A National Survey of Medical Students' Beliefs and Knowledge in Screening for Prostate Cancer

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BACKGROUND: Today's medical students are being educated at a time when there are no evidence-based guidelines for prostate cancer screening.

OBJECTIVE: To examine medical students' knowledge and beliefs concerning prostate cancer screening and specific determinants for their beliefs.

DESIGN, SETTING, AND PARTICIPANTS: One thousand six hundred and forty four students were sampled at 20 medical schools using a web-based, cross-sectional survey.

MAIN OUTCOME MEASURES: Basic knowledge and beliefs about prostate cancer testing, epidemiology, and therapy were ascertained.

RESULTS: Four of 8 knowledge items were answered incorrectly by 50% or more of students. Seven of 8 students believe that early diagnosis from screening can improve survival from prostate cancer. Second- and third-year students were more likely than fourth-year students to believe that the digital rectal exam (DRE) and the prostate-specific antigen test were accurate, adjusted odds ratio (AOR) 1.8; 95% confidence interval (CI), 1.2 to 2.7 and 1.7; 1.3 to 2.2 for second and third years, respectively, for the DRE. Black and Hispanic students were no more likely than white students to agree that early screening diagnosis improves survival, but blacks were more likely to agree with screening black or Hispanic men (AOR 7.8; 95% CI, 5.3 to 11.4 and 3.2; 2.2 to 4.7, respectively). More knowledgeable students were less likely to believe in the benefit of early detection and the accuracy of the prostate-specific antigen (AOR 0.3; 95%CI, 0.2 to 0.5).

CONCLUSIONS: Medical students generally are very optimistic about the benefits of screening for prostate cancer. Increased knowledge about prostate cancer is associated with a more conservative view of screening. Other predictors are independent of this knowledge.

KEY WORDS: prostate cancer; screening; medical students.

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Prostate cancer is particularly common among elderly men and is the second-leading cause of cancer deaths among men. Currently, there is no available evidence from randomized trials that early detection of prostate cancer improves health outcomes, but the prostate-specific antigen (PSA) test is commonly used to screen men for prostate cancer.[1,2] Findings support the PSA test's ability to detect early-stage prostate cancer,[3] but whether it should be used for screening continues to be debated.[4,5] Those who advocate for early, more aggressive screening claim that early detection and therapy saves lives and decreases associated morbidity. Others state that although therapy may be modestly effective, this has not been proven in the context of screening, and many men identified with prostate cancer may not benefit from therapy but could be harmed. Consequently, prostate cancer screening remains a contentious topic as illustrated by the range of recommendations from different medical organizations.[4,6]

Much of what a physician decides to discuss with the patient is predicated on various provider- and patient-related factors.[7–9] Though little research exists to explain what influences physicians to recommend a PSA test, some factors known to be associated with screening in general include physician knowledge and beliefs, physician specialty and practice style, patient attitudes and values, patient demographics, and clinical guidelines.[9–13] Factors influencing cancer screening may be formulated prior to and during a physician's training and may differ by race or ethnicity, age, gender, and orientation towards primary care.[7,14,15] Accordingly, medical students are an important population to study the determinants of screening for prostate cancer.

METHODS

Sample

We employed a 2-stage, stratified, cluster design to obtain a nationally representative sample of U.S. medical students. Institutional review boards at the University of Medicine and Dentistry of New Jersey–School of Public Health and the Centers for Disease Control and Prevention approved the study. In the first stage, we sampled medical schools; the frame was constructed from the Association of American Medical College Institutional Profile System (1998–1999) and was stratified by

minority enrollment. Twenty-eight medical schools were selected, and medical schools with a high proportion of minority enrollment were oversampled. Of these 28 schools, 20 (71%) agreed to participate.

The second stage sampled students from within each participating medical school. Thirty students were chosen at random from within each class year, except for fourth-year students, whom we oversampled (50 students) to facilitate a follow-up study (not discussed herein). Of 2,954 sampled students, 1,644 (56%) participated. Thirty-five responses were not included in the analysis because of suspected duplicates and/or partially completed surveys, resulting in a final sample of 1,609. Response rates by class year were consistent (55%, 59%, 51%, and 51%). The overall response rate (school × student rate) was 40%.

Data Collection and Administration

Many studies of medical students have used convenience samples from single institutions, and response rates have varied considerably across class years, with lower rates noted among third- and fourth-year students.[16,17] In view of such concerns, we used a web-based method of data collection allowing us to survey students who may be off-campus. We randomly selected students via an introductory e-mail, and completed surveys were electronically transmitted to the study investigators. No personal identifiers were requested. E-mail reminders and incentives were employed to enhance student response rates. The survey was administered during the 2001 academic year.

We developed the instrument based on previous studies associating various characteristics of residents and medical students with their attitudes towards disease prevention. Variables included demographic descriptors,[14,16,18–21] specialty orientation,[14,18–20] family experience with disease,[20] class year, [21] and knowledge of prostate cancer screening, epidemiology, and treatment.[10,12]

Knowledge

Students responded to a list of 8 true/false statements previously employed by Austin and colleagues.[12] There is no "unsure" choice in this instrument. The items address common facts about prostate cancer screening, treatment, and epidemiology. Two statements assess students' awareness of the American Cancer Society (ACS) and the United States Preventive Services Task Force (USPSTF) recommendations (circa 2000) on screening for prostate cancer. Scores were categorized by the number of correct responses as low (0–3, 17% of total), middle (4–5, 51% of total), or high (≥6, 32% of total) scores.

Beliefs

Our main outcomes are students' overall belief in the benefits of early detection and the accuracy of screening with a digital rectal exam (DRE) and PSA testing. We adapted 3 items from a survey developed by Hoffman et al.[10] Screening belief statements use the word "accurate" to connote an overall sense of the strength of the tests in contrast to knowledge statements that have definitive, correct responses. Three additional statements examine the level of support for screening specific subpopulations: men with a family history of prostate cancer, black men, and Hispanic men. Agreement with statements was graded using a 5-point Likert scale.

Analysis

The data set was weighted for the varying probability of selection for each school and class year. Statistical analyses were performed using SUDAAN (Research Triangle Institute, Research Triangle Park, NC, USA), which adjusts standard errors for the complex sample design. Point estimates with 95% confidence intervals were used for descriptive analyses. We considered a P value of ≤0.05 as significant. We constructed separate, multivariate logistic regression models for each belief in Table 3. We classified "agree strongly" and "agree somewhat" as a positive response, and "no opinion," "disagree somewhat," and "disagree strongly" as a negative response. We obtained adjusted odds ratios (AORs) for each belief with variables identified a priori as being possibly predictive: sex, race or ethnicity, age, class year, future specialty orientation, family history of prostate cancer, and knowledge score result from Table 2. We also modeled a composite outcome in which a positive result was defined as responding affirmatively to all of the first 3 screening statements in Table 3. The models were run with and without knowledge scores to see if this mediated any of the other associations with belief outcomes.

RESULTS

Weighted percentages for sex, race or ethnicity, class year, specialty orientation, and family history of cancer are shown in Table 1. The weighted composition by sex and race or ethnicity is comparable to overall national statistics for U.S. medical students.[22]

Knowledge about prostate cancer and prostate cancer screening by class year is shown in Table 2. Approximately half of all students incorrectly thought that there was evidence

Table 1. Characteristics of U.S. Medical Student Participants (N=1,609)

	Percent (*n**)
Sex	
Male	56.9 (805)
Female	43.1 (804)
Race/ethnicity	
White	64.5 (1,100)
Asian	16.6 (248)
Black	7.7 (118)
Hispanic	6.6 (51)
Other	4.4 (88)
Class year	
First	25.4 (369)
Second	24.6 (390)
Third	25.4 (346)
Fourth	24.6 (504)
Career orientation	
Specialist	44.5 (670)
Generalist	39.8 (717)
Do not know	15.7 (219)
Family history of cancer	
Prostate	10.3 (172)
Any other cancer	61.1 (1,034)

**Unweighted n.*

Table 2. Percentage of U.S. Medical Students Correctly Responding to Statements About Prostate Cancer Screening by Class Year (*N*=1,609)

	Class year				Total
	First	Second	Third	Fourth	
The mortality rate for prostate cancer has not declined in recent years (F)	50.3	49.7	48.2	46.2	48.6
Prostatectomy results in improved survival over the natural course of the disease (F)*	20	33.4	41.9	47.1	35.5
ACS recommends routine prostate cancer screening for all men over age 50 (T)	91.2	90.2	89.5	91.4	90.6
A normal PSA level rules out prostate cancer. (F)	86.3	93.5	92.1	92.6	91.1
Randomized control trials have clearly supported PSA prostate cancer screening. (F)	25.3	45.7	59.9	69.2	49.9
Elevated PSA levels almost always indicate a diagnosis of prostate cancer (F)	58.4	78.5	90.6	90.3	79.4
USPSTF recommends routine prostate cancer screening for all men over age 50 (F)	4.6	5.3	14.6	17.7	10.5
The PSA test is highly specific in prostate cancer screening (F)	58.9	78.1	81	80.8	74.6

N=1,609: unweighted N.
ACS American Cancer Society, PSA prostate-specific antigen, USPSTF United States Preventive Services Task Force, F the statement is factually false, T the statement is factually true.
**At the time of the study, evidence in support of prostatectomy did not exist.*

from randomized clinical trial(s) clearly supporting the use of PSA testing and that the mortality rate from prostate cancer had not decreased in recent years. Most (89.5%) were unaware that USPSTF guidelines do not recommend screening for prostate cancer. Two-thirds thought (incorrectly at the time) that there was evidence for the efficacy of radical prostatectomy for improving survival (the study showing a reduction in prostate cancer–related deaths after prostatectomy was not yet published.[23] For 5 of the 8 knowledge items in Table 2, there was progression toward a greater percentage of correct answers by advancing year. Few differences in knowledge were noted by sex, specialty orientation, or race/ethnicity (data not shown).

Nearly 90% of students agreed strongly or somewhat that an early diagnosis by screening can improve survival from prostate cancer (Table 3). When questioned specifically about the accuracy of the DRE or the PSA test for screening, 62.8% and 54.8% of the students, respectively, agreed either strongly or somewhat that they were accurate. Students were more likely to favor screening in context of a positive family history (83.4%) but were less certain if the patient was black or Hispanic (46.7% and 61.1% with no opinion, respectively).

In a series of logistic regression models (Table 4), we modeled each of the 6 screening beliefs as a function of the students' characteristics. Age was highly correlated with class year and it was dropped from the models. Sex was not significantly associated with any of the beliefs. Specialty-oriented students had nearly twice the odds of those oriented toward primary care of agreeing that early screening improves survival ($P = .005$). In contrast, Asian students and those scoring high in knowledge were more likely to have a negative response (AOR of 0.6, $P = .01$, and AOR of 0.2, $P < .0001$, respectively). With regard to the belief about the accuracy of the DRE, second- and third-year students had greater odds of responding affirmatively than fourth-year students (AORs of 1.8, $P = .005$ and 1.7, $P = .002$, respectively), while students scoring high in knowledge were more likely to respond negatively (AOR of 0.6, $P = .017$). Similar associations were noted for PSA test accuracy, except high-knowledge score students had an even lower AOR of 0.3 ($P < .0001$). Additionally, both specialty orientation (AOR of 1.5, $P = .01$) and a student's family history of prostate cancer (AOR of 1.7, $P = .008$) were positively associated with this belief.

The odds of responding positively to all of the first 3 beliefs for second- and third-year students were almost twice that of fourth-year students ($P = .003$ and $< .0001$, respectively). Specialty and knowledge associations were also significant with AORs of 1.4 and 0.3 ($P = .02$ and $< .0001$, respectively).

There were also some very significant differences in responses to the statements measuring the strength of belief in PSA screening of specific populations. For patients having a

Table 3. Beliefs Towards Prostate Cancer Screening Among U.S. Medical Students (*N*=1,609)

	Agree strongly %	Agree somewhat %	No opinion %	Disagree somewhat %	Disagree strongly %
An early screening diagnosis can improve survival for men with prostate cancer	61.1	26.5	4.1	7.4	0.8
The digital rectal examination is an accurate screening test for prostate cancer	11.3	51.5	13.5	19.8	3.9
The PSA test is an accurate screening test for prostate cancer	11.5	43.3	18.3	21.8	5.2
More likely to screen if a patient has a family history of prostate cancer	53.1	30.3	7.1	5.9	3.7
More likely to screen for prostate cancer if a patient is black	18.4	16.9	46.7	10.7	7.4
More likely to screen for prostate cancer if a patient is Hispanic	3.6	11.6	61.1	14.9	8.8

N=1,609: unweighted N.
PSA prostate-specific antigen.

Table 4. Characteristics Associated With Prostate Cancer Screening Beliefs Among U.S. Medical Students

	Early screening improves survival	DRE is an accurate screening test	PSA is an accurate screening test	More likely to screen if patient has family history	More likely to screen if patient is black	More likely to screen if patient is Hispanic
	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)
Sex						
Male	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)
Female	1.37 (0.81–2.31)	0.96 (0.64–1.45)	0.85 (0.70–1.04)	1.04 (0.78–1.39)	1.15 (0.80–1.66)	1.15 (0.81 –1.64)
Medical school year						
First	1.33 (0.68–2.63)	0.80 (0.57–1.13)	0.54 (0.36–0.81)	0.98 (0.66–1.45)	0.21 (0.13–0.36)	0.63 (0.32–1.26)
Second	1.05 (0.65–1.70)	1.82 (1.24–2.69)	1.70 (1.09–2.64)	1.98 (1.14–3.43)	0.60 (0.38–0.95)	1.06 (0.52–2.15)
Third	1.36 (0.87–2.13)	1.66 (1.25–2.20)	1.40 (0.93–2.13)	1.52 (0.99–2.34)	1.01 (0.67–1.53)	1.28 (0.85–1.92)
Fourth	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)
Future practice intention						
Primary care	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)
Specialty	1.93 (1.27–2.95)	1.18 (0.88–1.59)	1.45 (1.11–1.90)	0.85 (0.62–1.15)	0.84 (0.68–1.05)	0.88 (0.56–1.40)
Do not know	1.20 (0.68–2.09)	0.90 (0.62–1.32)	1.14 (0.69–1.88)	0.65 (0.35–1.23)	0.86 (0.59–1.26)	1.13 (0.60–2.13)
Race/ethnicity						
White	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)
Asian	0.58 (0.38–0.88)	0.98 (0.72–1.34)	0.83 (0.66–1.05)	1.39 (0.89–2.17)	0.69 (0.50–0.97)	1.16 (0.70–1.93)
Black	0.82 (0.33–2.03)	0.95 (0.57–1.58)	1.60 (0.98–2.60)	0.89 (0.50–1.58)	7.80 (5.32–11.43)	3.19 (2.17–4.69)
Hispanic	1.20 (0.45–3.20)	0.78 (0.46–1.33)	1.08 (0.69–1.70)	0.75 (0.19–2.95)	1.58 (0.64–3.86)	2.30 (1.10–4.83)
Other	0.79 (0.38–1.67)	1.87 (0.97–3.61)	0.81 (0.48–1.37)	0.88 (0.47–1.62)	1.52 (0.81–2.85)	2.09 (0.88–4.93)
Family history of prostate cancer						
No	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)
Yes	1.03 (0.53–2.02)	0.94 (0.65–1.35)	1.73 (1.18–2.54)	1.60 (0.75–3.40)	1.24 (0.88–1.75)	1.46 (0.98–2.16)
Knowledge*						
Low	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)	1.00 (referent)
Middle	0.62 (0.35–1.10)	0.94 (0.57–1.55)	0.72 (0.51–1.03)	0.60 (0.33–1.06)	0.79 (0.62–1.00)	0.74 (0.49–1.12)
High	0.21 (0.14–0.34)	0.57 (0.37–0.89)	0.34 (0.22–0.52)	0.55 (0.35–0.87)	0.72 (0.45–1.15)	0.70 (0.46–1.07)

DRE digital rectal exam, PSA prostate-specific antigen, AOR adjusted odds ratio, CI confidence interval.
**Assignment by number of statements correctly addressed in Table 2: low 0–3, middle 4–5, and high 6–8.*

positive family history, second-year students had twice the odds of agreement with screening compared to fourth-year students ($P = .019$). Students scoring highest in knowledge were less likely to agree (AOR of 0.6, $P = .013$). Marked differences by student's race/ethnicity were seen for beliefs in screening black and Hispanic men. Black students had 7.8 and 3.2 times the odds of agreement with being more likely to screen these respective groups relative to white students ($P < .0001$ for both comparisons). Hispanic students were also in greater agreement with being more likely to screen Hispanic men (AOR of 2.3, $P = .03$) but not black men.

When the models were examined without knowledge categories (not shown), there was almost no change in the AORs of the other covariates, indicating the absence of confounding or mediation by knowledge on these other factors.

COMMENT

In much the same manner that medical educators have to teach students about the nuances and uncertainties of prostate cancer screening, future physicians will eventually have to integrate this imperfect knowledge in communicating to their patients. To our knowledge, this is the first national sample of medical students in the United States who have been surveyed regarding their beliefs and knowledge concerning this controversial screening modality. Zapka and colleagues examined cancer knowledge and attitudes, but their sample was taken from 1 medical school, and they did not examine possible predictors of the attitudes or beliefs.[21]

Perhaps our most important finding is that medical students overwhelmingly believe that early detection of prostate cancer through screening improves survival. Moreover, most students agreed that the DRE and the PSA were accurate tests. While a belief in their accuracy does not necessarily imply a belief that these tests can increase survival, nearly half of second- and third-year students agreed with all of the first 3 screening belief statements (improving survival, accuracy of DRE and PSA); even 30% of fourth-year students agreed.

This survey also measured medical students' knowledge regarding prostate cancer screening and the change in this knowledge by class year. We detected significant improvement by class year for some items, but not for others. Students fared most poorly on knowledge of recent epidemiology of prostate cancer and evidence for or against efficacy studies of prostatectomy and the PSA test. Interestingly, most students did know that the ACS recommends PSA screening, but did not know that the USPSTF (2000) does not recommend PSA screening. However, it is possible that students just assumed that both organizations would recommend such a test without actual knowledge of their policies.

Beliefs reflect one's perceptions or assumptions about reality and can vary from individual to individual, whereas knowledge is grounded in facts. We suspected that students' factual knowledge of prostate cancer and performance characteristics of the PSA test would affect their beliefs about screening. We found this to be true as "high-knowledge" students were significantly less likely to agree with all 3 of the screening beliefs. In other words, increased knowledge was associated with a less optimistic stance towards prostate cancer screening.

More intriguing is the finding that several predictors of agreement with the first 3 screening beliefs, either individually or collectively, did not change significantly with the addition of knowledge scores. Indeed, the AORs for race/ethnicity, specialty orientation, and family history of prostate cancer changed very little after knowledge was added to the model, suggesting that these characteristics reflect feelings and attitudes more resistant to change. A student with a family member diagnosed with prostate cancer may be more willing to believe in the accuracy of a PSA test. Similarly, it is interesting to speculate why students oriented to a specialty are more optimistic about early screening and, to a lesser extent, the accuracy of the PSA test. Perhaps students who are more attracted to procedures or active intervention are more optimistic or, alternatively, those interested in primary care are more skeptical (or realistic?) of what modern medicine can do. It would be interesting for future research to see if this more aggressive approach to screening is present in specialist physicians who also practice primary care, as compared to traditional primary care practitioners.

Student race had a very large effect on prostate cancer screening beliefs towards black and Hispanic men. That black students were also more likely to screen Hispanic men—a subgroup that has not been shown to have a higher risk than white men—suggests that these students may perceive that minorities, in general, are more vulnerable to prostate cancer. Clinician-teachers should be aware of these perceptions—especially as they may influence the use of tests that have no firm guidelines. Future physicians should be taught to understand that their perceptions may not be based on evidence, and that they need to remain open and keep informed about new findings on the utility of specific screening programs.

The effect of class year on screening beliefs is interesting. Initially, the observation that first-year students are less likely to believe in PSA seems puzzling, but closer examination of the responses reveals that this was due more to the absence of opinion (49.8%) rather than actual disagreement. Why are second- and third-year students more likely to believe that the DRE and PSA tests are accurate than fourth-year students, even after accounting for knowledge? The general public is very optimistic about cancer screening in general,[24] and this is probably representative of beginning students as well. It is not until their third and fourth years that students have significant outpatient exposure to screening in practice. This experience most likely tempers the initial enthusiasm for prostate cancer screening. This should be reassuring to medical school faculty; it demonstrates that attitudes and beliefs continue to be formed throughout the medical school experience. Changes in beliefs by class year occur independently of knowledge, suggesting that other factors are operative, such as the importance of role models in the clinical years. Future research should focus on the "durability" of these beliefs into residency and practice.

These findings have important implications for those responsible for teaching medical students about subject matter that has no definite guidelines. First, medical students, on average, have an exaggerated belief in the accuracy of these screening tests. This may carry over into residency and practice, leading to "overselling" the value of prostate cancer screening to the average-risk patient. Medical educators must inculcate a perspective that acknowledges a possible benefit of screening while understanding that it may also have drawbacks such as overdiagnosis, labeling, and initiation of costly and potentially harmful treatments without necessarily increasing survival.[5] Finally, students should be taught to become self-aware of perceptions that may not be evidence-based but may interfere with incorporating new findings into their practice.

A limitation of our study is its cross-sectional design. Even so, the findings by class year have significant point estimates, and the graded progression through class years suggests a causal relationship between educational experience and student beliefs. A second limitation is our response rate: for students, it was 56%. A response bias is possible, but we could not analyze nonresponders. Our instrument to assess knowledge was an 8-item true/false questionnaire. By forcing a discrete yes or no answer, we have not obtained information about those students who were unsure of their answers. However, by "forcing" a categorization, we have described those that are "leaning to" a particular answer, thus still providing some value as a determinant. At the time of the survey, few validated questionnaires about prostate cancer knowledge existed, and none were designed for medical students. Several new knowledge assessment instruments have since become available, including the most recent one by Bell,[25] but again, none specifically for students. Finally, this survey was administered in 2000–2001, before Thompson revealed that prostate cancer is indeed common in men with PSA ≤4.0 ng/ml,[26] calling into question the traditional threshold for performing a biopsy, and prior to studies showing a beneficial effect of prostatectomy on mortality.[23,27] These well-publicized reports could influence today's medical students' beliefs in ways not reflected in our student sample.

A significant strength of the study is that we oversampled schools with a high proportion of minority students. This approach allowed us to study associations of race/ethnicity with screening beliefs. In addition, our web-based design provided an environment that allowed thoughtfulness for responses.[28]

To summarize, we have demonstrated in a national sample of medical students that misperceptions and inaccuracies about prostate cancer are common but improve somewhat with class year. Overall, students are very optimistic in perceiving a benefit from prostate cancer screening, but a moderate amount of knowledge about screening, treatment, and the epidemiology of prostate cancer substantially decreases the degree of optimism. Finally, we show that there are specific predictors of screening beliefs that are independent of the students' knowledge about this cancer.

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