

Perioperative and oncologic outcomes with robotic vs. open radical prostatectomy: A population-based study in Ontario, Canada

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ABSTRACT

Introduction: Robotic-assisted radical prostatectomy (RARP) is the predominant surgical treatment for localized prostate cancer worldwide, but adoption has been slower in Ontario due to funding constraints. This setting enables population-level comparison of RARP and open radical prostatectomy (ORP). We evaluated perioperative and short-term oncologic outcomes for men undergoing radical prostatectomy in Ontario between April 2017 and March 2024.

Methods: We conducted a retrospective cohort study of all patients who underwent publicly funded radical prostatectomy for localized prostate cancer. Co-primary

KEY MESSAGES

- In a population-based study of over 15 000 men in Ontario, RARP was associated with significantly lower transfusion rates, shorter hospital stay, and markedly fewer re-operations for vesico-urethral anastomotic stenosis compared with ORP.
- RARP was associated with improved oncologic indicators even after adjustment for stage, grade, comorbidity, surgeon volume, and region.
- Data suggested surgical experience and centralization may contribute to improved outcomes.
- Despite clinical advantages, RARP was associated with longer wait times, lower compliance with provincial wait time targets, and greater travel distances, highlighting ongoing equity and system-capacity challenges within a publicly funded healthcare system.

outcomes were blood transfusion rates and hospital length of stay (LOS). Secondary outcomes included operative time, 30-day readmission, vesico-urethral anastomosis stenosis (VUAS) requiring intervention, surgical wait time, and travel distance. Exploratory outcomes included 30-day mortality, positive surgical margins (PSM), and receipt of pelvic radiation post-prostatectomy.

Results: Among 15 073 patients, 6645 (44.1%) underwent RARP and 8428 (55.9%) ORP. Median followup was 36.8 months after RARP and 38.8 months after ORP. RARP was associated with lower transfusion rates (1.2% vs. 4.7%, $p<0.001$), shorter LOS (median 1.0 vs 2.0 days, $p<0.0001$), fewer 30-day readmissions (23.6% vs. 26.1%, $p=0.0005$), and markedly fewer VUAS interventions (1.2% vs. 12.0%, $p<0.0001$). RARP had longer adjusted operative time (+60 minutes, $p<0.001$), longer waits, and greater travel distance. PSM (31.0% vs. 38.2%, odds ratio 0.72, $p<0.001$) and need for post-prostatectomy radiotherapy (20.9% vs. 29.5%, hazard ratio 0.65, $p<0.0001$) were lower with RARP.

Conclusions: In Ontario, RARP demonstrated superior perioperative outcomes, lower VUAS, and improved oncologic indicators compared with ORP. As access expands, balancing quality, equity, and timeliness will be essential, alongside further study of cost implications.

INTRODUCTION

Prostate cancer is the most commonly diagnosed solid organ malignancy among Canadian men(1). Radical prostatectomy is an established and effective treatment for clinically localized prostate cancer regardless of risk category. Robotic assisted radical prostatectomy (RARP) has been utilized for more than 20 years globally. Since 2004, the use of robotic surgery has increased with more than 46 robotic platforms currently in use in the province of Ontario. While robotic-assisted radical prostatectomy (RARP) has become the preferred surgical treatment for localized prostate cancer in many parts of the world, its uptake has been slower in Ontario, Canada, due to the limitations of a publicly funded healthcare system. This unique context facilitates a large-scale comparison of RARP and open radical prostatectomy (ORP) outcomes across multiple surgeons and centers.

This analysis is a population-based retrospective study of Ontario-wide radical prostatectomy data initiated by the Surgical Oncology Program at Ontario Health (Cancer Care Ontario). The objective of the study was to compare peri-operative and short-term oncologic and surgical outcomes among men undergoing robotic and open radical prostatectomy in Ontario between April 1, 2017 and March 31, 2024.

METHODS

Study design and population

We conducted a retrospective cohort study that included adult (≥ 18 years) patients in Ontario, Canada, who underwent a Quality Based Procedures (QBP) funded radical prostatectomy for localized prostate cancer from April 1, 2017 to March 31, 2024. Patients were identified as undergoing prostate cancer surgery using International Classification of Diseases (ICD) diagnosis codes and Canadian Classification of Health (CCI) Intervention codes from Discharge Abstract Database (DAD), which collects data on inpatient admissions, and the National Ambulatory Care Reporting System (NACRS), which collects data on day surgeries. We excluded patients who (1) were non-Ontario residents, (2) had missing main intervention, (3) had interventions flagged as cancelled, abandoned, or out of hospital, (4) lacked a confirmed diagnosis of prostate cancer and (5) received pure (non-robot assisted) laparoscopic prostatectomy. Laparoscopic prostatectomies were excluded due to low volumes (Figure 1).

Outcomes and covariates

Our co-primary outcomes were packed red blood cell transfusion during hospital stay and length of hospital stay. Secondary outcomes included duration of surgery, 30-day readmission or emergency room (ER) visit following surgery, surgical intervention for vesico-urethral anastomosis stenosis (VUAS) at 31 days to 18 months post-operatively, surgical wait time, and distance travelled from home to hospital of surgery. Intervention for VUAS was defined as bladder neck dilation, bladder neck incision, urethral dilation, and urethrotomy. These procedures were captured using CCI procedure codes and Ontario Health Insurance Plan (OHIP) fee codes (Supplementary Appendix). Exploratory outcomes included 30-day all-cause mortality, and oncologic outcomes, including positive surgical margins and receipt of pelvic radiation after prostatectomy. As our cohort mainly consisted of priority 3 patients (meant to have their surgery within 28 days, with known/suspected invasive cancer that are not considered highly aggressive yet do not meet the criteria of priority 4) and priority 4 (patients meant to have their surgeries within 84 days, diagnosed with indolent malignancies), we conducted a subgroup analysis looking at positive margins in pT2 and pT3 patients.

The primary exposure was surgical approach: RARP compared to ORP, ascertained using CCI codes. Age at time of surgery, sex, residence and death date (where applicable) were obtained from the Registered Persons Database (RPDB) and the Ontario Cancer registry (OCR). Information related to positive margins were derived using ePath, which contains pathology reports submitted from public and commercial laboratories in Ontario. Surgical wait time information was obtained from the Wait Times Information System (WTIS), which provides standardized wait time tracking for most non-emergency surgeries in Ontario. Volumes of surgery were calculated per surgeon (surgeon volume) by linking to OHIP billing codes and filtering for prostatectomy billing codes (S650, S651, S652, S653) and surgeon specialty codes. Number of surgeries per surgeon were grouped by quartiles (≤ 7 , 8-27, 28-64, 65+ surgeries)

based on the total volume over all years of the study. Finally, pelvic radiation data was captured using the Cancer Activity Level Reporting (ALR) Database.

Economic and geographic determinants of health were assessed using neighbourhood income quintiles, rurality, and distance from home to hospital of surgery. Patient postal codes from RPDB were linked to Postal Code ON Conversion File (PCCF+) version 8B, which probabilistically links postal codes to dissemination areas. Neighbourhood income quintiles were assigned using census data (1 for lowest income, 5 for highest) to small geographic dissemination areas based on the before-tax income of households in that area. Rurality was defined based on community size defined in the 2021 census population from Statistics Canada. Distance from home to hospital of surgery was calculated using the spherical distance between the patient's home location and the hospital, based on their latitude and longitude coordinates. Maps were created to visualize regional variation of outcomes across Ontario's health planning districts [Regional Cancer Programs (RCP)]. Datasets were linked through each patients' unique Ontario Health Insurance Plan (OHIP) number and analyzed at Ontario Health.

Statistical analysis

Baseline characteristics were compared using ANOVA, Kruskal-Wallis, and chi-square tests as appropriate. The Mann-Kendall test was used to test for significance in trends. Logistic regression models were used to measure the association between clinical outcomes and ORP or RARP surgery. Covariates included patient age at surgery, Charlson Comorbidity Index (CCI), ISUP grade group, pathological stage, surgeon volume, and region of surgery. To compare distance traveled to surgery, we used a log-transformed linear model due to a right skewed distribution in the response variable, adjusting for fiscal year of surgery, patient age at surgery, CCI, pathological stage, grade group, and region of surgery. We checked linear regressions assumptions as appropriate. Duration of surgery in minutes was modeled using linear regression with the same covariates as the previous models. Surgeon volume was calculated by linking surgeries to OHIP billing claims to obtain physician numbers, then grouping the total volume of prostatectomies by each surgeon over the total time period into quartiles. Post-prostatectomy radiation was defined as receipt of pelvic radiation any time after surgery until the end of the data holding period, which was January 31st, 2025. Median follow-up time was defined as time from surgery to the end of follow-up period, time to pelvic radiotherapy, or time to death. We used a competing risks survival model to look at the association between time to salvage radiation with RARP/ORP surgery, with death as a competing risk. All analyses were conducted using R version 4.4.1 and SAS 9.4.

RESULTS

Baseline characteristics

A total of 15,073 patients were included in the final cohort: 6,645 (44.1%) patients who underwent RARP and 8,428 (55.9%) patients who underwent ORP. Median follow-up was 36.8

months (IQR: 18.2-63.8) among patients who underwent RARP and 38.8 months (IQR: 16.4-67.6) among patients who underwent ORP (Table 1).

Patients who underwent RARP tended to be younger (median age: 64.6 years versus 65.2 years with ORP), have fewer comorbidities (77% with a Charlson Comorbidity Index ≤ 2 versus 74% with ORP), lower grade group and stage (66% of RARP patients had grade group ≤ 2 versus 63% with ORP), and were more likely to have had their surgery performed by a high-volume surgeon (83% among RARP vs 51% among ORP) (Table 1).

The proportion of robotic surgeries increased from 35% in 2017 to 56% in 2023, (Mann-Kendall $p = 0.007$). Conversely, the proportion of ORP decreased over time, from 65% in 2017 to 44% in 2023 (Mann-Kendall $p = 0.007$). Volume of RARP and ORP varied widely by region (Supplementary Figures 1 and 2).

Clinical outcomes

Patients receiving RARP had significantly lower rates of blood transfusion during hospital stay (RARP 1.2% vs ORP 4.7%, $p < 0.001$). Patients undergoing RARP experienced a shorter median length of stay (1.0 days [IQR: 1.0-1.0 days]) compared to those undergoing ORP (2.0 days [IQR: 2.0-3.0 days]) $p < 0.0001$. RARP resulted in fewer 30-day unplanned readmissions or ER visits (23.6% vs 26.1% $p = 0.0005$), and surgical intervention for VUAS (1.2% vs 12.0%, $p < 0.0001$) (Supplementary Table 2 and 3) compared to ORP. Conversely, duration of surgery was longer with RARP compared to ORP (RARP median: 232 mins, IQR: 184-279 vs ORP median: 184 mins, IQR: 153-221) (Table 2). Patients travelled farther for RARP (RARP median: 23.1 km, IQR: 7.9-58.0 vs ORP median: 11.9 km, IQR: 5.2-30.4) and waited longer on average for surgery compared to ORP (RARP mean: 73 days, SD: 51 vs ORP mean: 42 days, SD: 32), with only 57% of RARP surgeries meeting their wait time targets (Priority 3 = 28 days, Priority 4 = 84 days), compared to 81% of ORP (Table 2, Supplementary Figures 1 and 2).

On exploratory analysis, there were very few 30-day mortality events in both groups. Rates of positive surgical margin (RARP 31.0% vs ORP 38.2%, $p < 0.0001$), and pelvic radiation (RARP 20.9% vs ORP 29.5%, $p < 0.0001$) were improved with RARP compared to ORP (Table 2).

Univariable and multivariable analyses

Logistic regression models (adjusting for age, stage, fiscal year of surgery, surgeon volume, grade, CCI, and RCP of surgery) yielded similar results, indicating that RARP was associated with lower odds of blood transfusion (adjusted OR: 0.25, 95% CI: 0.18-0.33, $p < 0.001$), length of stay over 2 days (adjusted OR: 0.05, 95% CI: 0.05-0.06, $p < 0.001$), and intervention for VUAS (adjusted OR: 0.12, 95% CI: 0.09-0.16, $p < 0.001$). However, RARP was not significantly associated with the odds of unplanned 30-day readmission/ER visit (adjusted OR: 0.99, 95% CI: 0.90, 1.10; Table 3). Duration of surgery was on average one hour longer for RARP surgery than ORP after adjustment (95% CI: 58-62 minutes) (Table 4).

Patients travelled on average 1.48 times farther for RARP than ORP (95% CI: 1.40-1.57, Table 4)(Figure 2). Patients treated with RARP were also more likely to undergo surgery outside wait

time targets (adjusted OR: 2.18, 95%CI: 1.94-2.42, $p < 0.001$). There appears to be regional variation in wait times, with some regions (Erie St. Clair, Hamilton, Simcoe-Muskoka, Central East, Mississauga, and Toronto) achieving over 80% compliance in wait time targets for ORP surgery. In contrast, for RARP, some regions (Hamilton and Waterloo Wellington) had less than 50% of patients meeting their wait time targets (Supplementary Figure 2).

On exploratory analysis, fewer patients had positive surgery margins with RARP in both pT2 (adjusted OR: 0.72, 95% CI: 0.62-0.84) and pT3 patients (adjusted OR: 0.72, 95% CI: 0.63-0.81). RARP was associated with lower risk of radiation therapy compared to ORP in both crude and adjusted survival models (adjusted HR: 0.65, 95% CI: 0.59-0.72, Supplementary Table 1). Kaplan-Meier curves and cumulative incidence functions for time to radiation are plotted in the Supplementary Appendix.

DISCUSSION

In this population-based cohort study of over 15,000 patients undergoing radical prostatectomy in Ontario from 2017 to 2023, we found that robotic-assisted radical prostatectomy (RARP) was associated with significantly improved perioperative outcomes compared to open radical prostatectomy (ORP). Patients treated with RARP had shorter hospital stays, fewer blood transfusions, and a markedly lower rate of surgical re-operation for VUAS. The positive margin rate and the rate of post-prostatectomy radiotherapy was lower in the RARP group. These findings persisted after adjusting for age, cancer grade and stage, comorbidity, and region of surgery. Importantly, nearly all RARP procedures were performed by high volume surgeons. This suggests surgical volume and experience may contribute meaningfully to the observed differences in outcomes; however, even with adjustment for surgeon volume there was a clear significant difference in many perioperative outcomes with RARP. To our knowledge, this is one of the first large-scale, real-world studies in a publicly funded Canadian health system to highlight re-operation rates as a robust quality marker associated with surgical modality and institutional context.

Our findings align with previous literature demonstrating that RARP is associated with favorable perioperative outcomes. Meta-analyses and large cohort studies have reported lower rates of blood loss, transfusion, and shorter hospital stays with RARP compared to ORP, with equivalent oncologic outcomes over the short and medium term(2-4). Much of this literature is based on institutional case series or US-based data, where robotic surgery is more widely accessible and supported by different funding structures. In Ontario, the progressive adoption of RARP provides a natural experiment that enables population-level comparison within a universal health care system. Our study extends prior evidence by demonstrating a near tenfold reduction in surgical re-operation rates for VUAS after RARP, a finding that remained significant after multivariable adjustment. This outcome is underreported in prior literature but may be particularly important as a real-world quality indicator(5).

The centralization of RARP in high-volume institutions likely plays a key role in these outcomes. Previous studies have shown that higher hospital or surgeon volume is associated with

better outcomes for prostatectomy, including lower complication rates, improved cancer control, and shorter length of stay(6-8). In our cohort, 82% of RARP procedures were performed by high volume surgeons, compared to 51% of ORP. The additional benefit of reduced positive surgical margins and lower rates of salvage radiation with RARP further supports the link between institutional expertise and oncologic outcomes(9). However, with adjustment for surgeon volume, there remained a significant effect on positive margin and post-prostatectomy radiotherapy rates. RARP was associated with longer operative time; this is consistent with prior studies(2, 10).

In contrast to its clinical benefits, RARP was associated with longer wait times and greater travel distances. Only 57% of RARP patients met wait time targets, compared to 81% for ORP. This reflects the limited availability of robotic platforms and the centralization of RARP delivery. Prior literature has raised concerns that advanced surgical technologies may exacerbate disparities in access(11). This suggests that Ontario's publicly funded system may buffer some inequities, though structural barriers related to geography and system capacity persist. This study has several limitations. Administrative data lack granularity on important clinical factors such as prostate-specific antigen levels, tumor volume, or patient and surgeon preferences. We could not identify the exact location of stricture requiring dilation after surgery (bladder neck versus meatal stenosis versus other). Although we were able to assess whether patients received radiation treatment post-operatively and the cancer diagnosis code associated with the treatment indication, could not determine the exact indication for treatment (adjuvant vs salvage). Very few patients (n=79) were diagnosed with a new cancer in the interval between prostatectomy and radiotherapy. When we repeated our analysis excluding these patients, there was no significant change in our model estimates (data not shown). For the above reasons, the assessment of post-prostatectomy radiotherapy is considered exploratory. We were unable to capture other patient-centered outcomes including continence and sexual function. Although we adjusted for hospital region and volume, unmeasured confounding related to individual provider experience or institutional pathways may remain. Economic and geographic measures may not accurately reflect individual social determinants of health. Key social determinants of health may differ among individuals characterized by similar measures. Finally, non-surgical management of complications and nuanced aspects of postoperative recovery are not captured.

CONCLUSIONS

Robotic-assisted radical prostatectomy in Ontario is associated with improved perioperative outcomes substantially lower re-operation rates, and less post-operative radiation compared to open surgery. As RARP capacity expands, efforts should focus on balancing quality, equity, and timeliness to optimize value in prostate cancer care. Further study of the economic impact of RARP in Ontario is needed.

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FIGURES AND TABLES

Figure 1. Proportion of RARP and ORP surgeries by RCP of surgery. Red dots represent hospital sites of surgery. ORP: open radical prostatectomy; RARP: Robotic-assisted radical prostatectomy; RCP: regional cancer programs.

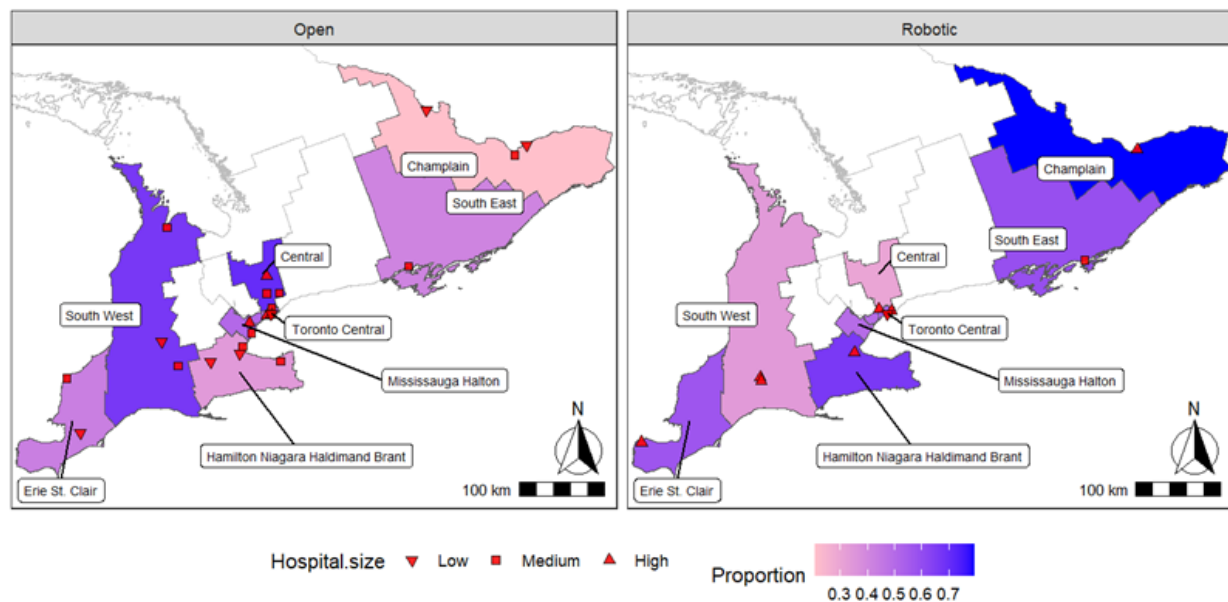


Table 1. Patient and hospital characteristics of all procedures

Variables	Total (N=15 073)	Open (n=8428)	Robotic (n=6645)	p
Fiscal year of surgery, n (%)				<0.0001
2017	2364 (15.7)	1533 (18.2)	831 (12.5)	
2018	2432 (16.1)	1501 (17.8)	931 (14.0)	
2019	2137 (14.2)	1186 (14.1)	951 (14.3)	
2020	1946 (12.9)	1144 (13.6)	802 (12.1)	
2021	1864 (12.4)	1002 (11.9)	862 (13.0)	
2022	2100 (13.9)	1085 (12.9)	1015 (15.3)	
2023	2230 (14.8)	977 (11.6)	1253 (18.9)	
Surgeon volume, n (%)[*]				<0.0001
Low (≤ 7 surgeries)	376 (2.5)	337 (4.0)	39 (0.6)	
Low-mid (8–27 surgeries)	1352 (9.0)	1087 (12.9)	265 (4.0)	
Upper-mid (28–64 surgeries)	3289 (21.8)	2481 (29.4)	808 (12.2)	

High (65+ surgeries)	9803 (65.0)	4317 (51.2)	5486 (82.6)	
Missing	253 (1.7)	206 (2.4)	47 (0.7)	
RCP of surgery**				<0.0001
01 Erie St. Clair	573 (3.8)	221 (2.6)	352 (5.3)	
02 South West	1381 (9.2)	961 (11.4)	420 (6.3)	
03 Waterloo Wellington	245 (1.6)	240–245 (2.8–2.9)	0–5 (0–0.08)	
04 Hamilton Niagara Haldimand Brant	2262 (15.0)	463 (5.5)	1799 (27.1)	
05\06 Central West\Mississauga Halton	1358 (9.0)	1084 (12.9)	274 (4.1)	
07 Toronto Central North	833 (5.5)	373 (4.4)	460 (6.9)	
07 Toronto Central South	2109 (14.0)	808 (9.6)	1301 (19.6)	
08 Central	1614 (10.7)	1219 (14.5)	395 (5.9)	
09 Central East	1453 (9.6)	1419 (16.8)	34 (0.5)	
10 South East	312 (2.1)	165 (2.0)	147 (2.2)	
11 Champlain	1796 (11.9)	333 (4.0)	1463 (22.0)	
12 North Simcoe Muskoka	603 (4.0)	598–603 (7.1–7.2)	0–5 (0–0.08)	
13 North East	373 (2.5)	368–373 (4.4–4.4)	0–5 (0–0.08)	
14 North West	161 (1.1)	156–161 (1.8–1.9)	0–5 (0–0.08)	
Age at surgery				<0.0001
Median (IQR)	64.9 (60.1– 68.9)	65.2 (60.6– 69.0)	64.6 (59.6– 68.8)	
≤49 years	215 (1.4)	94 (1.1)	121 (1.8)	
50–59 years	3124 (20.7)	1614 (19.2)	1510 (22.7)	
60–69 years	8480 (56.3)	4838 (57.4)	3642 (54.8)	
≥70 years	3254 (21.6)	1882 (22.3)	1372 (20.6)	
Grade group, n (%)				<0.0001
Missing	1109 (7.4)	628 (7.5)	481 (7.2)	
Grade group 1 (Gleason score 3+3 = 6)	539 (3.9)	344 (4.4)	195 (3.2)	
Grade group 2 (Gleason score 3+4 = 7)	8485 (60.8)	4579 (58.7)	3906 (63.4)	
Grade group 3 (Gleason score 4+3 = 7)	3448 (24.7)	1984 (25.4)	1464 (23.8)	

Grade group 4 (Gleason score 8)	530 (3.8)	335 (4.3)	195 (3.2)	
Grade group 5 (Gleason score 9/10)	962 (6.9)	558 (7.2)	404 (6.6)	
Pathologic stage, n (%)				0.089
Missing	775 (5.1)	393 (4.7)	382 (5.7)	
II	7003 (49.0)	3987 (49.6)	3016 (48.2)	
III/IV	7295 (51.1)	4048 (50.4)	3247 (51.8)	
Charlson comorbidity index, n (%)				0.0006
≤2	11 347 (75.3)	6254 (74.2)	5093 (76.6)	
>2	3726 (24.7)	2174 (25.8)	1552 (23.4)	
Rural/urban, n (%)				0.4346
Missing	7 (0.0)	0–5 (0–0.06)	2–7 (0.03–0.1)	
Urban	13 135 (87.2)	7331 (87.0)	5804 (87.4)	
Rural	1931 (12.8)	1096 (13.0)	835 (12.6)	
Income quintile, n (%)				<0.0001
Missing	9 (0.1)	0–5 (0–0.06)*	4–9 (0.06–0.1)	
1 (Low income)	2181 (14.5)	1282 (15.2)	899 (13.5)	
2	2815 (18.7)	1690 (20.1)	1125 (16.9)	
3	2904 (19.3)	1642 (19.5)	1262 (19.0)	
4	3187 (21.2)	1794 (21.3)	1393 (21.0)	
5 (High income)	3977 (26.4)	2018 (23.9)	1959 (29.5)	
Distance travelled to hospital (km)				<0.0001
Median (IQR)	16.1 (6.2–42.6)	11.9 (5.2–30.4)	23.1 (7.9–58.0)	

*Surgeon volumes were broken down into quartiles of total volume of surgeries per surgeon (across all prostatectomies and all fiscal years). **The following RCPs do not have a robot: South West, Champlain, North Simcoe Muskoka, North East, North West. Central East received a robot in 2023. ***As measured using the On-Marg 2021 Index.

Table 2. Clinical outcomes of patients receiving ORP vs RARP surgery				
Variables	Total (N=15 073)	Open (n=8428)	Robotic (n=6645)	p
Median followup time, months* (IQR)	38.0 (17.3, 65.7)	38.8 (16.4, 67.6)	36.8 (18.2, 63.8)	0.33
Length of stay				<0.0001
Missing, n (%)	18 (0.1)	7 (0.1)	11 (0.2)	
Median (IQR)	2.0 (1.0–3.0)	2.0 (2.0–3.0)	1.0 (1.0–1.0)	
Blood transfusion, n (%)	474 (3.1)	395 (4.7)	79 (1.2)	
30-day readmission, n (%)	3762 (25.0)	2196 (26.1)	1566 (23.6)	0.0005
Surgical re-operation (31 days to 18 months), n (%)	1086 (7.2)	1008 (12.0)	78 (1.2)	<0.0001
Duration of surgery, n (%)				<0.0001
Missing	10 (0.1)	6 (0.1)	4 (0.1)	
Median (IQR)	201.0 (165.5– 250.0)	184.0 (153.0– 221.0)	232.0 (184.0– 279.0)	
Positive margins among pT2/pT3, N (%)	4957 (35.1)	3027 (38.2)	1930 (31.0)	<0.0001
Positive margins among pT2, N (%)	1569 (22.5)	1009 (25.2)	560 (18.5)	<0.0001
Positive margins among pT3, N (%)	3383 (47.3)	2013 (50.8)	1370 (42.9)	<0.0001
Receipt of pelvic radiation (any time after surgery)	3881 (25.7)	2490 (29.5)	1391 (20.9)	<0.0001
Days from decision to treat to Surgery (priority 3)				<0.0001
N	3639	2350	1289	
Missing, n (%)	11 434 (75.9)	6078 (72.1)	5356 (80.6)	
Median (IQR)	28.0 (16.0– 55.0)	23.0 (14.0– 37.0)	51.0 (27.0– 91.0)	
Days from decision to treat to surgery (priority 4)				<0.0001
N	10,294	5253	5041	
Missing, n (%)	4779 (31.7)	3175 (37.7)	1604 (24.1)	
Median (IQR)	50.0 (30.0– 79.0)	42.0 (27.0– 62.0)	65.0 (36.0– 102.0)	
Percentage of P3 patients within wait target (28 days)				<0.0001
n (%)	1824 (50.1)	1475 (62.8)	349 (27.1)	

Percentage of P4 patients within wait target (84 days)				<0.0001
n (%)	8012 (77.8)	4735 (90.1)	3277 (65.0)	
30-day postoperative mortality, N (%)	18 (0.1)	13–18 (0.1–0.2)	0–5 (0–0.08)	

*Followup from date of prostatectomy until date of first radiation treatment, date of death, or end of followup period (January 31, 2025), whichever date was earlier. IQR: interquartile range.

Table 3. Logistic regression analyses of clinical outcomes for patients receiving RARP surgery (vs. ORP)					
Outcome*	n	Crude odds ratio (95% CI)	p	Adjusted odds ratio (95% CI)**	p
Length of stay ≥ 2 days	15 073	0.04 (0.03, 0.04)	<0.001	0.05 (0.05, 0.06)	<0.001
Blood transfusion	15 073	0.24 (0.19, 0.31)	<0.001	0.25 (0.18, 0.33)	<0.001
Surgical re-operation (31 days to 18 months)	15 073	0.09 (0.07, 0.11)	<0.001	0.12 (0.09, 0.16)	<0.001
Unplanned readmission within 30 days	15 073	0.88 (0.81, 0.94)	<0.001	0.99 (0.90, 1.10)	0.9
Positive margins among pT2	6946	0.65 (0.58, 0.74)	<0.001	0.72 (0.62, 0.84)	<0.001
Positive margins among pT3	7198	0.73 (0.67, 0.80)	<0.001	0.72 (0.63, 0.81)	<0.001
Received surgery outside of wait-time target (P3 and P4 only***)	13 932	3.33 (3.08, 3.59)	<0.001	2.18 (1.94, 2.42)	<0.001

*Comparing RARP surgery with ORP as the reference group. **Models were adjusted for pathological stage, grade group, surgeon volume, Charlson Comorbidity Index, age at surgery, fiscal year of surgery and RCP of surgery. ***P3 refers to priority 3 and P4 refers to priority 4, which have targeted wait times of 28 days and 84 days, respectively. CI: confidence interval; ORP: open radical prostatectomy; RARP: Robotic-assisted radical prostatectomy.

Table 4. Linear regression analyses for patients receiving RARP surgery vs. ORP					
Linear regression models*	n	Crude effect estimate (95% CI)	p	Adjusted effect estimate (95% CI)**	p
Duration of surgery	15 063	47 (45, 49)	<0.001	60 (58, 62)	<0.001
Distance traveled***	15 066	1.75 (1.68, 1.83)	<0.001	1.48 (1.40, 1.57)	<0.001

*Comparing RARP surgery with ORP as the reference group. **Models were adjusted for pathological stage, grade group, surgeon volume, Charlson Comorbidity Index, age at surgery, fiscal year of surgery and RCP of surgery. ***Distance was log-transformed. CI: confidence interval; ORP: open radical prostatectomy; RARP: Robotic-assisted radical prostatectomy.