Prostate cancer—testing, incidence, surgery and mortality

Laurie Gibbons and Chris Waters

Abstract

Objectives

This article examines recent use of the prostate-specific antigen (PSA) test and presents trends in prostate cancer incidence, surgery and mortality.

Data sources

Data are from the 2000/01 Canadian Community Health Survey, the National Cancer Incidence Reporting System and the Canadian Cancer Registry, the Hospital Morbidity Database, and the Canadian Mortality Database.

Analytical techniques

Descriptive data on PSA testing among men aged 40 or older were produced. Age-standardized prostate cancer incidence, surgery and mortality rates were calculated. Significant changes in linear trends were detected with joinpoint analysis. Provincial differences in incidence and mortality rates were tested using a one-way analysis of variance (ANOVA).

Main results

In 2000/01, 43% of Canadian men aged 40 or older reported having had a PSA test. Prostate cancer incidence rates rose in the early 1990s, but have since fallen. Prostate cancer mortality rates have decreased among men aged 60 or older, but show little change among younger men. While interprovincial differences in rates of PSA testing were significant, differences in incidence and mortality rates were not pronounced.

Key words

prostate-specific antigen (PSA), mass screening, radical prostatectomy, bilateral orchiectomy, health surveys

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Prostate cancer is the second most commonly diagnosed cancer in Canadian men, and it ranks second behind lung cancer in cancer mortality.[1] In 2002, an estimated 18,200 men were diagnosed with the disease, and about 4,300 died from it.[1]

Compared with other forms of cancer, the prognosis for prostate cancer is favourable, with five-year relative survival after diagnosis estimated at 88%.[2] As with most cancers, survival from prostate cancer depends on the extent to which the tumour has spread, or stage at diagnosis.

Advances in the early detection and diagnosis of prostate cancer—most importantly, the prostate-specific antigen (PSA) test—have contributed to sharp fluctuations in incidence rates over the past two decades.[3-5] At the same time, treatments for prostate cancer have changed dramatically, as new options became available.[6,7] A great deal of controversy surrounds the implications of these trends, especially the possible impact of widespread PSA

Methods

Data sources

The information on prostate-specific antigen (PSA) testing in this analysis is from cycle 1.1 of Statistics Canada's 2000/01 Canadian Community Health Survey (CCHS). The CCHS covers the household population aged 12 or older in all provinces and territories, except persons living on Indian reserves, on Canadian Forces bases, and in some remote areas. Data collection for cycle 1.1 began in September 2000 and was conducted over 14 months.

The CCHS uses the area frame designed for Statistics Canada's Labour Force Survey as its primary sampling frame. A multistage stratified cluster design was used to sample dwellings within the area frame. A list of the dwellings was prepared, and a sample of dwellings was selected from the list. The majority (83%) of the sampled households came from the area frame, and face-to-face interviews were held with respondents randomly selected from households in this frame. In some health regions, random digit dialling (RDD) and/or a list frame of telephone numbers was also used. Respondents in the telephone frames (the remaining 17% of the targeted sample) were interviewed by telephone.

In approximately 82% of the households selected from the area frame, one person was randomly selected; two people were randomly chosen in the remaining households. For households selected from the telephone frames, one person was randomly chosen.

The overall response rate for cycle 1.1 was 84.7%; the sample size was 131,535. The sample size for men aged 40 or older was 33,741, weighted to represent an estimated 6.6 million men.

Information on PSA testing is presented for Canada and the provinces. The national figures for PSA tests do not include the territories.

Incidence data for prostate cancer are from the National Cancer Incidence Reporting System (1980 to 1991) and from the Canadian Cancer Registry (1992 to 1998). Each year, provincial and territorial cancer registries report information on all cases of cancer diagnosed in their jurisdictions to the Health Statistics Division at Statistics Canada, which maintains these databases.

The data on radical prostatectomy and bilateral orchiectomy are from the Hospital Morbidity Database, maintained by Statistics Canada between 1981/82 and 1994/95, and by the Canadian Institute for Health Information since 1995/96. The information in this database comes from the admission/separation form completed by hospitals at the end of each stay when a patient is "separated" as a discharge or a death. The file contains data on all inpatient cases separated from general and allied special care hospitals during the fiscal year. Because a patient may be admitted and discharged several times during one year, the statistics are a count of separations, not individual patients.

Mortality data for 1980 to 1998 are from the Canadian Mortality Database, which compiles information provided by the vital statistics registrars in each province and territory. The database is maintained by Statistics Canada and is a virtually complete count of all vital statistics.

Analytical techniques

Information from the 2000/01 CCHS on self-reported use of the PSA test was examined for men aged 40 or older (see *Definitions*) by 10-year age group and by province. Proxy responses were not accepted for questions on PSA testing. Statistically significant differences in use of the PSA test between the overall rate and each age group and/or province were determined using a z-test on the weighted proportions. The critical value was set to account for multiple comparisons.

Age-standardized prostate cancer incidence and mortality rates were calculated for men aged 40 or older using the 1991 male population aged 40 or older as the standard population. Age-specific incidence and mortality rates were calculated by 10-year age group. Age-standardized rates for radical prostatectomies and bilateral orchiectomies among men diagnosed with prostate cancer were calculated for Canada and the provinces and by 10-year age group, based on the male population aged 40 or older.

Joinpoint regression analysis was performed on all incidence, mortality and surgery rates between 1980 and 1998.[8] This analysis fits regression lines to the data. The rates, because of their Poisson distribution, were fitted to the log scale, allowing a minimum of 0 and a maximum of 3 joinpoints. All other modelling options were unchanged from the system defaults. The year in which there was a statistically significant change in the slope of the regression line for each of the age-standardized and age-specific rates is a joinpoint.[9] Average annual percentage changes were computed between those time periods.

To examine provincial differences among the age-standardized rates, three-year cumulative averages of the provincial rates were computed and compared with each other with a one-way analysis of variance (ANOVA) using the Bonferroni t-test.

testing. Recently, data have been reported showing that prostate cancer mortality rates may be declining in Canada and the United States.[10-12]

This article examines PSA testing among men aged 40 or older for Canada and the provinces, based on information from the 2000/01 Canadian Community Health Survey (CCHS). National and provincial trends from 1980 to 1998 in prostate cancer incidence and mortality are presented. Trends in surgery related to prostate cancer are also shown (see *Methods, Definitions* and *Limitations).*

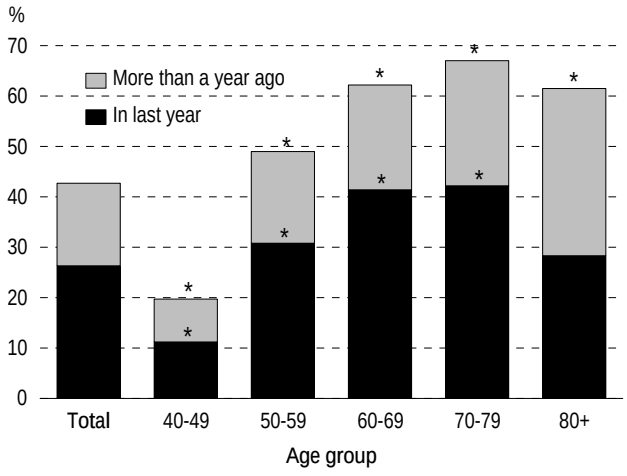
Less than half have had PSA test

Around the mid- to late 1980s, screening for prostate cancer using the PSA test gained widespread acceptance in Canada.[13-15] This test, which measures the level of prostate specific antigen in the blood, was initially developed to monitor the progress of prostate cancer, but its use for screening among asymptomatic men has increased dramatically.[14,16,17]

According to CCHS data, in 2000/01, 43% of Canadian men aged 40 or older reported having had a PSA test at some point (Chart 1). The proportion was highest at older ages, peaking at 67% among 70- to 79-year-olds. Close to half of men in their fifties had been tested; among those in their forties, the figure was just 20%. These rates were higher than in 1995 when, according to a telephone survey, 6% of men aged 40 to 49, 13% aged 50 to 59, and 23% aged 60 to 69 reported having had the test.[18]

Most men who reported to the CCHS that they had had a PSA test said it was fairly recent: three-quarters had had one in the last two years, and about 6 in 10 had been tested in the last year. As a percentage of all men aged 40 or older, however, just over one-quarter (26%) had been tested in the previous year. The figure was highest among men in their sixties and seventies (more than 40%), and lowest among those in their forties (11%).

Chart 1
Percentage of men aged 40 or older who had PSA test, by recency of test and age group, Canada excluding territories, 2000/01



Data source: 2000/01 Canadian Community Health Survey, Cycle 1.1
** Significantly different from total ($p \leq 0.05$)*

Definitions

Use of the PSA test was based on self-reports from men aged 40 or older who were asked the following question in the 2000/01 Canadian Community Health Survey: "Have you ever had a prostate-specific antigen test for prostate cancer, that is, a PSA blood test?" Those who said "yes" were asked when they had had the test. Response options were: less than six months ago, six months to less than one year ago, one year to less than two years ago, two years to less than five years ago, and five or more years ago.

For the incidence and mortality data, prostate cancer was identified by code 185 from the *International Classification of Diseases, Ninth Revision* (ICD-9).[19]

Incidence is the number of new cases of prostate cancer diagnosed each year.

Mortality is the number of deaths during the year attributed to prostate cancer, based on the underlying cause of death.

The *age-standardized rate* is the number of new prostate cancer cases or deaths per 100,000 that would have occurred in the standard population (1991 male population aged 40 or older) if the actual age-specific rates observed in a given population had prevailed in the standard population. For provincial comparisons, age-specific rates used to calculate age-standardized incidence and mortality rates were calculated by aggregating counts of new cases and deaths for three-year periods and dividing by the correspondingly aggregated population for each province.

In accordance with the *Canadian Classification of Diagnostic, Therapeutic, and Surgical Procedures* codes,[20] *radical prostatectomy* was defined as the presence of procedure code 72.4; *bilateral orchiectomy*, 74.3.

Provincial variations in PSA testing

National and provincial public health organizations do not recommend the use of PSA testing for population-based screening for early detection of prostate cancer.[21-26] Provincial health insurance plans do not cover PSA testing to screen for prostate cancer, although they do pay when the test is ordered by a physician for the diagnosis of suspected prostate cancer or for the follow-up of previously diagnosed prostate cancer.[27] It is likely that physician practices with regard to the use of the test vary widely across the country, depending on the insistence of their patients and their own views about the wisdom of using it for the early detection of prostate cancer. This makes it difficult to distinguish between men who received a PSA test for screening and those who had it for diagnostic purposes. And indeed, provincial differences are apparent in the proportions reporting having been tested.

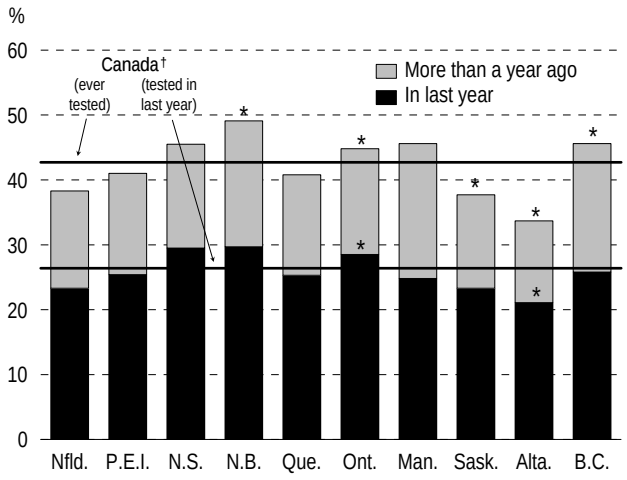
The percentage of men who reported ever having had a PSA test was significantly below the national level (43%) in Alberta (34%) and Saskatchewan (38%), and significantly above it in New Brunswick (49%), British Columbia (46%) and Ontario (45%) (Chart 2). When the percentage who reported being tested in the previous year was considered, just two provinces differed significantly from the national figure: Ontario, which at almost 29% was high, and Alberta, which at 21% was low.

Sharp rise in incidence in early 1990s

In 1998, 16,163 men aged 40 or older were diagnosed with prostate cancer, more than double the 6,079 diagnosed in 1980 (Appendix Table A). Of course, at the same time, the male population in this age range also increased. Yet the annual number of prostate cancers that were newly diagnosed outpaced population growth so that incidence rose from 186 new cases per 100,000 in 1980 to 296 per 100,000 in 1998.

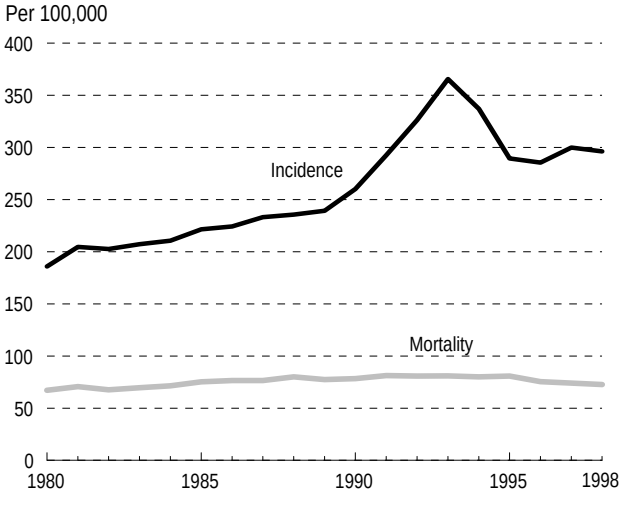
The overall rise in prostate cancer incidence masks considerable fluctuations. From 1980 to 1990, incidence rates increased steadily at an average of 2.8% a year (Chart 3). The annual rate of change jumped to 12.0% between 1991 and 1993. During the next three years (1994 to 1996), incidence rates dropped 8.6% a year, but by 1997 and 1998 were rising again, although at the relatively slow annual pace of 1.9%.

Chart 2
Percentage of men aged 40 or older who had PSA test, by recency of test and province, 2000/01



Data source: 2000/01 Canadian Community Health Survey, Cycle 1.1
† Excluding territories
** Significantly different from value for Canada ($p \leq 0.05$)*

Chart 3
Age-standardized prostate cancer incidence and mortality rates, men aged 40 or older, Canada, 1980 to 1998



Data sources: National Cancer Incidence Reporting System (1980 to 1991); Canadian Cancer Registry (1992 to 1998); Canadian Vital Statistics Database
Note: Standardized to age distribution of 1991 Canadian male population aged 40 or older, adjusted for net census undercoverage

Trends were similar in the United States, where prostate cancer incidence rose by 18% a year between 1989 and 1992, but then decreased by almost 13% a year.[28] It is widely thought that much of the steep rise in the early 1990s was attributable to increases in PSA testing.[4,5,29] When the US data are examined by stage at diagnosis, the subsequent decline was most dramatic for late-stage disease.[27] This may indicate a screening effect, whereby increased early detection exhausted the pool of prevalent cancers.[30] However, some of the decrease in incidence may reflect a decline in PSA testing since the early 1990s.[16,31]

Incidence up in most age groups

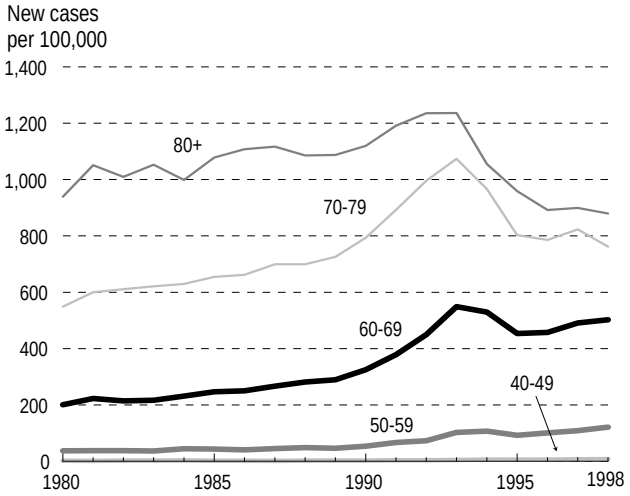
Like most cancers, prostate cancer incidence rates are highest at older ages (Chart 4, Appendix Table A). For example, in 1998, the rate was 879 new cases per 100,000 men aged 80 or older, compared with 121 per 100,000 men in their fifties and just 8 per 100,000 men in their forties.

Trends in prostate cancer incidence, however, differ by age group. The rise in 1990 was not as sharp among men aged 80 or older as among those in their seventies, and since 1994, rates have fallen or levelled off at age 60 or older. By contrast, after a brief downturn between 1994 and 1995, incidence rose among men in their fifties. Although very few men in their forties have prostate cancer, rates in this group rose as well.

These data suggest that the introduction of PSA testing led to more diagnoses among men younger than 80, while rates in older men seemed to have been unaffected. Whether early diagnosis of prostate cancer in younger men improves their prognosis remains to be seen. Some evidence suggests that men diagnosed before age 55 have lower five-year relative survival than do men aged 55 to 85,[2] perhaps because of the more aggressive nature of tumours in younger men. Most of this information, however, was based on cancers diagnosed before the PSA test was widely available.

Provincial differences in prostate cancer incidence rates are not pronounced. Throughout the period, rates in Newfoundland, based on three-year

Chart 4
Age-specific prostate cancer incidence rates, by 10-year age group, men aged 40 or older, Canada, 1980 to 1998



Data sources: National Cancer Incidence Reporting System (1980 to 1991); Canadian Cancer Registry (1992 to 1998)

Table 1
Age-standardized prostate cancer incidence rates, men aged 40 or older, Canada and provinces, 1981-1983 to 1996-1998

	Canada†	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
	New cases per 100,000										
1981-1983	195	125*	158	158	182	212	192	212	254	217	237*
1984-1986	215	152*	174	202*	213	219	206	240*	228	235*	275
1987-1989	237	160*	231	228	255	220	221	254	243	237	323*
1990-1992	296	178*	312	266	308	249	290	368	300	287	406*
1993-1995	351	228*	452	351	412	297	317	419	354	341	338
1996-1998	311	252*	352	324	369*	218*	314	316	300	326	341

Data source: National Cancer Incidence Reporting System (1981 to 1991); Canadian Cancer Registry (1992 to 1998)
Note: Based on three-year averages
† Includes territories
** Significantly different from value for Canada ($p \leq 0.05$, adjusted for multiple comparisons)*

averages, were significantly below the national level, and until the early 1990s, rates in British Columbia tended to be high. For the 1996-to-1998 period, rates were significantly low in Québec, and significantly high in New Brunswick (Table 1).

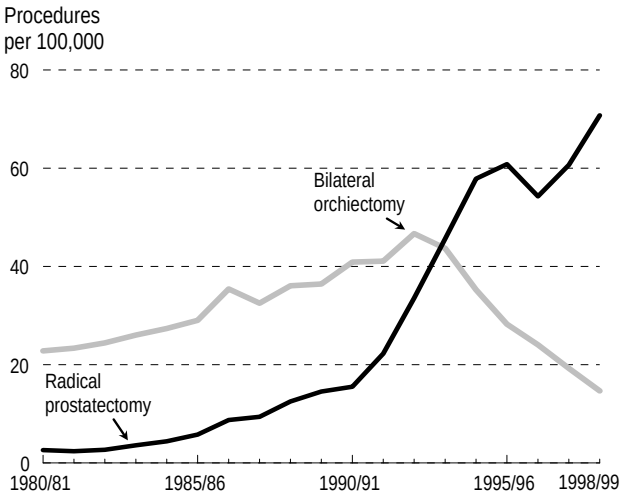
Treating prostate cancer

Once prostate cancer has been detected, treatment options depend on the extent of the disease. If the cancer is confined to the prostate, it can often be cured by radical prostatectomy, which is removal of the prostate gland. This is usually indicated for men who are in good health.[32,33] Radiation therapy is also an option for patients with localized disease, as is "watchful waiting" (observation with no treatment) for older men with no prostatic symptoms but other health conditions that may complicate treatment.[34] Advanced metastatic prostate cancer is not curable, but symptoms can be alleviated using treatments to block the hormones and slow the growth of tumours. This may consist of surgical removal of the testicles (bilateral orchiectomy) or the use of various hormonal treatments to decrease the amount of testosterone in the body.[35] Each treatment can have lifestyle implications, as major surgery, radiation and drugs often cause impotence and may cause incontinence.[32-35]

From 1980/81 to 1998/99, the rate of radical prostatectomy increased almost steadily from just 3 to 71 procedures per 100,000 men aged 40 or older diagnosed with prostate cancer (Chart 5, Appendix Table B). Throughout most of the period, rates were highest among men in their sixties, and rose sharply since 1991/92 (Chart 6). Beginning in 1990/91, rates also rose dramatically among men in their seventies, but since 1994/95, have showed signs of levelling off and perhaps decreasing. Among men in their fifties, rates rose almost continuously since 1989/90, and now exceed those for men in their seventies. Few men in their forties or aged 80 or older undergo radical prostactectomy.

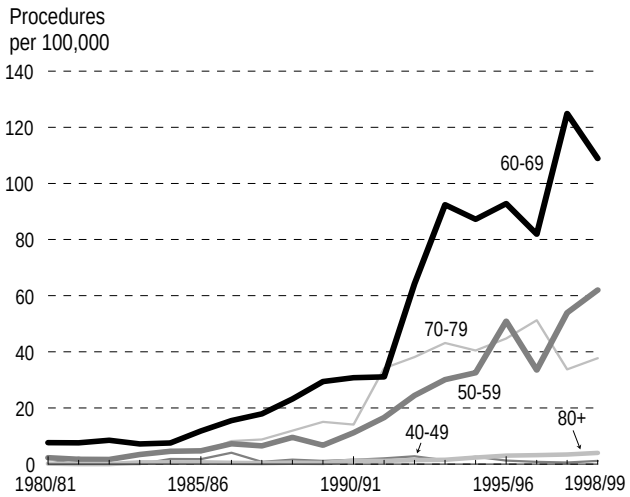
The rate of bilateral orchiectomy for men 40 or older rose between 1980/81 and 1992/93, but has since decreased (Chart 5). The 1998/99 rate was 14.6 per 100,000, compared with 22.8 in 1980/81 (Appendix Table C). However, the procedure does not always necessitate an overnight hospital stay, so it is possible that these figures underestimate the

Chart 5
Age-standardized surgery rates, by selected procedures, men aged 40 or older diagnosed with prostate cancer, Canada, 1980/81 to 1998/99



Data sources: Hospital Morbidity Database, 1980/81 to 1998/99
Note: Standardized to age distribution of 1991 Canadian male population aged 40 or older, adjusted for net census undercoverage

Chart 6
Age-specific radical prostatectomy rates, by 10-year age group, men aged 40 or older diagnosed with prostate cancer, Canada, 1980/81 to 1997/98



Data source: Hospital Morbidity Database, 1980/81 to 1998/99

number of surgeries, as they do not capture orchiectomies performed on a day-surgery basis. These trends mirror those reported in the United States.[6,7] The decrease in bilateral orchiectomies may be due, in part, to greater use of non-surgical hormonal treatments for late-stage prostate cancer, as well as a decrease in diagnoses of such cancers.[6,29]

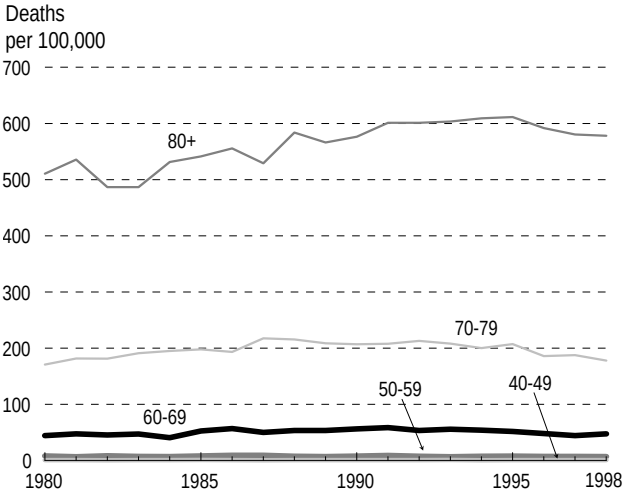
Mortality rate relatively stable

In 1980, prostate cancer claimed the lives of 2,034 Canadian men aged 40 or older; by 1998, the number was 3,664 (Appendix Table D). However, much of this numerical upturn was due to the increase of the adult male population. In fact, prostate cancer mortality rates were fairly stable (Chart 3). Rates rose steadily from 1980 by 1.1% a year, but since 1994 have decreased by 1.7% a year. In 1998, the rate was 73 deaths per 100,000 men aged 40 or older, relatively unchanged from 67 per 100,000 in 1980.

As expected, prostate cancer mortality rates were highest at older ages (Chart 7), although among men older than 60, rates began to decrease in the early to mid-1990s. By contrast, among men in their forties and fifties, prostate cancer mortality rates changed very little throughout the period.

Decreases in prostate cancer mortality rates in Canada and the United States have been noted previously.[10-12] Since the PSA test can detect cancers at earlier stages, this decline in mortality rates has provoked much interest.[28] An important consideration in any discussion of PSA tests and their possible effect on prostate cancer mortality is the amount of time by which diagnosis has been advanced by the test, also known as lead time. Slower-growing tumours will have long lead times, whereas aggressive cancers will have short lead times. A 1999 study concluded that PSA testing may have contributed to some of the recent decline in prostate cancer mortality by detecting cases that otherwise would have been diagnosed at a late stage.[36] It was felt that only patients with aggressive forms of prostate cancer would have short enough lead times for PSA testing to have had an effect. Others contend that most of the downturn happened too soon after the introduction of widespread PSA screening for it to have had an impact, and that the

Chart 7
Age-specific prostate cancer mortality rates, by 10-year age group, men aged 40 or older, Canada 1980 to 1998



Data source: Canadian Vital Statistics Database

Table 2
Age-standardized prostate cancer mortality rates, men aged 40 or older, Canada and provinces, 1981-1983 to 1996-1998

	Canada†	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
	Deaths per 100,000										
1981-1983	68	44*	68	68	76	74	67	72	78	70	68
1984-1986	76	61	85	82	70	80	70*	78	81	76	74
1987-1989	78	65	85	82	68	81	77	86	80	77	77
1990-1992	86	82	114	90	79	82	77*	90	85	82	76
1993-1995	84	80	98	88	82	81	80	82	90	85	75
1996-1998	78	71	78	86	82	70	73	79	94*	81	67

Data source: Canadian Vital Statistics Database
Note: Based on three-year averages
† Includes territories
** Significantly different from value for Canada ($p \leq 0.05$, adjusted for multiple comparisons)*

Limitations

Although information on the use of PSA tests is from self-reports (proxy reporting was not permitted), the degree to which data are inaccurate due to reporting error is not known.

Data on cancer incidence are provided by provincial cancer registries. While cancer registration is relatively consistent across the country, variations may exist in the way that new cases are registered. Some recent work in Québec has found that approximately one-third of prostate cancer cases are not registered because they have not been admitted to a hospital.[37] When incidence rates for Canada excluding Quebec were examined, there was little change in the overall or age-specific national trend (data not shown); nevertheless, interpretation of interprovincial differences should be made with caution.

The survey data on PSA testing were collected after that of prostate cancer incidence and mortality, and information on stage of disease at diagnosis is not available in the Canadian Cancer Registry. These two limitations make it difficult to draw any inferences about the possible influence of PSA on prostate cancer trends.

The surgical procedures reported in this article were limited to those performed in hospital, because outpatient procedures are not included in the Hospital Morbidity Database. This may result in underestimates, particularly of orchiectomies, which may not require an overnight hospital stay. As well, the use of non-surgical means of treating prostate cancer, namely radiation and hormonal therapy, could not be examined.

The numbers from the territories for prostate cancer incidence, mortality and surgery were very small, causing the rates for these regions to be unstable over time. Therefore, while territorial data are included in national estimates, they are not shown separately.

decline in mortality is due primarily to more aggressive treatment of later-stage disease.[38]

Three-year averages of prostate cancer mortality rates show few statistically significant differences between the provinces (Table 2). In the early 1980s, Newfoundland's rate was significantly below the national level, as was Ontario's in the mid-1980s and early 1990s. However, over the 1996-to-1998 period, the prostate cancer mortality rate differed from the national rate only in Saskatchewan, where it was significantly high.

Concluding remarks

An effective screening test is one that can detect a cancer early enough for the patient to be successfully treated, thereby leading to decreased mortality.[30,39] In 2000/01, about 4 in 10 men aged 40 or older reported having had a recent prostate-specific antigen test. While evidence suggests that PSA testing contributed to an increase in the diagnosis of prostate cancer in its early stages,[40-42] no data indicate that this resulted in decreased mortality.

It is likely that the decline in prostate cancer mortality rates occurred too soon after the initiation of population-based PSA testing for it to have been an effect of screening. The decrease is more apt to be due to improved treatments for later-stage cancer. Because of this, Canadian public health organizations do not currently advocate PSA testing for population-based screening. Other organizations, such as the Canadian Cancer Society, encourage men over 50 to discuss the possible risks and benefits of PSA and digital rectal exam (DRE) screening with their doctor.[27] Randomized trials of prostate cancer screening with PSA and DRE are underway, [43,44] but it will be some time before there will be definitive results about the effectiveness of these methods.

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Appendix

Table A
New cases of prostate cancer and age-specific incidence rates, by 10-year age group, men aged 40 or older, Canada, 1980 to 1998

	Age group											
	Total 40+		40-49		50-59		60-69		70-79		80+	
	Number	Rate per 100,000†	Number	Rate per 100,000	Number	Rate per 100,000	Number	Rate per 100,000	Number	Rate per 100,000	Number	Rate per 100,000
1980	6,079	185.9	26	2.0	440	37.1	1,679	200.7	2,470	548.5	1,464	938.7
1981	6,855	204.6	19	1.4	454	37.9	1,915	223.0	2,788	599.8	1,679	1,050.5
1982	6,966	202.6	36	2.7	454	37.5	1,890	214.2	2,923	610.3	1,663	1,008.8
1983	7,284	207.2	32	2.3	446	36.6	1,947	216.3	3,070	621.1	1,789	1,052.3
1984	7,684	210.6	41	2.9	546	44.6	2,122	231.2	3,214	629.0	1,761	998.3
1985	8,281	221.5	31	2.1	531	43.3	2,306	246.6	3,452	654.4	1,961	1,077.6
1986	8,569	224.1	33	2.2	499	40.6	2,390	249.9	3,574	661.5	2,073	1,107.4
1987	9,246	233.1	24	1.5	553	44.8	2,619	266.3	3,870	699.4	2,180	1,116.2
1988	9,633	235.5	42	2.5	604	48.6	2,844	281.0	3,943	699.0	2,200	1,085.5
1989	10,106	239.2	44	2.5	579	46.0	3,004	289.0	4,182	725.1	2,297	1,087.0
1990	11,386	260.1	47	2.6	682	53.7	3,447	325.1	4,743	793.3	2,467	1,119.4
1991	13,290	292.5	67	3.5	863	66.8	4,081	378.3	5,538	892.0	2,741	1,190.8
1992	15,274	326.3	71	3.6	960	73.1	4,904	449.1	6,388	995.2	2,951	1,235.4
1993	17,666	365.5	96	4.7	1,380	102.4	6,057	548.8	7,069	1,073.3	3,064	1,235.6
1994	16,731	336.9	126	6.0	1,485	106.8	5,887	529.5	6,518	966.0	2,715	1,054.4
1995	14,621	289.4	131	6.0	1,318	91.9	5,074	453.3	5,543	802.3	2,555	958.6
1996	14,790	285.4	137	6.1	1,497	100.8	5,154	457.4	5,564	785.2	2,438	891.6
1997	15,946	299.8	155	6.7	1,700	108.5	5,566	490.6	6,002	822.9	2,523	898.7
1998	16,163	296.2	155	7.7	1,989	121.0	5,735	502.1	5,725	761.4	2,534	879.2

Data source: National Cancer Incidence Reporting System (1980 to 1991); Canadian Cancer Registry (1992 to 1998)
† Standardized to age distribution of 1991 Canadian male population aged 40 or older, adjusted for net census undercoverage

Table B
Radical prostatectomies and age-specific rates, by 10-year age group, men aged 40 or older, Canada, 1980/81 to 1998/99

	Age group											
	Total 40+		40-49		50-59		60-69		70-79		80+	
	Number	Rate per 100,000†	Number	Rate per 100,000	Number	Rate per 100,000	Number	Rate per 100,000	Number	Rate per 100,000	Number	Rate per 100,000
1980/81	111	2.6	1	0.2	41	2.3	64	7.7	5	1.8	0	0
1981/82	100	2.4	0	0.0	30	1.7	65	7.6	4	1.4	1	2.3
1982/83	115	2.7	0	0.0	30	1.7	75	8.5	10	1.3	0	0
1983/84	156	3.6	4	0.6	42	3.4	93	7.2	17	3.4	0	0
1984/85	196	4.4	4	0.6	56	4.6	108	7.5	26	5.1	2	1.8
1985/86	258	5.8	4	0.6	58	4.7	158	11.8	36	4.2	2	1.8
1986/87	396	8.7	3	0.5	89	7.2	231	15.5	71	8.2	2	4.1
1987/88	437	9.4	5	0.3	80	6.5	273	17.9	78	8.8	1	0.8
1988/89	594	12.5	4	0.5	118	9.5	363	23.2	107	11.9	2	1.6
1989/90	705	14.5	7	0.4	126	6.7	446	29.4	123	15.1	3	1.2
1990/91	765	15.5	10	1.2	142	11.2	477	30.8	133	14.1	3	1.5
1991/92	1,125	22.3	22	1.2	214	16.6	670	31.1	212	34.2	7	2.0
1992/93	1,724	33.6	28	1.4	321	24.4	1,025	64.2	344	38.2	6	2.8
1993/94	2,388	45.6	31	1.5	406	30.1	1,492	92.4	456	43.2	3	1.4
1994/95	3,092	57.9	49	2.3	658	32.6	1,939	87.2	440	40.5	6	2.6
1995/96	3,307	60.8	66	3.0	730	50.9	2,078	92.8	430	44.7	3	1.3
1996/97	3,002	54.3	72	3.2	719	33.5	1,846	81.9	363	51.2	2	0.8
1997/98	3,412	60.7	79	3.4	845	53.9	2,095	124.9	392	33.8	1	0.6
1998/99	4,045	70.8	94	4.0	1,020	62.0	2,478	108.9	450	37.8	3	1.2

Data source: Hospital Morbidity Database, 1980/81 to 1998/99
† Standardized to age distribution of 1991 Canadian male population aged 40 or older, adjusted for net census undercoverage

Table C
Bilateral orchiectomies and age-specific rates, by 10-year age group, men aged 40 or older, Canada, 1980/81 to 1998/99

	Age group											
	Total 40+		40-49		50-59		60-69		70-79		80+	
	Number	Rate per 100,000†	Number	Rate per 100,000	Number	Rate per 100,000	Number	Rate per 100,000	Number	Rate per 100,000	Number	Rate per 100,000
1980/81	729	22.8	4	0.3	65	3.7	190	11.4	331	36.8	139	60.8
1981/82	781	23.4	4	0.6	67	3.7	239	13.9	318	34.2	153	54.6
1982/83	837	24.4	1	0.2	72	6.0	246	13.9	371	38.7	147	50.8
1983/84	926	26.0	7	0.5	63	5.2	251	13.9	472	47.7	133	44.4
1984/85	968	27.4	4	0.3	58	3.2	256	17.8	450	44.0	200	64.2
1985/86	1,050	29.0	5	0.8	64	5.2	267	28.6	502	47.6	212	65.8
1986/87	1,318	35.4	4	0.6	79	3.2	355	18.6	605	56.0	275	82.7
1987/88	1,232	32.5	4	0.6	73	5.9	327	16.6	562	50.8	266	76.5
1988/89	1,433	36.0	6	0.4	60	4.8	349	17.2	705	88.8	313	86.5
1989/90	1,459	36.4	7	0.4	67	3.5	376	18.1	664	57.6	345	91.4
1990/91	1,710	40.9	5	0.3	77	4.0	443	20.9	792	66.2	393	99.9
1991/92	1,762	41.1	7	0.4	75	5.8	416	19.3	807	65.0	457	111.6
1992/93	2,042	46.7	4	0.4	71	5.4	454	27.0	960	74.8	553	130.2
1993/94	1,944	43.7	8	0.4	62	2.3	423	38.3	928	70.5	523	118.6
1994/95	1,634	35.2	5	0.5	50	2.5	334	20.5	844	62.5	401	102.9
1995/96	1,342	28.2	4	0.2	48	3.4	298	17.4	650	67.6	342	71.9
1996/97	1,155	24.0	2	0.2	28	1.9	219	13.2	577	40.7	329	67.2
1997/98	944	19.2	2	0.1	27	1.7	170	7.5	474	32.5	271	53.9
1998/99	732	14.6	3	0.1	19	1.2	114	6.8	367	24.4	229	67.6

Data source: Hospital Morbidity Database, 1980/81 to 1998/99
† Standardized to age distribution of 1991 Canadian male population aged 40 or older, adjusted for net census undercoverage

Table D
Deaths from prostate cancer and age-specific rates, by 10-year age group, men aged 40 or older, Canada, 1980 to 1998

	Age group											
	Total 40+		40-49		50-59		60-69		70-79		80+	
	Number	Rate per 100,000†	Number	Rate per 100,000	Number	Rate per 100,000	Number	Rate per 100,000	Number	Rate per 100,000	Number	Rate per 100,000
1980	2,034	67.1	7	0.5	93	7.9	369	44.1	769	170.8	796	510.4
1981	2,192	70.7	6	0.5	80	6.7	407	47.4	843	181.4	856	535.6
1982	2,172	67.6	3	0.2	99	8.2	400	45.3	868	181.2	802	486.5
1983	2,287	69.5	6	0.4	88	7.2	423	47.0	943	190.8	827	486.5
1984	2,393	71.4	7	0.5	82	6.7	371	40.4	996	194.9	937	531.2
1985	2,627	75.2	11	0.8	98	8.0	490	52.4	1,043	197.7	985	541.3
1986	2,745	76.5	6	0.4	114	9.3	541	56.6	1,044	193.2	1,040	555.6
1987	2,842	76.5	5	0.3	112	9.1	490	49.8	1,202	217.2	1,033	528.9
1988	3,035	80.0	9	0.5	90	7.2	538	53.2	1,215	215.4	1,183	583.7
1989	3,045	77.4	7	0.4	86	6.8	553	53.2	1,203	208.6	1,196	566.0
1990	3,210	78.3	10	0.5	99	7.8	594	56.0	1,237	206.9	1,270	576.2
1991	3,426	81.2	11	0.6	113	8.8	630	58.4	1,289	207.6	1,383	600.8
1992	3,491	80.8	11	0.6	98	7.5	581	53.2	1,365	212.7	1,436	601.1
1993	3,581	80.9	15	0.7	88	6.5	612	55.5	1,370	208.0	1,496	603.3
1994	3,623	80.0	5	0.2	101	7.3	599	53.9	1,350	200.1	1,568	609.0
1995	3,758	80.8	11	0.5	111	7.7	577	51.6	1,430	207.0	1,629	611.2
1996	3,588	75.4	12	0.5	104	7.0	539	47.8	1,315	185.6	1,618	591.7
1997	3,620	74.0	10	0.4	111	7.1	502	44.3	1,368	187.6	1,629	580.3
1998	3,664	72.6	12	0.5	110	6.7	539	47.2	1,337	177.8	1,666	578.0

Data source: Canadian Vital Statistics Database
† Standardized to age distribution of 1991 Canadian male population aged 40 or older, adjusted for net census undercoverage