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

Richardson H, Aronson K, James A, McGregor SE, Bryant HE

## ABSTRACT

**Background:** There is currently very little data available on the determinants of PSA testing in Canada, and a debate exists about the usefulness of PSA testing in asymptomatic men age 50 and older who do not have any risk factors for prostate cancer. If PSA screening is introduced into periodic health exams, it will be important to know what factors influence the use of such screening services.

**Objectives:** The purpose of this study was 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 has been collected on medical history, sociodemographic factors, health status and lifestyle characteristics including physical activity and diet. This analysis includes 2136 males 50 years of age and older. The association between various factors and PSA screening utilization was estimated using logistic regression.

**Results:** Approximately 50% of men age 50 or over had one or more PSA examinations in their lifetime. Of these, 58% did not have a clinical indication for prostate disease at the time of their most recent PSA test. Variables significantly associated with recent PSA screening for prostate cancer in this population include older age, higher income, region of healthcare delivery, health status, increased number of chronic health conditions, a vasectomy and prior history of colorectal cancer screening.

**Conclusions:** An increasing proportion of men in Alberta are being tested for prostate cancer. 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 PSA testing rates.

**Introduction**

Evidence for the benefit of early prostate cancer screening using Prostate Specific Antigen (PSA) and Digital Rectal Examinations (DRE) is inconclusive.  While screening can result in earlier detection of prostate cancer, there has not been evidence to suggest a reduction in mortality which is considered the most reliable measure of benefit from a screening program. [Canadian Cancer Society (CCS), 2002; Coldman et al., 2003]  Consequently, unlike other cancer screening guidelines, such as mammography or Pap smear testing, prostate cancer screening guidelines remain less definitive.  The Canadian Task Force on the Periodic Health Exam has concluded that there is insufficient research to recommend PSA screening in asymptomatic men over the age of 50 [Feightner, 1994]. 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 [Smith et al. 2000; AUA, 2000]. 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 PSA and DRE so they can make informed decisions about the use of the tests [Canadian Cancer Society (CCS), 2002].

There are provincial differences in the population prevalence of reported PSA tests [Gibbons and Waters, 2003] suggesting that physician practices and public awareness with regard to the use of the test may vary widely across the country. A recent national survey of family physicians in Canada revealed that both patient-specific factors (such as anxiety and expectations) and physician-specific factors (such as perception of whether the test is recommended and whether or not their colleagues support PSA testing) can affect screening decisions, especially when guidelines are unclear or conflicting for tests such as PSA [Tudiver, 2002].

A few studies have examined factors associated with prostate cancer screening practices in defined populations such as medical clinics [Williams, et al., 1995], but very few that have done so in general population samples [Eisen et al., 1999; Merrill, 2001].  The presence of symptoms is strongly related to prostate cancer testing [McGregor et al., 2002; Perkins et al., 1998; Ward et al., 1997; Weller

et al., 1998; Hoffman and Gilliland, 1999), but, 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 [Eisen, et al., 1999; Merrill, 2001; Perkins et al., 1998; Livingston et al., 2002; Carter et al., 1999], being married [Merrill, 2001; Livingston et al., 2002], a family history of cancer, having a physical illness [Eisen, et al., 1999], having a regular physician [Eisen, et al., 1999; Hoffman and Gilliland, 1999] and having medical insurance [Merrill, 2001; Moran et al., 2000]. However, none of these studies have identified predictors of PSA testing for asymptomatic and symptomatic men separately. Since PSA testing is not currently a recommended test for population screening in Canada, it is critical for Public Health decision-makers to understand the dynamics of the increasing widespread "acceptance" of a test that is not actually recommended to men without clinical indications for prostate disease. Furthermore, if guidelines do change in the future and PSA testing becomes a recommended screening tool for the general population it may be of interest to know who is not being screened so that appropriate measures can be taken to better target and inform this group of men about prostate cancer and PSA tests.

Therefore, the purpose of this study was to identify factors associated with prostate cancer screening among men without any clinical indication for a PSA test, who are age 50 or older participating in the Tomorrow cohort study in Alberta. The Tomorrow Project offers the advantage of providing geographically diverse data to examine this important issue.

**Methods**

The Tomorrow Project is a research initiative of the Alberta Cancer Board, Division of Population Health and Information. As a population-based cohort study that began in October 2000, participants were recruited before February 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. The first stage used a random digit dial (RDD) procedure to select households in the 17 regional health authorities (RHAs) extant in Alberta in 2000, and the second stage selected one

eligible adult within each household [Bryant et al, 2006]. A total of 22,652 men and women aged 35 to 69 years of age without prior a history of cancer were recruited. Of these, 52.4% (n-11,865) were enrolled with 84% of Alberta communities represented. Study enrollment 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; and, 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.

**Statistical analyses**

The main dependent variable of interest in this analysis was PSA screening. A few variables in the dataset allowed us to distinguish between men who had received a PSA test in the last year despite an absence of symptoms, and men who had received a PSA test in the last year based on a battery of indications or based on a "first degree" family history of prostate cancer.  Those men who reported they had a PSA test because of their age or because it was part of their regular check-up were classified as asymptomatic and were compared to men who had never had a PSA examination in their lifetime (reference group), to better identify predictors of recent PSA screening.

Potential factors associated with recent PSA screening included socio-demographic 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), 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 five healthcare delivery regions: Calgary, Capital, Central (including: David Thompson, East Central, West View, Crossroads, Aspen, Lakeland), South (including: Chinook, Palliser, Headwaters, Health Authority 5) and North health regions (including: Mistahia, Peace, Keeweetinok Lakes, Northern Lights, Northwestern).

The association between various factors and PSA screening was estimated using unconditional logistic regression. 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 (p-value in=0.05, p-value out=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%) men did not know if they had ever had a PSA examination. Of the remaining 1965 men, 949 (48%) had never had a PSA examination, while 1016 (52 %) men had received one or more PSA examinations in their lifetime. Of those 1016, there were 426 (42%) men 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) (Table 1). This group represented those men at a possible higher-risk for prostate cancer and who were eligible for a PSA test under the Alberta provincial health insurance reimbursement plan [AMA 2002]. The remaining 590 (58%) men 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. This asymptomatic group represented those men at a perceived lower-risk for prostate cancer and who were not generally eligible for a PSA test under the health insurance reimbursement plan.

Table 2 shows the frequency distribution of sociodemographic and health related characteristics in the combined population of men who had never had a PSA test (n=949) or had been tested for PSA despite being asymptomatic (n=590). The table is stratified by men who are 50 to 59 years of age (n=1035) and men who are 60 and older (n=504). The majority of men in this study population are under 60 years of age, and are married. A greater proportion of men who are under 60 are better educated, are still in the workforce, and have fewer number of reported chronic health conditions. Men in both age

groups are similarly distributed according to ethnicity and weight as measured by body mass index  The vast majority of men have received a DRE (89%), and the time of the last DRE is highly correlated with the time of the last PSA (Spearman r=0.619, p-value<0.001) (data not shown). Approximately one third of the study population reported having high blood pressure and/ or low cholesterol, although the prevalence was higher in men 60 or older. Similarly the past history of a colorectal test (colonoscopy or sigmoidoscopy) was greater in men 60 years or over (28%) compared to men under 60 years of age (18%). The vast majority of the study population are current or former smokers.

Table 3 shows the crude and adjusted odds ratios for sociodemographic and health-related factors in association with PSA screening among men without any recent clinical indications for a test. There is a clear trend with age, and successively older men are more likely to have had a PSA examination.  Men who earn more then $80,000 per year are much more likely to have been screened for PSA than those earning less than $20,000 per year, and those using healthcare delivery programs outside Calgary and the Southern regions are significantly less likely to have received a PSA examination in their lifetime. Compared to Caucasians, men of other racial descent appear to be less likely to have a PSA test despite an absence of recent symptoms, although the differences were not statistically significant. Men with one or more chronic health conditions diagnosed by a physician are more likely to be screened for PSA compared to men with no chronic health conditions, and those with high cholesterol are much more likely to have been screened despite an absence of recent symptoms. However, having angina or diabetes is associated with a reduced likelihood of being recently screened. Having had a vasectomy and ever having had a fecal occult blood test (FOBT) for colorectal cancer screening are also significant predictors of recent PSA screening among those men without any clinical indications for a PSA test.

**Discussion**

A beneficial impact of population-based screening for prostate cancer demonstrating that early diagnosis and treatment reduces disease-related mortality has not yet been shown. There are two on-going randomized clinical trials studying this question; the Prostate, Lung, Colorectal and Ovarian 16

year Screening Trial (PLCO) [Gohagan et al 1994] and the European Randomized Study of Screening for Prostate Cancer Trial [Schroder 1991]. However, results are not anticipated for a few more years. However, a recent analysis of changes in mortality rates by screening intensity using data from the BC Cancer Registry during 1985-1999, Coldman et al. [2003] noted that no association was observed between intensity of PSA screening and subsequent decrease in prostate cancer mortality [Coldman et al., 2003]. The sensitivity of PSA tests to detect prostate cancer has also dropped dramatically in the past five years (after the detection of prevalent cases) [Mitka et al., 2004]. Consequently, there is still considerable debate whether asymptomatic men should undergo PSA screening and treatment. Concerns related to mass screening with PSA testing include the recognition that standard therapy frequently results in morbidity (e.g impotence, incontinence), and the need to treat by surgically resecting prostates is being questioned [Mitka et al., 2004; Stamey et al., 2004]. Furthermore, it is argued that most newly diagnosed cases through PSA screening would eventually die of competing causes before symptoms of prostate cancer clinically manifest, since the real odds of death is strongly correlated with age  [Merrill 2001; Hoffman 2003].

Despite the uncertainty about the benefits of prostate cancer screening, the prevalence of PSA examinations among men age 50 years and older in the general population has increased dramatically in the last two decades since PSA testing was first introduced. About half of all men of this age in the Tomorrow cohort study had one or more PSA tests in their lifetime. Similarly, a recent evaluation of PSA use among men ≥40 years old in Canada, from data collected in 2001 from a number of national databases, observed that the average proportion of men with one or more PSA tests in their lifetime was 43% [Gibbons et al., 2003]. This is a substantial increase from the 9% of men who answered yes to having ever had a PSA test in 1995, according to a Canada wide cross-sectional telephone survey of 662 men over 40 years of age [Mercer 1997]. The proportion of men receiving PSA tests has also been increasing systematically over the last decade in the US, and recent PSA testing rates are reported to be greater than 40% for men over 40 attending regular healthcare facilities [Carter et al.,  1999; Moran et

al., 2000; Merrill 2001]. However, few of these studies assessed the role of clinical indications in explaining patterns of PSA testing.

Clinical indications for ordering a PSA test include lower urinary tract symptoms (symptoms of prostatism), history of benign prostate hyperplasia (BPH), 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 BPH or moderate or severe urinary tract symptoms compared to apparently asymptomatic men [Meigs JB et al., 1998; McNaughton CM et al., 2000; Ward JE et al., 1997; Perkins JJ et al., 1998]. McGregor et al [2002] 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. Conversely, in the current survey the majority of the PSA tested men in the Alberta Tomorrow cohort were asymptomatic (58%) at the time of their most recent PSA (i.e. PSA tests were conducted as part of a routine check-up or because of advancing age). These new results suggest that a shift in clinical practice could be occurring and an increasing number of PSA tested men in Alberta are asymptomatic.

The factors related to prostate cancer screening have not been extensively studied, in part, because most public health care plans in North America do not support PSA testing for population-based screening for early detection of prostate cancer [Gibbons and Waters, 2003]. Current Canadian recommendations vary by province and only Saskatchewan, Nova Scotia and Quebec have funded PSA programs [Pickles, 2004]. Most other Canadian provincial health insurance plans do not cover PSA testing to screen for prostate cancer, although some provinces such as Alberta and Ontario do cover the costs of a PSA test that is ordered by a physician for the diagnosis of suspected prostate cancer.

While access to healthcare insurance is an important determinant of screening in the US [Hoffman and Gilliland1999; Moran 2000; McIssac 2001; Merrill 2001; Eisen 1999] we presumed it would be less of a factor in Canada, given our universal healthcare coverage. Interestingly, however, PSA screening rates differed significantly by household income in our population. Income has been

associated with prostate cancer screening participation in some American studies [Eisen 1999; Lemon et al., 2001] but not in other studies [Merrill 2001; McDavid et al., 2000]. However, all these studies observed a positive association with health insurance and PSA testing [Eisen et al 1999; Merrill 2001; McDavid et al., 2000]. While income has not regularly been identified as a predictor of PSA testing in a number of American cross-sectional studies [Merrill 2001; McDavid et al. 2000; Hoffman & Gilliland 1999], higher income was associated with PSA testing in a cohort of US male veterans, who were interviewed on two separate occasions in 1992 and 1995 [Eisen et al., 1999]. At least two Canadian surveys have observed that high income earners are more likely to have a family physician [Health Canada,1999; Klein et al., 2003] and regular visits with a family doctor appears to influence PSA testing rates [Bunting et al., 1999]. Therefore, it is possible that in our cohort, income is a reflection of increased healthcare access or increased awareness of the availability of PSA testing.

An increase in awareness of PSA testing may also explain part of the increased prevalence of testing. General practitioners' practices vary across Canada with regard to cancer screening strategies and appear to be influenced by their colleagues' practices and views [Tudiver et al., 2002]. Among men with family physicians, the use of PSA testing varies depending on the insistence of the patients, and on the physician's views about the wisdom of using PSA tests for early detection of prostate cancer [Gibbons et al., 2001; Moran et al., 2000; Lemon et al., 2001; Tudiver et al., 2002; Livingston et al., 2002]. According to a study in Ontario, family physicians were twice as likely to use PSA tests for screening purposes compared to urologists [Bunting et al., 1999]. However, since urologists are more likely to see individuals with indications, it seems reasonable that they would not use PSA tests for screening purposes to the same extent that family physicians might. Nonetheless, urologists can influence family doctors by advocating for screening which many urologic associations have done. A doubling in PSA testing rates from 1992 to 1994 was also observed in one study that reviewed medical records from three cross-sectional samples of male patients in Colorado and the authors noted that the increase in testing coincided with the American Cancer Society's endorsement of PSA screening among

men over 50 years of age [Moran et al., 2000]. The higher rates of PSA screening observed in the cohort of men from healthcare regions in Calgary and the South of Alberta may also reflect differences in practice patterns of family physicians and/or the urologists and/or differences in awareness due to activities of local advocacy groups.

We also found that health characteristics are important predictors of PSA testing among men without any clinical indication for prostate disease. Similar to a few other studies [Merrill 2001; Close et al., 1998], we observed that men who perceived their health status to be poor were less likely to have a PSA test compared to men who classified themselves to be in excellent health. This observation suggests that good health may be a marker for preventive health practices, including active participation in cancer control programs. Paradoxically, men who were diagnosed with one or more chronic health condition were significantly more likely to have a PSA test compared to men without any chronic health problems. Eisen et al [1999] also observed that physical health problems significantly influenced the likelihood of PSA testing, although no specific conditions were identified. The health condition most strongly associated with PSA screening in our cohort was high cholesterol. It is interesting to note, however, that a history of angina or diabetes was inversely associated with PSA testing.

The relationship between these identified health characteristics and PSA testing is likely driven by similar predisposing factors that motivate people to get medical check-ups. Check-ups, in turn, provide clinicians with the opportunity to discuss the risks and benefits of cancer screening strategies. Nonetheless, our results suggest that there may be selective screening on the part of the healthcare practitioner. For example, diagnosing high cholesterol requires blood tests, usually in men who are well, so one can speculate that it is possible that a physician may also order a PSA test at the same time, if a man is over 50. On the other hand, men with diabetes and angina may be seen as having shorter life spans and therefore less likely to benefit from PSA screening, or they may be seen as poor surgical risks, and so unlikely to do well with treatment. It may also be that doctors are so focused on looking after these more serious conditions that wellness testing takes a back seat.

One needs to be cautious not to over-interpret these study results. The objectives for this analysis were to study predictors of prostate cancer screening, by only considering the population of men in the Tomorrow cohort who did not have one or more clinical indications for a PSA test. Ideally we would have compared men who had a history of PSA testing but who have always been asymptomatic with a reference group of consistently 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 a PSA test were only asked of men who reported having a recent PSA test. Therefore, 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 men is very different from the untested group of asymptomatic men with respect to the distribution of identified predictors presented in this paper, then the mixture of the two groups in 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 and the current PSA test may be part of a follow-up examination. In this case, the identified predictors of "PSA screening" (in an asymptomatic population) may also be determinants of PSA testing (among men with a clinical indication).

**CONCLUSION**

In summary, an increasing proportion of men in Alberta are being tested for prostate cancer despite the absence of clinical symptoms or 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 healthcare 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. However, if PSA screening does translate into a net benefit, then the challenges encountered with administering population-based

screening programs (i.e. cervical and breast cancer) will likely plague prostate cancer screening programs as well, and despite our universal healthcare system public health strategies may have to target educational interventions to men of low socio-economic status, Aboriginal men and non-caucasian men born outside of North America, Europe or Australia. [Health Canada 2004]

**Table 1**

**Reasons for a PSA examination**

| Characteristics of PSA tested or screened men (N=1016) | Frequency (n) | Percent (%) |
|---|---|---|
| *A) Clinical indications for PSA examination (PSA testing; n=426)\** | | |
| Enlarged prostate: | 311 | 73.0 |
| Surgery on prostate: | 29 | 6.8 |
| 1$^{st}$ degree relation with history of prostate cancer: | 173 | 40.6 |
| Family history of prostate cancer not including 1$^{st}$ degree family member: | 29 | 6.8 |
| Possible symptoms: | 188 | 44.1 |
| Follow-up of previous problems: | 48 | 11.3 |
| | | |
| *B) Other reasons for PSA examination  (PSA screening; n=590)\** | | |
| Age: | 235 | 39.8 |
| Part of regular check up with personal physician: | 551 | 93.4 |

\*Note: categories are mutually exclusive between the two groups (A & B), but categories are not mutually exclusive within group A or group B.

## Table 2:  Characteristics of selected cohort* stratified by age

| | 50-59 years (N=1035) | | 60+ years (N=504) | |
|---|---|---|---|---|
| | Frequency (n) | Valid % | Frequency (n) | Valid % |
| | Socio-demographic characteristics, tobacco use and BMI | | | |
| **Marital Status** | | | | |
| Married | 825 | (79.7) | 404 | (80.3) |
| Not Married | 210 | (20.3) | 99 | (19.7) |
| **Employment Status** | | | | |
| Working (part & full time) | 876 | (84.8) | 204 | (40.5) |
| Unemployed | 22 | (2.1) | 4 | (0.8) |
| Retired | 74 | (7.2) | 271 | (53.8) |
| Other | 61 | (5.9) | 25 | (5.0) |
| **Education** | | | | |
| Less than high school | 129 | (12.5) | 154 | (30.6) |
| High school diploma | 157 | (15.2) | 89 | (17.7) |
| Some college/ university | 219 | (21.2) | 90 | (17.9) |
| Completed college | 251 | (24.3) | 82 | (16.3) |
| Completed university | 278 | (26.9) | 88 | (17.5) |
| **Income** | | | | |
| <$19,999 | 50 | (4.9) | 55 | (11.3) |
| $20,000-$39,999 | 125 | (12.3) | 151 | (30.9) |
| $40,000-$59,999 | 202 | (19.8) | 119 | (24.4) |
| $60,000-$79,999 | 222 | (21.8) | 87 | (17.8) |
| $80,000-$99,999 | 149 | (14.6) | 36 | (7.4) |
| >$100,000 | 270 | (26.5) | 40 | (8.2) |
| **Race** | | | | |
| White | 970 | (93.7) | 470 | (93.3) |
| Asian | 22 | (2.1) | 10 | (2.0) |
| First Nations | 20 | (1.9) | 17 | (3.4) |
| Other | 20 | (1.9) | 6 | (1.2) |
| **Healthcare delivery region** | | | | |
| Capital | 158 | (15.3) | 79 | (15.7) |
| Calgary | 160 | (15.5) | 71 | (14.1) |
| South | 289 | (27.9) | 127 | (25.2) |
| Central | 351 | (33.9) | 195 | (38.7) |
| North | 77 | (7.4) | 32 | (6.3) |
| **Current smoking status** | | | | |
| Non-smoker | 348 | (33.9) | 135 | (26.8) |
| Past smoker | 482 | (46.9) | 287 | (57.1) |
| Current-smoker | 198 | (19.3) | 81 | (16.1) |
| **Body mass index** | | | | |
| Underweight /Normal/ (<25) | 198 | (19.1) | 107 | (21.2) |
| Overweight (25-29.9) | 498 | (48.2) | 247 | (49.0) |
| Very overweight (30+) | 338 | (32.7) | 150 | (29.8) |

*Selected cohort includes those men never tested for PSA (N=949) and asymptomatic men who were PSA tested (N=590)*

**Table 2: Characteristics of selected cohort\* stratified by age (continued)**

| | 50-59 years (N=1035) | | 60+ years (N=504) | |
|---|---|---|---|---|
| | **n** | **(Valid %)** | **n** | **(Valid %)** |
| | **Health and screening characteristics** | | | |
| *Time of last PSA* | | | | |
| Never had a PSA test | 680 | (65.7) | 269 | (53.3) |
| <6 months | 123 | (11.9) | 76 | (15.1) |
| 6 mo. to <1 year | 95 | (9.2) | 70 | (13.9) |
| 1 yr to < 2 yrs | 79 | (7.6) | 49 | (9.7) |
| 2 yrs to < 5 yrs | 49 | (4.7) | 36 | (7.1) |
| ≥5 yrs ago | 9 | (0.9) | 4 | (0.8) |
| *Lifetime number of PSA tests* | | | | |
| Never had a PSA test | 680 | (65.7) | 269 | (53.3) |
| 1 test | 177 | (17.1 | 93 | (18.5) |
| 2 tests | 82 | (7.9) | 54 | (10.7) |
| 3 tests | 36 | (3.5) | 32 | (6.3) |
| ≥4 tests in life | 57 | (5.5) | 52 | (10.3) |
| *Self-rated health status* | | | | |
| Excellent | 143 | (14.2) | 50 | (10.3) |
| Very good | 454 | (45.0) | 189 | (38.8) |
| Good | 342 | (33.9) | 199 | (40.9) |
| Fair/ Poor | 69 | (6.8) | 49 | (10.1) |
| *Chronic Conditions* | | | | |
| No | 424 | (42.0) | 153 | (31.9) |
| Yes | 611 | (58.0) | 351 | (68.1) |
| *Number of Chronic Conditions* | | | | |
| None | 424 | (42.0) | 153 | (31.9) |
| 1 | 336 | (33.3) | 141 | (29.4) |
| 2 | 165 | (16.3) | 98 | (20.4) |
| 3 | 61 | (6.0) | 61 | (12.7) |
| ≥4 | 24 | (2.4) | 27 | (5.6) |
| ***High Blood Pressure*** (yes) | 296 | (28.8) | 193 | (38.7) |
| ***High cholesterol*** *(yes)* | 377 | (36.7) | 202 | (40.6) |
| ***Angina*** (yes) | 64 | (6.2) | 64 | (13.0) |
| ***Heart attack*** (yes) | 34 | (3.3) | 49 | (9.7) |
| ***Diabetes*** (yes) | 61 | (6.0) | 58 | (11.5) |
| ***Polyps in Colon/Rectum*** (yes) | 50 | (4.8) | 43 | (8.5) |
| ***Vasectomy*** (yes) | 308 | (29.8) | 133 | (26.4) |
| ***Family history of prostate cancer*** (yes) | 36 | (3.5) | 12 | (2.4) |
| ***Family history of breast cancer*** (yes) | 134 | (12.9) | 75 | (14.9) |
| ***Family history of other cancers*** (yes) | 110 | (10.6) | 76 | (15.1) |
| ***Fecal Occult Blood Test*** (Ever) | 317 | (31.7) | 193 | (39.9) |
| ***Endoscopy*** (Ever) | 190 | (18.4) | 139 | (27.8) |

*\* Selected cohort includes those men never tested for PSA (N=949) and asymptomatic men who were PSA tested (N=590)*

# Table 3: Predictors of PSA "screening": crude and adjusted odds ratios*

| Characteristics | N | Crude OR (95% CI) | Multivariate OR (95% CI) |
|---|---|---|---|
| **Socio-demographic characteristics** | | | |
| *Age Group* | | | |
| 50-54 | 611 | Reference | **Reference** |
| 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 | Reference | |
| Not Married | 309 | 0.66 (0.51, 0.86) | |
| *Employment Status* | | | |
| Working (part & full time) | 1080 | Reference | |
| 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 | Reference | |
| 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* | | | |
| <$19,999 | 105 | Reference | **Reference** |
| $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** |
| *Race* | | | |
| White | 1440 | Reference | |
| 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) | |
| *Healthcare delivery region* | | | |
| Capital | 237 | Reference | **Reference** |
| 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)** |

* *Analysis included those men never tested for PSA (N=949) and asymptomatic men who were PSA tested (N=590)*

## Table 3: Predictors of PSA "screening": crude and adjusted odds ratios* (continued)

| Characteristics | N | Crude OR (95% CI) | Multivariate OR (95% CI) |
|---|---|---|---|
| **Health characteristics** | | | |
| *Self-rated health status* | | | |
| Excellent | 193 | Reference | **Reference** |
| 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 | Reference | |
| Past smoker | 769 | 0.97 (0.77, 1.22) | |
| Current smoker | 279 | 0.58 (0.43, 0.80) | |
| *Body mass index* | | | |
| Normal/Underweight (<25) | 305 | Reference | |
| Overweight (25 – 29.9) | 745 | 1.26 (0.95, 1.66) | |
| Obese (30+) | 488 | 1.20 (0.89, 1.62) | |
| *Chronic Conditions* | | | |
| No | 589 | Reference | |
| Yes | 950 | 1.64 (1.32, 2.04) | |
| *Number of Chronic Conditions* | | | |
| 0 Conditions | 577 | Reference | **Reference** |
| 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 | Reference | **Reference** |
| Yes | 128 | 0.77 (0.52, 1.13) | **0.59 (0.36, 0.98)** |
| *High Cholesterol* | | | |
| No | 946 | Reference | **Reference** |
| Yes | 579 | 1.63 (1.32, 2.02) | **1.38 (1.00, 1.91)** |
| *Diabetes* | | | |
| No | 1397 | Reference | **Reference** |
| Yes | 119 | 0.74 (0.49, 1.11) | **0.59 (0.36, 0.98)** |
| **Reproductive male health** | | | |
| *Vasectomy* | | | |
| No | 1096 | Reference | **Reference** |
| Yes | 441 | 1.26 (1.01, 1.58) | **1.26 (0.97, 1.63)** |
| *Family history of breast cancer* | | | |
| No | 1330 | Reference | |
| Yes | 209 | 1.50 (1.12, 2.02) | |
| *Family history of other cancers (excluding breast or prostate)* | | | |
| No | 1353 | Reference | |
| Yes | 186 | 1.31 (0.96, 1.79) | |
| *Fecal Occult Blood Test* | | | |
| Never | 974 | Reference | **Reference** |
| Ever | 510 | 2.32 (1.87, 2.90) | **2.21 (1.73, 2.83)** |
| *Endoscopy* | | | |
| Never | 1202 | Reference | |
| 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 (N=590)*

6/30/15

**REFERENCES**

Alberta Medical Association (2002). Guideline for the use of PSA and the early diagnosis of prostate cancer.  Available at: http://mdm.ca/cpgsnew/cpgs-f/search/french/help/2ACPGP.htm

American Urological Association (AUA) (2000). Prostate-specific antigen (PSA) best practice policy. Oncology: 14;267-272, 277-278, 280, 283-286.

Bryant, H., Robson P.J., Ullman, R., Friedenreich C., Dawe, U. (2006) Population-based cohort development in Alberta, Canada: A Feasibility Study. (Chronic Diseases in Canada, *In Press*)

Bunting, P.S., Goel, V., Williams, J.I., Iscoe, N.A. (1999) Prostate specific antigen testing in Ontario: reasons for testing patients without diagnosed prostate cancer. Canadian Medical Association Journal, 160(1): 70-75.

Canadian Cancer Society (CCS) (2002) Prostate cancer screening.
http://www.cancer.ca/ccs/internet/standard/0,2939,3172_428338__langId-en,00.html

Carter, F., Graham, E., Pal, N., Gonazlez, E., Roetzheim, R.  (1999) Prostate cancer screening in primary care.  South Med J, 92(3): 300-4.

Close, D.R., Kristal, A.R., Li, S., Patterson, R.E., White, E. (1998) Associations of demographic and health-related characteristics with prostate cancer screening in Washington State. Cancer Epidemiol Biomarkers Prev, 7: 627-630.

Coldman, A.J., Phillips, N., Pickles, T.A. (2003). Trends in prostate cancer incidence and mortality: an analysis of mortality changes by screening intensity. <u>Canadian Medical Association Journal,</u> 168(1): 51-5.

De Grasse, C.E., O'Connor, A.M., Boulet, J., Edwards, N., Bryant, H., Breithaupt, K. (1999) Changes in Canadian women's mammography rates since the implementation of mass screening programs. <u>Am J Public Health,</u> 89(6): 927-9.

Edwards, N., Boulet, J. (1997) Implementing breast cancer screening guidelines: results of the Ontario Health Status Survey. <u>Am J Prev Med</u>, 13(2):143-9.

Eisen, S.A., Waterman, B., Skinner, C.S., Scherrer, J.F., Romeis, J.C. et al. (1999) Socio-demographic and health status characteristics associated with prostate cancer screening in a national cohort of middle-aged male veterans. <u>Urology,</u> 53: 516-522.

Feightner, J.W., editor (1994). Screening for prostate cancer. <u>Canadian Task Force on Periodic Health Examination.</u> Ottawa, Health Canada: 812-823.

Finkelstein, M.M. (2002). Preventive screening. What factors influence testing? <u>Can Fam Physician,</u> 48:1494-501.

Gibbons, L., Waters, C., Mao, Y., Ellison, L. (2001) Trends in colorectal cancer incidence and mortality. <u>Statistics Canada Health Report,</u> 12(2):41-55.

Gibbons, L. and Waters, C. (2003). Prostate cancer – testing, incidence, surgery and mortality. Statistics Canada Health Report, 14(3): 9-20.

Gohagan JK, Prorok PC, Kramer BS, Cornett JE. Prostate cancer screening in the prostate, lung, colorectal and ovarian cancer screening trial of the National Cancer Institute. J Urol. 1994 Nov;152(5 Pt 2):1905-9. (Available at:  http://www.cancer.gov/prevention/plco)

Health Canada. (1999) Statistical report on the health of Canadians. Ottawa, Ont.
Available at: http://www.statcan.ca/english/IPS/Data/82-570-XIE.htm

Health Canada. (2004) Progress report on cancer control in Canada. Ottawa, Ont.
Cat. No. H39-4/50-2004E-PDF    Available at: at http://www.hc-sc.gc.ca

Hoffman, R.M., Papenfuss, M.R., Buller, D.B, et al.  (1996). Attitudes and practices of primary care physicians for prostate cancer screening.  Am J Prev Med, 12: 277-281

Hoffman, R.M., and Gilliland, F.D. (1999) A population-based survey of prostate cancer testing in New Mexico. J Community Health, 24: 409-419

Hoffman, R.M. (2003) An argument against routine prostate cancer screening. Arch Intern Med, 163: 663-665.

Klein, D. (2003) Short Report: Adolescents' health. Does having a family physician make a difference? Can Fam Physician, 49: 1000-1002.

Lemon, S., Zapka, J., Puleo, E., Luckman, r., Chasen-Taber, L. (2001) Colorectal cancer screening participation: comparisons with mammography and prostate-specific antigen screening. Am J Public Health, 91(8): 1264-1272.

Livingston, P., Cohen, P., Frydenberg, M., Borland, R., Reading, D., Clarke, V., Hill, D. (2002). Knowledge, attitudes and experience associated with testing for prostate cancer: a comparison between male doctors and men in the community. Intern Med J, 32(5-6): 215-23

McDavid, K., Melnik, T.A., Derderian, H. (2000) Prostate cancer screening trends of New York State men at least 50 years of age, 1994 to 1997. Prev Med, 31: 195-202.

McGregor, S.E., Bryant, H.E., Brant, R.F., Corbett, P.J. (2002). Prevalence of PSA testing and effect of clinical indications on pattern of PSA testing in a population-based sample of Alberta men. Chronic Dis Canada, 23(3): 111-119.

McIssac, W.J., Fuller-Thomson, E., Talbot, Y. (2001) Does having regular care by a family physician improve preventive care? Can Fam Physician, 47: 70-76.

McNaughton, C.M., Stafford R.S., Barry, M.J. (2000) Age-specific patterns of prostate-specific antigen testing among primary care physician visits. J Fam Pract, 49(2): 169-172.

Meigs, J.B., Barry, M.J., Giovannucci, E., Rimm, E.B., Stampfer, M.J., Kawachi, I. (1998) High rates of prostate specific antigen testing in men with evidence of benign prostatic hyperplasia. Am J Med, 104(6): 517-25.

Mitka, M. (2004) Is PSA testing still useful? JAMA, 292(19): 2326-2327.

Mercer, S.L., Goel, V. (1997) Factors associated with the use of mammography: the Ontario Health

Survey.  Cancer Prev and Control, 1(2): 144-51.


Merrill, R.M.  Demographics and health-related factors of men receiving prostate-specific antigen

screening in Utah.  Prev Med, 33: 646-652.


Moran, W.P., Cohen, S.J., Preisser, J.S., Wofford, J.L., Shelton, B.J., McClatchey, M.W. (2000).  Factors

influencing use of prostate-specific antigen screening test in primary care.  Am J Manag Care, 6(3): 315-

24.


Perkins, J.J., Sanson-Fishe, R.W., Clarke, S.J., Youman, P. (1998) An exploration of prostate cancer

screening practices and associated community expenditure. British Journal of Urology, 82:524-29.


Pickles T. (2004) Current Status of PSA screening. Can Fam Physician, 50:57-63.


Rothman, K. (2002). Epidemiology. An Introduction. Oxford University Press, Inc. New York pp 204.


Saskatchewan Cancer Control Report (2002). Available at:

http://www.scf.sk.ca/sccr/2004/sccr_2004.pdf


Schroder FH. (2006) European Randomized Study of Screening for Prostate Cancer.

Nederlands Trial Register. Available at: http://www.trialregister.nl/trialreg/admin/contactview.asp?

CC=131

Sirovich B.E., Schwartz L.M., Woloshin, S. (2003) Screening men for prostate and colorectal cancer in the United States. JAMA, 289(11): 1414-1420.

Smith, RA., Mettlin, C.J., Davis, K.J., Eyre, H. (2000). American Cancer Society guidelines for the early detection of cancer. CA Cancer J Clin, 50(1): 34-49.

Stamey, T.A., Caldwell, M., McNeal, J.E., Nolley, R., Hemenez, M., Downs, J. (2004) The prostate specific antigen era in the United States is over for prostate cancer: What happened in the last 20 years? J Urology, 172: 1297-1301.

Tudiver, F., Fuller-Thomson, E. (1999) Who has screening mammography? Results from the 1994-1995 National Population Health Survey. Can Fam Physician, 45: 1901-7.

Tudiver, F., Guibert, R., Haggerty, J., Ciampi, A., Medved, W., Brown, J.B., Herbert, C., Katz, A., Ritvo, P., Grant, B., Goel, V., Smith, P., O'Beirne, M., Williams, J.I., Moliner, P. (2002) What influences family physician's cancer screening decisions when practice guidelines are unclear or conflicting? J Fam Pract, 51(9): 760.

Ward, J.E., Hughes, A.M., Hirst, G.H., Winchester, L. (1997). Men's estimates of prostate cancer risk and self-reported rates of screening. Med J Aust, 167(5): 250-253

Weller, D., Pinnock, C., Silagy, C., Hiller, J.E., Marshall, V.R. (1998). Prostate cancer testing in SA men: Influence of sociodemographic factors, health beliefs and LUTS. Australian and New Zealand Journal of Public Health, 22(3): 400-402.

Williams, R.B., Boles, M.D., and Johnson, R.E. (1995)  Use of prostate-specific antigen for prostate cancer screening in primary care practice.  <u>Arch Fam Med</u>, 4: 311-315.