A population-based study of the waiting times for prostatectomy in Ontario

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Introduction and objective: *Despite the high incidence of prostate cancer in Canada, there is currently limited information describing how these patients are being managed. The aim of this study was to review the surgical waiting times for radical prostatectomy in Ontario, utilizing existing population-based cancer databases, and to describe factors associated with prolonged waiting times.*

Methods: *This is a retrospective, population-based, observational study of men diagnosed with prostate cancer in Ontario between 1980 and 2000. The sources of data include the Ontario Cancer Registry linked to hospital discharge data, as well as census data from Statistics Canada. Study variables include age, county of residence, teaching hospital status, hospital surgical volume, area-level median household income and cause-specific survival. Waiting times were compared across study variables using univariate and graphical methods. Survival was compared across geographic regions with differing average wait times.*

Results: *We identified 9524 men treated with radical prostatectomy in Ontario over the study period and found the percentage of all patients with the disease who were treated surgically increasing from 3% to 20% over the last 2 decades. The overall time to prostatectomy has almost doubled with a median waiting time of 55 days in earlier eras to 91 days in 1996-2000. A few counties had significantly different wait times, whereas age and socio-economic factors were not associated with wait times across most eras. In the most recent eras, acute care hospitals and hospitals with higher surgical volumes had significantly higher waiting times (up to 20 days longer in 1996-2000, $p<0.0001$). Patients living in regions with the shortest wait times had statistically significant worse survival ($p=0.02$), implying that triaging has a greater impact than the potential effect of prolonged waits.*

Conclusions: *The observed increases in waiting times for radical prostatectomy from this study are similar to the known increases in waiting times for radiotherapy. This increased time to treatment is an illustration of the stress on the health care system in Ontario.*

Key Words: prostatic neoplasms, surgery, waiting times

Introduction

Prostate cancer is an important public health concern, representing the most common visceral cancer and the second leading cause of cancer deaths of North American males.[1] Despite the size of the problem, optimal management of both localized and metastatic disease remains elusive. The management of apparently localized cancer still remains less than satisfactory with 5-year biochemical failure rates for radical prostatectomy ranging from 27%[2] to 57%.[3] Although screening efforts attempt to detect cancer at earlier stages, it has been estimated that even today, 25% of men diagnosed with prostate cancer will

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eventually succumb to metastatic disease.[4]

There is some evidence that waiting times for cancer surgery in Canada is becoming a problem,[5] particularly for urologic cancers.[6] Prolonged waiting times have been associated with poorer outcomes in several surgical procedures, including those for benign and malignant disease.[7-9] Nam et al recently published a historical cohort of 645 patients treated with radical prostatectomy between 1987 and 1997 and suggested that patients had a decreased recurrence-free survival if waiting times were delayed greater than 3 months.[10] Although prolonged waiting times for prostate cancer surgery undoubtedly have significant effects on patients psychosocial well being,[11] there is still no apparent agreement on the optimal timing of treatment of these patients with either radiotherapy or prostatectomy. Therefore, we conducted a study in order to describe the waiting times of men for treatment of localized prostate cancer across Ontario utilizing existing population-based cancer databases, to describe factors associated with prolonged waiting times and to present survival probabilities by waiting time.

Methods

We performed a population-based observational study of those men diagnosed with prostate cancer between January 1, 1980 and December 31, 2000. The study made use of the cancer treatment database in the Division of Cancer Care and Epidemiology (CCE) in the Queen's Cancer Research Institute at Queen's University, Kingston, Ontario. This database is based upon linked electronic information from the Ontario Cancer Registry (OCR), the Canadian Institute for Health Information (CIHI), all of the regional cancer centres and census data from Statistics Canada.[12-14]

The OCR is a population-based cancer registry, which captures information on at least 97% of all incident cases diagnosed in the province of Ontario.[15,16] The CIHI database compiles data about all hospitalizations in Ontario including records of all diagnoses and surgical procedures. The cancer centre data provided information on radiotherapy. Area-level socio-economic data were linked to the CCE database from census data provided by Statistics Canada. The cancer registry also provides us with the date of death and cause of death. The details of this linkage have been previously described.[12] The database does not include information regarding stage, grade, PSA or functional status of patients.

We identified the study population using the code for prostate cancer from International Classification of Diseases (ICD). The Canadian Classification of Procedures code for radical prostatectomy was used to identify those who had surgery. We also separately identified prostate cancer cases treated with radiotherapy from every centre in Ontario. These centres are the sole providers of radiotherapy in the province.

The study variables included age at diagnosis, county of residence, teaching hospital status, hospital surgical volume based on radical prostatectomy rates, and survival. We also used the enumeration area-level median household income divided into quintiles based on the income distribution in the general population as an aggregate measure of socio-economic status. This variable was not available, however, for the years 1980-1985 due to the absence of postal codes that were used for the area assignment.

We defined the waiting period for surgery as that time from the diagnosis of prostate cancer in the registry to the admission date for radical prostatectomy in the hospitalization data. We compared wait times across categories of the study variables using univariate and graphical methods. For the analysis of the waiting time data we included those patients who had surgery greater than 1 week and less than 1 year from the date of diagnosis of prostate cancer. All analyses were run separately in the following eras: 1980-1985, 1986-1990, 1991-1995 and 1996-2000. As a comparator, we also calculated the waiting times for radical radiotherapy, defined as the time from diagnosis to the first date of high dose radiation treatment within 1 year after diagnosis. These radiotherapy data were not complete for the years 1998-2000 so these comparisons were restricted to 1980-1998.

To examine the potential effect of prolonged waiting times on patient survival and mitigate the effect of case selection for varying wait times (triaging), we compared the cancer-specific survival of patients living in counties with short and long wait times. We used two strategies to do these analyses. First, we ordered the forty-eight counties in the province by mean wait times. We compared the cause-specific survival of the patients living in the counties that made up the quintile with the shortest waits to those living in the counties that made up the quintile with the longest waits. Second, to partially control for possible case-mix differences among counties, we compared cancer-specific survival of patients in the subset of counties within the quintiles with the high and low wait times where the age adjusted incidence

of prostate cancer was similar to the provincial average. In the absence of staging information, our reasoning for this second strategy was that counties with similar age-adjusted incidence are more likely to have similar rates of PSA-detected disease. These analyses were restricted to those patients diagnosed before 1998 to ensure adequate follow up.

Data were analyzed using Statistical Analysis Software (SAS Institution Inc., Cary, NC, USA). The treatment rates and waiting times are reported with 95% confidence intervals. The waiting times across categories of the study variables were analyzed for trend using regression analyses that treated each variable's categories as ordinal. The survival of different groups based on their waiting time was compared using Cox proportional hazards regression to control for age.

Results

We identified 81101 men diagnosed with prostate cancer in Ontario between 1980 and 2000. We found 9524 men who subsequently had radical prostatectomy within 1 year of diagnosis. Table 1 describes the overall prostate cancer population and those treated with radical prostatectomy or radiotherapy by the year of diagnosis.

As expected the number of prostate cancer cases diagnosed in each era increased dramatically over the study period. Table 1 describes the percentage of cases managed by the two standard treatment modalities of radical prostatectomy and radiotherapy. The percentage of men diagnosed with prostate cancer who subsequently have surgical treatment has increased over the last decade, from nearly 3% in the earliest era to 19.7% in the latest era.

Table 1 also describes the percentage of men treated with prostatectomy by age at diagnosis and median household income. The proportion of men treated by prostatectomy increased with the highest quintiles of median household income in every era. The proportion of men treated with prostatectomy decreased with advancing age. In the most recent era, almost 60% of prostate cancer cases less than 50 years old were treated with prostatectomy compared to only 4% in the group who were over 70 years old.

TABLE 1. **Characteristics of men treated for prostate cancer in Ontario**

	1980-1985	**1986-1990**	**1991-1995**	**1996-2000**
Number diagnosed with prostate cancer	12,145	14,602	24,907	29,447
Number (%) treated with radiotherapy*	908 (7.5)	2,115 (14.5)	5,588 (22.4)	-
Number (%) treated with prostatectomy*	302 (2.5)	646 (4.4)	2,779 (11.2)	5,797 (19.7)
Percentage (95% confidence interval) treated with prostatectomy by median household income				
Lowest quintile	-	3.4 (2.8, 4.0)	7.6 (6.9, 8.3)	14.0 (12.9, 15.1)
2	-	4.1 (3.4, 4.8)	9.7 (9.0, 10.5)	16.5 (15.5, 17.5)
3	-	4.2 (3.4, 5.0)	11.5 (10.6, 12.4)	18.5 (17.5, 19.6)
4	-	5.7 (4.8, 6.7)	13.6 (12.6, 14.6)	24.2 (22.8, 25.6)
Highest quintile	-	6.3 (5.3, 7.4)	17.7 (16.5, 19.0)	29.4 (27.8, 31.1)
Percentage (95% confidence interval) treated with prostatectomy by age at diagnosis				
<50	1.5 (0, 4.5)	22.6 (12.2, 33.0)	41.0(33.5, 48.4)	58.9 (53.7, 64.1)
50-59	9.3 (7.5, 11.2)	15.7 (13.4, 18.0)	33.0 (31.0, 35.1)	49.1 (47.4, 50.8)
60-64	6.5 (5.2, 7.8)	11.0 (9.5, 12.5)	24.7 (23.2, 26.2)	40.6 (39.1, 42.1)
65-69	4.4 (3.6, 5.3)	6.8 (5.9, 7.8)	16.2 (15.2, 17.2)	27.1 (26.0, 28.2)
70+	0.3 (0.2, 0.4)	1.2 (1.0, 1.4)	2.7 (2.4, 3.0)	4.0 (3.7, 4.3)

*within 365 days from diagnosis

Figure 1 presents the median waiting times for treatment of men over the eras studied. The waiting times for surgery have almost doubled over the study period from a median of 55 days in the 1980-1985 era to 91 days in the 1996-2000 era. The Figure is restricted to 1998 as information for the later years were incomplete for radiotherapy. In comparison to surgical wait times, the waiting times for radiotherapy have also increased from a median of 80 days in the 1980-1985 era to 131 days in the 1996-1998 era.

Table 2 presents the mean wait times and 95% confidence intervals for prostatectomy by age at diagnosis, median household income, hospital surgical volume and hospital type (as defined by acute care teaching hospital). There was no difference in wait times by median household income in the latest eras. However, in the 1986-1990 era, there was a trend to increased wait times for men in higher income quintiles (p=0.04). There was no association between age and the surgical waiting times across the eras.

Table 2 also presents the mean wait times for prostatectomy by the hospital surgical volume and hospital type. In the latter two eras there is a longer wait time for men treated in a hospital with higher volumes of prostatectomies performed (p<0.0001). Also, the waiting times for surgery were longer in the

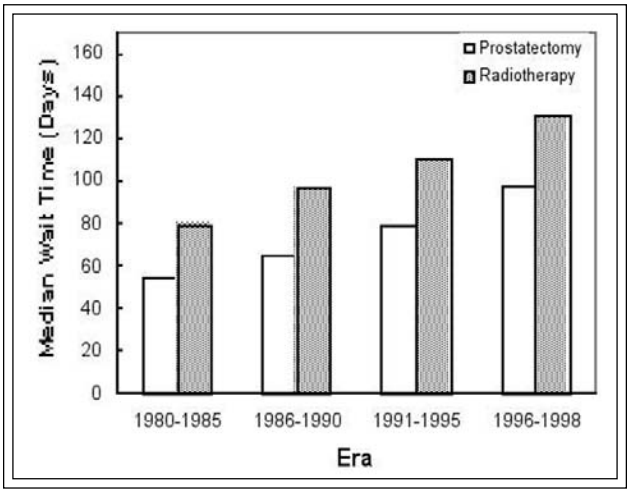

Figure 1. Median waiting times for prostate cancer treatment (radical prostatectomy and radiotherapy) in Ontario over the study eras from 1980-1998.

TABLE 2. **Wait times for prostate cancer surgery in Ontario**

	1980-1985	**1986-1990**	**1991-1995**	**1996-2000**
Wait times by age at diagnosis (days, 95% confidence interval)				
<50	83	91 (40, 142)	86 (72, 101)	99 (92, 107)
50-59	74 (59, 89)	79 (69, 88)	94 (89, 98)	105 (102, 108)
60-64	76 (63, 89)	73 (66, 79)	98 (94, 102)	109 (106, 112)
65-69	76 (65, 87)	78 (71, 86)	94 (90, 98)	109 (106, 112)
70+	72 (43, 101)	86 (74, 99)	89 (83, 95)	106 (101, 111)
Wait time by median household income (days, 95% confidence interval)				
Lowest quintile	-	70 (62, 80)	96 (90, 102)	112 (107, 118)
2	-	73 (66, 80)	96 (91, 101)	112 (107, 116)
3	-	76 (66, 86)	93 (88, 97)	107 (103, 111)
4	-	89 (77, 101)	91 (86, 96)	111 (107, 115)
Highest quintile	-	84 (74, 94)	96 (91, 100)	107 (103, 111)
Wait time by hospital surgical volume (days, 95% confidence interval)				
<12/year	74 (67, 82)	72 (68, 77)	88 (843, 92)	104 (100, 109)
12-23/year	84 (57, 111)	98 (87, 110)	97 (92, 101)	97 (94, 99)
24-35/year	-	71 (50, 92)	93 (88, 98)	108 (104, 112)
36+/year	-	83 (67, 99)	102 (96, 107)	113 (111, 116)
Wait time by hospital type (days, 95% confidence interval)				
Acute care teaching hospital	74 (64, 86)	79 (73, 85)	106 (102, 109)	119 (116, 121)
Non teaching hospital	75 (66, 85)	78 (72, 85)	85 (82, 88)	99 (97, 100)

TABLE 3. **Survival in counties with long and short average wait times**

	N	Cancer-specific survival		Overall survival	
		RR*	95% CI	RR*	95% CI
All counties considered:					
Quintile with shortest waits	846	1.00	-	1.00	-
Quintile with longest waits	831	0.34	0.15, 0.75	0.62	0.41, 0.92
Subset of counties with similar incidence:					
Quintile with shortest waits	560	1.00	-	1.00	-
Quintile with longest waits	666	0.33	0.14, 0.78	0.54	0.34, 0.86

*controlling for age at diagnosis

acute care teaching hospitals over the last two eras (p<0.0001).

Figure 2 represents the waiting time to prostatectomy of different counties in Ontario over the last era. The graph shows that there are a number of counties that experienced statistically longer and shorter wait times (outside of the 95% confidence interval on the mean), but there did not appear to be any correlation with these differences and number of prostatectomies performed. The pattern of surgical wait times for patients living in counties that contain regional cancer centers was not different from the rest of the province.

Table 3 presents the relative risks of a prostate cancer death and any-cause death for those who lived in the long-wait counties to those who lived in the short-wait counties. These two groups comprise the quintile of patients who waited the longest (mean 133.5 days, 95% confidence interval: 129, 138) and the quintile who waited the shortest (mean 76.5 days, 95% confidence interval: 73, 80). Patients living in the long-wait counties experienced statistically significantly better cancer-specific and overall survival (p=0.007, p=0.02, respectively). We observed the same result when we focused on the subset of counties with prostate cancer age-adjusted incidence rates that were similar to the provincial rate.

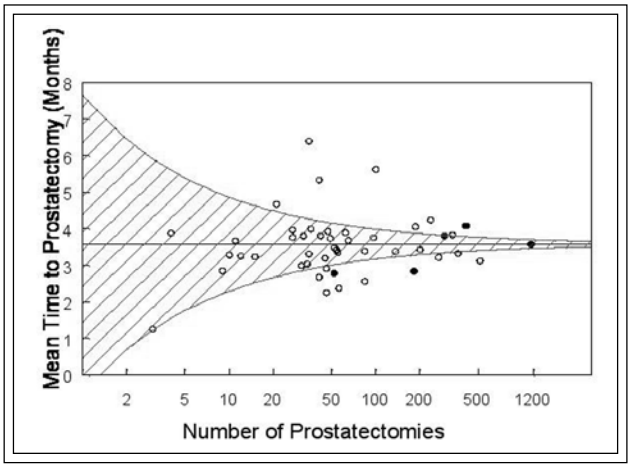

Figure 2. Mean time to prostatectomy in Ontario over the last study era (1996-2000) graphed by county and number of prostatectomies performed per year. Shaded area represents confidence interval of the mean. Solid circles represent counties that contain regional cancer centers

Discussion

The number of prostatectomies for prostate cancer has increased dramatically over the last 2 decades. The proportion of men treated with protatectomy is also increasing, most likely a result of earlier diagnosis of prostate cancer in the PSA era and the predilection of younger men to choose surgery as their preferred management option.

The waiting time for surgery has almost doubled over the study period with men waiting a median of 3 months from the time of diagnosis in the latest era. This increase of wait times has been mirrored by the waiting times for radiotherapy in the same patient population.

There appears to be differences in access to prostatectomy for men with lower socio-economic status over the last few eras studied, which could be explained by a staging effect. That is, men in the higher quintiles of household income may have been more likely to be diagnosed by a PSA test in the absence of symptoms, resulting in a lower stage distribution and more curable cases. As noted below, however, we could not explore this hypothesis in our database owing to the lack of systematic staging information. There was no corresponding difference in the waiting time for treatment based on median household income, implying similar access once the

diagnosis of a curable case has been made. Similarly, there was no difference in the waiting time to treatment based on the patient's age at diagnosis.

Hospitals with higher surgical volumes of prostatectomies had significantly longer waiting times. Longer waiting times were also identified when patients were treated at acute care teaching hospitals although there was a correlation between hospital type and a higher number of prostatectomies performed.

This population-based examination of waiting times for prostatectomy did not suggest that those patients currently waiting longer periods for surgery (up to 12 months) suffer a decrease in cancer-specific survival. Interestingly, those living in counties with short waiting times tended to have worse survival. This finding would be most consistent with the treating surgeons triaging patients with more significant disease. An individual patient-level comparison of the survival-waiting time association would have been invalid because we could not properly consider case mix differences among those who are triaged to varying waiting times for surgery. Our focus on county-level comparisons assumes that case mix is going to be more similar when the comparison groups are defined by where they live rather than on their individual wait time for treatment. We also attempted to reduce any between-county case mix differences through a secondary analysis that focused on counties with similar age-adjusted incidence (and therefore, similar rates of PSA-detected disease), but the triage effect was still present.

One major strength of our study is that it provides a comprehensive view into the care of patients across Ontario over a period that spanned the introduction of PSA and the large changes that have occurred in the health care system. The OCR captures information on at least 97% of all incident cases of cancer diagnosed in Ontario and the quality of the electronic data of major cancer surgery has been previously published.[17]

One major weakness of this study is the lack of a number of patient and tumor characteristics including tumor stage, Gleason grade and PSA values. Waiting times for prostatectomy could very well be dependent on the disease severity and, as just mentioned, our survival results do indeed suggest that there is some degree of triaging of patients with more significant disease.

In this study, we did not demonstrate an association between longer waiting times and poorer patient survival. Our results do not differ from those of Nam et al, who recently reported on the recurrence-free survival of a single-institution series of 645 patients. They observed no difference among the wait time groups when they controlled for differences in PSA, grade and stage in the analysis. Our results do demonstrate, however, substantial delays from diagnosis to prostatectomy that are longer in recent eras and in academic institutions. These increasing wait times are important regardless of their impact on patient survival, as they may have significant impact on patients' psychosocial well being, on physician or patient decision-making, or on other outcomes associated with a stressed health care system.

Our results describe increases in waiting times for prostatectomy over the last decade that are similar to the increase of the known waiting times for radiotherapy. This increased time to treatment is an illustration of the stress on the health care system in Ontario. Further study on the association between waiting times for treatment and patient survival will need to be conducted to help guide clinicians about the optimal timing of treatment for prostate cancer. □

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