Hip and Knee Replacements in Canada

CJRR Revision Risk Curves, 2019–2020

Data Tables

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About this document

This document presents revision risk curves for hip and knee replacements performed in Canada from 2009–2010 up to 2019–2020, along with corresponding data tables.

These revision risk curves, which show the cumulative percentage risk of having a revision surgery following a joint replacement, follow patients from the time of their primary surgery to revision within a specific period. Refer to Appendix A: Methodology notes for details.

This document is a companion product to *Hip and Knee Replacements in Canada: CJRR Annual Statistics Summary, 2019–2020*, which provides an overview of key statistics and trends for hip and knee replacement surgeries and patients.

Get more information about the Canadian Joint Replacement Registry (CJRR).

Revision risk curves based on hospitalization data

This section presents revision curves based on hospitalization and day surgery data in Canada, sourced from the Discharge Abstract Database–Hospital Morbidity Database (DAD-HMDB) and the National Ambulatory Care Reporting System (NACRS) at the Canadian Institute for Health Information (CIHI). Figure 1 shows the cumulative percentage revision for all primary hip and knee replacements performed in all Canadian jurisdictions with a main diagnosis of osteoarthritis (OA). From 2009–2010 to 2019–2020, there were 359,898 primary hip replacements and 634,526 primary knee replacements due to OA with up to 11 years of follow-up.[i]

Details regarding the methodology can be found in [Appendix A: Methodology notes](#).

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i. OA is the most common primary diagnosis for both hip and knee replacements in Canada (over 70% of primary hip replacements and over 99% of primary knee replacements).

Figure 1 Cumulative percentage revision for primary hip and knee replacement due to osteoarthritis, Canada, 2009–2010 to 2019–2020
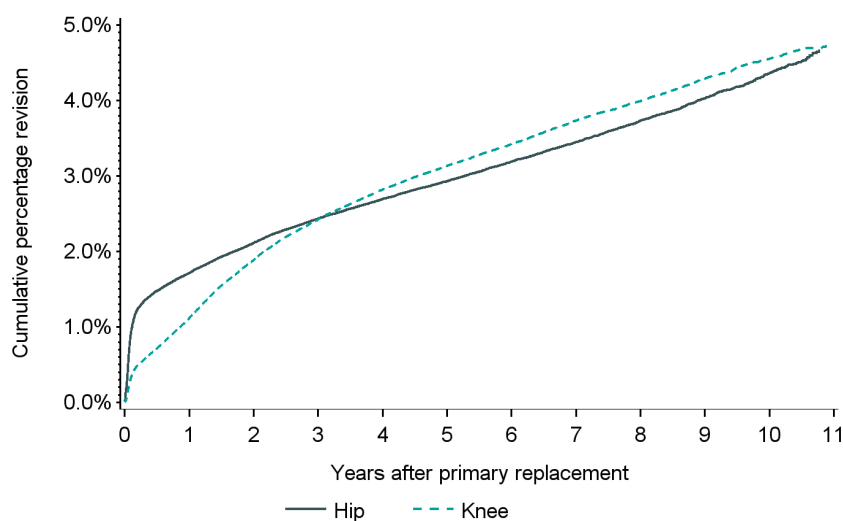
Sources
Discharge Abstract Database, Hospital Morbidity Database and National Ambulatory Care Reporting System, 2009–2010 to 2019–2020, Canadian Institute for Health Information.

Joint	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Hip	1	1.71	1.67–1.76	311,617
	2	2.11	2.07–2.16	268,489
	3	2.44	2.38–2.49	229,107
	4	2.70	2.64–2.75	192,269
	5	2.93	2.87–2.99	158,308
	6	3.19	3.13–3.26	126,268
	7	3.45	3.38–3.52	96,281
	8	3.73	3.65–3.81	69,324
	9	4.03	3.94–4.12	44,149
	10	4.36	4.25–4.47	21,325
	11	4.66	4.51–4.81	520

Joint	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Knee	1	1.12	1.09–1.15	556,549
	2	1.89	1.85–1.92	480,681
	3	2.42	2.38–2.46	412,421
	4	2.82	2.77–2.86	348,458
	5	3.13	3.08–3.18	288,573
	6	3.42	3.37–3.48	231,887
	7	3.73	3.68–3.79	177,439
	8	3.99	3.93–4.06	127,480
	9	4.29	4.22–4.36	80,980
	10	4.55	4.47–4.63	39,095
	11	4.73	4.63–4.83	933

Note
* At the end of each time period.
Sources
Discharge Abstract Database, Hospital Morbidity Database and National Ambulatory Care Reporting System, 2009–2010 to 2019–2020, Canadian Institute for Health Information.

Revision risk curves based on CJRR data

This section presents a set of revision curves based on primary replacements found in the Canadian Joint Replacement Registry (CJRR). Registry data contains more detailed information on these joint replacements, including prosthesis characteristics such as bearing surface, which allows for comparison of findings with other international arthroplasty registries. These cumulative revision risk curves are presented based on a large Canadian cohort of over 506,107 primary hip and knee surgeries from 3 provinces (Ontario, Manitoba and British Columbia) that have more than 90% coverage of CJRR prosthesis data.

Details on the methodology and subgroups examined can be found in Appendix A: Methodology notes.

Hip replacement

Figure 2a Cumulative percentage revision for primary total hip replacement for men, by age (primary diagnosis of osteoarthritis), 2012–2013 to 2019–2020
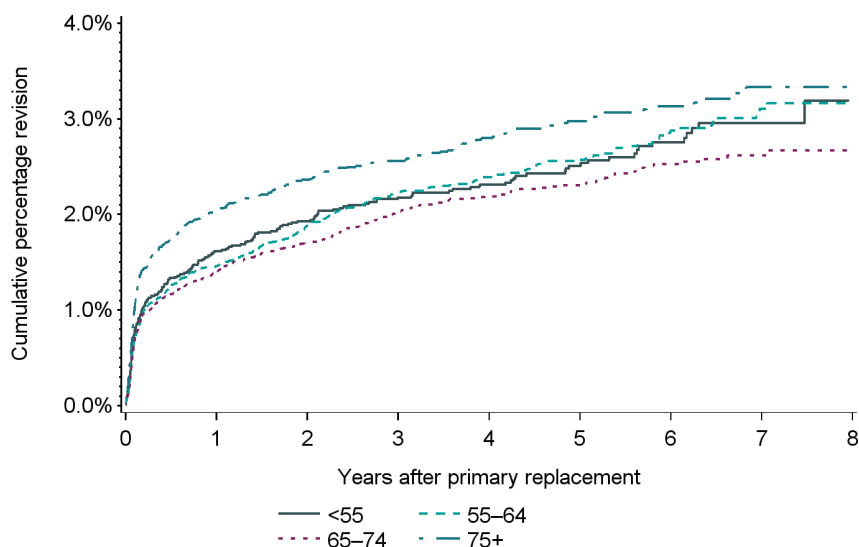
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Age	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
<55	1	1.62	1.37–1.86	8,727
	2	1.93	1.65–2.20	7,098
	3	2.18	1.88–2.48	5,812
	4	2.31	2.00–2.62	4,562
	5	2.51	2.17–2.85	3,369
	6	2.75	2.37–3.14	2,163
	7	2.96	2.52–3.39	1,028
55–64	1	1.46	1.30–1.62	18,039
	2	1.89	1.70–2.08	14,476
	3	2.23	2.02–2.45	11,516
	4	2.39	2.16–2.62	8,714
	5	2.57	2.33–2.82	6,249
	6	2.88	2.58–3.17	3,847
	7	3.11	2.76–3.46	1,788
65–74	1	1.40	1.25–1.56	19,757
	2	1.71	1.54–1.88	15,944
	3	2.01	1.82–2.20	12,641
	4	2.19	1.98–2.40	9,556
	5	2.30	2.09–2.52	6,733
	6	2.53	2.28–2.78	4,209
	7	2.62	2.35–2.89	1,898
75+	1	2.05	1.82–2.27	13,219
	2	2.36	2.12–2.61	10,685
	3	2.56	2.30–2.82	8,473
	4	2.80	2.52–3.08	6,315
	5	2.97	2.67–3.27	4,391
	6	3.13	2.80–3.45	2,733
	7	3.33	2.95–3.71	1,242

Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Figure 2b Cumulative percentage revision for primary total hip replacement for women, by age (primary diagnosis of osteoarthritis), 2012–2013 to 2019–2020

Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Age	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
<55	1	1.56	1.28–1.83	7,017
	2	2.16	1.83–2.49	5,784
	3	2.43	2.07–2.79	4,762
	4	2.76	2.36–3.15	3,703
	5	3.02	2.59–3.45	2,753
	6	3.17	2.71–3.64	1,753
	7	3.61	3.03–4.18	795
55–64	1	1.46	1.30–1.62	18,027
	2	1.92	1.73–2.12	14,718
	3	2.29	2.07–2.51	11,794
	4	2.54	2.31–2.78	8,966
	5	2.70	2.45–2.95	6,454
	6	2.89	2.61–3.16	4,053
	7	3.14	2.80–3.49	1,876

Age	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
65–74	1	1.54	1.41–1.68	26,172
	2	1.89	1.73–2.05	21,112
	3	2.14	1.97–2.31	16,746
	4	2.32	2.13–2.50	12,664
	5	2.53	2.32–2.73	8,890
	6	2.70	2.48–2.92	5,587
	7	2.75	2.52–2.98	2,578
75+	1	2.08	1.90–2.25	21,757
	2	2.39	2.20–2.58	17,679
	3	2.56	2.36–2.76	14,192
	4	2.73	2.51–2.94	10,979
	5	2.87	2.64–3.09	7,808
	6	3.06	2.81–3.30	4,920
	7	3.22	2.94–3.49	2,306

Note
* At the end of each time period.
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

**Table 1** Reasons for revision of total hip replacement for osteoarthritis, by age and sex, 2012–2013 to 2019–2020

Sex	Age	Aseptic loosening	Infection	Instability	Periprosthetic fracture	Remaining reasons
Women	<55	24 (17.9%)	30 (22.4%)	32 (23.9%)	13 (9.7%)	35 (26.1%)
	55–64	69 (22.0%)	75 (24.0%)	62 (19.8%)	49 (15.7%)	58 (18.5%)
	65–74	67 (15.8%)	107 (25.3%)	79 (18.7%)	111 (26.2%)	59 (13.9%)
	75+	59 (14.6%)	77 (19.1%)	74 (18.4%)	133 (33.0%)	60 (14.9%)
Men	<55	30 (19.6%)	49 (32.0%)	30 (19.6%)	12 (7.8%)	32 (20.9%)
	55–64	71 (23.3%)	111 (36.4%)	47 (15.4%)	28 (9.2%)	48 (15.7%)
	65–74	70 (23.6%)	101 (34.0%)	45 (15.2%)	40 (13.5%)	41 (13.8%)
	75+	40 (17.2%)	69 (29.7%)	35 (15.1%)	50 (21.6%)	38 (16.4%)

Note
Only revision records with a specific revision reason were included. Revisions with a reason listed as "other" (n = 618) and ones in the DAD and NACRS that could not be linked to a CJRR reason for revision (n = 761) were excluded. Remaining reasons for revision included bearing wear, osteolysis, pain of unknown origin, implant fracture, implant dissociation, acetabular erosion, leg length discrepancy and stiffness.
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Figure 3 Cumulative percentage revision for primary total hip replacement, by bearing surface (primary diagnosis of osteoarthritis), 2012–2013 to 2019–2020

HR — adjusted for age, sex and fixation

Ceramic-on-ceramic versus Metal-on-XLPE
   HR = 0.89 (0.72–1.09), p = 0.266

Ceramic-on-XLPE versus Metal-on-XLPE
   HR = 0.92 (0.83–1.01), p = 0.082
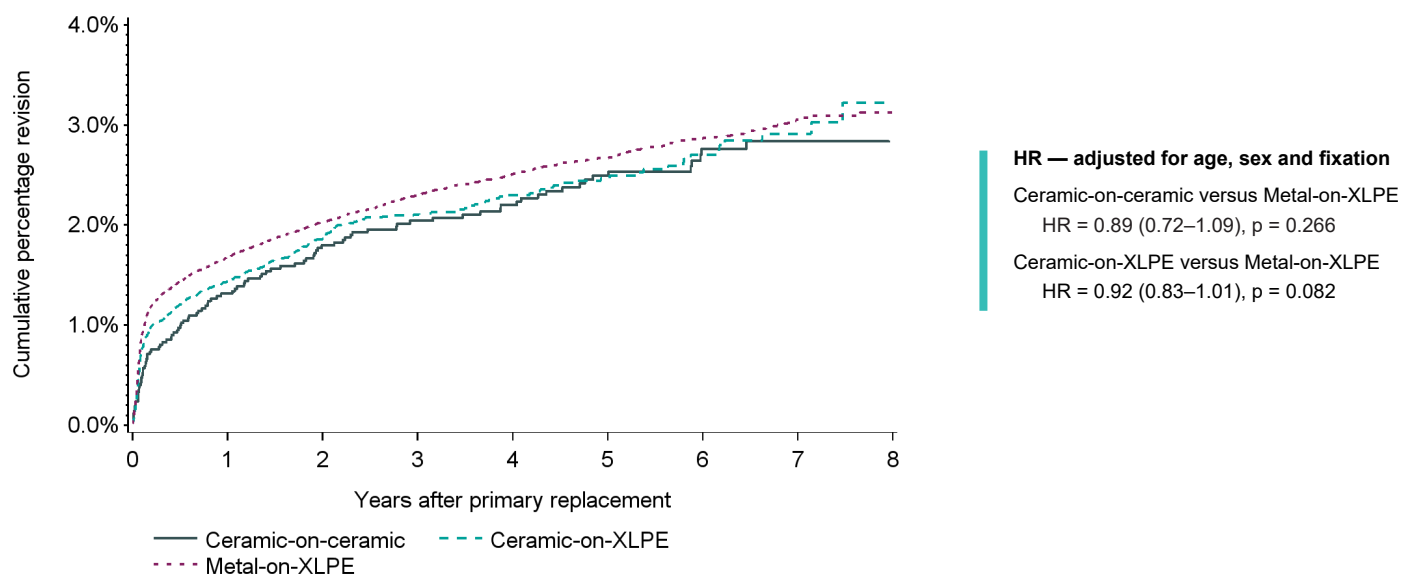
Notes
XLPE: Cross-linked polyethylene.
HR: Hazard ratio.
p: p-value.
Metal-on-non-XLPE is no longer being reported since this bearing surface is no longer widely used.
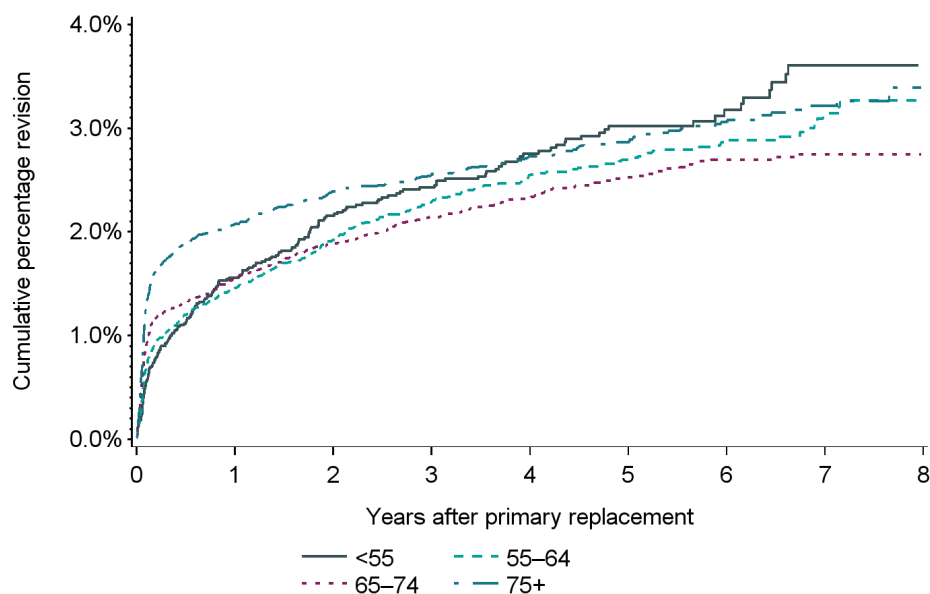**Sources**
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Bearing surface of primary replacement	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Ceramic-on-ceramic	1	1.31	0.97–1.66	4,009
	2	1.80	1.39–2.20	3,751
	3	2.04	1.61–2.48	3,376
	4	2.20	1.74–2.66	2,918
	5	2.49	1.99–2.99	2,384
	6	2.76	2.21–3.31	1,659
	7	2.84	2.27–3.41	861

Bearing surface of primary replacement	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Ceramic-on-XLPE	1	1.44	1.30–1.58	21,040
	2	1.86	1.69–2.04	14,332
	3	2.11	1.92–2.30	9,297
	4	2.30	2.08–2.52	5,808
	5	2.47	2.22–2.71	3,723
	6	2.71	2.40–3.01	2,298
	7	2.91	2.55–3.28	1,030
Metal-on-XLPE	1	1.68	1.60–1.75	95,119
	2	2.03	1.95–2.12	79,932
	3	2.30	2.21–2.40	65,635
	4	2.51	2.41–2.61	50,658
	5	2.67	2.57–2.78	36,002
	6	2.87	2.75–2.99	22,186
	7	3.05	2.91–3.19	10,014

Notes
* At the end of each time period.
XLPE: Cross-linked polyethylene.
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Table 2 Top reasons for revision of total hip replacement for osteoarthritis, by bearing surface, 2012–2013 to 2019–2020

Bearing surface	Aseptic loosening	Infection	Instability	Periprosthetic fracture
Ceramic-on-ceramic	16 (29.1%)	22 (40.0%)	11 (20.0%)	6 (10.9%)
Ceramic-on-XLPE	54 (22.0%)	74 (30.1%)	78 (31.7%)	40 (16.3%)
Metal-on-XLPE	316 (23.3%)	429 (31.6%)	276 (20.4%)	335 (24.7%)

Notes
Only revision records with a specific revision reason were included. Revisions with a reason listed as "other" (n = 580) and ones in the DAD and NACRS that could not be linked to a CJRR reason for revision (n = 690) were excluded. Remaining reasons for revision are not shown in table due to small cell counts and include bearing wear, osteolysis, pain of unknown origin, implant fracture, implant dissociation, leg length discrepancy and stiffness (n = 331).
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Figure 4   Cumulative percentage revision for primary hip replacement, by type of procedure (primary diagnosis of acute hip fracture), 2012–2013 to 2019–2020

HR — adjusted for age, sex and fixation

Total hip arthroplasty versus Bipolar hemiarthroplasty
    HR = 0.83 (0.69–0.99), p = 0.045

Modular monopolar hemiarthroplasty versus Bipolar hemiarthroplasty
    HR = 0.93 (0.79–1.08), p = 0.354

Monoblock monopolar hemiarthroplasty versus Bipolar hemiarthroplasty
    HR = 0.94 (0.70–1.25), p = 0.694

Legend:
— Monoblock monopolar hemiarthroplasty
- - - Modular monopolar hemiarthroplasty
· · · Bipolar hemiarthroplasty
· — Total hip arthroplasty

Notes
HR: Hazard ratio.
p: p-value.
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Type of hip arthroplasty	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Total hip arthroplasty	1	3.06	2.52–3.61	3,102
	2	3.53	2.93–4.13	2,436
	3	4.15	3.47–4.82	1,872
	4	4.42	3.70–5.14	1,323
	5	4.67	3.90–5.45	951
	6	4.93	4.08–5.78	596
	7	5.62	4.45–6.79	263
Modular monopolar hemiarthroplasty	1	2.64	2.24–3.04	4,927
	2	3.05	2.60–3.49	3,905
	3	3.49	3.00–3.98	3,020
	4	3.84	3.31–4.38	2,208
	5	4.12	3.53–4.71	1,536
	6	4.21	3.60–4.83	890
	7	4.54	3.78–5.31	351

Type of hip arthroplasty	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Bipolar hemiarthroplasty	1	2.76	2.52–3.00	14,459
	2	3.32	3.05–3.59	11,233
	3	3.79	3.49–4.09	8,703
	4	4.18	3.85–4.51	6,448
	5	4.48	4.12–4.83	4,499
	6	4.52	4.16–4.89	2,746
	7	4.67	4.27–5.06	1,300
Monoblock monopolar hemiarthroplasty	1	2.75	1.89–3.62	1,195
	2	3.27	2.31–4.22	1,093
	3	3.73	2.70–4.76	1,009
	4	3.83	2.78–4.87	930
	5	3.83	2.78–4.87	792
	6	3.83	2.78–4.87	589
	7	3.83	2.78–4.87	303

Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Figure 5 Cumulative percentage revision for primary partial hip replacement, by type of procedure (primary diagnosis of acute hip fracture, patients age 70 and older), 2012–2013 to 2019–2020

HR — adjusted for sex and fixation

Modular monopolar hemiarthroplasty versus Bipolar hemiarthroplasty
HR = 0.89 (0.75–1.06), p = 0.185

Monoblock monopolar hemiarthroplasty versus Bipolar hemiarthroplasty
HR = 0.87 (0.63–1.17), p = 0.382

— Monoblock monopolar hemiarthroplasty
- - - Modular monopolar hemiarthroplasty
···· Bipolar hemiarthroplasty

Notes
HR: Hazard ratio.
p: p-value.
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Type of hip arthroplasty	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Bipolar hemiarthroplasty	1	2.54	2.30–2.78	12,711
	2	2.98	2.71–3.25	9,849
	3	3.35	3.06–3.65	7,623
	4	3.72	3.39–4.05	5,630
	5	3.98	3.62–4.33	3,920
	6	4.03	3.66–4.39	2,363
	7	4.07	3.69–4.44	1,099
Modular monopolar hemiarthroplasty	1	2.54	2.12–2.95	4,438
	2	2.87	2.41–3.32	3,518
	3	3.15	2.66–3.63	2,708
	4	3.35	2.83–3.87	1,986
	5	3.60	3.03–4.18	1,370
	6	3.71	3.10–4.32	781
	7	3.71	3.10–4.32	308

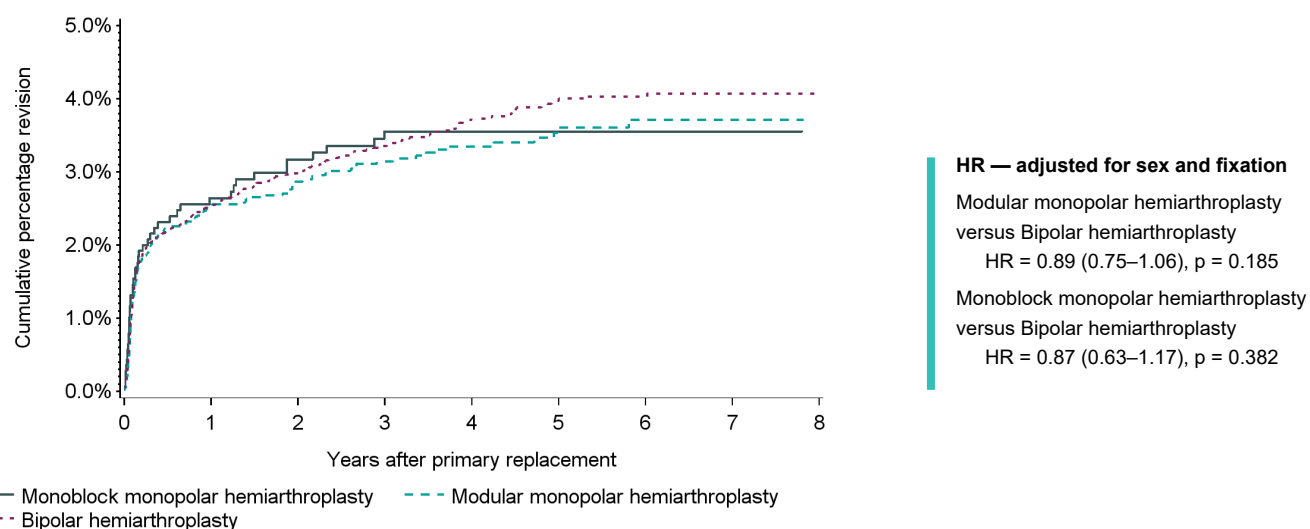| Type of hip arthroplasty	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Monoblock monopolar hemiarthroplasty	1	2.64	1.78–3.50	1,154
	2	3.17	2.21–4.13	1,059
	3	3.55	2.53–4.58	980
	4	3.55	2.53–4.58	907
	5	3.55	2.53–4.58	774
	6	3.55	2.53–4.58	576
	7	3.55	2.53–4.58	297

Note
* At the end of each time period.
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Figure 6   Cumulative percentage revision for primary partial hip replacement, by femoral fixation (primary diagnosis of acute hip fracture, patients age 70 and older), 2012–2013 to 2019–2020

HR — adjusted for sex

Cemented versus Cemented
   HR = 1.41 (1.20–1.67), p<0.0001

Notes
HR: Hazard ratio.
p: p-value.
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

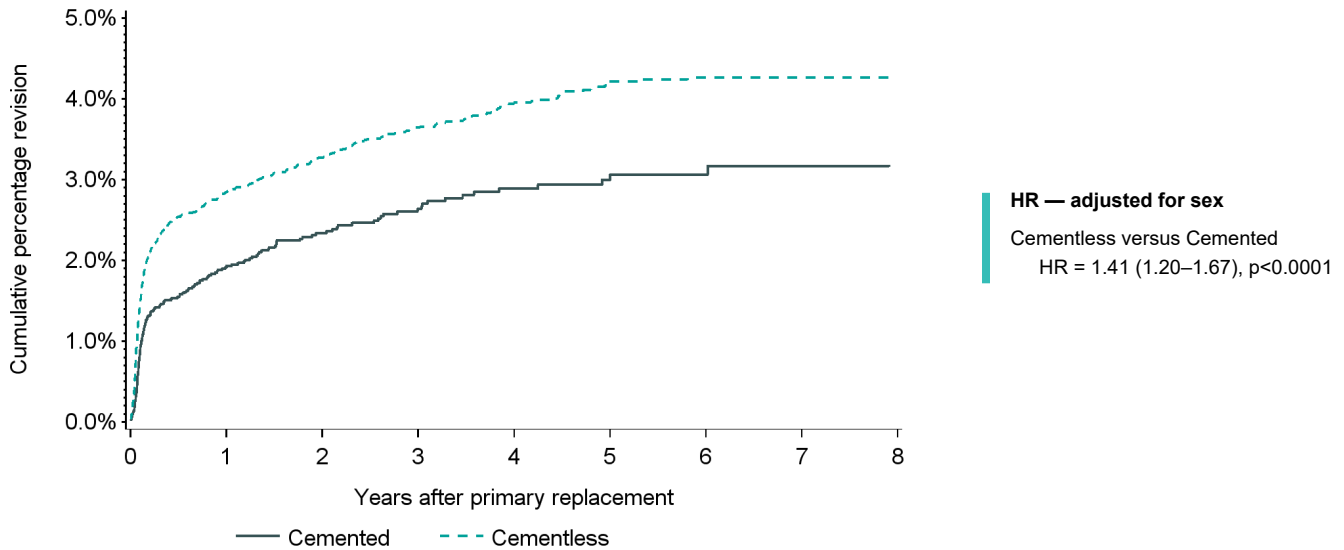| Femoral fixation	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Cemented	1	1.93	1.62–2.25	5,633
	2	2.34	1.98–2.70	4,056
	3	2.64	2.24–3.04	3,033
	4	2.89	2.45–3.33	2,195
	5	3.00	2.53–3.47	1,532
	6	3.06	2.58–3.54	912
	7	3.17	2.64–3.70	456
Cementless	1	2.85	2.58–3.11	12,670
	2	3.27	2.99–3.56	10,370
	3	3.64	3.33–3.95	8,278
	4	3.95	3.62–4.29	6,328
	5	4.21	3.85–4.57	4,532
	6	4.27	3.90–4.63	2,808
	7	4.27	3.90–4.63	1,248

Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Figure 7 Cumulative percentage revision for primary partial hip replacement, by femoral fixation and surgeon hip arthroplasty volume (primary diagnosis of acute hip fracture), 2012–2013 to 2019–2020
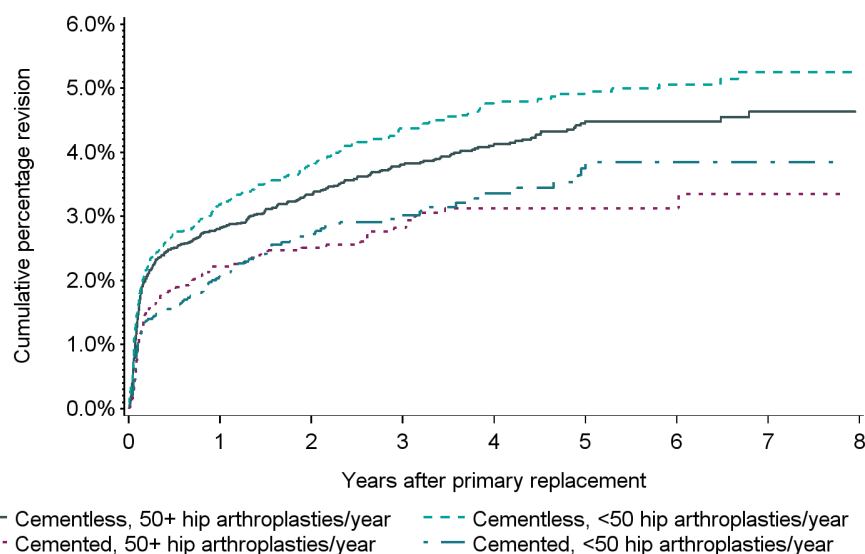
HR — adjusted for age and sex

Cementless, <50 hip arthroplasties/year versus Cementless, 50+ hip arthroplasties/year
  HR = 1.11 (0.96–1.29), p = 0.161

Cemented, <50 hip arthroplasties/year versus Cemented, 50+ hip arthroplasties/year
  0–1.5 years: HR = 0.96 (0.72–1.28), p = 0.786
  1.5 years+: HR = 1.61 (0.83–3.11), p = 0.159

Cementless, <50 hip arthroplasties/year versus Cemented, <50 hip arthroplasties/year
  HR = 1.37 (1.11–1.70), p = 0.004

Cementless, 50+ hip arthroplasties/year versus Cemented, 50+ hip arthroplasties/year
  HR = 1.29 (1.05–1.56), p = 0.017

Notes
HR: Hazard ratio.
p: p-value.
Surgeon volume refers to the number of hip arthroplasties performed by the surgeon in a fiscal year.
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Femoral fixation	Surgeon volume	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Cementless	50 or more procedures a year	1	2.82	2.50–3.14	8,454
		2	3.34	2.98–3.69	7,010
		3	3.81	3.42–4.20	5,562
		4	4.13	3.71–4.55	4,255
		5	4.48	4.02–4.94	3,032
		6	4.48	4.02–4.94	1,894
		7	4.64	4.13–5.14	901
	Fewer than 50 procedures a year	1	3.19	2.78–3.60	5,974
		2	3.79	3.34–4.24	4,864
		3	4.37	3.87–4.87	3,941
		4	4.79	4.25–5.34	3,027
		5	4.95	4.39–5.51	2,225
		6	5.06	4.48–5.64	1,427
		7	5.26	4.62–5.90	645

Femoral fixation	Surgeon volume	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Cemented	50 or more procedures a year	1	2.22	1.77–2.67	3,046
		2	2.51	2.02–3.01	2,231
		3	2.82	2.27–3.37	1,668
		4	3.13	2.52–3.74	1,157
		5	3.13	2.52–3.74	769
		6	3.13	2.52–3.74	439
		7	3.35	2.60–4.10	224
	Fewer than 50 procedures a year	1	2.10	1.65–2.55	3,044
		2	2.73	2.19–3.27	2,224
		3	3.02	2.43–3.61	1,671
		4	3.36	2.70–4.02	1,255
		5	3.75	2.99–4.50	907
		6	3.85	3.07–4.64	570
		7	3.85	3.07–4.64	286

Notes

* At the end of each time period.

Surgeon volume refers to the number of hip arthroplasties performed by the surgeon in a fiscal year.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Knee replacement

Figure 8 Cumulative percentage revision for primary total and partial knee replacement, by type of procedure (primary diagnosis of osteoarthritis), 2012–2013 to 2019–2020
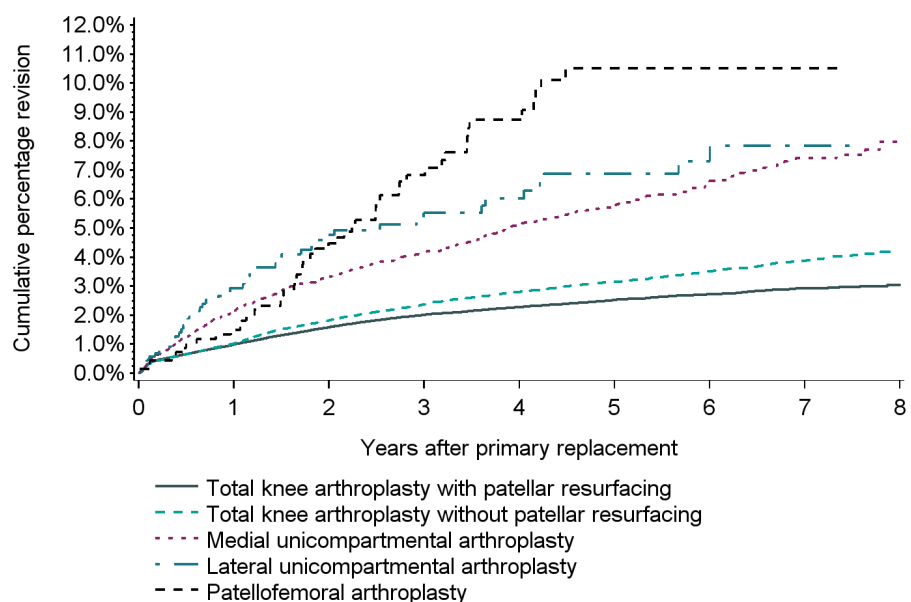
HR — adjusted for age and sex

Total knee arthroplasty without patellar resurfacing versus Total knee arthroplasty with patellar resurfacing
    HR = 1.20 (1.13–1.26), p<0.0001

Medial unicompartmental arthroplasty versus Total knee arthroplasty with patellar resurfacing
    HR = 1.98 (1.81–2.16), p<0.0001

Lateral unicompartmental arthroplasty versus Total knee arthroplasty with patellar resurfacing
    HR = 2.35 (1.74–3.10), p<0.0001

Patellofemoral arthroplasty versus Total knee arthroplasty with patellar resurfacing
    0–1 year: HR = 1.27 (0.64–2.24), p = 0.452
    1 year+: HR = 3.65 (2.61–4.92), p<0.0001

Notes

HR: Hazard ratio.
p: p-value.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Type of knee arthroplasty	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Total knee arthroplasty with patellar resurfacing	1	0.99	0.94–1.04	147,078
	2	1.58	1.52–1.64	124,556
	3	2.01	1.94–2.08	102,498
	4	2.28	2.20–2.36	80,380
	5	2.52	2.43–2.61	58,539
	6	2.72	2.62–2.82	37,687
	7	2.92	2.81–3.03	18,029
Total knee arthroplasty without patellar resurfacing	1	1.03	0.96–1.10	78,564
	2	1.82	1.73–1.91	59,485
	3	2.37	2.25–2.48	45,389
	4	2.80	2.67–2.93	33,678
	5	3.15	3.00–3.29	23,856
	6	3.51	3.35–3.68	14,939
	7	3.87	3.67–4.07	6,802

Type of knee arthroplasty	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Medial unicompartmental arthroplasty	1	2.13	1.87–2.39	10,555
	2	3.32	2.99–3.66	8,519
	3	4.17	3.78–4.56	6,890
	4	5.13	4.68–5.59	5,423
	5	5.77	5.27–6.28	4,001
	6	6.62	6.03–7.20	2,610
	7	7.42	6.72–8.11	1,362
Lateral unicompartmental arthroplasty	1	2.93	1.77–4.09	705
	2	4.76	3.22–6.29	554
	3	5.53	3.83–7.22	458
	4	6.01	4.20–7.83	341
	5	6.88	4.83–8.93	266
	6	7.31	5.11–9.52	175
	7	7.84	5.42–10.27	100
Patellofemoral arthroplasty	1	1.49	0.57–2.40	612
	2	4.49	2.82–6.15	506
	3	6.83	4.71–8.95	377
	4	8.73	6.23–11.24	278
	5	10.51	7.60–13.41	192
	6	10.51	7.60–13.41	125
	7	10.51	7.60–13.41	59

Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Table 3 Reasons for revision of total knee replacement for osteoarthritis, by type of procedure, 2012–2013 to 2019–2020

Primary procedure type	Infection	Instability	Aseptic loosening	Remaining reasons
Total knee arthroplasty with patellar resurfacing	761 (35.9%)	487 (23.0%)	385 (18.2%)	485 (22.9%)
Total knee arthroplasty without patellar resurfacing	361 (27.6%)	249 (19.1%)	226 (17.3%)	470 (36.0%)

Note

Only revision records with a specific revision reason were included. Revisions with a reason listed as "other" (n = 859) and ones in the DAD and NACRS that could not be linked to a CJRR reason for revision (n = 1,422) were excluded. Remaining reasons included pain of unknown origin, patella maltracking or instability, periprosthetic fracture (femur or tibia), bearing wear, implant dissociation, implant fracture, osteolysis and stiffness.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Figure 9a   Cumulative percentage revision for primary total knee replacement for men, by age (primary diagnosis of osteoarthritis), 2012–2013 to 2019–2020
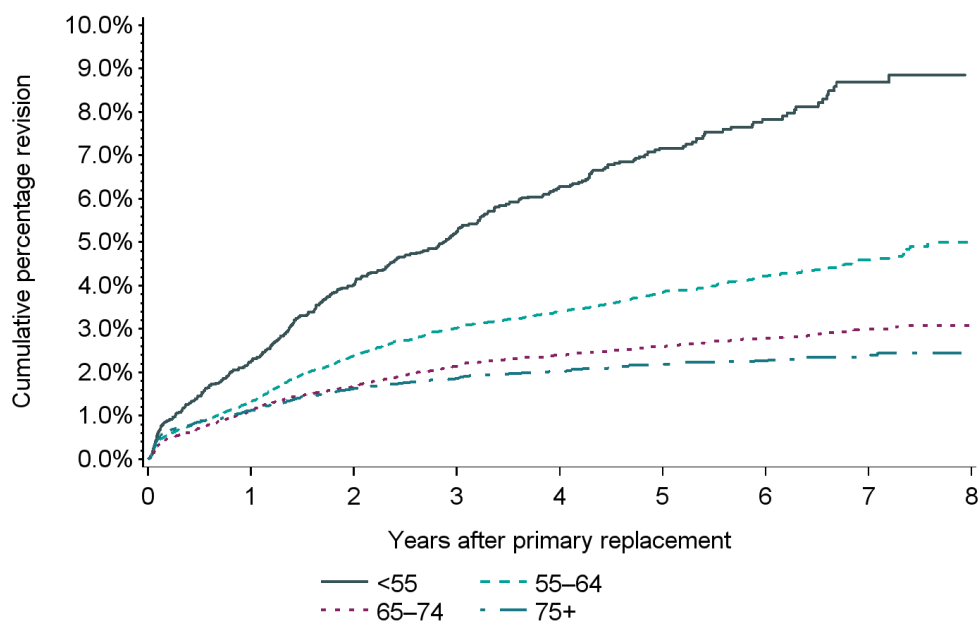
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Age	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
<55	1	2.27	1.89–2.64	5,510
	2	4.03	3.52–4.54	4,586
	3	5.24	4.64–5.84	3,782
	4	6.29	5.61–6.97	3,022
	5	7.17	6.41–7.92	2,288
	6	7.83	7.00–8.67	1,456
	7	8.68	7.70–9.67	690
55–64	1	1.33	1.20–1.47	25,699
	2	2.38	2.20–2.57	20,920
	3	3.02	2.80–3.23	16,804
	4	3.40	3.16–3.64	13,038
	5	3.84	3.57–4.10	9,399
	6	4.22	3.92–4.51	5,916
	7	4.59	4.24–4.94	2,817

Age	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
65–74	1	1.13	1.03–1.24	34,657
	2	1.69	1.56–1.83	27,871
	3	2.14	1.98–2.29	22,077
	4	2.40	2.23–2.57	16,886
	5	2.59	2.41–2.78	12,004
	6	2.79	2.58–2.99	7,651
	7	3.01	2.77–3.25	3,535
75+	1	1.12	0.99–1.25	21,473
	2	1.63	1.46–1.79	17,354
	3	1.86	1.68–2.04	13,803
	4	2.02	1.83–2.21	10,575
	5	2.17	1.97–2.38	7,520
	6	2.26	2.04–2.48	4,726
	7	2.36	2.12–2.59	2,222

Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Figure 9b Cumulative percentage revision for primary total knee replacement for women, by age (primary diagnosis of osteoarthritis), 2012–2013 to 2019–2020

Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Age	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
<55	1	1.22	1.02–1.43	10,464
	2	2.48	2.18–2.77	8,801
	3	3.51	3.15–3.88	7,307
	4	4.44	4.01–4.86	5,762
	5	5.03	4.56–5.51	4,307
	6	5.57	5.05–6.09	2,797
	7	6.02	5.43–6.61	1,322
55–64	1	0.93	0.84–1.02	40,307
	2	1.67	1.55–1.79	33,333
	3	2.27	2.12–2.42	27,101
	4	2.65	2.48–2.82	20,971
	5	2.96	2.77–3.15	15,347
	6	3.31	3.10–3.52	9,876
	7	3.61	3.37–3.86	4,717

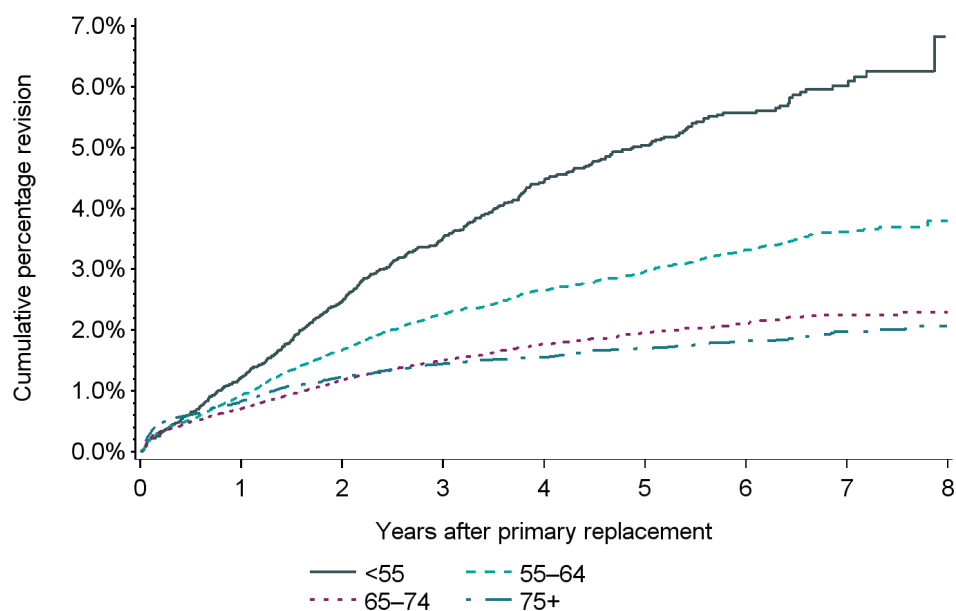| Age	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
65–74	1	0.71	0.64–0.77	54,351
	2	1.18	1.09–1.27	44,104
	3	1.50	1.40–1.61	35,124
	4	1.77	1.65–1.89	26,943
	5	1.96	1.83–2.09	19,202
	6	2.11	1.97–2.26	12,193
	7	2.25	2.09–2.42	5,599
75+	1	0.84	0.74–0.93	33,181
	2	1.23	1.11–1.34	27,072
	3	1.45	1.32–1.57	21,889
	4	1.55	1.41–1.68	16,861
	5	1.71	1.56–1.86	12,328
	6	1.83	1.66–1.99	8,011
	7	1.97	1.78–2.16	3,929

Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Table 4 Reasons for revision of total knee replacement for osteoarthritis, by age and sex, 2012–2013 to 2019–2020

Sex	Age	Aseptic loosening	Infection	Instability	Remaining reasons
Women	<55	59 (19.2%)	67 (21.8%)	87 (28.3%)	94 (30.6%)
	55–64	148 (21.4%)	159 (22.9%)	182 (26.3%)	204 (29.4%)
	65–74	95 (15.9%)	182 (30.5%)	124 (20.8%)	196 (32.8%)
	75+	41 (12.8%)	114 (35.5%)	61 (19.0%)	105 (32.7%)
Men	<55	47 (19.6%)	78 (32.5%)	47 (19.6%)	68 (28.3%)
	55–64	109 (19.4%)	200 (35.6%)	123 (21.9%)	130 (23.1%)
	65–74	90 (19.3%)	185 (39.6%)	84 (18.0%)	108 (23.1%)
	75+	22 (9.3%)	137 (57.8%)	28 (11.8%)	50 (21.1%)

Note

Only revision records with a specific revision reason were included. Revisions with a reason listed as "other" (n = 859) and ones in the DAD and NACRS that could not be linked to a CJRR reason for revision (n = 1,422) were excluded. Remaining reasons for revision included bearing wear, osteolysis, pain of unknown origin, patellar maltracking, periprosthetic fracture, implant fracture, implant dissociation, arthritis in previously unresurfaced compartment and stiffness.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Figure 10 Cumulative percentage revision for primary total knee replacement, by stability and patella resurfacing (primary diagnosis of osteoarthritis), 2012–2013 to 2019–2020

HR — adjusted for age and sex

Cruciate-retaining, no patella versus Cruciate-retaining, patella resurfaced
  0–1 year: HR = 1.01 (0.88–1.16), p = 0.917
  1 year+: HR = 1.41 (1.24–1.59), p<0.0001
Posterior-stabilized, no patella versus Posterior-stabilized, patella resurfaced
  HR = 1.16 (1.09–1.25), p<0.0001
Cruciate-retaining, no patella versus Posterior-stabilized, no patella
  HR = 0.84 (0.77–0.92), p = 0.0001
Cruciate-retaining, patella resurfaced versus Posterior-stabilized, patella resurfaced
  HR = 0.81 (0.75–0.87), p<0.0001
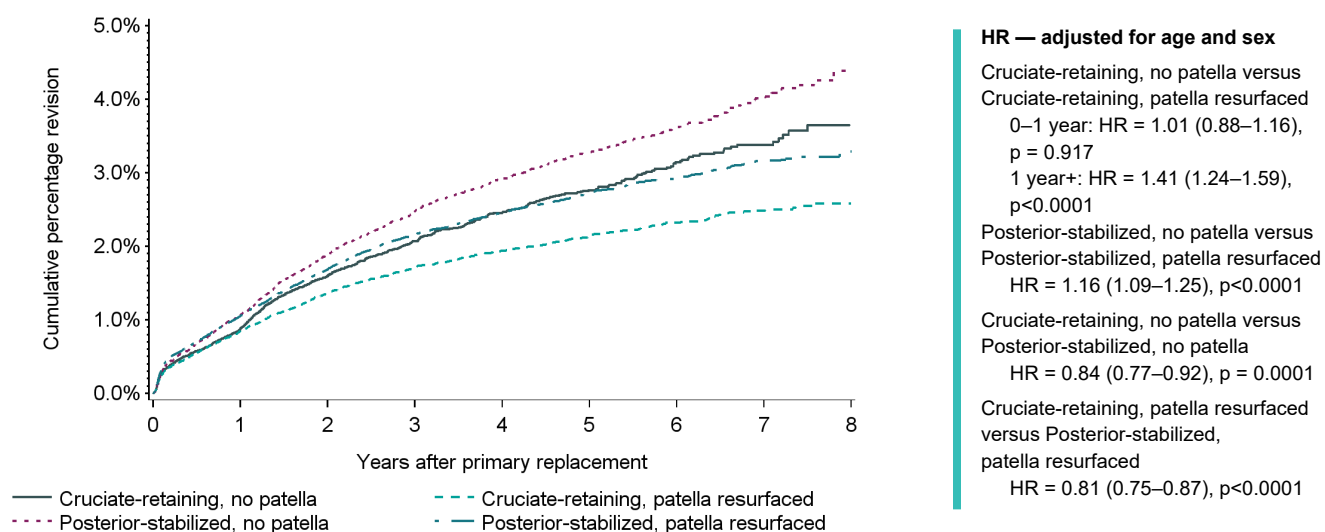
Notes
HR: Hazard ratio.
p: p-value.
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Stability and patella resurfacing	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Cruciate-retaining, no patella	1	0.89	0.79–0.98	32,191
	2	1.60	1.46–1.73	23,778
	3	2.06	1.90–2.23	17,850
	4	2.45	2.26–2.64	13,063
	5	2.76	2.55–2.98	9,197
	6	3.14	2.88–3.39	5,633
	7	3.38	3.09–3.67	2,591
Cruciate-retaining, patella resurfaced	1	0.85	0.77–0.92	52,547
	2	1.36	1.26–1.46	44,235
	3	1.70	1.59–1.81	36,659
	4	1.94	1.81–2.06	29,097
	5	2.13	2.00–2.27	21,593
	6	2.32	2.18–2.47	14,203
	7	2.49	2.32–2.65	6,896

Stability and patella resurfacing	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Posterior-stabilized, no patella	1	1.07	0.98–1.16	43,212
	2	1.89	1.76–2.01	33,595
	3	2.47	2.32–2.63	26,013
	4	2.92	2.74–3.09	19,677
	5	3.28	3.08–3.47	14,012
	6	3.62	3.40–3.84	8,964
	7	4.01	3.74–4.28	4,071
Posterior-stabilized, patella resurfaced	1	1.06	0.99–1.12	91,270
	2	1.69	1.61–1.77	77,799
	3	2.16	2.06–2.26	63,820
	4	2.46	2.35–2.56	49,731
	5	2.73	2.61–2.84	35,979
	6	2.93	2.80–3.06	23,028
	7	3.16	3.01–3.30	10,948
	8	3.28	3.08–3.49	45

Note
* At the end of each time period.
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Table 5   Reasons for revision of total knee replacement for osteoarthritis, by stability and patella resurfacing, 2012–2013 to 2019–2020

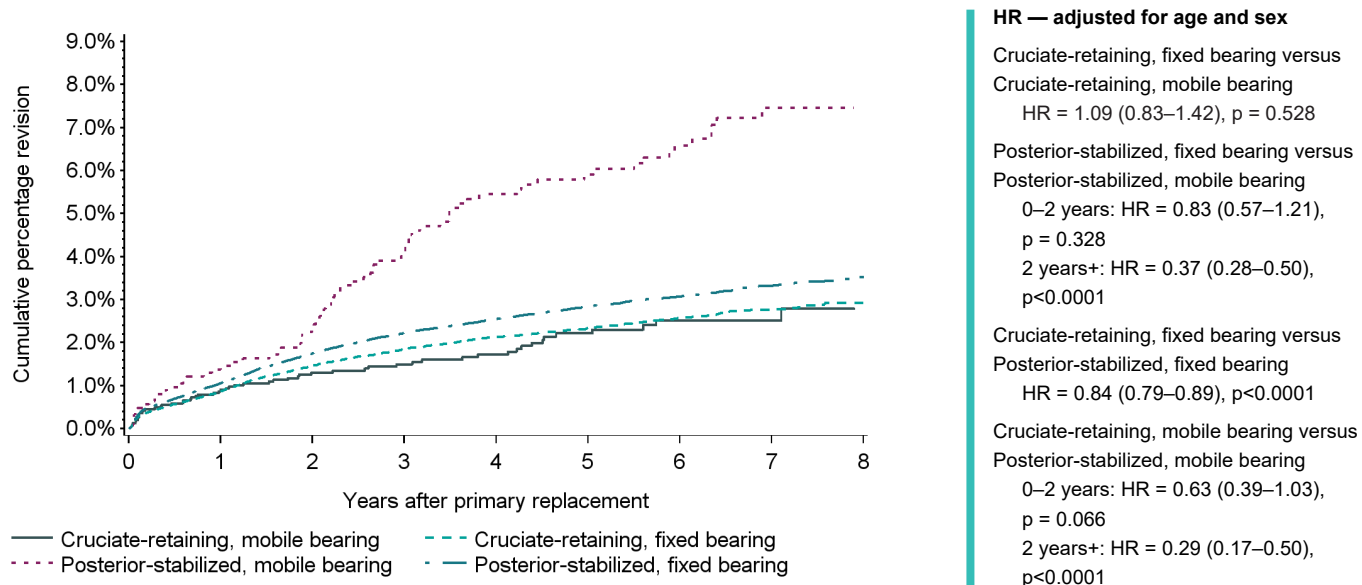| Stability and patella resurfacing	Infection	Instability	Aseptic loosening	Remaining reasons
Cruciate-retaining, no patella	122 (26.1%)	95 (20.3%)	83 (17.8%)	167 (35.8%)
Cruciate-retaining, patella resurfaced	232 (35.4%)	167 (25.5%)	113 (17.3%)	143 (21.8%)
Posterior-stabilized, no patella	219 (29.6%)	134 (18.1%)	122 (16.5%)	265 (35.8%)
Posterior-stabilized, patella resurfaced	496 (35.4%)	313 (22.3%)	266 (19.0%)	328 (23.4%)

Note
Only revision records with a specific revision reason were included. Revisions with a reason listed as "other" (n = 837) and ones in the DAD and NACRS that could not be linked to a CJRR reason for revision (n = 1,360) were excluded. Remaining reasons for revision included bearing wear, osteolysis, pain of unknown origin, patellar maltracking, periprosthetic fracture, implant fracture, implant dissociation and stiffness.
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Figure 11 Cumulative percentage revision for primary total knee replacement, by stability and mobility (primary diagnosis of osteoarthritis), 2012–2013 to 2019–2020

HR — adjusted for age and sex

Cruciate-retaining, fixed bearing versus
Cruciate-retaining, mobile bearing
    HR = 1.09 (0.83–1.42), p = 0.528

Posterior-stabilized, fixed bearing versus
Posterior-stabilized, mobile bearing
    0–2 years: HR = 0.83 (0.57–1.21),
    p = 0.328
    2 years+: HR = 0.37 (0.28–0.50),
    p<0.0001

Cruciate-retaining, fixed bearing versus
Posterior-stabilized, fixed bearing
    HR = 0.84 (0.79–0.89), p<0.0001

Cruciate-retaining, mobile bearing versus
Posterior-stabilized, mobile bearing
    0–2 years: HR = 0.63 (0.39–1.03),
    p = 0.066
    2 years+: HR = 0.29 (0.17–0.50),
    p<0.0001

Notes
HR: Hazard ratio.
p: p-value.
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Stability and mobility	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Cruciate-retaining, fixed bearing	1	0.87	0.80–0.93	74,323
	2	1.45	1.37–1.54	61,286
	3	1.83	1.74–1.93	49,983
	4	2.12	2.01–2.23	39,002
	5	2.33	2.21–2.45	28,472
	6	2.57	2.43–2.70	18,336
	7	2.76	2.61–2.92	8,709
Cruciate-retaining, mobile bearing	1	0.90	0.56–1.23	2,731
	2	1.30	0.88–1.72	2,242
	3	1.49	1.03–1.95	1,889
	4	1.72	1.21–2.22	1,523
	5	2.21	1.59–2.83	1,170
	6	2.51	1.80–3.22	751
	7	2.51	1.80–3.22	375

Stability and mobility	Years after primary replacement	Cumulative percentage revision (%)	95% confidence interval	Number at risk*
Posterior-stabilized, fixed bearing	1	1.05	1.00–1.11	127,592
	2	1.74	1.67–1.81	106,859
	3	2.22	2.14–2.30	86,741
	4	2.54	2.45–2.63	67,149
	5	2.83	2.73–2.94	48,290
	6	3.07	2.96–3.18	30,720
	7	3.32	3.19–3.45	14,349
	8	3.52	3.33–3.71	64
Posterior-stabilized, mobile bearing	1	1.46	0.79–2.13	1,178
	2	2.33	1.48–3.18	1,084
	3	4.10	2.95–5.25	962
	4	5.45	4.10–6.80	853
	5	5.91	4.49–7.33	766
	6	6.58	5.06–8.11	653
	7	7.45	5.76–9.15	379

Note

* At the end of each time period.

Sources

Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Appendices

Appendix A: Methodology notes

Study population and data sources

- **For cumulative revision curves using hospitalization data:** Primary hip and knee replacement surgeries (total or partial) performed on patients age 18 and older in Canada, followed up to a maximum of 11 years
  - **Primary and revision surgeries:** Discharge Abstract Database, Hospital Morbidity Database and National Ambulatory Care Reporting System, 2009–2010 to 2019–2020
- **For cumulative revision curves using CJRR data:** Primary hip and knee replacement surgeries (total or partial) performed on patients age 18 and older from 3 provinces where CJRR submission is mandated (Ontario, Manitoba and British Columbia), followed up to a maximum of 8 years
  - **Primary surgeries:** Canadian Joint Replacement Registry, 2012–2013 to 2019–2020, and Discharge Abstract Database, 2019–2020
  - **Revision surgeries:** Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020
  - **Prosthesis characteristics:** Sourced from the International Prosthesis Library (IPL),[ii] downloaded on January 7, 2021
  - **GTIN product number:** Mapped to catalogue number based on Global Trade Item Number (GTIN) cross-reference tables from the following manufacturer websites:
    - [Zimmer-Biomet](#)
    - [Johnson & Johnson](#)
    - [Smith & Nephew](#)
    - [Stryker](#)

Survival analysis

- Time from the primary replacement to the first revision for a revised joint event. For censored surgeries, time from primary replacement to in-hospital death or the end of the study period (March 31, 2020) was used.[iii]
- Stratified Kaplan–Meier survival analysis was used to estimate the survival curves, and the Cox proportional hazards model was used to compare different groups while adjusting for age, sex or cement fixation, as appropriate.
- The level of significance was set at 0.05 for all statistical tests.

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ii.   A standardized hip and knee arthroplasty product library owned by the International Society of Arthroplasty Registries. For more information, email cjrr@cihi.ca.
iii. In-hospital death was identified using the DAD or NACRS.

Unit of analysis

- 1 primary hip or knee joint replacement surgery

Study outcome

- The cumulative percentage revision, also known as a joint replacement failure rate, is calculated as the probabilistic complement of the Kaplan–Meier survivorship function at the given time point, multiplied by 100.
- Cumulative percentage revision at 1 to 8 years is presented with 95% confidence interval at each year. Number of cases at risk by the end of each time period is also reported. The cumulative percentage revision is displayed until the number at risk for the group reaches 40.
- Hazard ratios for specific comparisons adjusted for age, sex and cement fixation, as appropriate, are presented with 95% confidence intervals and p-values. Analytical comparisons of revision rates using the proportional hazards model are based on all available data.

Considerations

- The first occurrence of a revision surgery was identified by linkage to the primary surgery using encrypted health care number and the jurisdiction issuing the health care number, as well as a match for joint type (hip or knee) and replacement side (left or right). As such, surgeries with an invalid health care number or surgery side were excluded from the analysis.
- Patients who died during the primary replacement surgery were excluded from the analysis.
- Bilateral replacement patients are double-counted because different prostheses may be used for each side.
- The revision surgery could have been performed in any Canadian province or territory; however, each jurisdiction manages its own health care numbers, so any patient movements may result in slight under-reporting.
- Quebec does not provide CIHI with information on procedures done on individuals from out of province; thus any revision surgery done in Quebec following a primary surgery performed outside of Quebec for non-Quebec residents is not available for this analysis.
- This analysis assumes that the survivorship of a replacement on one side is independent from survivorship on the other side, even if performed on the same patient.
- Revisions done on the same day as the primary surgery were excluded from this analysis, as were revisions recorded as occurring earlier than the primary surgery.
- Re-revisions are not included, even though patients may have more than one revision on the same side.
- Only in-hospital deaths could be identified using the data sources for this analysis, which could potentially influence the results for the oldest age group more than for other groups. As a result, the true probability of revision may be under-estimated.

Definitions for derived categories

Bearing surface for total hip replacement

- For the bearing surface analysis, CJRR catalogue numbers submitted for the total hip replacements identified in the cohort were linked to the IPL, January 7, 2021.
- Bearing surface was determined as the material of the femoral head on the material of the acetabular articulating surface (the insert, if one existed; otherwise, the acetabular component).
  - Bearing surface materials were categorized as ceramic, metal, cross-linked polyethylene and non-cross-linked polyethylene.
  - A joint replacement's bearing surface was considered missing if linkage to the IPL indicated
    - Missing bearing surface material for the femoral or acetabular articulating surface; and/or
    - More than one material for femoral or acetabular articulating surface identified.

Monopolar hemiarthroplasty: Monoblock versus modular

- This information is collected in CJRR using the data element Primary Procedure Type.
- Among procedures identified as monopolar hemiarthroplasties, the following criteria were used:
  - If it had a femoral component but no femoral head, it was considered a **monoblock** monopolar hemiarthroplasty.
  - If it had a femoral component and a femoral head, it was considered a **modular** monopolar hemiarthroplasty.
  - If it did not have a femoral component, the procedure type was **unknown**. These were removed from the cohort for analyses examining the procedure type of partial hip replacements.

Fixation for hip replacement: Cement used versus cementless

- This was determined based on cement information reported in CJRR and the intervention code in DAD.

Surgeon arthroplasty volume

- This was determined as the number of hip replacements a surgeon performed in a fiscal year. It was dichotomized as low volume (fewer than 50 hip replacements a year) and high volume (50 or more hip replacements a year) based on the univariate distribution of the variable.

Knee stability

- Stability can be determined from both the femoral component and the tibial insert; however, the stability of the insert is sufficient for determining stability of the construct. If the insert information was missing, stability of the femoral component was considered. Records where stability was other than minimally stabilized (cruciate-retaining) or posterior-stabilized, as well as those where stability information was not available, were excluded from the cohort for analyses examining the effect of stability.

Knee bearing mobility

- Mobility can be determined from both the tibial component and the tibial insert; however, the mobility of the insert is sufficient for determining mobility of the construct. If the insert information was missing, bearing mobility of the tibial component was considered. Bearing mobility was classified into mobile (rotating, sliding, or rotating and sliding) and fixed. Records where mobility information was not available were excluded from the cohort for analyses examining the effect of knee bearing mobility.

Appendix B: Text alternative for figures

Text alternative for Figure 1: Cumulative percentage revision for primary hip and knee replacement due to osteoarthritis, Canada, 2009–2010 to 2019–2020

The cumulative percentage revision for primary hip and knee replacements due to osteoarthritis is plotted as 2 separate curves. The x-axis represents the number of years after primary replacement and ranges from 0 to 11 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 5.0%. The curve for hip replacements shows a steep increase to around 1% quite close to the baseline (year 0). After that, there is a steady increase to 4.7% at 11 years. The curve for knee replacements shows an increase over time from 1.1% at year 1 to 4.7% at year 11. The table below the figure includes the related statistics.

Sources
Discharge Abstract Database, Hospital Morbidity Database and National Ambulatory Care Reporting System, 2009–2010 to 2019–2020, Canadian Institute for Health Information.

Text alternative for Figure 2a: Cumulative percentage revision for primary total hip replacement for men, by age (primary diagnosis of osteoarthritis), 2012–2013 to 2019–2020

The cumulative percentage revision for each age group is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 8 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 4.0%. The 4 curves have a similar shape: a steep increase to around 1% quite close to the baseline (year 0). After that, the increase is quite flat. The curve for age 75 and older is higher than the curves for the other 3 age groups, with a more profound steep increase, to about 1.5% close to year 0. The table below the figure includes the related statistics.

Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Text alternative for Figure 2b: Cumulative percentage revision for primary total hip replacement for women, by age (primary diagnosis of osteoarthritis), 2012–2013 to 2019–2020

The cumulative percentage revision for each age group is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 8 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 4.0%. 3 of the 4 curves (age groups younger than 55, 55 to 64 and 65 to 74) have a very similar shape: a steep increase to about 1% quite close to the baseline (year 0). The curve for age 75 and older is considerably higher than those for the other 3, with a more profound steep increase, to about 2%. After that, the increase is quite flat for all curves. Just after the 3-year mark, the 75 and older curve becomes closer to the others, and it overlaps with the first 2 younger groups after the 4-year mark, while the 65 to 74 curve starts to separate, becoming considerably lower. The table below the figure includes the related statistics.

Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Text alternative for Figure 3: Cumulative percentage revision for primary total hip replacement, by bearing surface (primary diagnosis of osteoarthritis), 2012–2013 to 2019–2020

The cumulative percentage revision for each bearing surface (ceramic-on-XLPE, ceramic-on-ceramic and metal-on-XLPE) is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 8 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 4.0%. The 3 curves have a similar shape: a steep increase to around 1% quite close to the baseline (year 0). After that, the increase is quite flat. The table below the figure includes the related statistics.

Notes
XLPE: Cross-linked polyethylene.
Metal-on-non-XLPE is no longer being reported since this bearing surface is no longer widely used.
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Text alternative for Figure 4: Cumulative percentage revision for primary hip replacement, by type of procedure (primary diagnosis of acute hip fracture), 2012–2013 to 2019–2020

The cumulative percentage revision for each replacement type (total, monoblock monopolar, modular monopolar and bipolar hemiarthroplasty) is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 8 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 6.0%. All curves look very similar, with a steep increase to about 2% quite close to the baseline (year 0). After that, the increase is quite flat. The table below the figure includes the related statistics.

Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Text alternative for Figure 5: Cumulative percentage revision for primary partial hip replacement, by type of procedure (primary diagnosis of acute hip fracture, patients age 70 and older), 2012–2013 to 2019–2020

The cumulative percentage revision for each hemiarthroplasty type (modular monopolar, monoblock monopolar and bipolar) is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 8 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 5.0%. The bipolar and modular monopolar curves look very similar, with a steep increase to just under 2% quite close to the baseline (year 0); after that, the increase is quite flat. The curve representing monoblock monopolar hemiarthroplasties is slightly higher than the other 2 curves. The table below the figure includes the related statistics.

Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Text alternative for Figure 6: Cumulative percentage revision for primary partial hip replacement, by femoral fixation (primary diagnosis of acute hip fracture, patients age 70 and older), 2012–2013 to 2019–2020

The cumulative percentage revision for each of the 2 femoral fixation approaches, cemented and cementless, is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 8 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 5.0%. The curve for the cementless femoral fixation is higher and increases in a steeper manner shortly after the baseline (year 0). After that, the increase is quite flat for both curves. The table below the figure includes the related statistics.

Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Text alternative for Figure 7: Cumulative percentage revision for primary partial hip replacement, by femoral fixation and surgeon hip arthroplasty volume (primary diagnosis of acute hip fracture), 2012–2013 to 2019–2020

The cumulative percentage revision for each of the 4 groups studied (cemented, 50+ hip arthroplasties a year; cemented, fewer than 50 hip arthroplasties a year; cementless, 50+ hip arthroplasties a year; cementless, fewer than 50 hip arthroplasties a year) is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 8 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 6.0%. The cemented curves (both 50+ and fewer than 50 arthroplasties) are considerably lower than the cementless curves. All 4 curves have a steep increase shortly after the baseline (year 0); cemented curves reach just higher than 1%, while cementless ones are close to 2.5%. When comparing the cementless curves, the one for fewer than 50 is considerably higher than the 50+ one. The table below the figure includes the related statistics.

Note
Surgeon volume refers to the number of hip arthroplasties performed by the surgeon in a fiscal year.
Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Text alternative for Figure 8: Cumulative percentage revision for primary total and partial knee replacement, by type of procedure (primary diagnosis of osteoarthritis), 2012–2013 to 2019–2020

The cumulative percentage revision for each knee replacement type (medial, lateral and patellofemoral partials, as well as total knee arthroplasties with and without patellar resurfacing) is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 8 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 12.0%. The total knee replacement curves are lower than the partial ones, with the total knee replacement with patellar resurfacing being the lowest. Near 2.5 years, the lateral unicompartmental curve is the highest. The patellofemoral curve has the steepest increase and after 2.5 years becomes the highest after overlapping the lateral curve. The table below the figure includes the related statistics.

Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Text alternative for Figure 9a: Cumulative percentage revision for primary total knee replacement for men, by age (primary diagnosis of osteoarthritis), 2012–2013 to 2019–2020

The cumulative percentage revision for each age group is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 8 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 10.0%. The highest curve and the curve with the steepest increase is for the age group younger than 55. The other 3 curves almost overlap up until the 1-year mark, after which they start diverging, with the 75+ group being the lowest, followed by 65 to 74, then 55 to 64. The increase for those 3 curves is steady over time. The table below the figure includes the related statistics.

Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Text alternative for Figure 9b: Cumulative percentage revision for primary total knee replacement for women, by age (primary diagnosis of osteoarthritis), 2012–2013 to 2019–2020

The cumulative percentage revision for each age group is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 8 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 7.0%. The 4 curves have a very similar shape, although they diverge shortly after year 1, with the exception of the age groups 65 to 74 and 75+, which almost overlap. The increase is steady over time. The highest curve is for the age group younger than 55, then 55 to 64, followed by 65 to 74, then 75+. The table below the figure includes the related statistics.

Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Text alternative for Figure 10: Cumulative percentage revision for primary total knee replacement, by stability and patella resurfacing (primary diagnosis of osteoarthritis), 2012–2013 to 2019–2020

The cumulative percentage revision for each of the 4 groups studied (cruciate-retaining, no patella; cruciate-retaining, patella resurfaced; posterior-stabilized, no patella; posterior-stabilized, patella resurfaced) is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 8 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 5.0%. All curves have a similar shape, although they diverge slowly after year 1. The posterior-stabilized with no patella curve is highest and the cruciate-retaining with patella resurfaced curve is lowest. The cruciate-retaining with no patella and the posterior-stabilized with patella resurfaced curves almost overlap. The table below the figure includes the related statistics.

Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.

Text alternative for Figure 11: Cumulative percentage revision for primary total knee replacement, by stability and mobility (primary diagnosis of osteoarthritis), 2012–2013 to 2019–2020

The cumulative percentage revision for each of the 4 groups studied (cruciate-retaining, mobile bearing; cruciate-retaining, fixed bearing; posterior-stabilized, mobile bearing; posterior-stabilized, fixed bearing) is plotted as a separate curve. The x-axis represents the number of years after primary replacement and ranges from 0 to 8 years. The y-axis represents the cumulative percentage revision and ranges from 0.0% to 9.0%. Both fixed curves (posterior-stabilized and cruciate-retaining) have a similar shape. The posterior-stabilized and mobile bearing curve is the highest and diverges significantly from all others after the 2-year mark. The table below the figure includes the related statistics.

Sources
Canadian Joint Replacement Registry (Ontario, Manitoba and British Columbia only), Discharge Abstract Database and National Ambulatory Care Reporting System, 2012–2013 to 2019–2020, Canadian Institute for Health Information.