Analysis in Brief

August 2014

The Delivery of Radical Prostatectomy to Treat Men With Prostate Cancer

Introduction

Prostate cancer is the most commonly diagnosed cancer and the second leading cause of cancer death among Canadian men. In 2013, there were an estimated 23,600 new cases identified and 3,900 deaths attributable to prostate cancer.[1] How prostate cancer is treated depends on the extent of the disease. Men with cancer that is confined to the prostate gland may opt for surgery, radiation therapy, hormone therapy, a combination of these interventions or a "wait and see" approach, either active surveillance or watchful waiting.[i] Studies conducted to date have not conclusively differentiated the relative benefits of one therapy over another in terms of survival or quality of life outcomes.[2, 3] Treatment decisions are therefore largely based on the preferences of men and their doctors, taking into consideration age, health status, attitudes toward potential treatment side effects and perceptions of the risk of disease relative to the potential benefits of the treatment.[4]

This report describes surgery for prostate cancer in Canada from 2006–2007 to 2012–2013, with a focus on radical prostatectomy (RP), a potentially curative surgical intervention. RP completely removes the prostate, surrounding tissue and seminal vesicles and is indicated when the cancer is confined to the prostate gland. RP may be performed using either an open procedure, where surgeons make an incision into the lower abdomen (retropubic), or minimally invasive laparoscopic approaches. RPs performed laparoscopically are associated with lower rates of complications compared with the open approach.[5, 6]

i. Active surveillance involves closely monitoring men who have a diagnosis of prostate cancer that has characteristics that confer a favourable risk of remaining symptom free. Such men are followed according to a schedule of prostate-specific antigen (PSA) tests and periodic biopsies. If there is evidence of disease progression, appropriate therapy is considered.[2, 35, 36] Another approach, watchful waiting, is a strategy that foregoes curative treatment and initiates treatment only when symptoms occur.[37]

A robotic surgical system became available in 2000 to help perform laparoscopic RP.[7, 8] This expensive technology allows 3D visualization and 10 times magnification of the neurovascular and urinary structures involved in the procedure.[9] Whether the use of a robot adds value in terms of clinical outcomes relative to cost remains controversial.[10–14] While similar rates of cancer control are achieved with robot-assisted and open RPs, it remains uncertain whether either procedure is advantageous in terms of lowering rates of perioperative complications (e.g., blood loss) or longer-term outcomes (e.g., incontinence, impotence).[7, 10, 15–22] RPs are complex and lengthy procedures, and surgeons who have adopted robotic technology report that it facilitates ease of pelvic access, aids visualization and improves ergonomic comfort during surgery.[23, 24]

The delivery of surgical care for men with prostate cancer in Canada has not been well described. This report describes trends in surgical approaches to prostate cancer by province and territory, as well as the extent to which length of stay, duration of surgery and hospital readmission vary by surgical approach.

Methods

This section describes the data sources used, how prostate cancer patients were identified and how related surgical procedures were defined (see the website for further information on methods).

Data Sources

Three sources of information were used to identify all inpatient and day surgery surgical procedures that took place between 2006–2007 and 2012–2013, inclusive:

- Hospital Morbidity Database, Canadian Institute for Health Information (CIHI)
- National Ambulatory Care Reporting System, CIHI
- Alberta Ambulatory Care Reporting System, Alberta Health

Identifying Cancer Patients and Surgical Procedures

Men who received potentially curative surgical treatment for primary prostate cancer were defined as those with hospital discharges with a most responsible diagnosis of primary prostate cancer and a cancer-related surgical intervention indicated anywhere on the abstract (see CIHI's website for a list of diagnostic and intervention codes). This report focuses specifically on RP, which accounts for 97% of potentially curative surgeries performed to treat men with prostate cancer (see Table A1 on CIHI's website).

Hospitalizations were calculated using episodes of care. An episode of care refers to all contiguous inpatient and day surgery[ii] records. To construct an episode of care, transfers within and between facilities were linked. These treatment episodes were used to calculate lengths of stay and readmissions.

Results shown by province pertain to the location of surgery, not the province of patient residence.

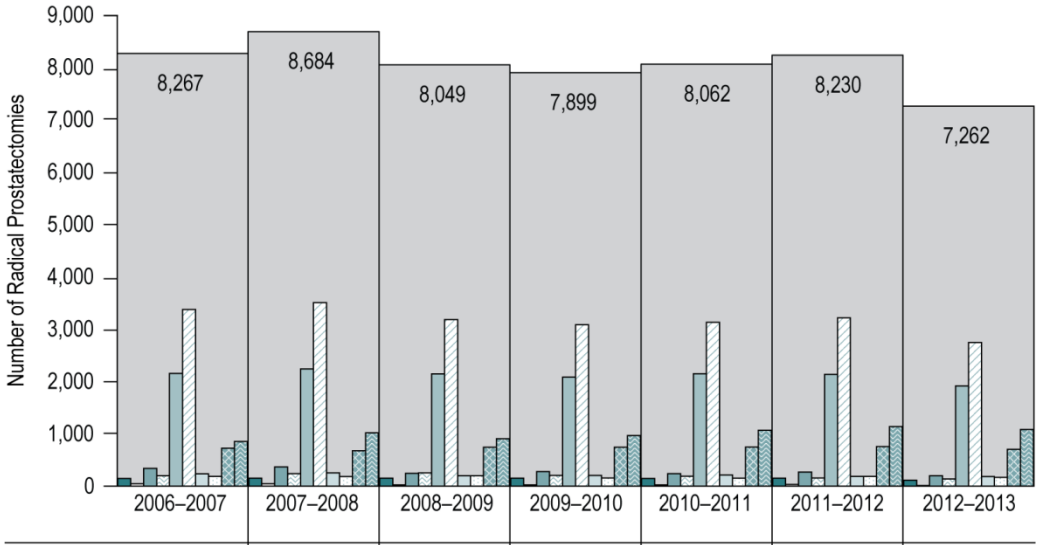
ii. Virtually all (more than 99%) RPs are performed as inpatient procedures.

Results

Potentially Curative Surgical Treatment

The annual RP[iii] volume over the seven-year study period ranged from 7,262 to 8,684, with no significant trend observed. There was a large decrease in RP from 2011–2012 to 2012–2013 (Figure 1). This decline was observed across all provinces.

Figure 1: Number of Radical Prostatectomies by Province of Surgery, 2006–2007 to 2012–2013



	2006–2007	2007–2008	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013
Canada	8,267	8,684	8,049	7,899	8,062	8,230	7,262
N.L.	150	152	151	152	149	153	111
P.E.I.	46	48	26	24	24	33	13
N.S.	342	367	244	279	238	272	201
N.B.	199	242	254	206	191	156	138
Que.	2,151	2,239	2,143	2,083	2,148	2,133	1,918
Ont.	3,375	3,504	3,180	3,086	3,130	3,214	2,742
Man.	236	253	201	203	213	189	183
Sask.	189	182	200	157	154	189	170
Alta.	725	676	744	742	749	755	702
B.C.	854	1,021	906	967	1,066	1,136	1,084

Sources

Hospital Morbidity Database and National Ambulatory Care Reporting System, 2006–2007 to 2012–2013, Canadian Institute for Health Information; Alberta Ambulatory Care Reporting System, 2006–2007 to 2009–2010, Alberta Health.

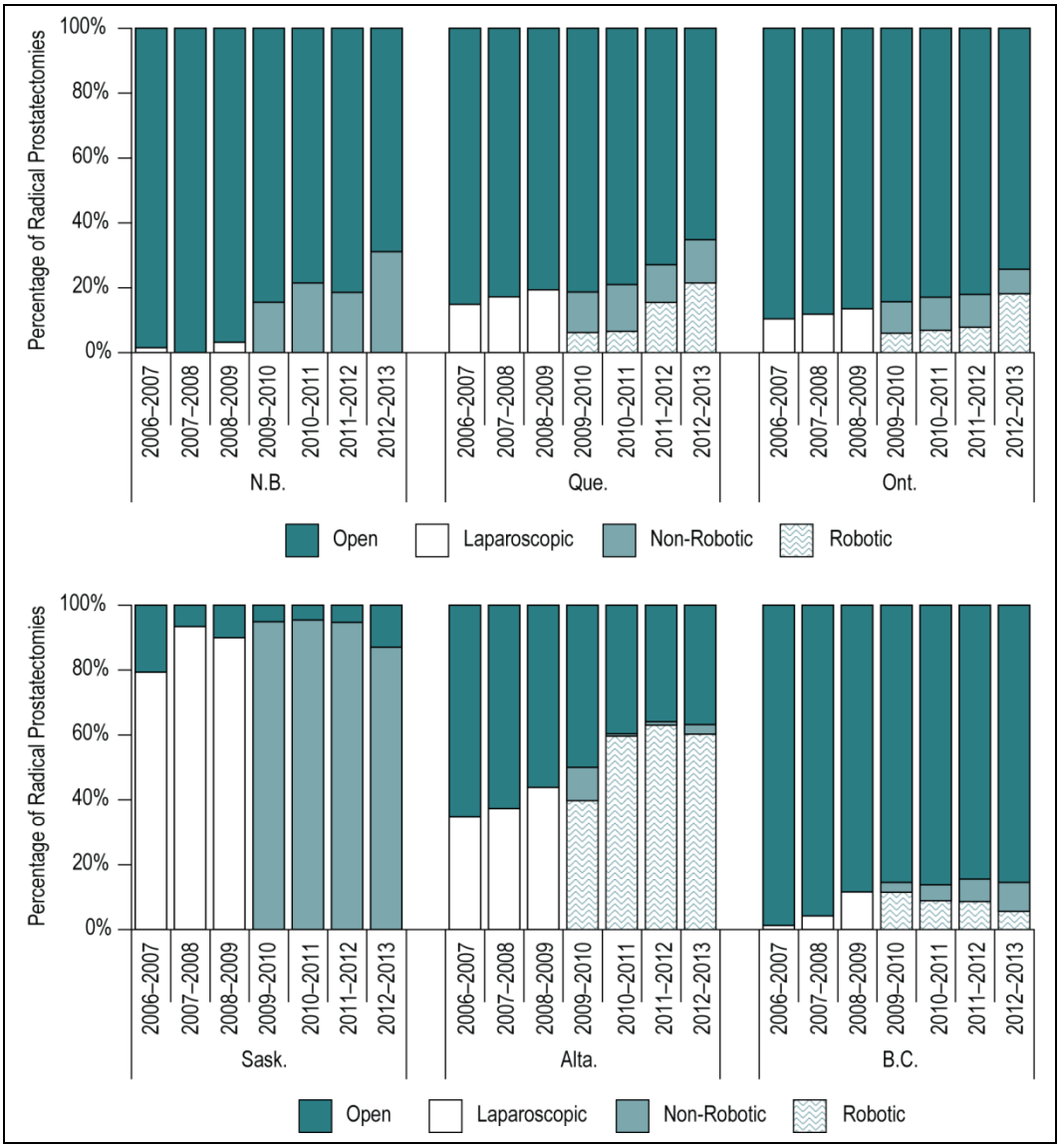
iii. RP is almost exclusively performed to treat prostate cancer (98.7% of all RPs were performed on men with prostate cancer).

Adoption of Surgical Approaches Across Canada

The focus of the subsequent analyses is on surgical approach: whether RP was performed using an open or laparoscopic approach with or without robotic assistance. Codes for the use of robots to perform RP became available in 2009–2010. Consequently, descriptions of surgical approaches prior to 2009–2010 are limited to comparing open RP with laparoscopic RP. Laparoscopic RP is broken down into robotic versus non-robotic for the last four years of the study period (2009–2010 to 2012–2013).

Figure 2 presents the percentage of RPs by jurisdiction, surgical approach and year. A table showing the volume of RPs by jurisdiction, surgical approach and year is available on CIHI's website (Table A2).

Figure 2: Percentage of Radical Prostatectomies by Surgical Approach, Selected Jurisdictions, 2006–2007 to 2012–2013



Sources

Hospital Morbidity Database and National Ambulatory Care Reporting System, 2006–2007 to 2012–2013, Canadian Institute for Health Information; Alberta Ambulatory Care Reporting System, 2006–2007 to 2009–2010, Alberta Health.

Open Versus Laparoscopic Surgical Approach

There was a two-fold increase in the use of laparoscopic RP in Canada over the study period, rising from 13% in 2006–2007 to 30% in 2012–2013. There were significant differences across jurisdictions in the use of the open versus laparoscopic approach. Almost all (99.6%) laparoscopic RPs were performed in six provinces: New Brunswick, Quebec, Ontario, Saskatchewan, Alberta and British Columbia. Virtually all RPs done in Newfoundland and Labrador, Prince Edward Island, Nova Scotia and Manitoba were performed using the open surgical approach.

Among the six provinces performing laparoscopic RP, there were large differences in the share of RPs performed laparoscopically, as well as in the seven-year trends in the use of laparoscopic RP (Figure 2).

- Alberta had the largest increase in the use of the laparoscopic approach, with an absolute increase of nearly 30%. The rate plateaued in the last three years of the study period.
- New Brunswick, Quebec and Ontario experienced a steady increase in the use of laparoscopic surgery, although a smaller absolute increase than that seen in Alberta.
- B.C. had a large initial increase in the use of laparoscopic surgery, but its use remained relatively constant at 15% over the last four years of the study period.
- In Saskatchewan, nearly all RPs were performed laparoscopically over the study period.

Robotic Assistance (2009–2010 to 2012–2013)

During the study period, Quebec, Ontario, Alberta and B.C. were using robots to perform RP. The number of robot-assisted RPs performed in these provinces grew from 720 in 2009–2010 to 1,394 in 2012–2013.

- In Quebec and Ontario, robot-assisted RP increased markedly, nearly doubling during the most recent four-year period (Figure 2). The previously noted increases in laparoscopic RP in Quebec and Ontario were almost exclusively driven by the increased use of robotic assistance (non-robotic laparoscopic RP was relatively constant over the four years).
- In Alberta, virtually all laparoscopic RPs were performed using robotic assistance (Figure 2). The increase in laparoscopic RP in Alberta was exclusively driven by the increase in robotic assistance (non-robotic laparoscopic RP declined over the four years).
- In B.C., robotic assistance declined. The share of laparoscopic RPs performed with robotic assistance in 2012–2013 was half that observed in 2009–2010 (Figure 2). Overall laparoscopic RP remained relatively constant in B.C. at 15% (non-robotic laparoscopic RP increased over the four years).
- In Saskatchewan, where nearly all RPs were performed laparoscopically, none of the procedures involved robotic assistance (Figure 2).

The share of RPs performed in Canada that used robotic assistance doubled over the four-year period from 9.1% in 2009–2010 to 19.2% in 2012–2013.

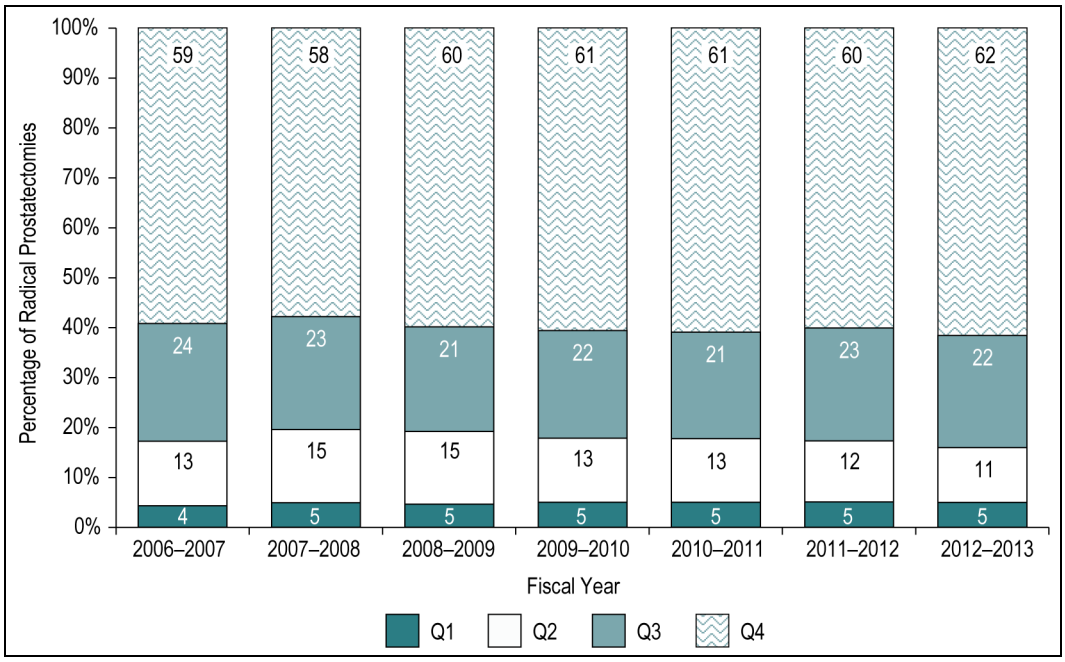
Impact on Organization of Care

Centralization

A trend toward increased centralization of surgical care is characterized by a larger share of procedures being performed over time at hospitals with the largest volumes. In the case of RP, centralization could occur if patients were drawn away from small-volume hospitals without laparoscopic RP to larger hospitals that offer laparoscopic surgery.

The number of hospitals performing RP decreased slightly, from 157 in 2006–2007 to 145 in 2012–2013. That there were relatively few hospitals performing RP may be explained by the reliance on specialists rather than general surgeons to perform the procedure. Virtually all (99.7%) RPs over the study period were performed by urologists. The hospitals performing RP were sorted into quartiles according to the number of RPs performed each year (see Table A3 on CIHI's website). The first quartile (Q1) includes the 25% of hospitals with the lowest volumes (performed 17 or fewer surgeries in 2012–2013), while Q4 includes the 25% of hospitals with the highest volumes (performed between 59 and 345 surgeries in 2012–2013).

Figure 3: Percentage of Radical Prostatectomies by Hospital Volume Quartile, 2006–2007 to 2012–2013



Sources

Hospital Morbidity Database and National Ambulatory Care Reporting System, 2006–2007 to 2012–2013, Canadian Institute for Health Information; Alberta Ambulatory Care Reporting System, 2006–2007 to 2009–2010, Alberta Health.

There was no change in the degree of centralization of RP in Canada over the seven-year study period, as indicated by the lack of marked variation in the distribution of RPs by hospital volume quartile over time (Figure 3). For example, the highest-volume hospitals (Q4) did not account for an increasingly larger share of procedures over the study period. The 25% of hospitals with the highest volumes accounted for approximately 60% of all RPs (ranging from 58% to 62% over the study period). This stability in the distribution of RP across hospital volume occurred at the same time as there was a two-fold increase in the use of laparoscopic RP in Canada.

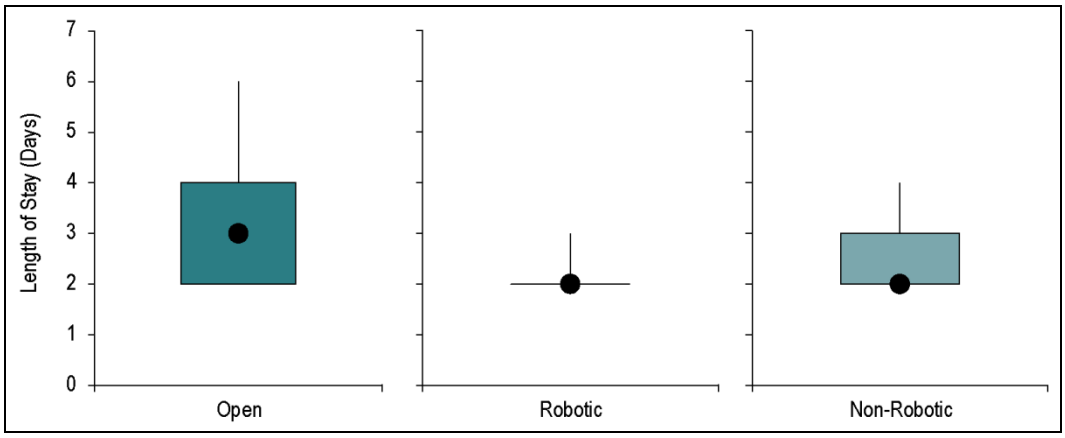
Surgical Outcomes (2009–2010 to 2012–2013)

Information on important potential complications of RP (e.g., incontinence, impotence, urethral stricture) was not available for analysis. Information presented on outcomes of surgery is confined to length of stay, duration of surgery and unplanned readmission within 30 days.

Length of Stay

Open RP was associated with a longer length of stay than laparoscopic procedures (Figure 4). Among laparoscopic procedures, those that were robot-assisted had shorter lengths of stay than those performed without robotic assistance. Of men undergoing open RPs, 37.6% had a length of stay of more than three days, compared with 8% of the men who had robot-assisted RP and 14.6% of the men who had non–robot assisted RP. Among men undergoing laparoscopic RP, 24% with robot-assisted RP spent more than two days in the hospital, compared with 37% of men with non-robotic laparoscopic RP. Length of stay decreased over the study period, with a more rapid decrease observed for the open approach than the laparoscopic approaches.

Figure 4: Median, Interquartile Range and 90th Percentile for Length of Stay by Surgical Approach, 2009–2010 to 2012–2013



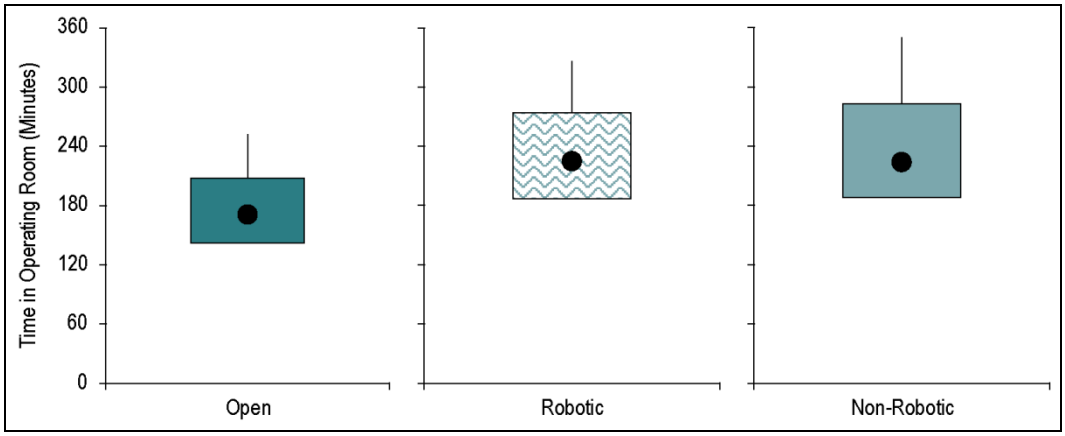
Sources

Hospital Morbidity Database and National Ambulatory Care Reporting System, 2006–2007 to 2012–2013, Canadian Institute for Health Information; Alberta Ambulatory Care Reporting System, 2006–2007 to 2009–2010, Alberta Health.

Time in Operating Room[iv]

Men undergoing open RPs spent less time (median 171 minutes) in the operating room than men undergoing a laparoscopic procedure, whether robot-assisted or not (median 220 minutes for each) (Figure 5). Less than half (43%) of men undergoing open procedures were in the operating room for three or more hours. In contrast, more than three-quarters of men undergoing laparoscopic RP were in the operating room for three or more hours.

Figure 5: Median, Interquartile Range and 90th Percentile for Time in Operating Room by Surgical Approach, 2009–2010 to 2012–2013



Sources

Hospital Morbidity Database and National Ambulatory Care Reporting System, 2009–2010 to 2012–2013, Canadian Institute for Health Information; Alberta Ambulatory Care Reporting System, 2009–2010, Alberta Health.

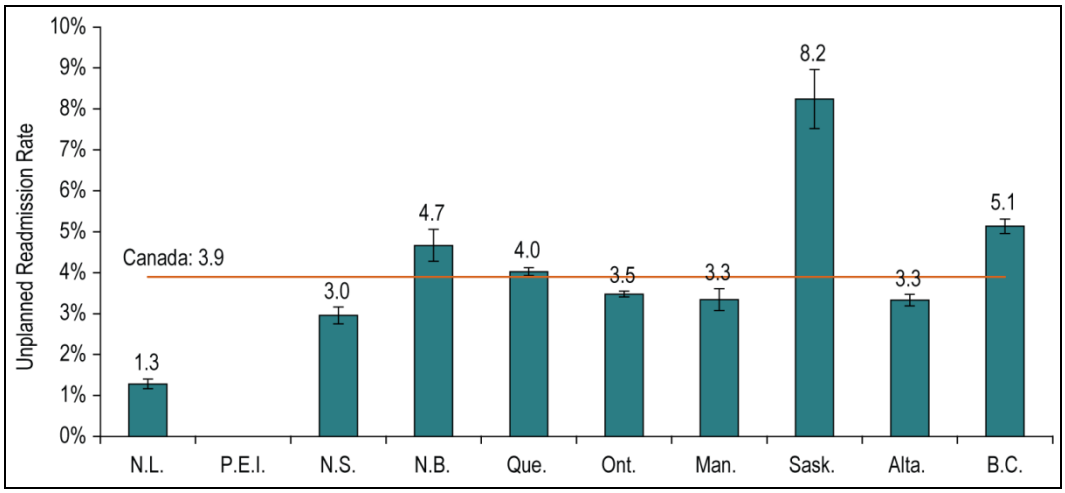
Unplanned Readmission Rates

The rate of unplanned readmissions occurring within 30 days of surgery was similar by type of surgical approach from 2009–2010 to 2011–2012 (3.8%, 3.9% and 3.8% for open, robotic laparoscopic and non-robotic laparoscopic procedures, respectively). Age-standardized unplanned readmission rates ranged from 1.3% in Newfoundland and Labrador to 8.2% in Saskatchewan[v] during this period (Figure 6).

iv. Surgeries performed in Quebec were not included in this analysis due to lack of data elements required to calculate time in operating room.

v. Given the high rate in Saskatchewan, additional analyses were conducted to confirm the validity of this result. Rates for Saskatchewan include readmissions to the Regina reassessment unit, which should be excluded (these are considered emergency department visits). However, although the exclusion of this small number of readmissions (<5 over 2009–2010 to 2011–2012) would slightly reduce the Saskatchewan readmission rate, it would still remain significantly higher than the Canadian average.

Figure 6: Age-Standardized Unplanned Readmission Rate by Province of Surgery, 2009–2010 to 2011–2012



Sources

Hospital Morbidity Database and National Ambulatory Care Reporting System, 2009–2010 to 2012–2013, Canadian Institute for Health Information; Alberta Ambulatory Care Reporting System, 2009–2010, Alberta Health.

Conclusions

Men with early-stage prostate cancer often face difficult choices—whether to undergo aggressive treatment with surgery or radiation or to consider active surveillance and forego, or at least postpone, invasive treatments with their attendant risks of long-term complications. These decisions are ideally made after being fully informed of the known risks and benefits of alternative approaches. If surgery is the preferred treatment course, it appears from the findings presented here that a man's surgical destiny is dictated largely by geography.

Surgical approaches to prostate cancer vary greatly by a hospital's geographic location. A man cared for in one jurisdiction is almost certain to have an open procedure, while one cared for in another is as certain to have a laparoscopic procedure. The variation in rates of surgical approaches for RP across Canada may be influenced by the preferences of patients, surgeons' training and preferences, as well as geographic and financial access. For example, four provinces have hospitals with da Vinci robots, making this approach available to some, but not all, men. Furthermore, payment for robot-assisted RP varies by jurisdiction. For example, in B.C., if a man wants to have his RP performed with robotic assistance, he must pay $5,800 to cover the additional cost of its use. In contrast, the Alberta Health Care Insurance Plan covers the use of robotic assistance in that province. Alberta has experienced the greatest increase in the use of the robot.

In terms of adopting robotic technology, Canada—with 11% of RPs performed with robotic assistance in 2010–2011—is similar to the United Kingdom, where 13% of RPs were performed robotically in that year.[25] In contrast to the limited uptake of robot-assisted RP in Canada, a dramatic trend toward centralization has been documented in the United States where, by 2008, 80% of RPs were being performed robotically[7] and in the highest-volume hospitals.[26] This rapid increase in use in the U.S. has been explained by aggressive marketing on the part of the robot's manufacturer, advertising to the public, competition among hospitals for market share and patient demand.[10, 26–29] In another contrast with the U.S., Canada's volume of RPs and number of hospitals performing RPs was relatively stable over the study period. In the U.S., the annual RP volume from 2000 to 2008 increased by 74%, and the number of hospitals performing RPs decreased by 19%.[30]

In response to the absence of adequate evidence on the effectiveness of robot-assisted RP, the Institute for Clinical Evaluative Sciences (ICES) conducted a study in 2012 of post-surgical complications following prostatectomy.[31] The investigators found a gradual uptake of robot-assisted RP in Ontario from 2005 to 2011 and discerned a benefit of robotic assistance in terms of surgical complications (e.g., blood transfusions, stricture) relative to RP performed by other methods. An earlier evaluation of robot-assisted RP based on a systematic review of the literature found that evidence was limited and uncertainty remained about the clinical benefits of the procedure compared with alternative approaches.[24] Currently, the cost relative to the benefit of robot-assisted RP is unknown.

Some of the findings reported here have been noted elsewhere. For example, length of stay has been shown to be longer for open versus laparoscopic RP.[5, 6, 21, 22] In addition, similar readmission rates by RP approach, but variation by jurisdiction, have been documented elsewhere.[32] Some have suggested that surgical outcomes are largely dictated by surgeon experience and institutional volume of procedures, not by surgical approach.[23, 33, 34]

At present, there is no systematic, population-based collection of longitudinal data on prostate cancer surgical outcomes in Canada. Consequently, the full range of complications associated with RP (e.g., incontinence, impotence) could not be described. In the absence of rigorous trials, a surveillance system could be used to capture information on surgical outcomes. The Ontario Health Technology Advisory Committee has recommended that a provincial steering committee on robot-assisted minimally invasive surgery be established to[31]

1. Advise on the development of province-wide registries to systematically collect outcomes data associated with this technology (e.g., patient-reported outcome measures, functional and surgical outcomes);
2. Monitor key performance indicators associated with this technology; and
3. Recommend training for surgeons on the use of this technology (e.g., mentorship, accreditation).

These recommendations highlight the challenge of effectively analyzing the outcomes of hospital-based treatments when complications may occur and be treated in a community care setting after discharge. In this report, analyses of complications of RP were limited to length of stay, operative time and unplanned readmission within 30 days.

This report is part of a larger, more comprehensive study of treatments for men with prostate cancer. Subsequent work will examine the treatment of men newly diagnosed with prostate cancer and will attempt to document the use of alternative modalities, including watchful waiting and active surveillance, radiation therapy, androgen-deprivation therapy and surgery. To conduct this larger study, CIHI's administrative data will be linked with data from cancer registries and other data sources. With such a linkage, a clearer picture will emerge of the range of available interventions to treat men with prostate cancer.

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How to cite this document:
Canadian Institute for Health Information. *The Delivery of Radical Prostatectomy to Treat Men With Prostate Cancer*. Ottawa, ON: CIHI; 2014.

Cette publication est aussi disponible en français sous le titre *Prostatectomie radicale pour le traitement du cancer de la prostate*.

ISBN 978-1-77109-310-1 (PDF) 8181-0814

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