgery in another province. Residents of Northwest Territories went to Alberta and, 18 of the 20 residents from Nova Scotia went to New Brunswick, while the remaining went to Ontario for total knee replacement surgery. All the 34 residents from Saskatchewan traveling to another province for total knee replacement surgery went to Alberta. Similar to the pattern seen with hip replacement recipients, only a small proportion of residents of

Alberta and Ontario (< 1%) had their knee replacement surgeries out-of-province. The majority of out-of-province knee replacements for Quebec residents were carried out in Ontario and, almost all out-of-province patients (48 of 49) from British Columbia went to the neighboring province of Alberta to have their knee replacement surgery. Accordingly, Alberta (n=87) and Ontario (n=41) received the highest number of out-of-province patients for a total knee replacement. New Brunswick (3.6%) and Alberta (3.1%) had the highest proportion of out-of-province residents, among provinces.

Table 17. Movement of Total Knee Replacement Patients Across Provinces, Fiscal 2002

Province	Number (%) of patients residing in this province who had their total knee replacement done in another province	Number (%) of out-of-province patients who had their total knee replacement done in this province
Newfoundland and Labrador	5 (1.8%)	2 (0.7%)
Prince Edward Island	10 (7.2%)	0 (0%)
Nova Scotia	20 (1.9%)	17 (1.6%)
New Brunswick	7 (0.9%)	30 (3.6%)
Quebec	36 (0.9%)	0 (0%)
Ontario	6 (<0.1%)	41 (0.3%)
Manitoba	11 (0.8%)	6 (0.5%)
Saskatchewan	34 (3.2%)	14 (1.3%)
Alberta	8 (0.3%)	87 (3.1%)
British Columbia	49 (1.5%)	19 (0.6%)
Northwest Territories	2 (13.3%)	1 (7.1%)
Yukon Territory	17 (100%)*	0 (0%)
Nunavut	12 (100%)*	0 (0%)

*No joint replacements were performed in Nunavut and Yukon Territory.

Notes: There were 10 total knee replacement procedures performed in Manitoba for which the patients' home provinces were unknown. Denominator for percentages is number of patients (Canadian residents only) treated in that province.

Source: Hospital Morbidity Database, CIHI, Fiscal 2002.

Length of Hospital Stay

Important 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 for total hip and knee replacement patients in 2002–2003 are shown in Figure 11. Total hip replacement patients had longer lengths of stay than patients undergoing a total knee replacement in all provinces except in Prince Edward Island, where there was no disparity between the two procedures. On average, patients with a total hip replacement remained in hospital for 9.6 days compared to 7.4 days for those receiving a total knee replacement. Ontario and Alberta had lower average lengths of stay than the national average for both total hip and total knee replacements. British Columbia had a lower average rate for total knee replacements. In contrast, Manitoba, Prince Edward Island, Newfoundland and Labrador and Quebec had higher-than-national-average lengths of stay for both total hip and knee procedures.

On average, women undergoing a total hip or total knee replacement procedure remained in hospital longer than men undergoing the same procedures in all provinces (Figures 12 and 13).

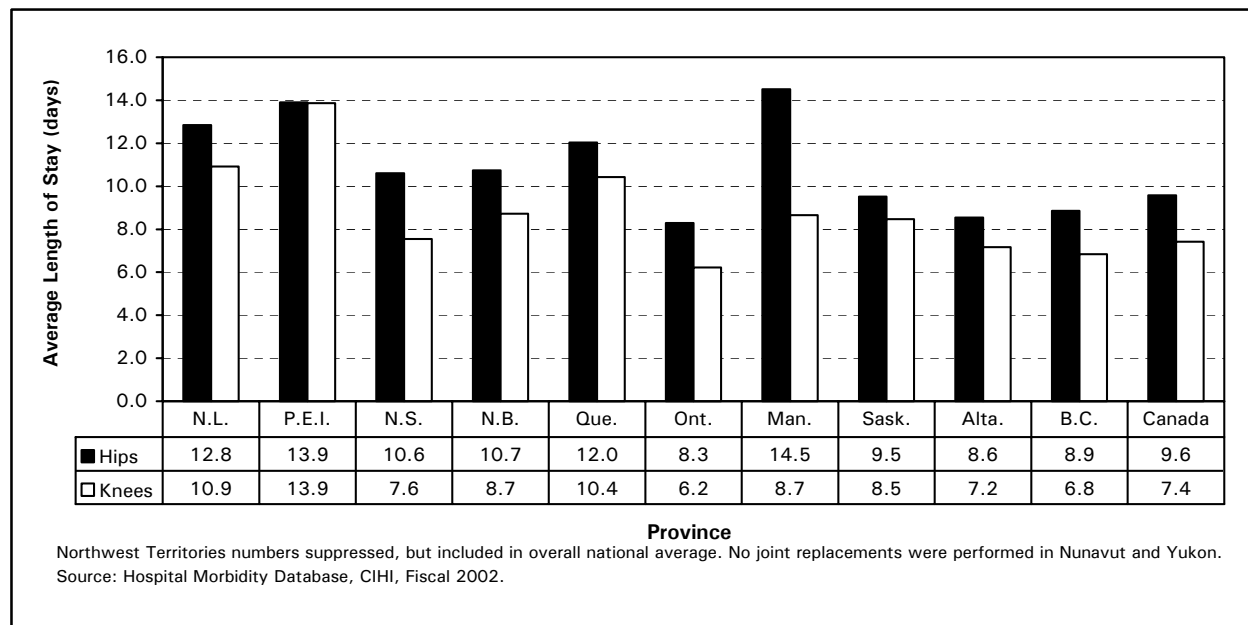


Figure 11. Average Length of Stay (Days) for Total Hip and Total Knee Replacement Patients by Province, Fiscal 2002

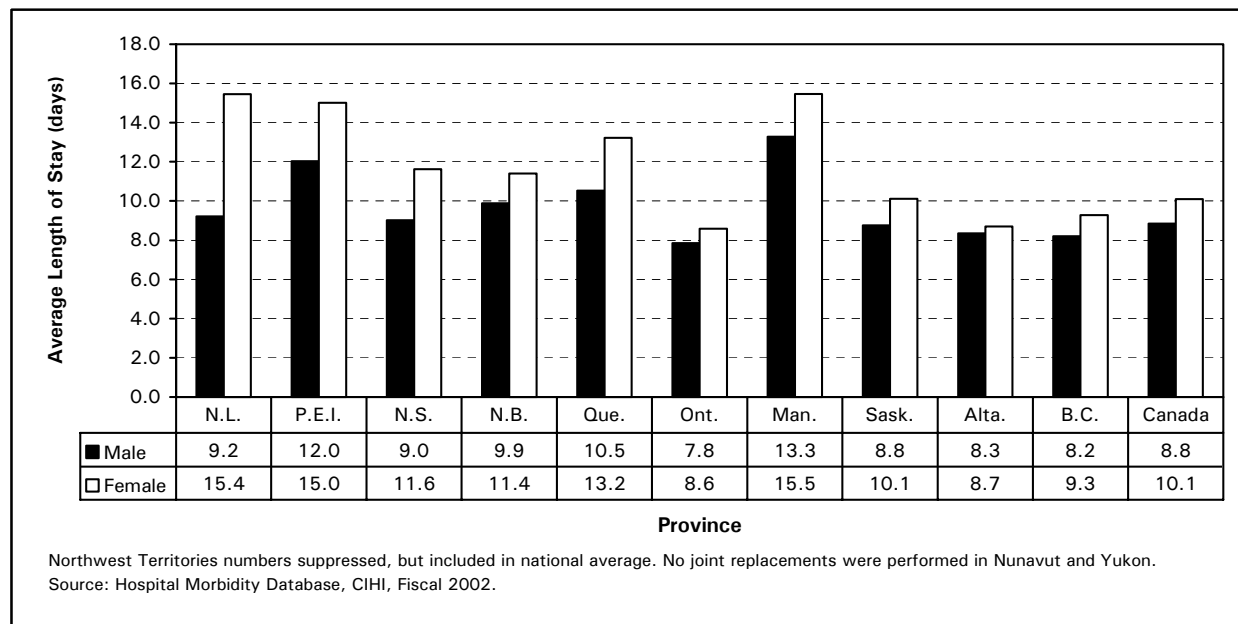


Figure 12. Average Length of Stay for Total Hip Replacement Patients by Sex and Province, Fiscal 2002

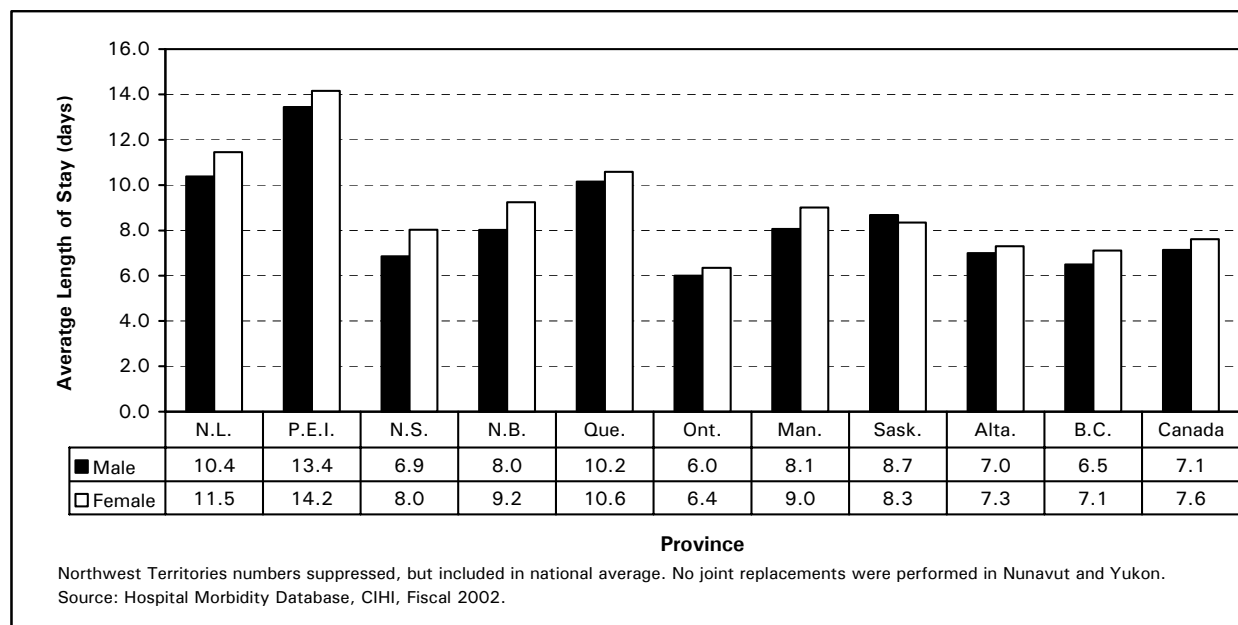


Figure 13. Average Length of Stay for Total Knee Replacement Patients by Sex and Province, Fiscal 2002

There was a noticeable decrease in the length of stay for total hip and knee replacements in all provinces as compared to 1994–1995. Nationally, the average length of stay for patients undergoing a total hip replacement decreased by 29% from 13.6 days in 1994–1995 to 9.6 days in 2002–2003. Similarly, total knee replacement recipients now spend an average of 7.4 days in hospital compared to 12.2 days in 1994–1995, a decrease of 39%.

In-Hospital Mortality

Post-operative in-hospital mortality is a relatively rare event among patients receiving a total hip or a total knee replacement (Table 18). Overall, in 2002–2003, less than 1% of patients undergoing total hip or total knee replacement surgery died in hospital (0.8% and 0.2%, respectively).

The risk of post-operative in-hospital death appears to increase with age. For example, the percentage mortality of total hip replacement patients under 75 years was 0.3%, compared with 4.8% for patients over the age of 85. Among knee replacement patients, the percent mortality increased from 0.1% among patients under age 75 to 0.6% among patients aged 85 and older.

Table 18. Number of In-Hospital Deaths Among Total Hip and Total Knee Replacement Patients by Age Group, Canada, Fiscal 2002

Age group	Total hip replacement patients		Total knee replacement patients	
	Number of recipients	Number of in-hospital deaths	Number of recipients	Number of in-hospital deaths
< 75	14,461	43 (0.3%)	18,325	15 (0.1%)
75–84	6,153	71 (1.1%)	7,409	40 (0.5%)
85 +	1,341	65 (4.8%)	786	5 (0.6%)
Total	21,955	179 (0.8%)	26,520	60 (0.2%)

Source: Hospital Morbidity Database, CIHI, Fiscal 2002.

Among patients who died during or after a hip or knee replacement procedure, most in-hospital deaths occurred among the 75 to 84 age category for both men and women and for both hip and knee replacements as shown below in Table 19.

Table 19. Number of In-Hospital Deaths Among Total Hip and Knee Replacement Patients by Age Group and Sex, Canada, Fiscal 2002

Age groups	Number of in-hospital deaths					
	Total hip replacement patients			Total knee replacement patients		
	Male	Female	Total	Male	Female	Total
<75	20	23	43	7	8	15
75-84	39	32	71	22	18	40
85+	22	43	65	<5	<5	5
All ages	81	98	179	32	28	60

Source: Hospital Morbidity Database, CIHI, Fiscal 2002.

The primary diagnosis reported most often for patients who died while having a hip replacement were fracture (37%), followed by osteoarthritis (10%) and mechanical complication (9%) as shown below in Figure 14. For those patients who died while having a knee replacement procedure, the primary diagnosis reported was mostly arthrosis (primary, secondary or unspecified—nearly 58%), followed by mechanical complication (5%) as seen in Figure 15.

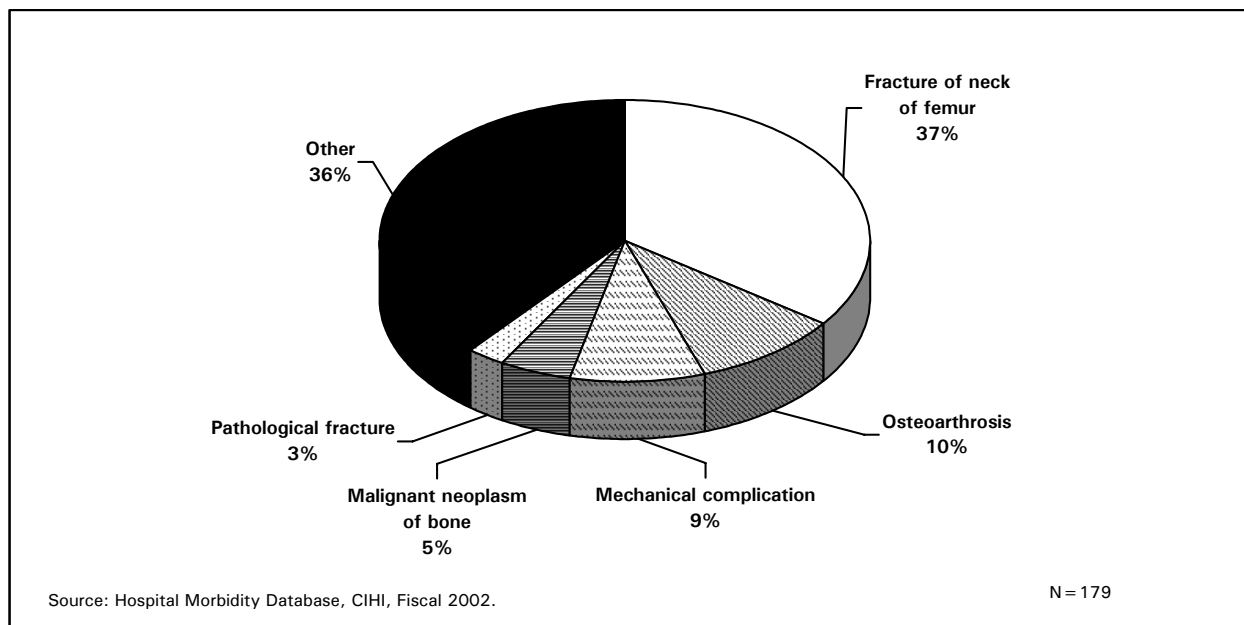


Figure 14. Primary Diagnosis Reported for Total Hip Replacement Patients, In-Hospital Deaths, Canada, Fiscal 2002

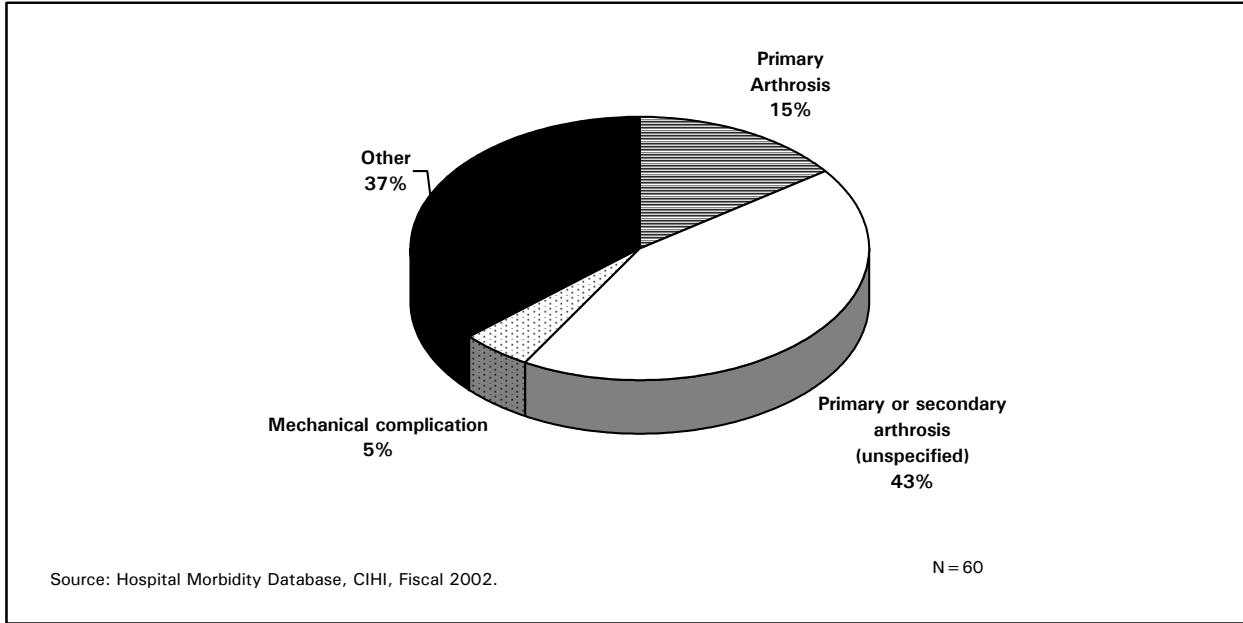


Figure 15. Primary Diagnosis Reported for Total Knee Replacement Patients, In-Hospital Deaths, Canada, Fiscal 2002

Surgical and Clinical Characteristics

Important Note: Analyses in this section are based on the CJRR database for fiscal 2002 and/or fiscal 2003. Except for the general counts of total hip and total knee replacements by sex, age, body mass index, and replacement type, all the analyses on surgical and clinical factors were conducted based on primary and revision procedures. All statistical tests performed in this section are two-sided tests (Chi-square or Fisher Exact, as appropriate) with a significance level of 0.05.

Also note that 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.

Overall Trends

Of the 44,997 submissions to the CJRR for total hip and total knee replacements during both fiscal 2002 and 2003 (from April 1, 2002 to March 31, 2004), 45% (n = 20,301) were total hip replacements and 55% (n = 24,696) were total knee replacements. Among the total submissions, 18,481 (41%) were from fiscal 2002 and 26,516 (59%) were from fiscal 2003. Overall, total data submissions have significantly increased by 43% from fiscal 2002 to 2003 (P = 0.014) (Figure 16).

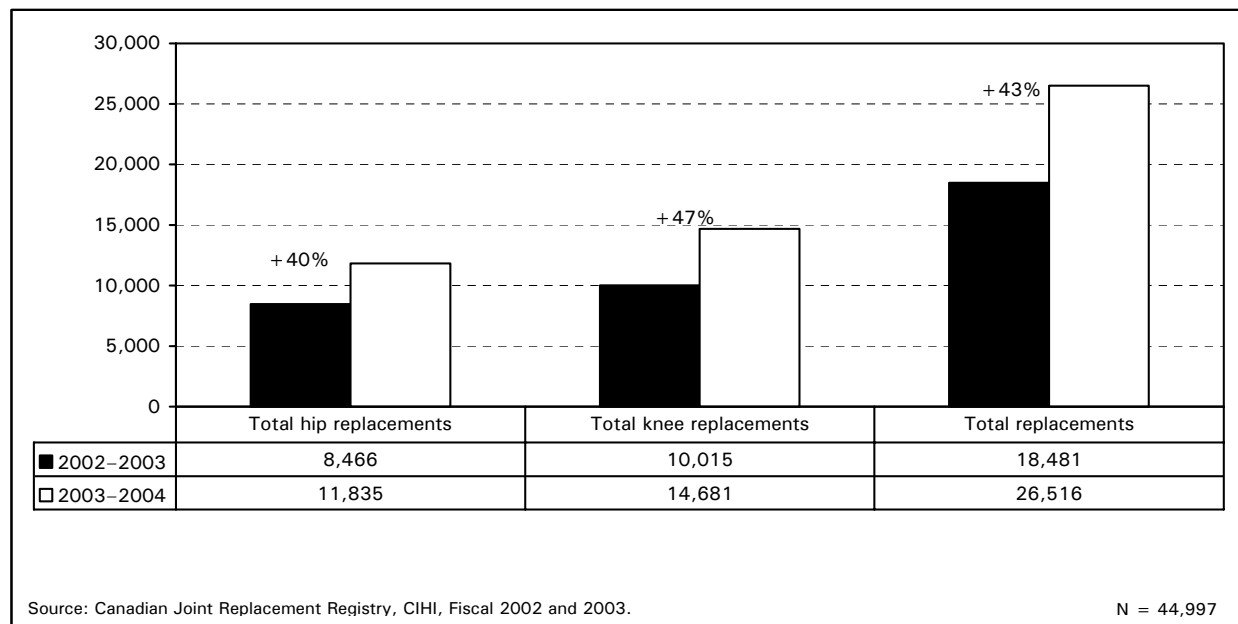


Figure 16. Total Hip and Total Knee Replacement Procedure Submissions to CJRR, Fiscal 2002 and 2003

Patient Demographics

A higher proportion of cases were female, as opposed to male, for hip replacement and knee replacement procedures, and this difference was statistically significant (58% and 61%, respectively, $P < 0.0001$).

With respect to patient age at the time of surgery, among hip and knee replacement patients, the highest proportions of cases were in the 65–74 age group, followed by the 75–84 age group, then the 55–64 age group (Figure 17). The lowest proportions of cases were in the youngest (<45 years) and oldest (≥ 85 years) age groups.

Although the distribution patterns across age groups were similar, patients undergoing knee replacements were older than those undergoing hip replacements, and this difference was statistically significant ($P < 0.0001$).

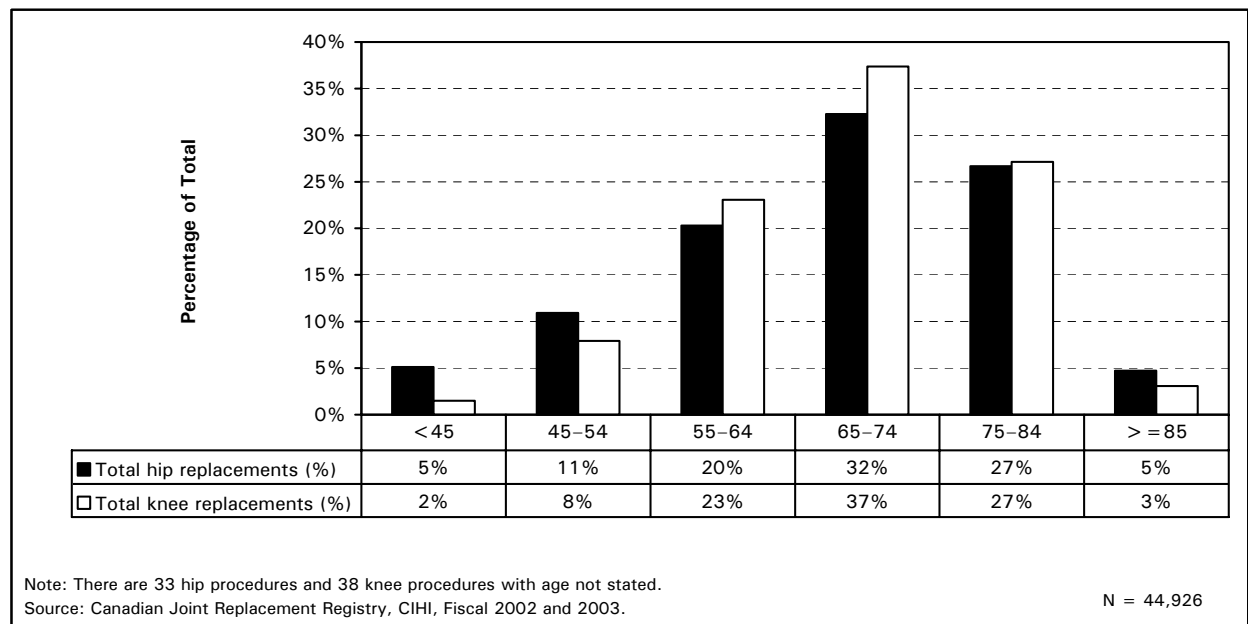


Figure 17. Total Hip and Total Knee Replacement Procedures by Age Group, Fiscal 2002 and 2003

Purpose of Surgery (Primary vs. Revision)

For both fiscal years, among total hip replacements, 87% (n = 17,553) were primary surgeries and 13% (n = 2,707) were revisions (Table 20). Primary total knee replacements accounted for 94% (n = 23,121) of all total knee replacements (Table 21). Revision surgeries accounted for the remaining 6% (n = 1,531). From fiscal 2002 to fiscal 2003, there were increases of 39% and 45% respectively for total primary hip replacements and total revision hip replacements, while the increases were 46% and 52% respectively for total primary knee replacements and total revision knee replacements.

Table 20. Type of Total Hip Replacement Procedures, Fiscal 2002 and 2003

Type of replacement	Fiscal 2002	Fiscal 2003	Fiscal 2002 and 2003		
	Number of replacements	Number of replacements	One-year % increase	Number of replacements	% of total
Primary	7,345	10,208	39.0%	17,553	86.5%
Revision	1,103	1,604	45.4%	2,707	13.3%
First revision	797	1,157	45.2%	1,954	72.2%
Second revision	222	314	41.4%	536	19.8%
Third revision	66	84	27.3%	150	5.5%
> 3 revisions	18	49	172.2%	67	2.5%
Excision	< 5	< 5	N/A	7	0.0%
Not stated	14	20	42.9%	34	0.2%
Total	8,466	11,835	39.8%	20,301	100.0%

Note: There are 34 hip forms for which type of procedure was not indicated.

Source: Canadian Joint Replacement Registry, CIHI, Fiscal 2002 and 2003.

Table 21. Type of Total Knee Replacement Procedures, Fiscal 2002 and 2003

Type of replacement	Fiscal 2002	Fiscal 2003	Fiscal 2002 and 2003		
	Number of replacements	Number of replacements	One-year % increase	Number of replacements	% of total
Primary	9,387	13,734	46.3%	23,121	93.6%
Revision	607	924	52.2%	1,531	6.2%
First revision	496	757	52.6%	1,253	81.8%
Second revision	92	136	47.8%	228	14.9%
Third revision	13	20	53.8%	33	2.2%
>3 revisions	6	11	83.3%	17	1.1%
Excision	5	5	0.0%	10	0.0%
Not stated	16	18	12.5%	34	0.1%
Total	10,015	14,681	46.6%	24,696	100.0%

Note: There are 34 knee forms for which type of procedure was not indicated.

Source: Canadian Joint Replacement Registry, CIHI, Fiscal 2002 and 2003.

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 grouping indicated for both primary total hip replacements (81%) and primary total knee replacements (92%) (Figures 18 and 19).

For primary total hip replacements, the second most commonly reported diagnosis grouping was osteonecrosis (5%), followed by inflammatory arthritis (4%). For primary total knee replacements, the second most commonly reported grouping was inflammatory arthritis (5%), followed by post-traumatic osteoarthritis (2%).

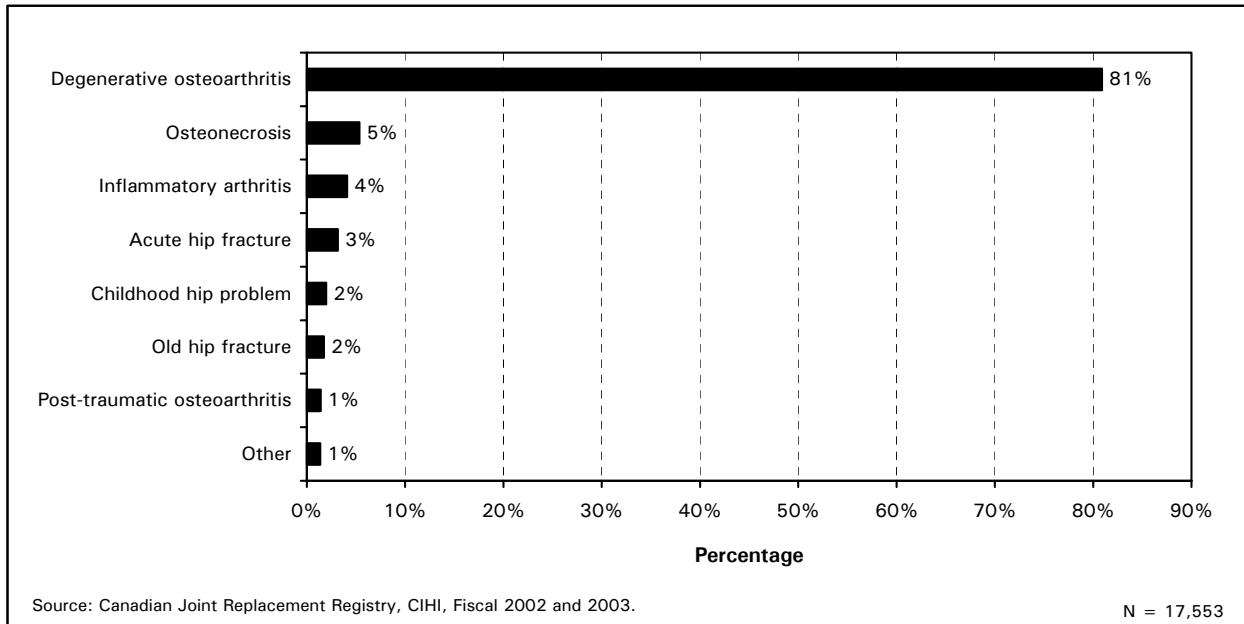


Figure 18. Primary Total Hip Replacement Procedures by Diagnosis Grouping, Fiscal 2002 and 2003

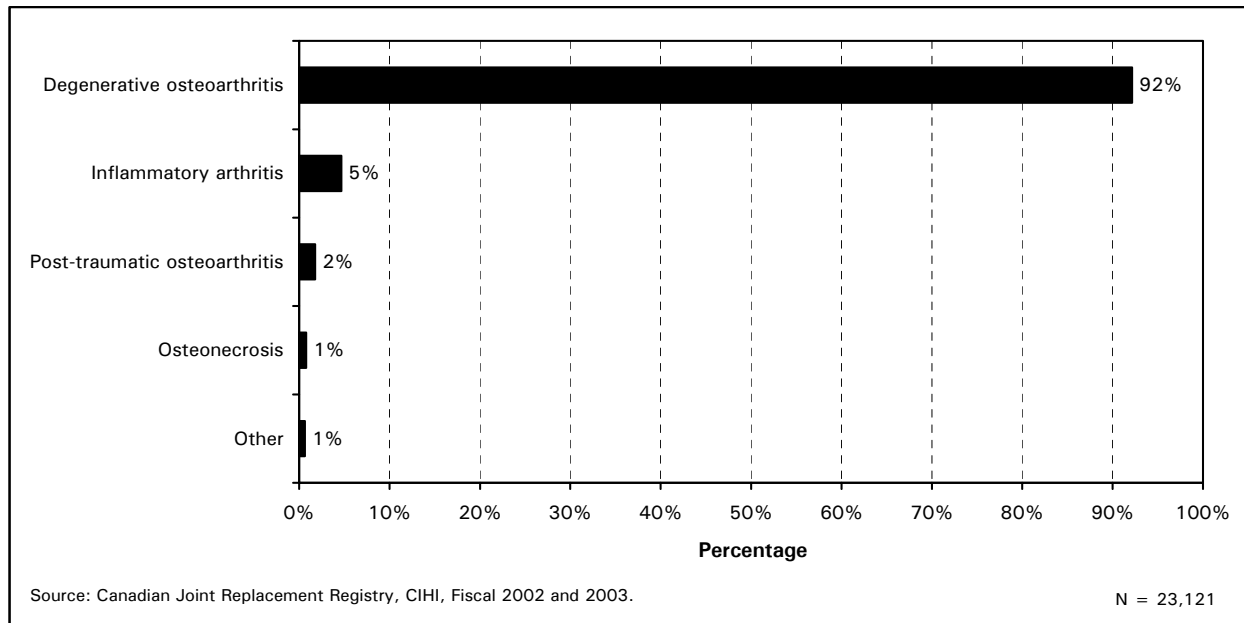


Figure 19. Primary Total Knee Replacement Procedures by Diagnosis Grouping, Fiscal 2002 and 2003

Reasons for Revision

For revision replacements 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 (57%), followed by osteolysis (30%), poly wear (24%) and instability (15%) (Figure 20).

Among the knee replacement revisions, the most common reason for revision reported was aseptic loosening (49%), followed by poly wear (36%), osteolysis (22%) and instability (13%) (Figure 21).

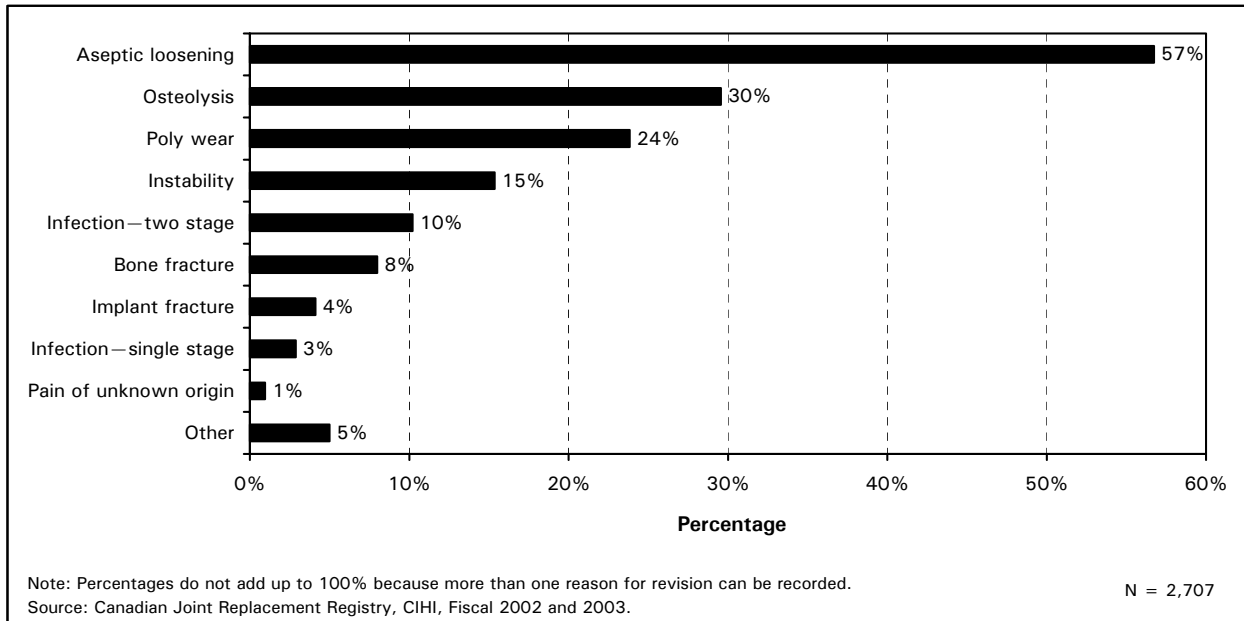


Figure 20. Reasons Reported for Revising Total Hip Replacement Procedures, Fiscal 2002 and 2003

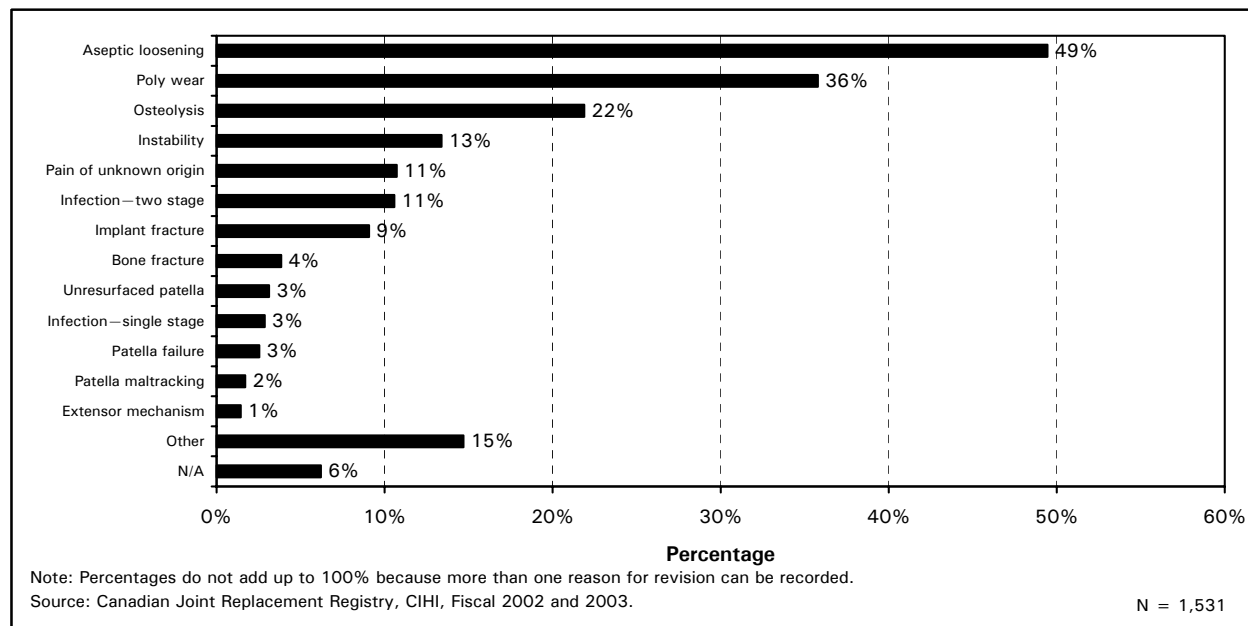


Figure 21. Reasons Reported for Revising Total Knee Replacement Procedures, Fiscal 2002 and 2003

Previous Operations

Among primary total hip replacement procedures, 93% (n = 16,363) had no previous operation recorded.

Among primary total knee replacement procedures (Figure 22), 72% (n = 16,695) did not have a previous operation reported. Arthroscopic debridement was reported 16% of the time, with arthroscopic meniscectomy and open meniscectomy reported 7% and 6% of the time, respectively.

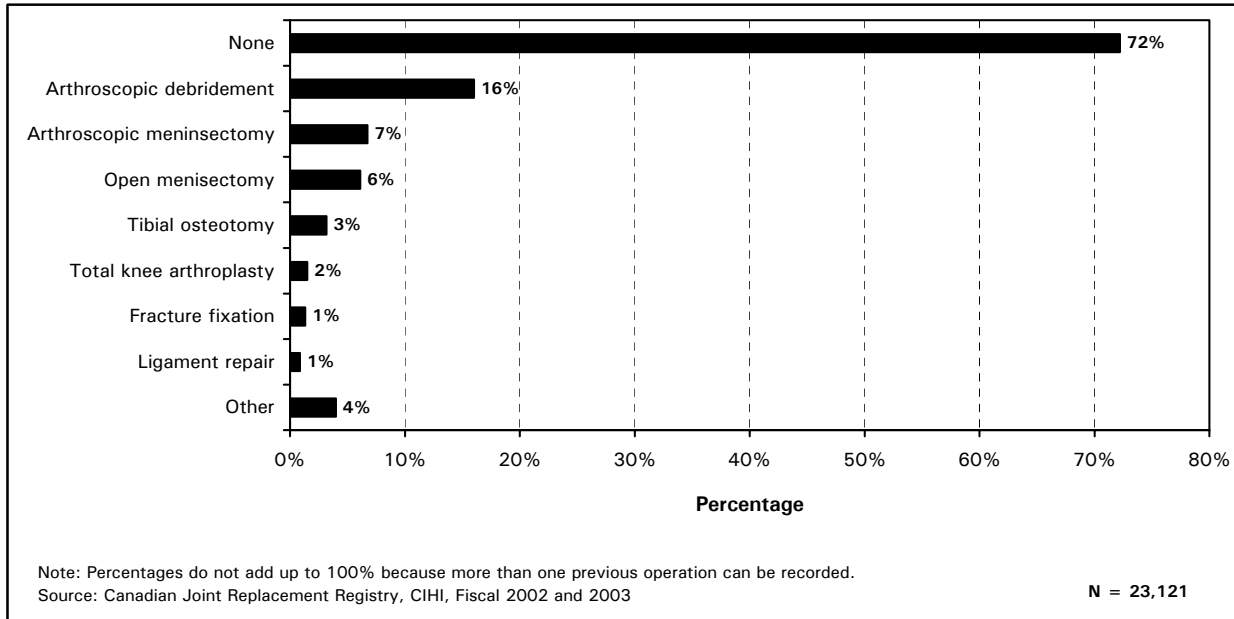


Figure 22. Previous Operations Reported for Total Knee Replacement Patients, Primary Replacements Only, Fiscal 2002 and 2003

Surgical Approach

The distribution of total hip replacement procedures by surgical approach is shown in Figure 23. The greatest proportion of the procedures was reported to have employed the direct lateral approach (47%), followed by the anterolateral approach (28%), and the posterolateral approach (24%). The Smith/Peterson approach and 2-incision approach were used in less than 1% of surgeries, respectively.

Figure 24 shows the distribution of surgical approaches among total knee replacements. The medial parapatellar approach was used in the majority (90%) of procedures. The intravastus, subvastus and lateral parapatellar approaches were used in only 8%, 1% and 1% of the procedures, respectively.

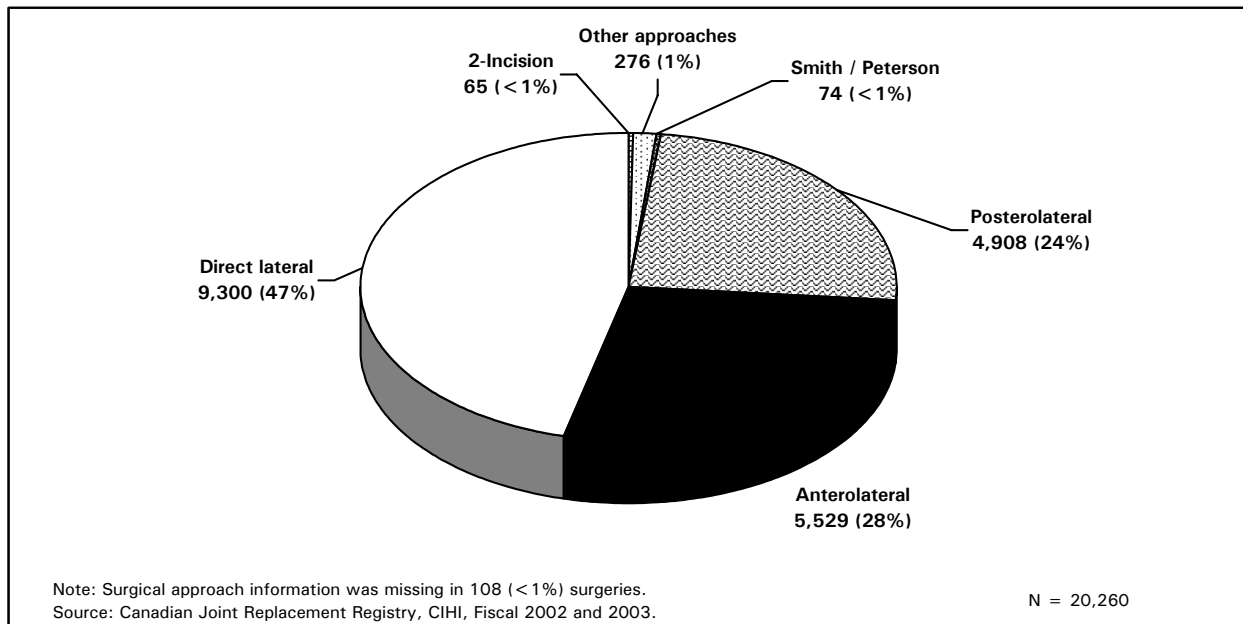


Figure 23. Surgical Approach for Total Hip Replacement Procedures, Fiscal 2002 and 2003

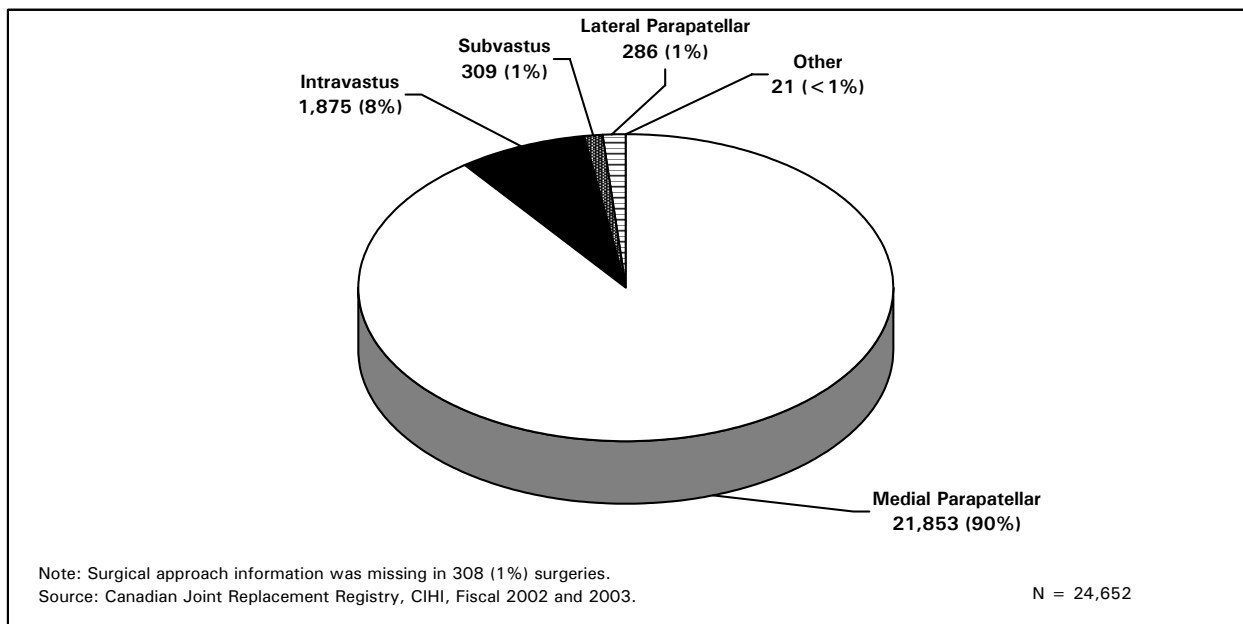


Figure 24. Surgical Approach for Total Knee Replacement Procedures, Fiscal 2002 and 2003

Deep Vein Thrombosis (DVT) Prevention

Total joint replacement surgery is associated with a high risk of deep venous thrombosis (DVT), therefore, it was not surprising that DVT prevention was reported in almost all (97%) total hip and total knee replacement procedures during fiscal 2002 and 2003. The three most common DVT prophylactic agents used were low molecular weight Heparin (61%), Warfarin (42%), and pneumatic stockings (10%) (Figure 25).

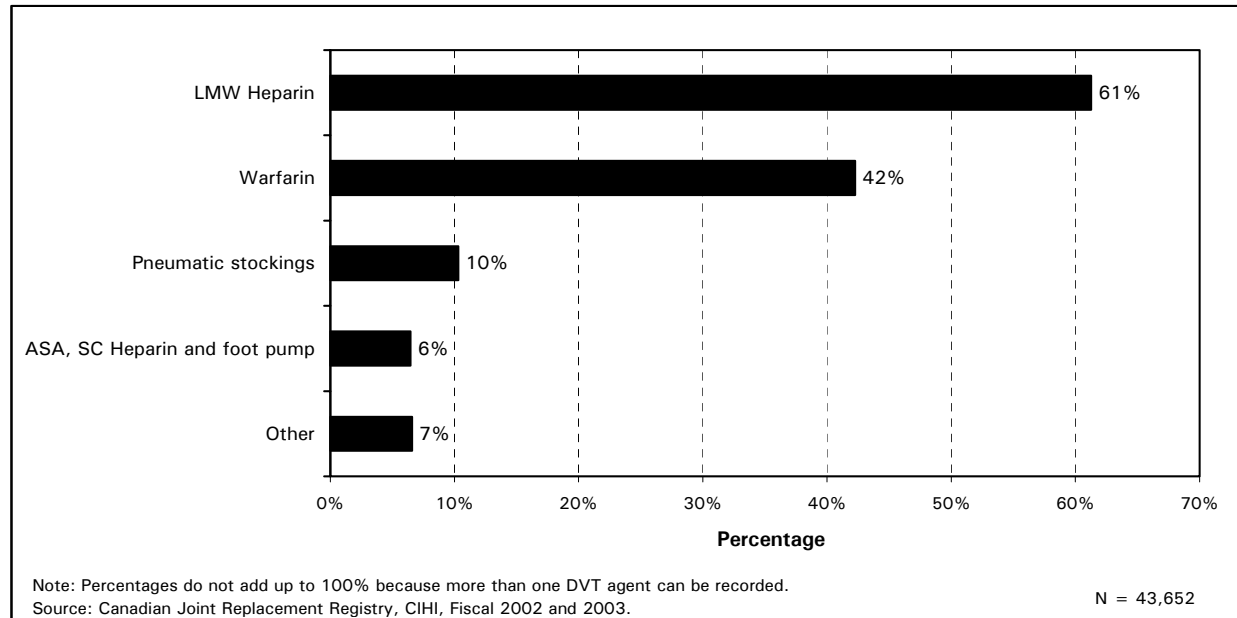


Figure 25. DVT Prevention Agent Used For Total Hip and Knee Replacement Procedures, Fiscal 2002 and 2003

Component Characteristics

Type of Components Replaced

Tables 22 and 23 indicate the number of components replaced in primary and revision total hip and total knee replacement procedures for both fiscal 2002 and 2003. Among primary hip and knee replacements, most components were replaced more than 90% of the time. Among revision procedures, however, the proportions of replaced components differed significantly among hip replacements ($P < 0.0001$) and knee replacements ($P < 0.0001$).

Among hip replacement revisions, femoral heads were most likely to be replaced (96%), and femoral stems were least likely to be replaced (75%). Among knee replacement revisions, the tibial component was most likely to be replaced (90%), followed by the femoral component (77%). The patella was resurfaced in 51% of revised total knee replacements, with the previous patellar implants being retained or the patella being left un-resurfaced in the remainder.

Table 22. Total Hip Replacements (Primary and Revision) by Type of Components Replaced, Fiscal 2002 and 2003

Response category	Primary—Components replaced							
	Femoral stem	%	Femoral head	%	Acetabular component	%	Acetabular inserts	%
Yes	17,410	99.2%	17,518	99.8%	17,334	98.8%	16,312	93.0%
No	130	0.7%	23	0.1%	202	1.1%	1,216	6.9%
Not stated	13	0.1%	12	0.1%	17	0.1%	25	0.1%
Total primary	17,553	100.0%	17,553	100.0%	17,553	100.0%	17,553	100.0%
Revision—Components replaced								
Yes	2,030	75.0%	2,592	95.8%	2,161	79.8%	2,251	83.2%
No	675	24.9%	112	4.1%	543	20.1%	454	16.7%
Not stated	2	0.1%	3	0.1%	3	0.1%	2	0.1%
Total revisions	2,707	100.0%	2,707	100.0%	2,707	100.0%	2,707	100.0%

Source: Canadian Joint Replacement Registry, CIHI, Fiscal 2002 and 2003.

Table 23. Total Knee Replacements (Primary and Revision) by Type of Components Replaced, Fiscal 2002 and 2003

Response category	Primary—Components replaced/resurfaced					
	Femoral component replaced	%	Tibial component replaced	%	Patella component resurfaced	%
Yes	23,085	99.8%	22,991	99.4%	17,238	74.6%
No	21	0.1%	115	0.5%	5,852	25.3%
Not stated	15	0.1%	15	0.1%	31	0.1%
Total primary	23,121	100.0%	23,121	100.0%	23,121	100.0%
Revision—Components replaced/resurfaced						
Yes	1,174	76.7%	1,374	89.8%	781	51.0%
No	355	23.2%	154	10.0%	740	48.3%
Not stated	2	0.1%	3	0.2%	10	0.7%
Total revisions	1,531	100.0%	1,531	100.0%	1,531	100.0%

Source: Canadian Joint Replacement Registry, CIHI, Fiscal 2002 and 2003.

Size of Components Replaced

Figures 26 and 27 show the distribution of reported head sizes for replaced femoral heads among primary and revised total hip replacements, respectively. Among primary hip replacements, by far, the most frequently reported head size was 28 mm (79%), followed by the 32 mm head size (12%).

As with primary hip replacements, among revised total hip replacements, a head size of 28 mm was also the leading choice, representing about half of the procedures (50%). The 32 mm head size was again the second most frequently reported option (31%). A study published recently on the effect of larger head sizes for total hip arthroplasty on the type of impingement, range of motion, and joint stability reported that larger femoral heads offered potential in providing greater range of motion and joint stability.⁴

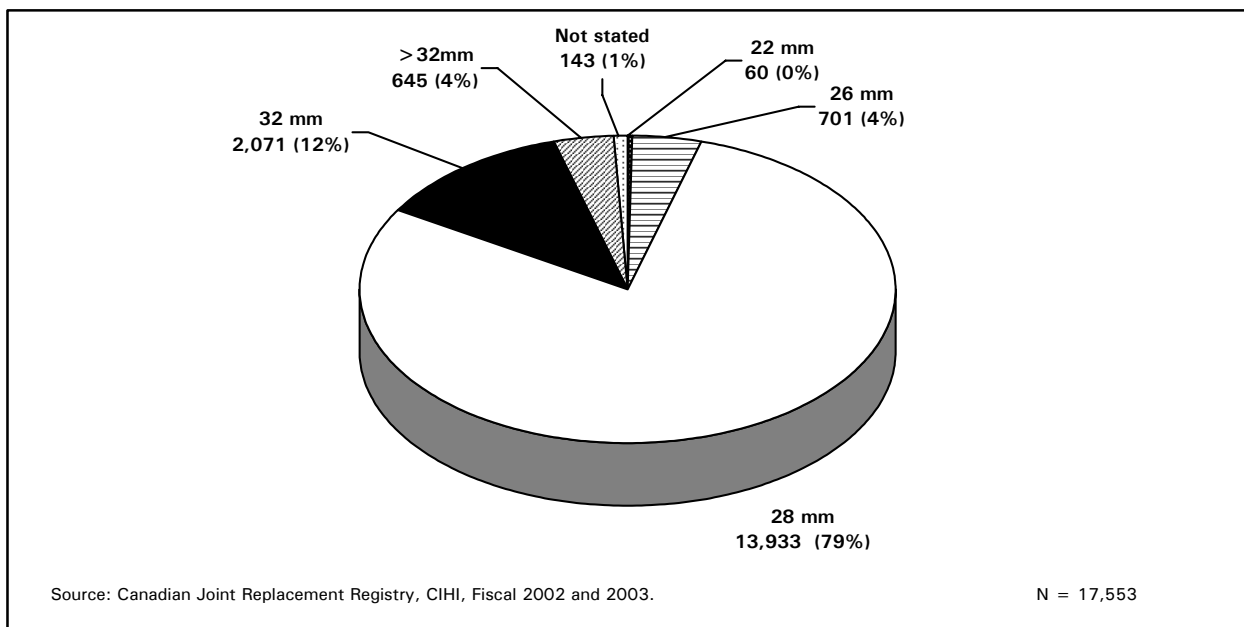


Figure 26. Primary Total Hip Replacements by Size of Femoral Head, Fiscal 2002 and 2003

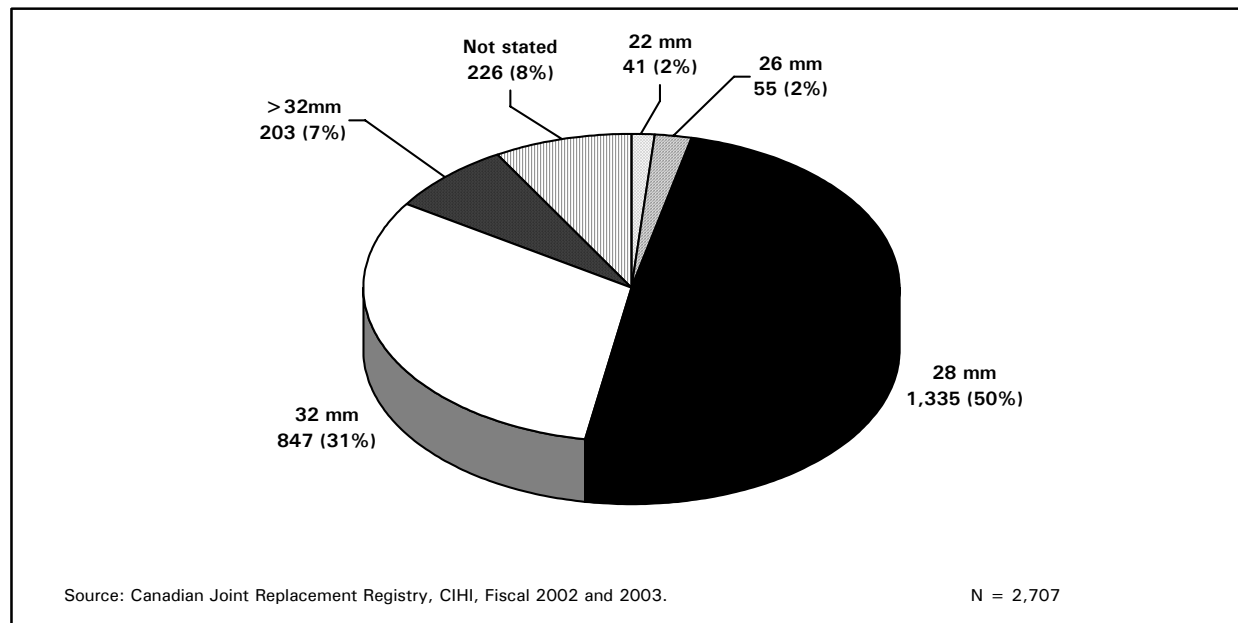


Figure 27. Revised Total Hip Replacements by Size of Femoral Head, Fiscal 2002 and 2003

Fixation Method

Overall

Use of cement fixation varied between hip and knee replacements. While most hip replacements were cementless (61%), the converse was true for knee replacements, with 83% of them being cemented (Figures 28 and 29). Use of hybrid cement fixation was reported for nearly one-third (31%) of all hip replacements and 14% of all knee replacements.

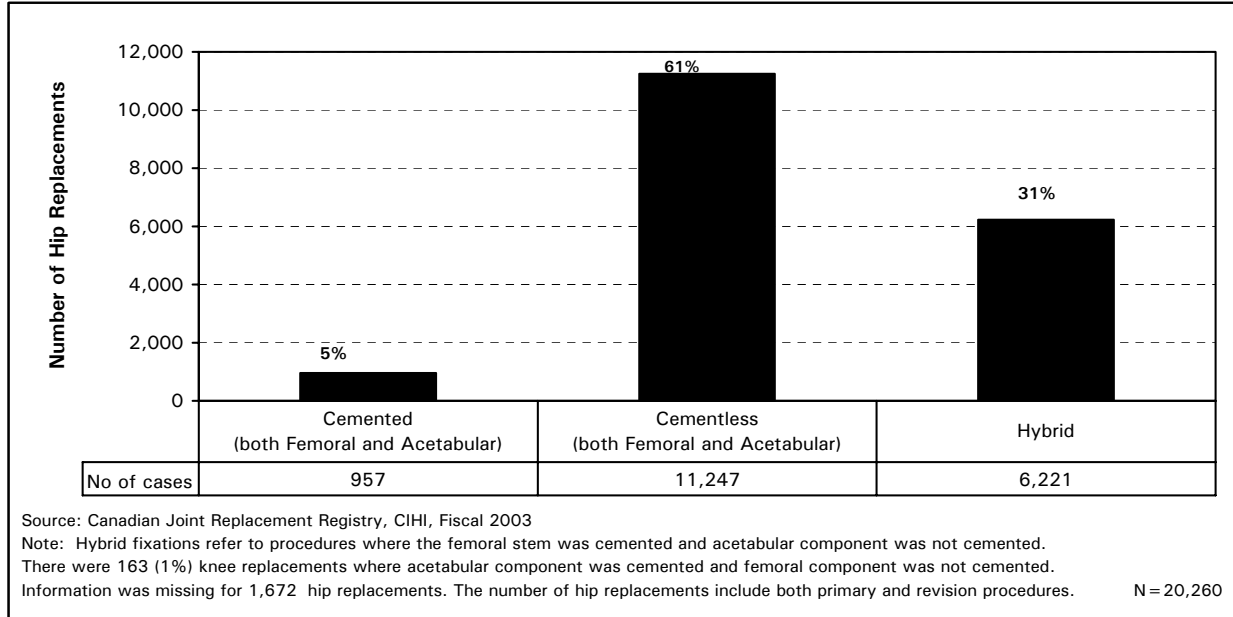


Figure 28. Fixation Method For Total Hip Replacement Procedures, Fiscal 2002 and 2003

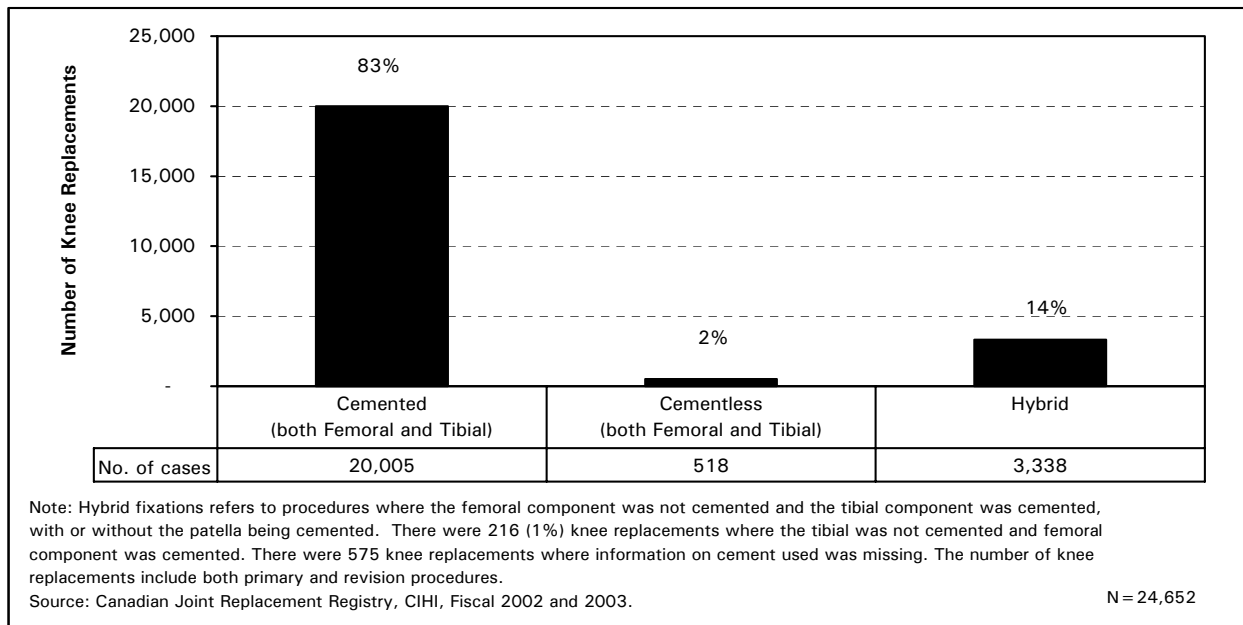


Figure 29. Fixation Method for Total Knee Replacement Procedures, Fiscal 2002 and 2003

Fixation Method by Components Replaced

Figure 30 shows the type of fixation method used for replaced femoral stems and replaced acetabular components among total hip replacements. Cement was used in about 37% of the procedures for femoral stems, whereas for acetabular components only 6% of the

Fixation Method by Components Replaced

Figure 30 shows the type of fixation method used for replaced femoral stems and replaced acetabular components among total hip replacements. Cement was used in about 37% of the procedures for femoral stems, whereas for acetabular components only 6% of the procedures used cement. The differing cement use between the two components was found to be statistically significant ($P < 0.0001$).

Figure 31 shows the type of fixation method used for replaced femoral, tibial and resurfaced patella components among total knee replacement surgeries. Cement was used among 82% of femoral replacements, 95% for tibial replacements, and 71% for resurfaced patella components, and these differences were statistically significant ($P < 0.0001$).

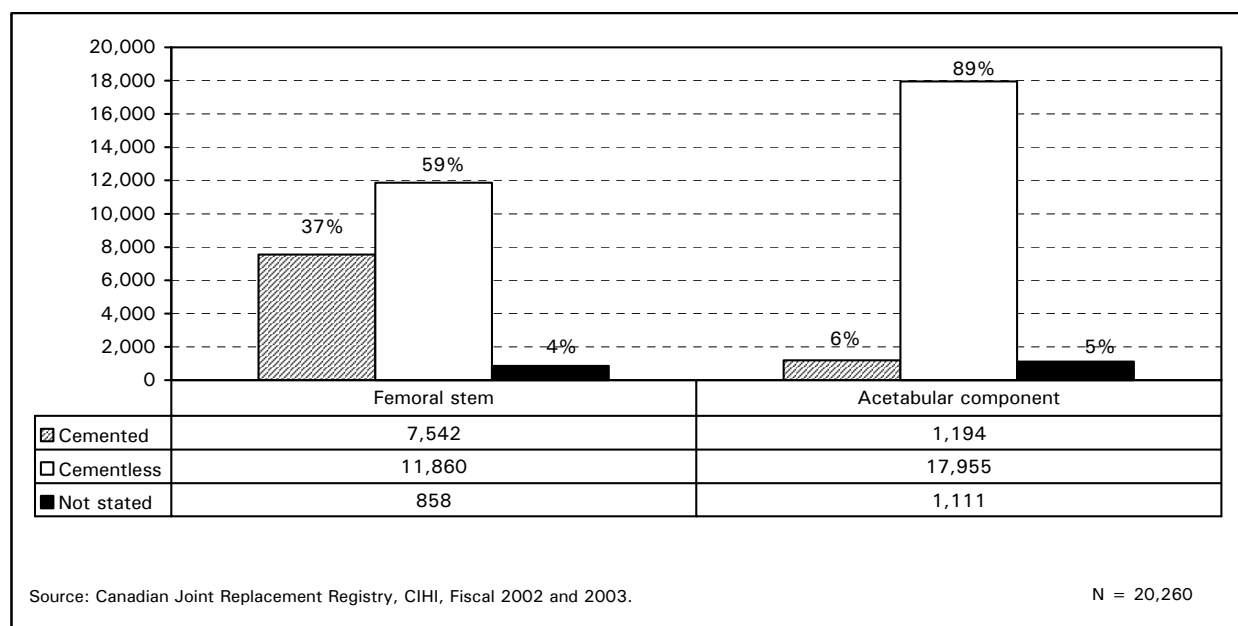


Figure 30. Fixation Method Used for Replaced Femoral Stems and Acetabular Components, Total Hip Replacements, Fiscal 2002 and 2003

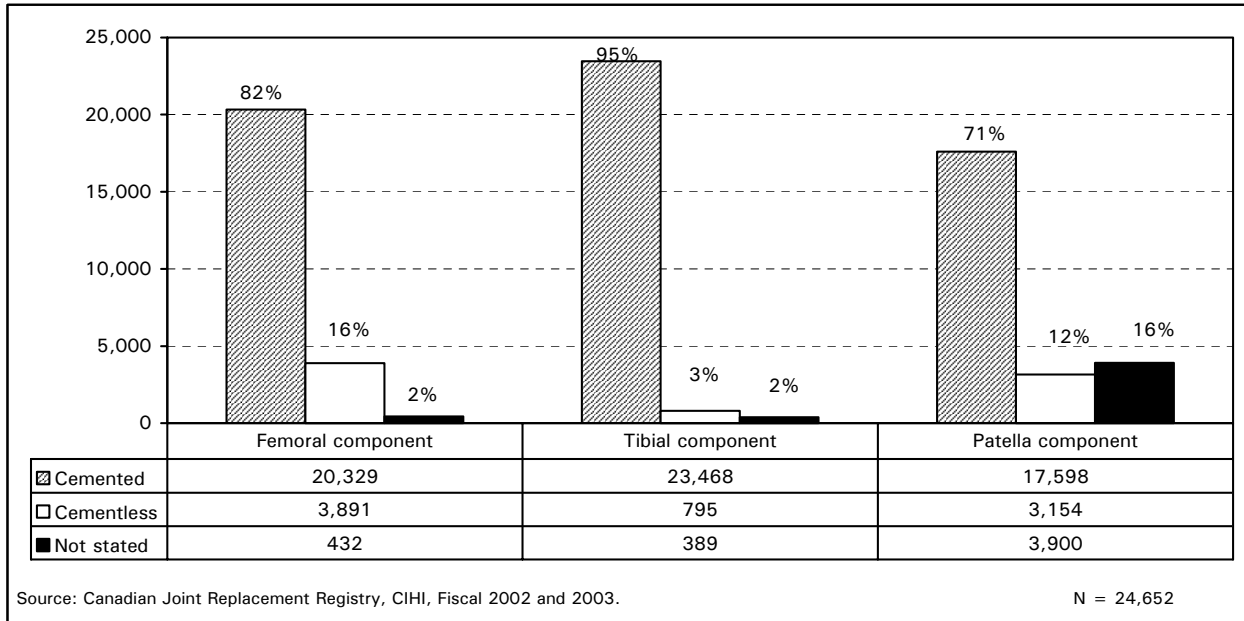


Figure 31. Fixation Method Used for Replaced Femoral, Tibial and Patella Components, Total Knee Replacements, Fiscal 2002 and 2003

Bearing Surfaces for Hip Replacements

Figure 32 shows the various combinations of femoral head and acetabular liner material used in total hip replacements. Among bearing surfaces, the two most frequently reported combinations were a cobalt chrome femoral head with a polyethylene standard liner (36%) and cobalt chrome head with a polyethylene cross-linked liner (35%). Ceramic with ceramic was reported more often (6%) than metal on metal (1.5%). The one-piece combination was quite rare accounting for < 1 % of all cases.

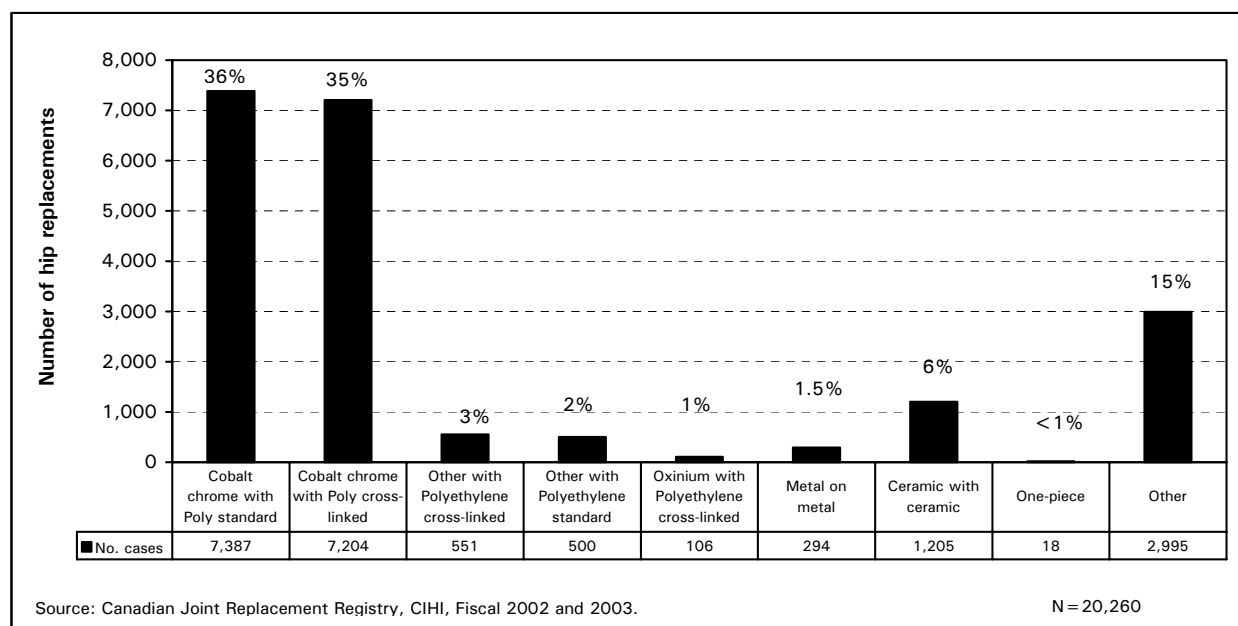


Figure 32. Bearing Surfaces for Total Hip Replacements, Fiscal 2002 and 2003

Bone Graft Use

Starting with data collection in fiscal 2003, information was captured regarding bone graft use on the femur and acetabulum among hip replacements, as well as on the femur and tibia among knee replacements. Overall, bone grafts were reportedly used on a limited basis within either primary or revision procedures for each component. However, as shown in Tables 24 and 25, bone grafts were used much more frequently among revision procedures compared to primary procedures for both total hip and total knee replacements. For example, in the case of hip replacements, the proportions of bone graft use on femur were only 2.1% among primary procedures versus 26.2% among revisions. The respective proportions for acetabulum were 6.6% versus 28.5%. The variations of bone graft use on each of the components between primary and revision procedures were all statistically significant ($P < 0.0001$).

Table 24. Bone Graft Use on Femur and Acetabulum, Total Hip Replacements (Primary and Revision), Fiscal 2003

Bone graft use	Femur				Acetabulum			
	Primary	%	Revision	%	Primary	%	Revision	%
Yes	209	2.1%	420	26.2%	674	6.6%	457	28.5%
No	9,154	89.7%	943	58.8%	8,708	85.3%	945	58.9%
Not stated	845	8.2%	241	15.0%	826	8.1%	202	12.6%
Total	10,208	100.0%	1,604	100.0%	10,208	100.0%	1,604	100.0%
Chi-Square test	P < 0.0001				P < 0.0001			

Source: Canadian Joint Replacement Registry, CIHI, Fiscal 2003.

Table 25. Bone Graft Use on Femur and Tibia, Total Knee Replacements (Primary and Revision), Fiscal 2003

Bone graft use	Femur				Tibia			
	Primary	%	Revision	%	Primary	%	Revision	%
Yes	709	5.2%	153	16.6%	252	1.8%	142	15.4%
No	12,131	88.3%	682	73.8%	12,588	91.7%	693	75.0%
Not stated	894	6.5%	89	9.6%	894	6.5%	89	9.6%
Total	13,734	100.0%	924	100.0%	13,734	100.0%	924	100.0%
Chi-Square test	P<0.0001				P<0.0001			

Source: Canadian Joint Replacement Registry, CIHI, Fiscal 2003.

Body Mass Index

Obesity is one of the factors associated with osteoarthritis.⁵ Since osteoarthritis is a primary reason for joint replacement procedures, it was of interest to examine Body Mass Index (BMI) distributions among hip and knee replacement patients. BMI is calculated as: weight in kilograms divided by height in metres squared. Patients were assigned to the following internationally accepted BMI categories: under 18.5 (underweight); 18.5–24.9 (acceptable weight); 25.0–29.9 (overweight); 30.0 or higher (obese).⁶

Analyses were applied to fiscal 2003 data with valid height and weight values, comprising 65% (n = 17,244) of all cases. BMI distributions were found to be significantly different between patients having hip replacements versus those having knee replacements (P<0.0001). Patients with knee replacements were more likely to be overweight or obese (87% combined), compared to hip replacement patients (72% combined) (Figure 33). Both hip and knee replacement patients were rarely underweight (2% and 1%, respectively).

Although 65% of cases were acceptable for this study, data may not be completely representative of the BMI distribution of all hip and knee joint replacement patients in Canada. This topic will be investigated further in the future as more complete height and weight values are captured and collected by the registry.

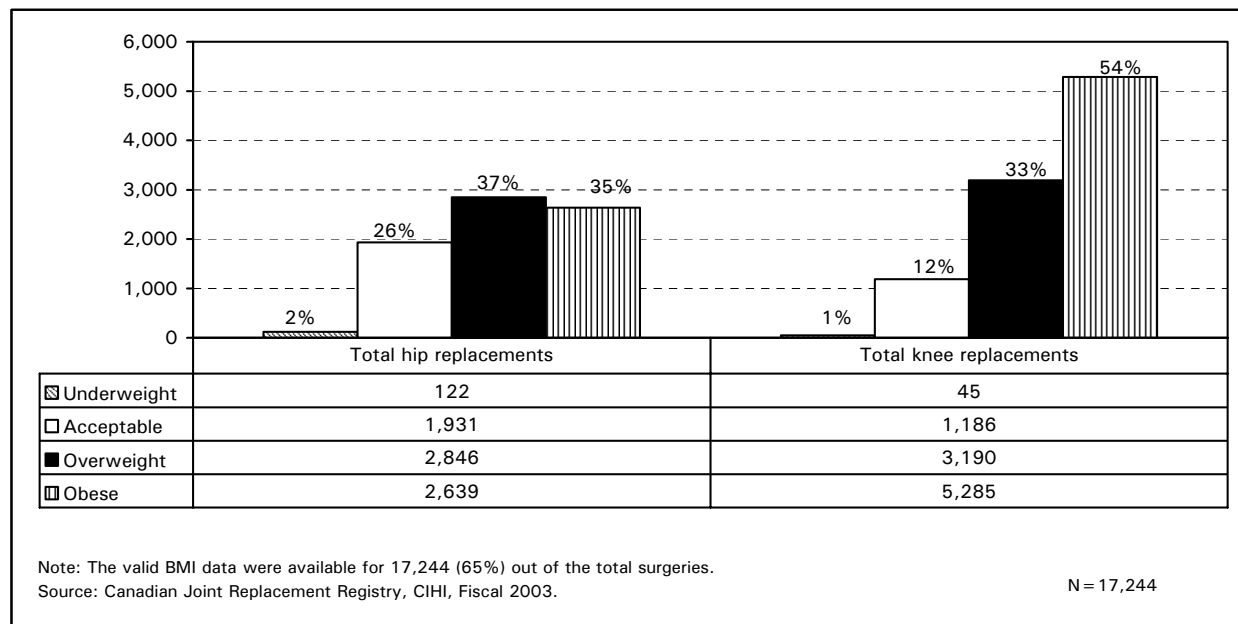


Figure 33. Total Hip and Total Knee Replacement Patients by Body Mass Index Category, Fiscal 2003

Special Surgical Techniques

Minimally Invasive Surgery (MIS)

MIS is an emerging surgical technique used for hip and knee replacements. The purported benefits of this approach include: smaller dissections, reduction in blood loss, shorter length of stays in hospital and quicker rehabilitation process.⁷ Beginning from fiscal 2003, CJRR started collecting information on MIS.

Overall, only a small percentage (8%) of the surgical approaches were classified as minimally invasive—9% of total hip replacements and 7% of total knee replacements (Figure 34).

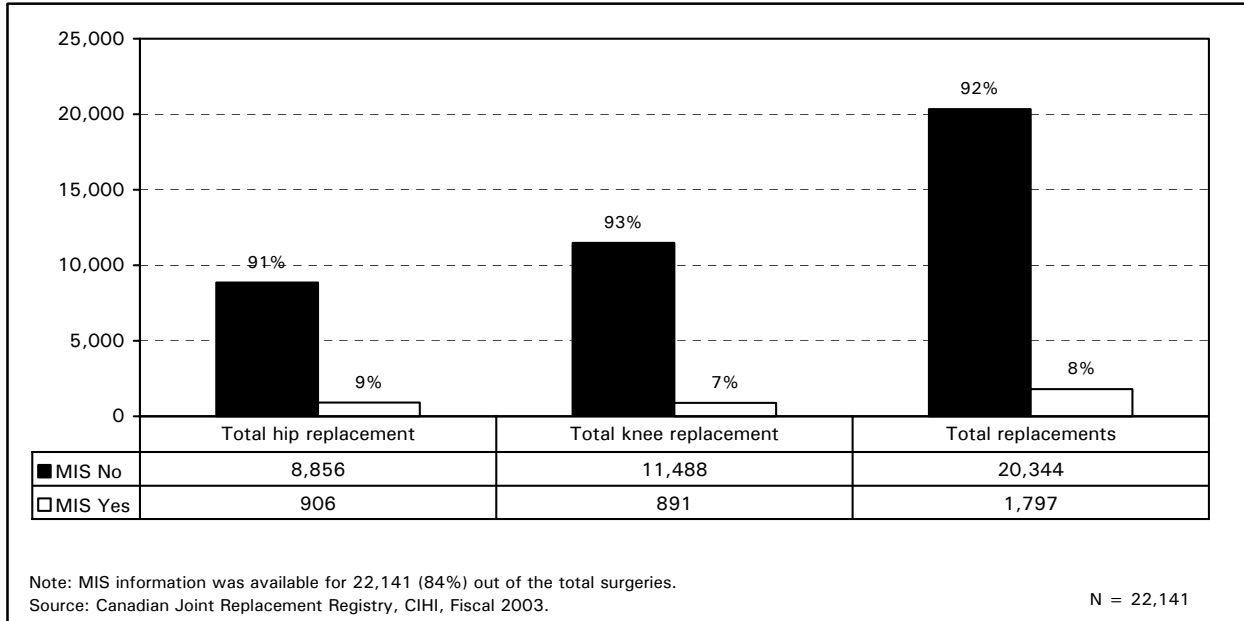


Figure 34. Use of Minimally Invasive Surgery in Total Hip and Knee Replacement Procedures, Fiscal 2003

Tables 26 and 27 show the number and percent of hip and knee replacements that were performed using the traditional (non-MIS) and the MIS approach by age and by gender. MIS approach was more common among patients aged <45 yrs and 45 to 54 years for hip replacements (9%) and among patients aged 45–54 years for knee replacements (10%).

Overall, the use of MIS approach did not vary widely by sex. The number of procedures where MIS approach was used was slightly higher for females (53% for hips and 55% for knees) than for males.

Table 26. Use of Minimally Invasive Surgery in Total Hip and Knee Replacements by Age Group, Fiscal 2003

Age groups	Hip replacements			Knee replacements		
	MIS	All THR	% MIS	MIS	All TKR	% MIS
< 45	59	634	9%	19	215	9%
45–54	119	1,279	9%	117	1,152	10%
55–64	182	2,388	8%	280	3,403	8%
65–74	288	3,782	8%	292	5,494	5%
75–84	215	3,162	7%	164	3,975	4%
> = 85	43	574	7%	18	431	4%
Total	906	11,819	8%	890	14,670	6%

Source: Canadian Joint Replacement Registry, CIHI, Fiscal 2003.

Notes:

- 1) There were 2,069 cases where surgical approach was not indicated and 16 cases where age was not indicated for hip replacements.
- 2) There were 2,297 cases where surgical approach was not indicated and 11 cases where age was not indicated for knee replacements.

Table 27. Use of Minimally Invasive Surgery in Total Hip and Knee Replacements by Sex, Fiscal 2003

Sex	Hip replacements				Knee replacements			
	MIS		Traditional		MIS		Traditional	
	Counts	%	Counts	%	Counts	%	Counts	%
Male	425	47%	3,698	42%	404	45%	4,438	39%
Female	481	53%	5,158	58%	487	55%	7,049	61%
Total	906	100%	8,856	100%	891	100%	11,487	100%

Source: Canadian Joint Replacement Registry, CIHI, Fiscal 2003.

Note: Patient's sex was not indicated for 1 knee replacement.

Unicompartmental Knee Arthroplasty (UKA)

Unicompartmental prostheses were used in 7% of all knee replacements reported to CJRR in fiscal 2002 and 2003.

Unicompartmental knee arthroplasty procedures were performed most often on the medial compartment as opposed to the lateral or the patellofemoral compartment. Among UKA procedures where information on compartments were reported to CJRR, nearly 97% were performed on the medial followed by the lateral (2%) and very few on the patellofemoral (1%) compartment.

Though the use of an MIS approach was quite rare across all knee replacement procedures, this technique was employed in nearly 61% of all unicompartmental knee arthroplasty procedures. It must be noted that these findings are similar to those of the Swedish Knee Arthroplasty Register, which has reported that use of MIS has been increasing over time. MIS approach was used in 58% of unicompartmental knee arthroplasty cases in 2003, compared to 46% in 2002 and 15% in 1999.⁸

Hip Resurfacing

Starting from fiscal 2003, information was collected on whether surface replacement was performed on the femoral head for total hip replacement surgeries. Based on data for fiscal 2003 only, surface replacements were performed in only 5% of hip replacements where the femoral head was replaced. No surface replacements were reported for 57% of hip replacements and this information was not available for 38% of hip replacements.

Discussion and Future Directions

The CJRR 2005 Annual Report makes use of multiple data sources to highlight important trends and regional variations for total hip and knee replacements across Canada, as well as provide detail on the nature and type of surgeries performed. This information is used by decision-makers involved in managing health care systems, orthopaedic surgeons and related care providers, researchers, as well as the general public.

This year, additional analyses are presented on topics of clinical interest such as bearing surface, bone graft use, minimally invasive surgery, unicompartmental knee arthroplasty, and hip resurfacing. This information is needed to keep up with continually changing practices in the orthopaedic field. Of note, CJRR has recently enhanced its data collection tool. New CJRR data collection forms were launched as of April 1, 2005 that included the capture of surgical techniques such as the use of metal augments, including trabecular metal, as well as a new section capturing wait time information.

At least over the next few years, reporting on hospitalization statistics from hospital abstracts will be based on a mix of coding classification systems, the Canadian Classification of Procedures (CCP) and the newer Canadian Classification of Health Interventions (CCI). CCI coding allows for greater detail in the coding for hip and knee replacements. Most importantly, partial knee replacements can now be distinguished from total knee replacements in CCI, a feature not available in the CCP classification system. The switch to the new ICD-10-CA, CCI classification system has occurred in a staggered manner across the country. All provinces and territories, except Manitoba, Quebec, and New Brunswick have made the change as of HMDB fiscal 2002, which is the data year presented in this report. New Brunswick has made the change as of fiscal 2003, and Manitoba has made the change as of fiscal 2004. Quebec plans to implement ICD-10-CA/CCI in 2006.

Despite these coding issues, CJRR is able to report on the variations in rates of hip and knee replacement surgeries across the country. Although the data do not provide the reasons behind these variations, factors such as health human resources, referral patterns, operating room time, and clinical management practices may play a role. In addition, the prevalence of predisposing clinical conditions (e.g. osteoarthritis), the aging population, as well as patient preferences and awareness would also upwardly influence the demand for total joint replacements. Of note, rates in this report have already been adjusted for differences in age structures between provinces and territories, leading to the conclusion that factors other than age structures account for variations in provincial rates.

Little is currently known about how many patients are waiting for a total joint replacement in Canada and how long they wait to have their operation once a decision is made to proceed with the surgery. CIHI's interest in the capture of wait time information for hip and knee replacement patients is part of a broader initiative to collect national wait time data. Indeed, wait time may impact pre-operative physical functioning and post-operative clinical outcomes of joint replacement candidates. A number of national as well as regional initiatives are underway. The federal/provincial/territorial Ministers of Health have committed to establish benchmarks for medically acceptable wait times for joint

replacements and other priority areas by December 31, 2005, as part of a process to achieve meaningful reductions in wait times in these areas by 2007.⁹ Both the national Wait Time Alliance,¹⁰ consisting of 6 medical specialty societies including the Canadian Orthopaedic Association, as well as the Western Canada Waiting List Project,¹¹ have put forward wait time benchmarks for joint replacement patients according to the patient's assessed priority level. Provincial-level wait time information is available in several regions, such as British Columbia,¹² Alberta,¹³ Saskatchewan,¹⁴ and Ontario.¹⁵

Looking ahead, CJRR is anticipating a continued growth trajectory, allowing it to become an increasingly relevant source of health information for decision-makers. With the ongoing creation of regional databases, such as the Winnipeg Regional Health Authority's Joint Replacement Registry, the amount of data captured in the CJRR will continue to increase. CJRR has experienced both increases in participation numbers as well as increases in the volume of submissions to the database. The most recent data show a participation rate of 72% for CJRR, in comparison with 63% reported in the 2004 CJRR Annual Report. Gains have been made in every province, with notable increases in Saskatchewan, Manitoba, and Alberta. Seven of the 10 provinces now have participation rates over 85%. Furthermore, the number of paper submissions to CJRR has increased by 14%, and the total data submissions (including electronic data) have increased by 43% over the past two years. Electronic data increases are attributed to an increased caseload from the OJRR, and the addition of a large acute care facility in British Columbia as an electronic data provider to the CJRR.

One of the objectives of CJRR is to provide outcome information. CJRR is working towards obtaining and analyzing information on health outcomes of joint replacement patients, in partnership with Statistics Canada and other organizations. The concept of health outcomes has moved beyond survival, adverse effects and clinical efficacy and has broadened to reflect the need to understand patients' experiences of health, illness, and treatment. Therefore, it is important to assess not only the clinical and economic impacts of health care, but also humanistic outcomes for these patients within the framework of the personal and social limitations, functional status changes, and impact on daily life. Health outcomes measure relevant variables that are expected to be affected by interventions, such as joint replacement surgery, or reduced wait times for that surgery. An important component of health outcome assessment is to demonstrate the value of a new treatment or technology, and CJRR will pursue outcomes assessment in terms of technologies used in joint replacement. Clearly, the physical conditions leading to the need for joint replacement can be debilitating and CJRR will continue to strive to assess broader health outcomes.

CJRR is also working with Statistics Canada to collect vital statistics data on joint replacement patients, as part of capturing the complete spectrum of outcome information. Vital statistics data will add significantly to the registry's ability to reflect a truly longitudinal picture of patient outcomes related to hip and knee replacement surgery. Such data will enhance the national scope of the database.

Other future directions for CJRR include the measuring and monitoring of revision rates, particularly as they relate to specific implants. New health care therapies, including new surgical techniques and prostheses for joint replacement should be evaluated by comparing the new therapy to both existing practice and minimum standard of care. Costs, as well as safety, effectiveness and quality of life and other patient reported outcomes should be incorporated into any such comparison.

As new technologies and surgical techniques appear on the horizon for joint replacements, CJRR is committed to providing health outcomes data that is reflective of the ever changing hip and knee replacement experience in Canada. CJRR is 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.

References

1. Canadian Institute for Health Information (CIHI). *Canadian Joint Replacement Registry (CJRR). Total Hip and Total Knee Replacements in Canada (includes 1994–1995 to 1999–2000 data)*. (Ottawa: CIHI, 2002).
2. Ontario Joint Replacement Registry (OJRR). *Total Joint Replacements in Ontario: Annual Report 2004*. (London: OJRR, 2005).
3. Statistics provided by Med-Écho, Quebec, December 2004.
4. Burroughs B. R., Hallstrom B., Golladay G.J., Hoeffel D., Harris W.H., "Range of Motion and Stability in Total Hip Arthroplasty With 28-, 32-, 38-, and 44-mm Femoral Head Sizes: An In Vitro Study," *Journal of Arthroplasty*, January 2005; Volume 20 (1).
5. Felson DT, Lawrence RC, Dieppe PA, Hirsch R, Helmick CG, Jordan JM et al, "Osteoarthritis: new insights. Part I," *Ann Intern Med* 2000; 133(8):635–646.
6. Health Canada. *Canadian Guidelines for Body Weight Classification in Adults*. (Ottawa: Minister of Public Works and Government Services Canada, 2003).
7. Bogoch.R. E., *Minimally Invasive Arthroplasty—Proceed with Caution: COA Scientific articles, 2002*. <http://www.coa-aco.org/library_NEW/Minimally_Invasive_Arthropla.asp>. Accessed February 24, 2005.
8. Swedish Knee Arthroplasty Register. Part I- Annual Report 2004. (Sweden: Swedish Knee Arthroplasty Register, 2004).
9. *A 10-year Plan to Strengthen Health Care*. <<http://pm.gc.ca/eng/news.asp?id=260>> Accessed April 6, 2005.
10. Wait Time Alliance. *No More Time to Wait: Toward Benchmarks and Best Practices in Wait-Time Management*. An Interim Report by the Wait Time Alliance for Timely Access to Health Care. March 2005.
11. Western Canada Waiting List (WCWL) Project. *Final Report: Moving Forward*. WCWL; February 28, 2005.
12. British Columbia Ministry of Health Services Surgical Wait List Registry <<http://www.healthservices.gov.bc.ca/waitlist/>>. Accessed April 6, 2005.
13. Alberta Waitlist Registry <<http://www.health.gov.ab.ca/waitlist/WaitListPublicHome.jsp>>. Accessed April 6, 2005.
14. Saskatchewan Surgical Care Network Wait List Information <<http://www.sasksurgery.ca/wait-list-info.html>>. Accessed April 6, 2005.
15. Institute for Clinical Evaluative Sciences (ICES). *Access to Health Services in Ontario*. (Toronto: ICES, April 2005).
16. Amstutz H.C, *History of Hip Resurfacing*: Joint Replacement Institute, UCLA <http://www.jri-oh.com/jri_hip_surface.php>. Accessed March 13, 2005.

Appendix A

Report Methodology—Hospitalization Statistics

Methodology

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.

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, primary and revision surgeries, as well as elective and emergency surgeries, are included in the analyses for all years of data. In 2002–2003, the proportion of total hip replacements and total knee replacements that were revisions is estimated at 8.9% and 5.9%, respectively (excluding Quebec). The estimated proportion of total hip replacements and total knee replacements that are performed on an emergency basis is 16% and 5%, respectively.

Population Reference Period

HMDB data reported in this document are hospitalizations for total hip and knee replacements (including primary and revisions) performed in Canada, mainly for patients discharged between April 1, 2002 and March 31, 2003 (2002–2003). 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

In previous CJRR annual reports, counts reported were based on the number of procedures performed. Beginning with the 2005 CJRR Annual Report, counts reported are based on the number of hospitalizations. 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). In earlier reports, these procedures were counted as two separate procedures, whereas in this report, they are counted as one, to be consistent with the reporting of procedures in the Canadian Classification of Health Interventions (CCI). Therefore, counts and rates for historical years may appear lower in this report compared to previously released CJRR reports.

Geographical Reporting

With the exception of the sections on length of stay and in-hospital deaths, all HMDB analyses define 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 2004 Postal Code Conversion File, which is updated semi-annually by Statistics Canada. Patients with incomplete postal codes were included in the provincial and national count 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. With a revised methodology, incomplete or unknown postal codes were mapped to provinces or territories using the first two or three digits or the Forward Sortation Area (FSA) of the postal code where possible. The impact is a significant reduction in the number of patients in the “Unknown” (patient’s residence province) category 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. In other words, they are adjusted for variations in age structure over populations differing by geography or over time. Sex-specific rates are reported, as there are considerable differences in rates of total hip and total 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 arrive at the age-standardized rates.

Inclusion of All Ages in Report

Although older patients are more likely to require a hip or knee replacement surgery, patients in all age groups, including those less than 20 years were included in this report. A closer analysis of patients whose age was less than 20 years revealed that:

- (1) There were very few patients (< 0.5%) in this age group for both hip and knee replacements. Most were 15 years and over.
- (2) The principal diagnosis indicated a need for urgent joint replacement surgery or, was specific to this patient population (for e.g. malignant neoplasm, juvenile rheumatoid arthritis).

Inclusion of patients aged less than 20 years therefore 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* or CCP†. ICD-9-CM codes were converted to CCP for the purpose of this report. Beginning in fiscal 2001, ICD-10-CA/CCI‡ 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 uncemented procedures, it also permits separation of partial versus total replacements.

Nearly 76% of all hip replacements and 78% of knee replacements were reported using the ICD-10-CA/CCI classification system in the Hospital Morbidity Database in fiscal 2002–2003. As the decision to adopt ICD-10-CA/CCI rests with the individual provinces and territories, in fiscal 2001, only British Columbia, parts of Saskatchewan, Nova Scotia, Prince Edward Island, Newfoundland and Labrador and Yukon Territory were using the new system. The rest of Saskatchewan, Alberta, Manitoba, Ontario, Northwest Territories, and Nunavut joined in fiscal 2002. The remaining provinces were using ICD-9/CCP, ICD-9-CM, or a combination of the two.

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.

Total Hip Replacements

Table A-1 presents the codes used to identify total 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 will be mandatory beginning from fiscal year 2003–2004.

* ICD-9-CM 9th Revision—Clinical Modification

† ICD-9-CCP 9th Revision—Canadian Classification of Diagnostic, Therapeutic, and Surgical Procedures

‡ International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Canada and Canadian Classification of Health Interventions.

For total hip replacement procedures coded in the CCP classification, codes of interest are 93.51 *Total hip replacement with methyl methacrylate* and 93.59 *Other total hip replacement*. Prior to fiscal 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				
	Cemented	Uncemented	Using bone autograft [uncemented]	Using bone homograft [uncemented]	Using combined bone graft and cement or paste
1.VA.53.^ ^ Implantation of internal device, hip joint					
open approach					
dual component prosthetic device [femoral & 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 & 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 Codes		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 prosthetic device, hip
 Hemiarthroplasty with implantation prosthetic device, hip
 Replacement, hip, using prosthetic device
 Reduction with fixation and implantation of prosthetic device, hip
- Excludes: Implantation, prosthetic device to acetabulum alone

* 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.

Total Knee Replacements

Table A-2 presents the codes of interest used to identify total 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. The percent of cement spacer procedures reported in the total knee replacement counts was extremely low: 1.0% in fiscal 2001 and 1.3% in fiscal 2002.

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.

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

RUBRIC	CCI Codes				
	Cemented	Uncemented	With bone autograft	With bone homograft	With combined bone graft and cement or paste
1.VG.53.^ ^ Implantation of internal device, knee joint					
cement spacer [temporary] [impregnated with antibiotics]	1.VG.53.LA-SL-N	---	---	---	---
dual component prosthetic device [bicondylar]	1.VG.53.LA-PN-N	1.VG.53.LA-PN	1.VG.53.LA-PN-A	1.VG.53.LA-PN-K	1.VG.53.LA-PN-Q
single component prosthetic device [unicondylar]	1.VG.53.LA-PM-N	1.VG.53.LA-PM	1.VG.53.LA-PM-A	1.VG.53.LA-PM-K	1.VG.53.LA-PM-Q
tri component prosthetic device [medial, lateral & 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 Codes		CCP Description		
93.4 - Arthroplasty of the knee and ankle	93.41		Total Knee Replacement, (geomedic)		
	93.40		Revision of Total Knee Replacement, (geomedic)		

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
- Excludes: Patellaplasty alone using prosthetic device
Replacement, patellofemoral alone

*All of these CCI codes were considered for analysis of data from the Hospital Morbidity Database.

§ Total knee replacements are defined by codes indicating dual and tri-component prosthetic devices, whereas partial knee replacements are defined by codes indicating single component prosthetic devices and cement spacers.

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

Submitting hospital province	Extent of knee replacement procedure					
	Partial* (CCI)		Total** (CCI)		All knee replacements (CCI)	
	Number	%	Number	%	Number	%
Newfoundland and Labrador	16	5.7%	265	94.3%	281	100.0%
Prince Edward Island	3	2.3%	126	97.7%	129	100.0%
Nova Scotia	76	7.1%	1,000	92.9%	1,076	100.0%
Ontario	1,245	10.3%	10,832	89.7%	12,077	100.0%
Saskatchewan	88	8.4%	964	91.6%	1,052	100.0%
Alberta	175	6.3%	2,605	93.7%	2,780	100.0%
British Columbia	218	6.9%	2,955	93.1%	3,173	100.0%
Northwest Territories	2	14.3%	12	85.7%	14	100.0%
Total	1,823	8.9%	18,759	91.1%	20,582	100.0%

* CCI codes (Partial): 1VG53-LAPM, 1VG53-LASL

** CCI codes (Total): 1VG53-LAPP, 1VG53-LAPN

Source: Hospital Morbidity Database, CIHI, Fiscal 2002.

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 is not identifiable in HMDB as the fifth digit is 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. In fiscal 2002, there were 276 knee replacement revision procedures in Quebec, 255 in 2001–2002, 240 in 2000–2001, 171 in 1999–2000, and 184 in 1998–1999.³

Hip revisions are not coded in Quebec at all. Therefore, it is not possible to distinguish between primary and revision procedures performed in Quebec facilities.

Appendix B

Report Methodology – Surgical and Clinical Characteristics

Introduction

The CJRR is a national registry that collects information on total hip and total knee replacement surgeries performed in Canada and follows joint replacement recipients over time to monitor their outcomes (including revision rates). The ultimate goal of the CJRR is to improve the quality of care and clinical outcomes of joint replacement recipients through post-market surveillance of orthopaedic implants, improvement in the quality of surgical practices and the study of risk factors affecting outcomes.

The CJRR is a joint effort between CIHI and the orthopaedic surgeons of Canada. This initiative was championed by CIHI and orthopaedic surgeons from each province who were working under the auspices of the Canadian Orthopaedic Association and the Canadian Orthopaedic Foundation. A number of other key partners contributed to the successful development and implementation of the CJRR including the federal, provincial, and territorial ministries of health, the Arthritis Society, the Canadian Arthritis Network and the OJRR. The registry was launched in June 2000 at the Canadian Orthopaedic Association Annual Meeting and data collection began in May 2001.

Collection of CJRR Data

Orthopaedic surgeons participating in the CJRR complete a two-page data collection form following a total hip or a total knee replacement surgery. Patients are required to provide consent prior to being included in the registry. Currently, an average of approximately 1,500 forms are submitted to the CJRR on a monthly basis. Ontario surgeons participate in the CJRR via the Ontario Joint Replacement Registry (see following section). In addition, for the first time in 2004, data were submitted 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). 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 OJRR is 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 Registry is housed at the London Health Sciences Centre. The OJRR is being implemented on a region-by-region basis, beginning in Southwestern Ontario in May 2001. The OJRR has released its third data report, based on data collected between May 14, 2001 and March 31, 2004.²

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 are greater in both scope and specificity compared to those of the CJRR. For instance, the OJRR collects data related to post-operative functional status scores. Therefore, in several instances, data from OJRR had to be mapped to be comparable to CJRR fields and definitions. OJRR data are also subject to CIHI's edit checks intended to identify potential errors such as out-of-range values and problems with data logic.

Ontario data incorporated in the CJRR are subject to revision as data from this report's fiscal year are still being corrected and submitted by orthopaedic surgeons to the OJRR. In the future, the OJRR will provide updated data to the CJRR from historical years in order to ensure that the Ontario data housed in both registries are up-to-date and consistent.

Methodological Notes

Population Reference Period

Surgical and clinical data presented in this report are based on total hip and total knee replacement surgeries and revisions performed in Canadian acute care hospitals. Data are presented on a fiscal year basis, with a focus on fiscal 2002 and 2003 (patients undergoing surgery between April 1, 2002 and March 31, 2004). In instances where surgery date was not available, admission date was imputed 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. Fiscal 2002 data 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 for fiscal 2003–2004 was estimated to be 67% with rates by province ranging from 47% in Quebec to 100% in New Brunswick and Nova Scotia. The total data submissions have increased by 43% over the past two years. Data via OJRR contributes the greatest proportion (43%) of the total submissions. With the combined data of two fiscal years, the data set used for this report is over two and a half times the size of the data set in last year's CJRR report, reflecting the higher representative of CJRR data capture as well as the annual increase in CJRR participation. It is possible that replacement procedures performed by surgeons participating in the CJRR differ from those of non-participating surgeons; therefore, some results should not be generalized to all joint replacements performed in Canada.

Figure B-1 shows the distribution of submissions by province for total hip and knee replacement procedures received from orthopaedic surgeons for fiscal 2002 and 2003 combined. By far over the past two years, orthopaedic surgeons from Ontario accounted for the greatest proportion of submissions (43%), followed by surgeons from Quebec (12%), British Columbia (12%) and Nova Scotia (8%).

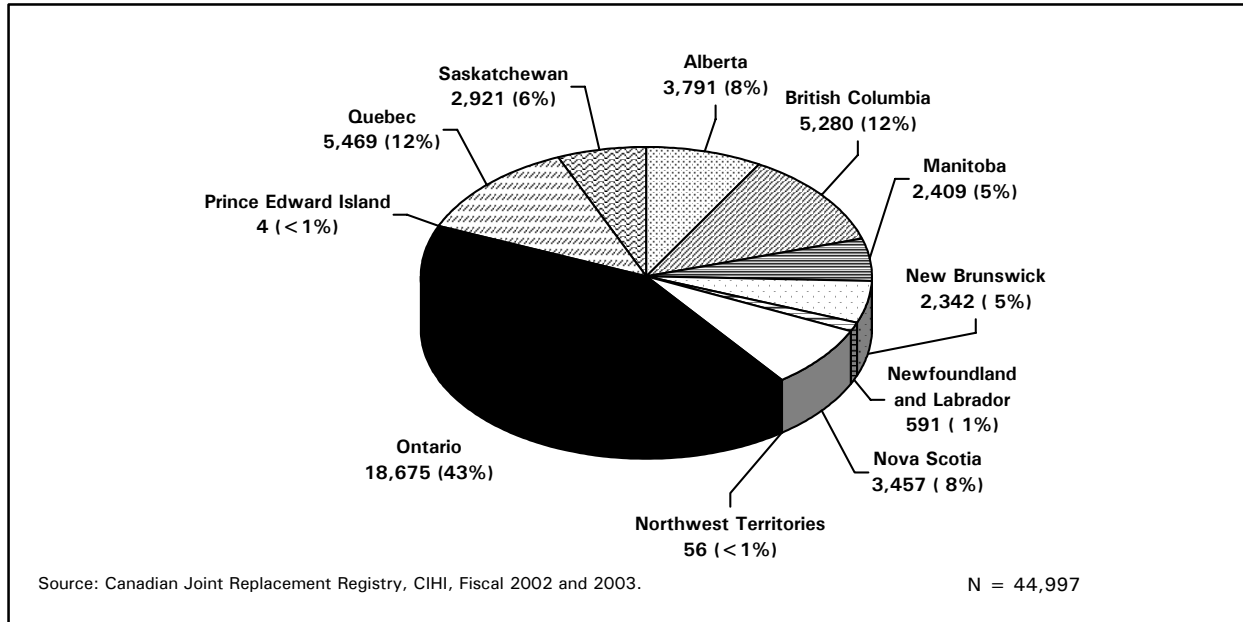


Figure B-1. Number of Total Hip and Total Knee Replacement Procedures Submitted to CJRR, by Province, Fiscal Year 2002 and 2003

Figure B-2 shows the increases of total hip and total knee replacements during the past two years across different provinces and territories. From fiscal 2002 to 2003, the data submissions increased dramatically for Alberta (+169%), Northwest Territories (+129%) and Manitoba (+98%), followed by British Columbia (+56%), Quebec (39%), Nova Scotia (37%) and other provinces. The increase for Ontario is 26%. Ontario also contributed to the highest proportion of the total submissions for both fiscal years, with 45% for fiscal 2002 and 39% for fiscal 2003, respectively.

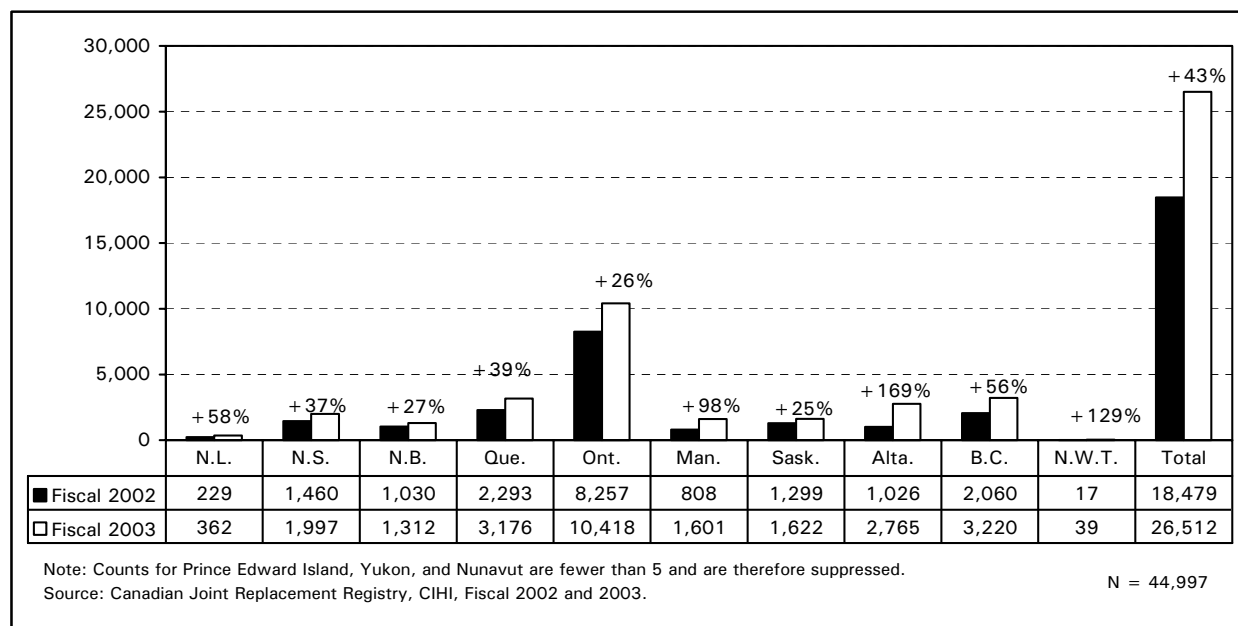


Figure B-2. Total Hip and Total Knee Replacement Procedures Across Provinces by Fiscal Years 2002 and 2003

External Comparability

Each record in the CJRR should be available in the Hospital Morbidity Database (HMDB). Both databases share common fields such as admission date, date of surgery, patient health card, patient gender and patient birth date. CJRR is currently conducting a pilot study to assess the feasibility of linking CJRR with the Hospital Morbidity database for data quality purposes. If successful, this linkage would help CJRR work towards tracking patient outcomes (e.g. complications and hospital readmissions following hip or knee replacement procedures).

The overall number of CJRR submissions during fiscal 2003–2004 as a proportion of the Hospital Morbidity Database (HMDB) hip and knee replacement cases in fiscal 2002–2003 is 54%.

Appendix C

Glossary

Glossary

Age-Standardized Rate

Age-standardized rate eliminates the effect of different age distributions in the population over time. This is calculated using a direct and the indirect method. In this report the direct method was used, wherein the age distribution of the patient population was adjusted based on a standard (i.e. Canadian 1991) population.

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 useful co-morbidity indicator. The index helps to determine if an individual has a healthy weight based on their height. BMI is calculated as: weight in kilograms divided by height in metres squared. To be consistent with OJRR, we assigned patients to the following internationally accepted BMI categories: under 18.5 (underweight), 18.5–24.9 (acceptable weight), 25.0–29.9 (overweight), 30.0 or higher (obese).⁶

CCI and CCP

CCI (Canadian Classification of Health Interventions) and CCP (Canadian Classification of Procedures) contain a list of codes that facilities in Canada use to report procedures or interventions submitted to CIHI via the Discharge Abstract Database. While CCI is the corresponding procedure classification for ICD-10-CA, CCP is the corresponding procedure classification for ICD-9.

Crude Rate

This is calculated by dividing the number of cases of interest (in this case, number of hip/knee replacements) observed during a given time by the corresponding number of people in the population at risk. The crude rate is not adjusted for age or sex and is usually expressed as an annual rate per 100,000 population.

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. Hybrid refers to the situation in which one component is cemented while the other is not. In a hip replacement a hybrid refers to a cementless acetabular cup paired with cemented femoral component and in a knee replacement, cementless femoral component is paired with a cemented tibial component.

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.¹⁶

ICD-9, ICD-10-CA

ICD-9 and ICD-10 refer to the International Classification of Diseases—9th and the 10th versions, Canadian modification, respectively. The ICD codes are used by facilities in Canada to report a number of diagnoses relating to the patient's admission on the discharge abstract that is submitted to CIHI.

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.

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.

Revision Rate

The revision rate is the percentage of primary replacements that have had a subsequent removal or exchange of one or more components.

Percent Revisions

Number of revisions relative to total number of replacements, expressed as a percentage.

Total Hip Replacement

Total hip replacement (THR) or total hip arthroplasty (THA) involves the replacement of the natural hip joints with artificial hip prostheses. In other words, the two parts of the hip joint (femoral and acetabulum) are removed and replaced with smooth artificial surfaces.

Total Knee Replacement

Total knee replacement (TKR) or total knee arthroplasty (TKA), involves the replacement of injured or damaged parts of the natural knee joint (femur, tibia and patella, if required) with artificial components.

Unicompartmental Knee Arthroplasty (UKA)

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

