ment of obesity in these patients. It has been estimated that up to 80% to 90% of patients with OSA are undiagnosed,[8] and weight reduction as a treatment of OSA is underrated by many clinicians. There are no national programs for screening OSA or preventing its progression. Thus, there is a definite need for larger, well-controlled trials on the effects of different lifestyle programs among patients with OSA to determine the overall efficacy and long-term success, before large-scale programs may be implemented in clinical settings, as have been done for prevention of type 2 diabetes mellitus, for example.

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## LESS IS MORE

### Investigation Momentum: The Relentless Pursuit to Resolve Uncertainty

Debate regarding the prostate-specific antigen (PSA) screening test centers around test reliability and whether screening reduces mortality.[1-3] We consider yet another potential downside to the widespread use of unreliable screening tests: the downstream effect of receiving inconclusive or ambiguous

*For editorial comment see page 847*

results. When receiving information from screening tests, we usually want to know whether the result is a "yes" or a "no." Receiving an inconclusive result amounts to a "don't

**Table. Characteristics of Survey Respondents by Assigned Prostate-Specific Antigen (PSA) Test Result Group**

| Characteristic | Respondents, No. (%) (n = 727)[a] | | | | *P* Value |
|---|---|---|---|---|---|
| | No PSA Test (n = 163) | Inconclusive PSA Level (n = 185) | Elevated PSA Level (n = 182) | Normal PSA Level (n = 197) | |
| Age, y | | | | | |
| 40-50 | 28 (17.2) | 33 (17.8) | 34 (18.7) | 26 (13.2) | |
| 51-60 | 49 (30.1) | 64 (34.6) | 53 (29.1) | 62 (31.5) | |
| 61-70 | 51 (31.3) | 54 (29.2) | 51 (28.0) | 67 (34.0) | .51[b] |
| 71-75 | 15 (9.2) | 16 (8.6) | 21 (11.5) | 19 (9.6) | |
| Unanswered | 20 (12.3) | 18 (9.7) | 23 (12.6) | 23 (11.7) | |
| Perceived lifetime risk of prostate cancer, % | | | | | |
| 0-25 | 109 (66.9) | 130 (70.3) | 117 (64.3) | 122 (61.9) | |
| 26-50 | 26 (16.0) | 35 (18.9) | 36 (19.8) | 49 (24.9) | |
| 51-75 | 19 (11.7) | 13 (7.0) | 12 (6.6) | 21 (10.7) | .34[b] |
| 76-100 | 8 (4.9) | 6 (3.2) | 14 (7.7) | 5 (2.5) | |
| Unanswered | 1 (0.6) | 1 (0.5) | 3 (1.6) | 0 | |
| Previous screening examinations | | | | | |
| PSA and DRE | 83 (50.9) | 105 (56.8) | 93 (51.1) | 112 (56.9) | |
| PSA only | 31 (19.0) | 23 (12.4) | 31 (17.0) | 33 (16.8) | |
| DRE only | 18 (11.0) | 20 (10.8) | 20 (11.0) | 17 (8.6) | .90[c] |
| Neither PSA nor DRE | 26 (16.0) | 34 (18.4) | 32 (17.6) | 30 (15.2) | |
| I don't know | 5 (3.1) | 3 (1.6) | 6 (3.3) | 5 (2.5) | |
| Race/ethnicity | | | | | |
| White | 144 (88.3) | 167 (90.3) | 165 (90.7) | 178 (90.4) | |
| Other races and ethnicities | 18 (11.1) | 17 (9.2) | 16 (8.7) | 19 (9.6) | .90[c] |
| Unanswered | 1 (0.6) | 1 (0.5) | 1 (0.6) | 0 | |
| History of prostate cancer in father or brothers | | | | | |
| Yes | 30 (18.4) | 24 (13.0) | 22 (12.1) | 30 (15.2) | |
| No | 124 (76.1) | 149 (80.5) | 148 (81.3) | 157 (79.7) | .72[c] |
| I don't know | 9 (5.5) | 12 (6.5) | 12 (6.6) | 10 (5.1) | |
| History of breast cancer in mother or sisters | | | | | |
| Yes | 26 (16.0) | 30 (16.2) | 25 (13.7) | 37 (18.8) | |
| No | 133 (81.6) | 152 (82.2) | 151 (83.0) | 154 (78.2) | .81[c] |
| I don't know | 4 (2.5) | 3 (1.6) | 6 (3.3) | 6 (3.0) | |
| Would you undergo a prostate biopsy? | | | | | |
| Yes | 40 (24.5) | 73 (39.5) | 112 (61.5) | 25 (12.7) | <.001[c] |
| No | 123 (75.5) | 112 (60.5) | 70 (38.5) | 172 (87.3) | |
| How certain are you in whether or not you would receive a biopsy? | | | | | |
| −100 to −61 (most certain would not) | 55 (33.7) | 43 (23.2) | 22 (12.1) | 99 (50.3) | |
| −60 to −21 | 27 (16.6) | 43 (23.2) | 29 (15.9) | 44 (22.3) | |
| −20 to 20 (most uncertain) | 45 (27.6) | 30 (16.2) | 23 (12.6) | 31 (15.7) | <.001[b] |
| 21 to 60 | 20 (12.3) | 31 (16.8) | 34 (18.7) | 12 (6.1) | |
| 61 to 100 (most certain would) | 16 (9.8) | 38 (20.5) | 74 (40.7) | 11 (5.6) | |

Abbreviation: DRE, digital rectal examination.

[a] Participants were recruited from a sample of golf players. The study protocol was approved by the institutional review board of Duke University, Durham, North Carolina, and included a waiver for written consent. In 2012, we e-mailed 14 692 men and stopped recruiting once we received 1003 responses. We excluded 276 participants who completed the survey in less than 1.5 minutes, were inconsistent responders, or had previously received a diagnosis of prostate cancer, leaving a resulting sample size of 727 for analysis. A likelihood ratio (LR) test revealed that these excluded participants were not unequally distributed across the 4 conditions: LR = 2.45; $P = .48$.

[b] Calculated by means of analysis of variance test.

[c] Calculated by means of $\chi^2$ test.

know"; this situation should have a level of uncertainty regarding the diagnosis similar to that of not conducting the test at all. Yet, we propose that the psychological uncertainty experienced after an inconclusive test result can lead to *investigation momentum:* additional, and potentially excessive, diagnostic testing. In contrast, not conducting the unreliable test would result in no further action. To investigate this, we evaluated whether receiving an inconclusive result from an unreliable test (the PSA screening), compared with undergoing no test, motivated more individuals to undertake an additional, more invasive and costly, test (a prostate biopsy).

**Methods.** We recruited 727 men aged between 40 and 75 years to an online survey through e-mail solicitation (data were subsequently collected and analyzed anonymously). Participants received information regarding prostate cancer and answered some background questions (see **Table**). They were randomized to 1 of 4 conditions. In the first condition, "no PSA," participants were given information about the risks and benefits of prostate biopsies and asked whether they would have a biopsy (yes or no) and their certainty, ranging from −100 (most certain they would not undergo biopsy) to +100 (most certain they would). In the other 3 conditions, participants were given information about PSA tests, as well as prostate biopsies, and were then presented with a scenario that asked them to imagine that they had just received their PSA test result at 1 of 3 PSA levels: normal, elevated, or inconclusive—the latter result stated "this result provides no information about whether

or not you have cancer." After getting the information about the PSA test and a particular outcome, participants were asked to indicate whether, under these conditions, they would undergo a biopsy and their level of certainty in that decision.

We conducted 2-sided $\chi^2$ tests and analyses of variance with planned contrasts to examine differences between the 4 conditions. $P < .05$ was considered statistically significant.

**Results.** There were no significant differences among the 4 conditions in participant age, believed likelihood of developing prostate cancer, previous screening examinations, race, and family history of prostate or breast cancer (Table). As hypothesized, significantly more men indicated that they would undergo a prostate biopsy if they received an inconclusive PSA test result (40%) than if they had no PSA test (25%; $\chi^2 = 8.80$; $P = .003$). Men in the elevated and normal PSA level conditions also responded significantly differently: Those assigned an elevated PSA test result were more likely to state that they would undergo a biopsy (62%) compared with those who had no PSA test ($\chi^2 = 47.76$; $P < .001$) and compared with those assigned an inconclusive PSA test result ($\chi^2 = 17.89$; $P < .001$) (although 38% of men with an elevated PSA test result still would not opt for a biopsy). Those assigned a normal PSA test result were less likely to state that they would undergo a biopsy (13%) compared with those who had no PSA test ($\chi^2 = 8.47$; $P = .004$) (demonstrating some, but not total, reassurance from receiving a normal PSA test result)[4] and compared with those assigned an inconclusive PSA test result ($\chi^2 = 35.85$; $P < .001$) and those assigned an elevated PSA test result ($\chi^2 = 97.80$; $P < .001$). Similar results, and significance, were obtained with participants' certainty ratings (Table).

**Comment.** These results are likely not confined to the PSA test and provide evidence that an inconclusive test result sparks investigation momentum. When tests give no diagnostic information, rationally, from an information perspective, it should be equivalent to never having had the test for the purpose of future decision making. Yet, we find that more men would opt to undergo the more invasive biopsy after receiving a meaningless test result than when they have no result at all. This has financial and clinical implications owing to the cost and invasive nature of further investigations. Furthermore, such a tendency is likely to have an impact not only on those physicians who incorporate patients' preferences into medical decision making[5] but on all physicians, because they are vulnerable to the same psychological processes that encourage patients to resolve ambiguity.[6] These results suggest that the ubiquitous use of simple but unreliable screening tests may lead to consequences beyond the initial cost and patient anxiety of inconclusive results; they could also lead to investigation momentum. Furthermore, it is possible that just ordering a test may lead to a commitment to pursue and find abnormalities.[7] As we have also seen previously, sometimes "less is more" when it comes to health care procedures with incremental benefit but definite risks such as imaging for low back pain (a symptom likely to generate investigation momentum).[8] These findings need to be replicated in broader populations and clinical settings to allow us to better understand how ambiguous information affects medical decision making.

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## COMMENTS AND OPINIONS

### Internists: Who Are We—And Where Are We Going?

*Nothing will sustain you more potently than the power to recognize in your humdrum routine, as perhaps it may be thought, the true poetry of life—the poetry of the commonplace, of the ordinary man, of the plain, toil-worn woman, with their lives and their joys, their sorrows and their griefs.*

William Osler[1]

When I began my internal medicine practice, internists were experts in diagnosis and medical treatment and consultants, who cared for the sickest of the sick.