Factors related to use of prostate cancer screening: the Alberta Tomorrow Project

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ABSTRACT

Background: Very few data are available on the determinants of PSA testing in Canada, and it is a matter of debate whether prostate-specific antigen (PSA) screening in asymptomatic men age 50 and older with no risk factors for prostate cancer is useful. If PSA screening is introduced into the periodic health examination, it will be important to know what factors influence its use.

Objectives: The purpose of this study is to determine the factors associated with PSA testing among asymptomatic men age 50 and older participating in the Tomorrow Project in Alberta.

Methods: The Tomorrow Project is a population-based cohort study with over 11,000 participants accrued in Alberta since February 2003. Information was collected on medical history, sociodemographic factors, health status and lifestyle characteristics. This analysis includes 2136 men 50 years of age and older. The independent association between various factors and recent PSA screening is estimated using logistic regression.

Results: Approximately 50% of of the study group had received one or more PSA tests in their lifetime. Of these, 58% were asymptomatic for prostate disease at the time of their most recent PSA test. Variables independently associated with recent PSA screening for prostate cancer in this population include older age (≥ 65 versus < 55 years: adjusted odds ratio [OR] 2.60; 95% confidence interval [CI] 1.77–3.83), higher income (≥ $80,000 versus < $20,000, OR 1.97; 95% CI 1.09–3.55), region of health care delivery, perception of health status (good versus excellent health status; OR 0.65, CI 0.43–0.96], increased number of chronic health conditions (OR 1.73, 95% CI 1.10–2.71), and history of colorectal cancer screening with fecal occult blood test (OR 2.21; 95% CI 1.73–2.83).

Conclusions: An increasing proportion of men in Alberta are receiving a PSA test. A number of significant predictors of having a PSA test were identified, suggesting that factors other than having a clinical indication for prostate disease can influence decisions about PSA screening.

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EVIDENCE FOR THE BENEFIT OF EARLY PROSTATE cancer screening using prostate-specific antigen (PSA) and digital rectal examination (DRE) is inconclusive. Although screening can result in earlier detection of prostate cancer, there is insufficient high-quality evidence to suggest a reduction in mortality (the most reliable measure of benefit from a screening program).[1,2-6] As such, prostate cancer screening guidelines remain less definitive than other cancer screening guidelines. The Canadian Task Force on the Periodic Health Exam has concluded that there is insufficient evidence to recommend PSA screening in asymptomatic men over the age of 50.[7] However, both the American Cancer Society and the American Urology Association recommend PSA and DRE testing in men over 50 years or at high risk.[8,9] Similarly, the Canadian Cancer Society recommends that all men over the age of 50 years discuss with their doctor the potential benefits and risks of early detection of prostate cancer using a PSA test and DRE so they can make informed decisions about the use of the tests.[1] Provincial differences in the population prevalence of reported PSA tests[10] suggest that physician practices and public awareness with regard to the use of the test may vary widely across Canada.[11]

Some studies have examined factors associated with prostate cancer screening practices in defined populations such as medical clinics,[12,13] but very few that have done so in general population samples.[14,15] The presence of symptoms is strongly related to prostate cancer testing;[16-18] however, because screening by definition applies only to asymptomatic individuals, it can not be said to predict prostate cancer screening. Other frequently cited factors related to PSA testing include increasing age,[14,19,20] being married,[15,21] a family history of prostate cancer, having a physical illness,[14] having a regular physician[14,19] and having medical insurance.[15,22] However, none of these studies have identified predictors for PSA testing for asymptomatic and symptomatic men separately. It is important for health care decision-makers to understand the dynamics of the increasing widespread "acceptance" of a test that is not currently recommended for asymptomatic men. Furthermore, if guidelines do change to recommend PSA screening for the general population it may be of interest to know who is *not* being screened in order to better target and inform men about prostate cancer and PSA testing.

Therefore, the purpose of this study was to identify factors associated with prostate cancer screening among participants in the Tomorrow cohort study in Alberta who are aged 50 or over and have no clinical indication for PSA testing. Our hypothesis was that men with a recent PSA test and with no clinical indication of prostate disease are different with respect to sociodemographic and health-related factors from men of a similar age who have never had a PSA test.

Methods

The Tomorrow Project is a research initiative of the Alberta Cancer Board, Division of Population Health and Information. This population-based cohort study began in October 2000, and recruited participants aged 35–69 years prior to Feb. 20, 2003, from households in over 583 cities, towns, villages and rural areas throughout the province of Alberta. A two-stage sampling design was used to identify eligible individuals without a history of cancer. The first stage used a random digit dial procedure to select households in the 17 regional health authorities extant in Alberta in 2000, and the second stage selected one eligible adult within each household.[23] Of the 77,327 randomly selected households, one individual from each of the 47,169 households engaged in a screening interview. Approximately 50% of those interviewed were ineligible to participate, primarily because they were outside the target age range. Of the 22,652 men and women who were eligible for the study, 11,865 (52.4%) were enrolled, representing 84% of Alberta communities. Limited information on sociodemographic factors was available for interviewees who were eligible but did not join the study. The Tomorrow cohort (n = 11,865) was comparable with the Canadian Community Health Survey (CCHS) sample in Alberta with respect to marital status, annual household income below and above $50,000, and completion of postsecondary education.[23] Study enrolment included completion of a detailed consent form and a set of self-administered questionnaires asking about: (1) baseline health and lifestyle factors; (2) physical activity; (3) habitual diet. Included in this analysis are 2136 consenting male participants in the Tomorrow Project who were 50 years of age or older and had completed all three questionnaires.

For the purposes of this study, only baseline data collected from the health and lifestyle questionnaire were used. This questionnaire is a composite of items used in other large studies relating to personal health and reproductive history, psychosocial factors, anthrometric measures, use of cancer screening services, smoking behaviour, sun exposure and sociodemographic characteristics.[23] The items concerning the PSA test originated from the Canadian Community Health Survey (CCHS 2000/01). Men were asked the following questions: "Have you ever had a PSA test for prostate cancer?"; "When was the last time you had a PSA test?"; "Why did you have the last PSA test?". For this last question, there were 6 possible responses: (a) Family history of prostate cancer; (b) Part of regular check-up/routine screening; (c) Age; (d) Signs or symptoms of possible problem; (e) Follow-up of previous problem; (f) Other (and specify).

Statistical analyses

The main dependent variable of interest in this analysis was PSA screening. Therefore, those men who reported they had their last PSA test because of their age or because it was part of their regular check-up were classified as asymptomatic and were compared with men who had never had a PSA examination (reference group), to better identify predictors of recent PSA screening.

Potential factors associated with recent PSA screening included: sociodemographic characteristics such as age, education, employment status, income, marital status, ethnicity, and health region; health characteristics such as self-reported health status, health conditions, and personal or family history of cancer (not including prostate cancer); cancer screening practices, including a history of endoscopic examinations (colonoscopy or sigmoidoscopy) for colorectal cancer and precancer detection; and male reproductive health and other lifestyle factors, such as history of vasectomy, smoking status and body mass index. The 17 different geographic health regions were classified into the following 5 health care delivery regions: Calgary, Capital, Central, South and North.

The association between various factors and recent PSA screening was estimated using unconditional logistic regression.[24] Independent variables for which at least one of their categories yielded a p value of 0.20 or less for the Wald test in the univariate analysis were evaluated in multivariable models. The independent effect of these potential predictors on PSA screening was assessed separately using a backward stepwise regression technique (removed from model if p value ≥ 0.10). All analyses were conducted using SPSS version 12.0.

Results

Of the 2136 men in the Tomorrow Project who were 50 years of age or older, 171 (8%) did not know whether they had ever had a PSA test and were excluded from the analyses. Of the remaining 1965, 949 (48%) had never had a PSA test, while 1016 (52 %) had received one or more PSA tests in their lifetime. Of those 1016, there were 426 (42%) who had at least one PSA test because of specific indications that may be related to prostate cancer risk (i.e., possible urological symptoms, enlarged prostate or surgery of the prostate, family history of prostate cancer, or follow-up of a previous problem)(see Table 1). The remaining 590 (58%) responded that they had their most recent PSA test because of their age or because it was part of their regular check-up with their physician.

Tables 2—4 show the frequency distribution of sociodemographic and health-related characteristics stratified by men with different PSA testing status. There were no striking differences in the distribution of these factors between the PSA screening and PSA testing groups. However, men who were tested for PSA with a clinical indication tended to be older than men in the PSA screening group. Furthermore, the distribution of men attending the 5 main health care delivery regions differed between the two groups of men who had received PSA tests. The vast majority of men in the cohort received at least one DRE in their lifetime, and the time of the last DRE was highly correlated with the time of the last PSA test (Spearman r = 0.619, p < 0.001; data not shown). The most striking difference in the non-PSA tested group was the greater number of men who had never had a digital rectal examination compared to the other groups of men.

Table 1: Characteristics of men who received PSA testing or screening, *n* (%)

Group A: Clinical indications for PSA testing (*n* = 426)*		
Enlarged prostate	311	(73)
Surgery on prostate	29	(7)
First-degree relative with history of prostate cancer	173	(41)
Family history of prostate cancer, not including first-degree family member	29	(7)
Possible symptoms	188	(44)
Follow-up of previous problems	48	(11)
Group B: Reasons for PSA screening (*n* = 590)*		
Age	235	(40)
Part of regular check-up with personal physician	551	(93)

PSA = prostate-specific antigen
*Groups A and B are mutually exclusive, but categories are not mutually exclusive within group A or group B.

Table 5 shows the crude and adjusted odds ratios for sociodemographic and health-related factors in association with PSA screening among men without recent clinical indications for a test. There is a clear trend with age; successively older men (65 or older) are more likely to have had a PSA test compared with men younger than 55 years of age (adjusted odds ratio [OR] 2.14; 95% CI 1.57–2.97). Higher income and place of health care delivery are also significant predictors of PSA screening. Men served by the South and Calgary Health Region are more than twice as likely to have had a recent PSA test compared with men served by the Capital Health Region (OR 2.20, CI 1.50–3.2 and OR 2.81, CI 1.83–4.32, respectively) despite an absence of symptoms. Other factors significantly associated with PSA screening included the presence of at least one chronic health condition and having had a fecal occult blood test for colorectal cancer screening (OR 2.21, 95% CI 1.73–2.83).

Table 2: Sociodemographic characteristics, tobacco use and body mass index of selected cohort stratified by PSA testing status, n (%)

Patient characteristic	Never had PSA test, (N = 949) n (%)	Asymptomatic, had PSA test (screening), (N = 590) n (%)	Symptomatic, had PSA test, (N = 426) n (%)
Age			
50–54	415 (43.7)	196 (33.2)	93 (21.8)
55–59	265 (27.9)	159 (26.9)	100(23.5)
60–64	155 (16.3)	120 (20.3)	121 (28.4)
≥ 65	114 (12.0)	115 (19.5)	112 (26.3)
Marital status			
Married	735 (77.4)	494 (83.7)	347 (81.5)
Not married	214 (22.6)	95 (16.1)	78 (18.5)
Not reported		*1 (0.2)*	*1 (0.2)*
Employment status			
Working (full or part-time)	691 (72.8)	389 (65.9)	236 (55.4)
Unemployed	15 (1.6)	11 (1.9)	4 (0.9)
Retired	180 (19.0)	165 (28.0)	167 (39.2)
Other	62 (6.5)	24 (4.1)	19 (4.5)
Not reported	*1 (0.1)*	*1 (0.2)*	
Education			
Less than high school	172 (18.1)	111 (18.4)	77 (18.1)
High school diploma	160 (16.9)	86 (14.6)	66 (15.5)
Some college / university	177 (18.7)	132 (22.4)	83 (19.5)
Completed college	226 (23.8)	107 (18.1)	84 (19.7)
Completed university	212 (22.3)	154 (26.1)	116 (27.2)
Not reported	*2 (0.2)*		
Income			
< $19,999	72 (7.6)	33 (5.6)	23 (5.4)
$20,000–$39,999	176 (18.5)	100 (16.9)	94 (22.1)
$40,000–$59,999	221 (23.2)	100 (16.9)	98 (23.0)
$60,000–$79,999	184 (19.4)	125 (21.2)	83 (19.5)
$80,000–$99,999	102 (10.7)	83 (14.1)	41 (9.6)
> $100,000	175 (18.4)	135 (22.9)	75 (17.6)
Not reported	*19 (2.0)*	*14 (2.3)*	*12 (3.0)*
Ethnicity			
Caucasian	884 (93.4)	556 (94.4)	409 (96)
Asian	21 (2.2)	11 (1.9)	8 (1.9)
First Nations	27 (2.9)	10 (1.7)	6 (1.4)
Other	14 (1.9)	12 (2.0)	3 (0.7)
Not reported	*3 (0.3)*	*1 (0.2)*	
Health care delivery region			
Capital Health Region	156 (16.4)	81 (13.7)	90 (21.1)
Calgary Health Region	108 (11.4)	123 (20.8)	67 (15.7)
South Health Region	226 (23.8)	190 (32.2)	114 (26.8)
Central Health Region	383 (40.4)	163 (27.6)	130 (30.5)
Northern Health Regions	76 (8.0)	33 (5.6)	25 (5.9)
Current smoking status			
Non-smoker	286 (30.1)	197 (33.4)	136 (31.9)
Past smoker	461 (48.6)	308 (52.2)	237 (55.6)
Current smoker	199 (21.0)	80 (13.6)	52 (12.2)
Not reported	*3 (0.3)*	*5 (0.8)*	*1 (0.2)*
Body mass index			
Underweight / normal (< 25)	200 (21.1)	105 (17.8)	87 (20.4)
Overweight (25-29.9)	449 (47.3)	296 (50.2)	196 (46.0)
Very overweight (30+)	299 (31.5)	189 (32.0)	143 (33.6)
Not reported	*1 (0.1)*		

PSA = prostate-specific antigen

Analysis included those men never tested for PSA (N = 949) and asymptomatic men who were PSA tested, the "screening group" (N = 590). All variables in Table 2–4 were included in multivariable model but only those variables *not* removed during backward stepwise selection are listed.

Table 3: Screening history of selected cohort stratified by PSA testing status, n (%)

Patient characteristic	Never had PSA test, (*N* = 949)n(%)	Aysymptomatic, had PSA test (screening) (*N* = 590) n(%)	Symptomatic, had PSA test (*N* = 426) n(%)
Time since last PSA			
< 6 months	N/A	199 (33.7)	153 (35.9)
6 months to < 1 year	N/A	165 (28.0)	104 (24.4)
1 year to < 2 years	N/A	128 (21.7)	87 (20.4)
2 years to < 5 years	N/A	85 (14.4)	61 (14.3)
≥ 5 years	N/A	13 (2.2)	20 (4.7)
Not reported			*1 (0.2)*
Lifetime number of PSA tests			
1	N/A	270 (45.8)	167 (39.2)
2	N/A	136 (23.1)	88 (20.7)
3	N/A	68 (11.5)	63 (14.8)
≥ 4	N/A	108 (18.3)	108 (25.4)
Not reported		*8 (1.4)*	
Time since last DRE			
Never	189 (19.9)	31 (5.3)	12 (2.8)
< 6 months	105 (11.1)	192 (32.5)	155 (36.4)
6 months to < 1 year	129 (13.6)	168 (28.5)	112 (26.3)
1 year to < 2 years	159 (16.8)	112 (19.0)	88 (20.7)
2 years to < 5 years	180 (19.0)	67 (11.4)	44 (10.3)
≥ 5 years	187 (19.7)	20 (3.4)	15 (3.5)
Lifetime number of DRE tests			
None	189 (19.9)	31 (5.3)	12 (2.8)
1	168 (17.7)	54 (9.2)	27 (6.3)
2	162 (17.1)	67 (11.4)	37 (8.7)
3	120 (12.6)	75 (12.7)	43 (10.1)
≥	308 (32.5)	370 (62.7)	307 (72.1)
Not reported	*2(0.2)*	*1 (0.1)*	
Fecal occult blood test			
Never	668 (73.0)	306 (51.9)	198 (46.5)
Ever	247 (27.0)	263 (44.6)	210 (49.3)
Not reported		*21 (3.6)*	*18 (4.2)*
Endoscopy			
Never	765 (81.0)	437 (74.1)	272 (63.8)
Ever	180 (19.0)	149 (25.3)	148 (34.7)
Not reported		4 (0.7)	*6 (1.4)*

PSA = prostate-specific antigen DRE = digital rectal examination

Analysis included those men never tested for PSA (N = 949) and asymptomatic men who were PSA tested, the "screening group" (*N* = 590). All variables in Table 2–4 were included in multivariable model but only those variables *not* removed during backward stepwise selection are listed.

Discussion

About half of all men 50 years and older in the Tomorrow Project had received one or more PSA tests in their lifetime. This prevalence is consistent with data collected in 2001 from national databases, which indicated that the average proportion of men who had received one or more PSA tests in their lifetime was 43% among those 40 years or age or older[10] and 47.5% among those over the age of 50.[19] This was a substantial increase from the 9% who, in 1995, reported having had had a PSA test in their lifetime, in a Canada-wide cross-sectional telephone survey of 662 men over 40 years of age.[25] The proportion of men receiving PSA tests has also been increasing systematically over the last decade in the United States, and recent PSA test rates are reported to be greater than 40% for men over 40 attending regular health care facilities.[15,22]

Clinical indications for ordering a PSA test can include lower urinary tract symptoms (symptoms of prostatism), history of benign prostate hyperplasia, a recent abnormal DRE, and a history of first-degree relatives diagnosed with prostate cancer. Some surveys conducted within clinical settings have observed that PSA testing rates are much higher among men with benign prostatic hyperplasia or moderate or severe urinary tract symptoms compared with asymptomatic men.[17] McGregor and colleagues16 also observed that the majority of men in a 1996 population-based Alberta survey who had received a PSA test had a clinical indication for the test. This group represented those men at a possibly higher risk for prostate cancer and who were eligible for a PSA test under the Alberta provincial health insurance reimbursement plan. Conversely, the majority of the PSA tests in the Alberta Tomorrow cohort were in asymptomatic men (58%), suggesting a possible shift toward opportunistic screening in clinical practice.

Table 4: Health characteristics of the selected cohort stratified by PSA testing status, *n* (%)

Patient characteristic	Never had PSA test (*N* = 949) n(%)	Asymptomatic, had PSA test (screening) (*N* = 590) n(%)	Symptomatic, had PSA test (*N* = 426) n(%)
Self-rated health status			
Excellent	112 (11.8)	81 (13.7)	43 (10.1)
Very good	374 (39.4)	269 (45.6)	160 (37.6)
Good	349 (36.8)	192 (32.5)	170 (39.9)
Fair / Poor	81 (8.5)	37 (6.3)	37 (8.7)
Not reported		*11 (1.9)*	*16 (3.8)*
Chronic health conditions			
No	405 (42.7)	184 (31.2)	126 (29.6)
Yes	544 (57.3)	406 (68.8)	300 (70.4)
Chronic health conditions, *n*			
None	398 (41.9)	179 (30.3)	124 (29.1)
1	269 (28.3)	208 (35.3)	135 (31.7)
2	144 (15.2)	119 (20.2)	89 (20.9)
3	73 (7.7)	49 (8.3)	39 (9.2)
≥ 4	37 (3.9)	14 (2.4)	22 (5.2)
Not reported	*28 (3.0)*	*21 (3.6)*	*17 (4.0)*
High blood pressure			
Never	658 (69.3)	379 (64.2)	271 (63.6)
Ever	285 (30.0)	204 (34.6)	149 (35.0)
Not reported	*6 (0.6)*	*7 (1.2)*	*6 (1.4)*
High cholesterol			
Never	625 (65.9)	321 (54.4)	229 (53.8)
Ever	315 (33.2)	264 (44.7)	191 (44.8)
Not reported	*9 (0.9)*	*5 (0.8)*	*5 (1.2)*
Angina			
Never	848 (89.4)	538 (91.2)	378 (88.7)
Ever	86 (9.1)	42 (7.1)	41 (9.6)
Not reported	*15 (1.6)*	*10 (1.7)*	*7 (1.6)*
Heart attack			
Never	877 (92.4)	553 (93.7)	395 (92.7)
Ever	58 (6.1)	25 (4.2)	23 (5.4)
Not reported	*14 (1.5)*	*12 (2.0)*	*8 (1.9)*
Diabetes			
No	856 (90.2)	541 (91.7)	383 (89.9)
Yes	81 (8.5)	38 (6.4)	34 (8.0)
Not reported	*12 (1.3)*	*11 (1.9)*	*9 (2.1)*
Polyps in colon/rectum			
Never	879 (92.6)	541 (91.7)	376 (88.3)
Ever	57 (6.0)	36 (6.1)	43 (10.1)
Missing	*13 (1.4)*	*13 (2.2)*	*7 (1.6)*
Vasectomy			
No	694 (73.1)	402 (68.1)	298 (70.0)
Yes	255 (26.9)	186 (31.5)	128 (30.0)
Not reported		*2 (0.3)*	
Family history of breast cancer			
No	838 (88.3)	492 (83.4)	361 (84.7)
Yes	111 (11.7)	98 (16.6)	65 (15.3)
Family history of prostate cancer			
No	904 (95.3)	566 (95.9)	322 (75.6)
Yes	45 (4.7)	24 (4.1)	104 (24.4)
Family history of other cancer (excluding breast and prostate)			
No	845 (89.0)	508 (86.1)	367 (86.2)
Yes	104 (11.0)	82 (13.9()	59 (13.8)

Analysis included those men never tested for PSA (N = 949) and asymptomatic men who were PSA tested, the "screening group" (*N* = 590). All variables in Table 2–4 were included in multivariable model but only those *not* removed in backward stepwise selection are listed.

Table 5: Factors associated with PSA "screening": crude and adjusted odds ratios*

	N	Crude OR (95% CI)	Adjusted OR (95% CI)
Sociodemographic characteristics			
Age group			
50–54	611	1.00	**1.00**
55–59	424	1.27 (0.98, 1.65)	**1.38 (1.02, 1.87)**
60–64	275	1.64 (1.22, 2.20)	**2.20 (1.55, 3.12)**
65+	229	2.14 (1.57, 2.91)	**2.60 (1.77, 3.83)**
			p* value test for trend < *0.001
Marital status			
Married	1229	1.00	
Not married	309	0.66 (0.51, 0.86)	
Employment status			
Working (part & full time)	1080	1.00	
Unemployed	26	1.30 (0.59, 2.86)	
Retired	345	1.63 (1.27, 2.08)	
Other	86	0.69 (0.42, 1.09)	
Education			
Less than high school	283	1.00	
High school diploma	246	0.83 (0.58, 1.19)	
Some college/university	309	1.16 (0.83, 1.61)	
Completed college	333	0.73 (0.53, 1.02)	
Completed university	366	1.13 (0.82, 1.54)	
Income			
< $20,000	105	1.00	**1.00**
$20,000–$39,999	276	1.24 (0.77, 2.00)	**1.28 (0.74 2.23)**
$40,000–$59,999	321	0.99 (0.61 1.59)	**1.04 (0.60, 1. 82)**
$60,000–$79,999	309	1.48 (0.93, 2.37)	**1.88 (0.97, 2.92)**
$80,000–$99,999	185	1.78 (1.07, 2.90)	**1.97 (1.09 3.55)**
> $100,000	310	1.68 (1.05, 2.69)	**1.88 (1.07, 3.31)**
			p* value test for trend < *0.001
Ethnicity			
Caucasian	1440	1.00	
Asian	32	0.73 (0.34, 1.60)	
First Nations	37	0.61 (0.21, 1.77)	
Other	26	0.43 (0.15, 1.25)	
Health care delivery region			
Capital	237	1.00	**1.00**
Calgary	231	2.19 (1.51, 3.18)	**2.81 (1.83, 4.32)**
South	414	1.62 (1.16, 2.25)	**2.20 (1.50, 3.22)**
Central	546	0.82 (0.59, 1.13)	**1.10 (0.76, 1.60)**
North	109	0.84 (0.51, 1.36)	**0.93 (0.52, 1.66)**
Health and screening characteristics			
Self-rated health status			
Excellent	193	1.00	**1.00**
Very good	643	1.00 (0.72, 1.38)	**0.96 (0.66, 1.38)**
Good	541	0.76 (0.54, 1.06)	**0.65 (0.43, 0.96)**
Fair / Poor	118	0.63 (0. 39, 1.02)	**0.59 (0.33, 1.06)**
			p* value test for trend *0.010
Current smoking status			
Non-smoker	483	1.00	
Past smoker	769	0.97 (0.77, 1.22)	
Current smoker	279	0.58 (0.43, 0.80)	
Body mass index			
Norma l/ Underweight (< 25)	305	1.00	
Overweight (25 – 29.9)	745	1.26 (0.95, 1.66)	
Obese (30+)	488	1.20 (0.89, 1.62)	

Table 5, continued

Chronic health conditions, n			
None	577	1.00	**1.00**
1 Condition	477	1.72 (1.34, 2.21)	**1.69 (1.22, 2.36)**
2+ Conditions	436	1.59 (1.23, 2.07)	**1.73 (1.10, 2.71)**
			p* value test for trend < *0.005
Angina			
No	1386	1.00	**1.00**
Yes	128	0.77 (0.52, 1.13)	**0.59 (0.36, 0.98)**
High cholesterol			
No	946	1.00	**1.00**
Yes	579	1.63 (1.32, 2.02)	**1.38 (1.00, 1.91)**
Diabetes			
No	1397	1.00	**1.00**
Yes	119	0.74 (0.49, 1.11)	**0.59 (0.36, 0.98)**
Vasectomy			
No	1096	1.00	**1.00**
Yes	441	1.26 (1.01, 1.58)	**1.26 (0.97, 1.63)**
Family history of breast cancer			
No	1330	1.00	
Yes	209	1.50 (1.12, 2.02)	
Family history of other cancer (excluding breast and prostate)			
No	1353	1.00	
Yes	186	1.31 (0.96, 1.79)	
Fecal occult blood test			
Never	974	1.00	**1.00**
Ever	510	2.32 (1.87, 2.90)	**2.21 (1.73, 2.83)**
Endoscopy			
Never	1202	1.00	
Ever	329	1.45 (1.13, 1.86)	

Analysis included those men never tested for PSA (N = 949) and asymptomatic men who were PSA tested, the "screening group" (*N* = 590).

*All variables in Table 2–4 were included in multivariable model but only those variables *not* removed during backward stepwise selection are listed.

In our study population we observed that the PSA screening rates differed significantly by household income. Higher income was not identified as a predictor of PSA testing in a number of cross-sectional studies conducted in the United States,[15,26] but was associated with PSA testing in a cohort of American veterans who were interviewed on two separate occasions in 1992 and 1995.[14] Interestingly, all these studies observed a positive association between access to health insurance and PSA testing.[14,15,26] Although access to health care insurance is an important determinant of screening in the United States,[18,22,27] this is not the case in Canada, given our universal health care coverage. However, measuring access to care by socioeconomic status can be important to help determine if provincial health care systems are delivering access to services in an equitable manner. At least two Canadian surveys have observed that high-income earners are more likely to have a family physician,[28,29] and regular visits with a family doctor appears to influence PSA testing rates.[19,30] Interestingly, the men in this cohort study who had ever undergone screening for colon cancer with a fecal occult blood test were significantly more likely to have a PSA test despite an absence of symptoms, and the frequency fecal occult blood testing also appeared to increase with increasing income (data not shown). Therefore, it is possible that, in our cohort, a higher income is related to increased health care access or an increased awareness of the availability of PSA testing and other cancer screening options by patient or health care provider.

An increase in physician awareness of PSA testing may also explain part of the increased prevalence of testing. Among men with family physicians, the use of PSA testing varies depending on the insistence of the patient and on the physician's views on the wisdom of using PSA tests for early detection of prostate cancer.[11,12,31] According to a study in Ontario, family physi-

cians were twice as likely as urologists to use PSA tests for screening purposes.[30] The higher rates of PSA screening observed in the cohort of men from health care regions in Calgary and the South of Alberta may also reflect differences in practice patterns among family physicians and/or urologists in those regions.

As has been seen in a few other studies,[15,32] we observed that men who perceived their health status to be poor were less likely to have a PSA test compared with men who classified themselves to be in excellent health. This observation suggests that good health may be a marker for preventive health practices. Paradoxically, men who were diagnosed with one or more chronic health conditions, notably high cholesterol, were significantly more likely to have a PSA test compared to men without any chronic health problems. Eisen and colleagues[14] also observed that physical health problems significantly influenced the likelihood of PSA testing, although no specific conditions were identified, suggesting that there may be selective screening on the part of health care practitioners.

Our study has several limitations. Our objective was to study predictors of prostate cancer screening in asymptomatic men in the Tomorrow Project cohort. Ideally, we would have compared asymptomatic men who had a history of PSA screening (or received a PSA test) with a reference group of asymptomatic men who have never had a PSA test. However, it was not possible to ascertain whether the population of untested men in the cohort was also asymptomatic, since questions about clinical indications for their last PSA test were only asked of men who reported ever having a PSA test. As such, the reference group is likely to contain a small proportion of men who were never tested but may have had clinical indications for a PSA test. If this group of symptomatic but untested men is very different from the asymptomatic and untested group, combining them into one reference group could lead to biased measures of effect. Secondly, some men in the screened group may have had a previous PSA test because of a clinical indication. In this case, the identified predictors of PSA *screening* (in an asymptomatic population) may also be determinants of PSA *testing* (among men with a past history of clinical indications).

In summary, an increasing proportion of men in Alberta are being tested for prostate cancer despite the absence of clinical symptoms or of a familial history of prostate cancer. A number of significant predictors of having a PSA test were identified in this study, including higher income, good health status, and variation in the regional health care delivery facilities, suggesting that factors other than having a clinical indication for prostate disease can influence PSA testing rates.

Whether this increase in PSA testing among asymptomatic men translates into a net benefit with longer survival and reduced mortality rates remains to be answered by ongoing long-term randomized clinical trials.[33,34] However, if PSA screening is found to be beneficial, public health strategies will need to identify how best to educate and screen certain groups, including men of low socioeconomic status and perceived poor health status.

Additional research to identify the main factors that motivate physicians in Canada to recommend screening is warranted. Future research may also want to address the apparent variation in regional health care delivery services and study factors that may explain differences in the administration of cancer control programs.

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