Short Communication

Associations of Demographic and Health-related Characteristics with Prostate Cancer Screening in Washington State

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Abstract

This report describes associations of demographic and health-related characteristics with use of prostate cancer screening. Data are from a random-digit dial survey of Washington State residents. Analyses are restricted to men ages 40–79 years (n = 332) and examine both digital rectal examination (DRE) and blood tests for prostate-specific antigen (PSA) in the previous 2 years. Results are adjusted to be representative of the state's population. In 1996, 53.6% of men received either DRE, PSA, or both. Among those screened, 42% received DRE alone, 15% PSA alone, and 43% both PSA and DRE, and the percentages of men receiving PSA increased markedly with age (30%, ages 40–49 years; 58%, ages 50–59 years; and 77%, ages 60–79 years). After control for other demographic characteristics, the relative odds for any prostate cancer screening were 5.5 for ages 60–79 *versus* 40–49 years, 2.4 for 16+ *versus* ≤12 years of education, and 4.0 for 2+ *versus* no physician visits in the previous 2 years (all $P < 0.05$). Characteristics generally associated with good health, including regular exercise and low fat and high fruit and vegetable intakes, were also significantly associated with prostate cancer screening. In conclusion, in 1996, approximately one-half of the men in Washington State over age 40 years had received prostate cancer screening in the previous 2 years. Few men were screened with PSA alone, and the use of PSA as part of prostate cancer screening increased markedly with age. Because PSA screening increases detection of prostate cancer, epidemiological studies of health behavior and cancer risk must carefully control for screening history to avoid detection bias.

Introduction

In the United States, prostate cancer is the most common cancer among men and second only to lung cancer as the leading cause of cancer-related mortality. Known risk factors for prostate cancer include increasing age, black race, and a family history of prostate cancer. With the possible exception of dietary exposures, there are no known modifiable risk factors, and efforts to control prostate cancer are focused on early detection and treatment.

Approaches to prostate cancer screening have changed dramatically over the past decade. In March of 1986, the Food and Drug Administration approved a blood test for measuring the serum concentration of PSA[2] as a means of monitoring progression of prostate cancer, but it has since gained acceptance as a screening test. In Washington State, the rapid increase in prostate cancer incidence starting in 1986, continuing through 1991 and declining rapidly since, is largely attributable to patterns of PSA screening (1). National trends in prostate cancer incidence are similar, although approximately 2–3 years behind those in Washington State (2, 3). Despite the profound public health impact of PSA screening, there have been few population-based studies of prostate cancer screening that include rates of screening with PSA (4–6). In particular, no studies have described the patterns of use of different types of prostate cancer screening, and no studies have examined demographic and psychosocial correlates of screening with PSA.

This report describes patterns of prostate cancer screening in Washington State in 1996. This report also examines demographic characteristics and health-related behavior and attitudes associated with prostate cancer screening.

Materials and Methods

Data are from the Washington State Cancer Risk Behavior Survey, an ongoing random digit dial survey of Washington State residents to monitor changes in behavior and attitudes related to cancer risk and prevention. The survey (n = 332 men, ages 40–79 years) was conducted between October 1995 and May 1996. The response rate, conservatively calculated as completed interviews divided by known eligible plus estimated eligibles, was 0.63. This rate is similar to or better than those reported in other statewide surveys (7). Details on survey and data collection methods are described in previous reports (8, 9).

Survey questions included demographic items (age, education, income, marital status, smoking, and ethnicity), health status items (chronic disease history, height, and weight), and items regarding health behavior and attitudes (physician visits, dietary habits, and physical exercise). Participants were asked about history of chronic disease (diabetes, hypertension, heart disease or angina, heart attack, stroke, high cholesterol, and cancer) and for their height and weight. Fat intake was estimated from a previously validated questionnaire (10) and categorized into tertiles, and fruit and vegetable intakes were estimated using items from the National Cancer Institute's

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[2] The abbreviations used are: PSA, prostate-specific antigen; DRE, digital rectal exam; TRUS, transrectal ultrasound.

Table 1 Percentage[a] of Washington State residents reporting prostate cancer screening in the previous 2 years, by demographic and health-related characteristics, 1996

		Screening test			
	n	Any test (%)	PSA only (%)	DRE only (%)	DRE and PSA (%)
Total	332	53.6	7.8	22.5	23.4
Age (yr)					
40–49	151	37.7	3.4	26.6	7.8
50–59	100	50.9	5.0	21.3	24.5
60+	81	78.1	16.4	17.7	44.0
Education (yr)					
≤12	79	41.5	6.7	20.2	14.6
13–15	127	53.8	12.6	21.7	19.5
16+	125	61.3	3.3	24.8	33.2
Household annual income ($)					
<25,000	56	34.7	1.6	22.3	10.9
25–50,000	121	56.7	9.0	24	23.7
>50,000	129	59.0	9.5	23.6	25.9
Marital status					
Married	216	57.6	9.6	21.8	26.2
Other	116	46.1	4.4	23.7	18.1
Chronic disease					
Yes	169	60.6	10.5	20.6	29.5
No	163	46.0	4.8	24.5	16.7
Smoking					
Current	71	39.5	5.2	26.8	7.5
Non	260	57.5	8.5	21.4	27.6
Body mass index[b]					
Normal	222	55.7	5.9	23.8	25.9
Overweight	60	40.0	8.6	14.6	16.7
Obese	50	60.9	15.2	26.0	19.8

[a] Adjusted to Washington State intercensal population estimates.
[b] Categories from Surgeon General's Report on Nutritional Health (21).

5-a-day program evaluation (11). Physical exercise was assessed as the weekly frequency of participating in any physical activity for at least 20 min. Participants also answered questions on history of prostate cancer among first-degree relatives and on intention to receive genetic testing for prostate cancer risk if such tests were available.

To assess prostate cancer screening, we asked men of age 40 years and older if they had ever had a DRE and, if so, how long it had been since the last DRE. We asked identically structured questions about TRUS and PSA. If participants did not understand the question, the interviewer described each test as follows: for DRE, "when a gloved finger is inserted into the rectum to check for problems"; for TRUS, "an ultrasound or X-ray of the prostate"; and for PSA, "a blood test that the doctor orders to check for a factor in the blood that may indicate prostate cancer."

We report screening rates, both total and stratified by demographic characteristics, which are adjusted for sampling probability and the Washington State intercensal population estimates. To describe associations of demographic and health-related characteristics with prostate cancer screening, we calculated the relative odds of screening across categorized levels of demographic and health-related factors. In these analyses, we addressed use of each screening test independently (DRE *versus* no DRE, and PSA *versus* no PSA), use of "recommended" screening (both DRE and PSA *versus* not both), and use of any screening (either PSA or DRE *versus* no test). We calculated odds ratios using logistic regression and report results both unadjusted (raw) and adjusted for age, education, income, marital status, and chronic disease history. Due to small numbers, we could not examine effects of race or ethnicity. We combined participants reporting prostate cancer screening by TRUS alone ($n = 6$) with those reporting DRE, because it is unlikely that TRUS was performed without DRE.

Results

Table 1 gives rates of prostate cancer screening that are representative of the Washington State population, stratified by demographic characteristics. Overall, 53.6% of men received DRE, PSA, or both in the previous 2 years. Among the men who were screened, ~42% received DRE alone, 15% received PSA alone, and 43% received both PSA and DRE. The types of screening differed markedly by some demographic and health-related characteristics. Among those screened, the percentages receiving PSA were higher among men who were older (77% for ages 60–79 *versus* 58% for ages 50–59 and 30% for ages 40–49), married (62% *versus* 49% for others), and nonsmokers (63% *versus* 33% for current smokers) and those who had a history of chronic disease (66% *versus* 47% with none) and higher incomes (60% for income over $50,000 *versus* 36% for income under $25,000). The percentages receiving PSA were similar across groups classified by education and body mass index.

Table 2 gives associations of age, education, income, marital status, and chronic disease history with prostate cancer screening in 1996, each adjusted for other characteristics in the table. Men age 60 and over were 5.5 times more likely to receive any prostate cancer screening compared with those ages 40–49, and men with college degrees were 2.4 times more likely to receive screening than those with up to a high school education. With the exception of education, associations of demographic characteristics tended to be stronger for contrasts that included PSA. For example, the relative odds of screening for age 60+ *versus* 40–49 years was 12.3 for PSA *versus* No PSA and 3.0 for DRE *versus* no DRE. Associations of marital status and chronic disease history with all screening test contrasts were modest, and after control for other demographic characteristics, none remained statistically significant.

Table 2 Relative odds of prostate cancer screening in previous 2 years associated with demographic characteristics, Washington State 1996 (n = 332)

	Screening test							
	DRE *vs.* No DRE		PSA *vs.* No PSA		Both DRE and PSA *vs.* Not both		Any test *vs.* No test	
	Raw	Adj[a]	Raw	Adj	Raw	Adj	Raw	Adj
Age (yr)								
40–49	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
50–59	1.58	1.51	3.38[b]	2.99[c]	3.86[b]	3.54[c]	1.67[d]	1.58
60+	2.98[d]	3.07[d]	12.70[b]	12.30[b]	9.74[b]	9.72[b]	5.61[b]	5.52[c]
P for trend		<0.001		<0.001		<0.001		<0.001
Education (yr)								
≤12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13–15	1.36	1.13	1.71	1.70	1.46	1.23	1.62	1.46
16+	2.50[c]	2.57[c]	2.10[b]	2.23[d]	2.85[c]	3.01[d]	2.18[c]	2.36[d]
P for trend		<0.01		0.08		<0.01		0.02
Income ($)								
<25,000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25–50,000	1.62	1.50	3.08	2.86[d]	2.39	2.07	2.09[d]	1.92
>50,000	1.92	1.52	3.50[d]	3.79[d]	2.87[d]	2.43	2.42[c]	2.13
P for trend		0.33		0.02		0.12		0.11
Married *vs.* Not	1.24	1.05	1.70[d]	1.14	1.47	0.97	1.46	1.17
Chronic disease history *vs.* None	1.49	1.06	2.56[b]	1.56	2.25[c]	1.43	1.83[c]	1.16

[a] Adjusted for other variables in the table.
[b] $P < 0.001$.
[c] $P < 0.01$.
[d] $P < 0.05$.

Table 3 gives associations of health-related behavior and attitudes with prostate cancer screening in 1996. Compared with men not visiting a physician within the past 2 years, men with one visit were 2.3 times more likely to receive any prostate cancer screening and men with two or more visits were 4.0 times more likely to receive screening. Men who said they would definitely take a genetic test for prostate cancer risk if it were available were 4.2 times more likely to receive any screening compared with men who did not intend to be tested for genetic risk. Number of physician visits and intent to take a genetic test for prostate cancer risk were strongly associated with all contrasts of screening tests. In contrast, healthful dietary behavior and regular exercise were only associated with contrasts that included PSA screening. Family history of prostate cancer and smoking status were weakly associated with screening, and after control for demographic characteristics, no associations remained statistically significant.

Discussion

PSA has become a primary modality for prostate cancer screening. Among all men receiving prostate cancer screening in 1996, 58% received PSA. Few men received PSA alone, and most received both DRE and PSA. The percentages of men receiving PSA as part of prostate cancer screening increased with age and income. These results on increasing use of PSA with increasing age are consistent with other population-based studies (4, 6), and although methods are not directly comparable, rates of PSA use in Washington State appear to be somewhat higher than those reported in other studies (4–6).

Demographic characteristics generally associated with use of health services, including higher age, education, and income, were associated with receiving all types of prostate cancer screening. However, increasing age and income were more strongly associated with screening by PSA than by DRE. Practicing healthful behavior, including regular exercise and eating diets high in fruits and vegetables and low in fat, were also associated with PSA screening. In addition, although history of prostate cancer in a first-degree relative did not predict screening, an intent to receive a hypothetical test for genetic risk for prostate cancer (when such a test becomes available) was strongly associated with screening. In general, these results are consistent with earlier studies that found that rates of prostate cancer screening (primarily DRE) are higher among men better educated, with higher incomes, and who practice healthful behavior (12–14).

There are three limitations to the interpretation of these results: (*a*) the response rate to the survey was ~63%, and thus respondents may not be representative of the population overall. In particular, respondents may be more interested in health and more likely to use preventive health services; (*b*) we cannot generalize results to minority groups. Blacks have a higher risk of prostate cancer than whites, and studies are needed to examine screening rates among black men; and (*c*) lacking a validity study based on medical records, we cannot verify whether screening occurred as reported. Some men may not have been informed by their physicians that blood was being used for PSA testing, although the accuracy of reporting DRE screening is relatively high (15, 16).

Approximately one-half of men ages 40–79 living in Washington State do not receive regular prostate cancer screening. The implications of this finding are unclear. There are no data to support increased survival due to either PSA screening specifically or to any prostate cancer screening (17, 18). However, prostate cancer incidence for white men from the Surveillance Epidemiology and End Results program (19) peaked in 1992 and had fallen 32% by 1995; mortality peaked in 1991 and had fallen 7% by 1995. Among white men under age 75 years, mortality peaked in 1992 and fell 14.7% by 1995. These secular trends are the first evidence that PSA screening may reduce prostate cancer mortality. Large randomized clinical trials, such as the Prostate, Lung, Colon and Ovary screening trial (19) and the Prostate Cancer Intervention *versus* Observation Trial (20), are focused on this issue.

Table 3 Relative odds of prostate cancer screening in previous 2 years associated with health-related characteristics in the 1996 Washington State Cancer Risk Behavior Survey (n = 332)

	%	Screening test							
		DRE *vs.* No DRE		PSA *vs.* No PSA		Both DRE and PSA *vs.* Not both		Any test *vs.* No test	
		Raw	Adj[a]	Raw	Adj	Raw	Adj	Raw	Adj
Physician visits in past 2 years									
0	28.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1	24.4	2.07[b]	1.91[b]	2.21	1.60	1.47	1.15	2.64[c]	2.30[b]
2+	47.6	3.51[d]	3.04	6.60[d]	4.83[d]	4.85[d]	3.62[c]	5.11[d]	4.03[d]
P for trend			<0.001		<0.001		<0.001		<0.001
Family history of prostate cancer *vs.* Not	6.8	1.01	0.85	2.54[b]	1.89	2.08	1.53	1.34	1.04
Intent to take genetic test for prostate cancer risk									
Probably/Definitely no	16.1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Probably yes	45.8	0.76	0.76	1.32	1.48	0.81	0.91	1.03	1.03
Definitely yes	38.1	3.35[d]	3.24[c]	3.74[c]	3.83[c]	3.29[c]	3.40[b]	4.19[d]	4.18[d]
P for trend			<0.001		<0.001		<0.001		<0.001
Current smoker *vs.* Not	21.5	0.60	0.87	0.33[c]	0.50	0.26[c]	0.42	0.57[b]	0.84
Body mass index[e]									
Normal	66.9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Overweight	18.1	0.46	0.44[b]	0.64	0.64	0.54	0.56	0.50[b]	0.47[b]
Obese	15.1	0.99	1.10	1.19	1.30	0.76	0.78	1.41	1.61
P for trend			0.54		0.81		0.33		0.69
Fat intake									
High	28.9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Average	39.8	1.35	1.27	1.88	1.99	1.97	2.03	1.44	1.37
Low	31.3	1.36	1.23	3.15[d]	3.82[d]	3.25[c]	3.60[c]	1.55	1.45
P for trend			0.51		<0.001		<0.01		0.24
Fruit and vegetable intake (servings/day)									
<2	27.1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2–4	50.0	1.57	1.28	1.90[b]	1.67	2.51[b]	2.18	1.44	1.19
4+	22.9	1.64	1.31	2.65[c]	2.72[b]	2.57[b]	2.34	2.01[b]	1.72
P for trend			0.43		0.02		0.08		0.13
Physical exercise (times/week)									
0	21.7	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1	9.3	1.31	1.11	0.99	0.99	1.19	1.37	1.19	0.99
2+	69.0	1.17	0.91	2.10[b]	1.95	2.15[b]	2.19	1.27	0.94
P for trend			0.71		0.06		0.06		0.83

[a] Adjusted for age, education, income, marital status, and chronic disease history.
[b] $P < 0.05$.
[c] $P < 0.01$.
[d] $P < 0.001$.
[e] Categories from Surgeon General's Report on Nutritional Health (22).

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