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ORIGINAL RESEARCH | Annals of Internal Medicine

Vignette-Based Study of Ovarian Cancer Screening: Do U.S. Physicians Report Adhering to Evidence-Based Recommendations?

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Background: No professional society or group recommends routine ovarian cancer screening, yet physicians' enthusiasm for several cancer screening tests before benefit has been proven suggests that some women may be exposed to potential harms.

Objective: To provide nationally representative estimates of physicians' reported nonadherence to recommendations against ovarian cancer screening.

Design: Cross-sectional survey of physicians offering women's primary care. The 12-page questionnaire contained a woman's annual examination vignette and questions about offers or orders for transvaginal ultrasonography (TVU) and cancer antigen 125 (CA-125).

Setting: United States.

Participants: 3200 physicians randomly sampled equally from the 2008 American Medical Association Physician Masterfile lists of family physicians, general internists, and obstetrician-gynecologists; 61.7% responded. After exclusions, 1088 respondents were included; their responses were weighted to represent the specialty distribution of practicing U.S. physicians nationally.

Measurements: Reported nonadherence to screening recommendations (defined as sometimes or almost always ordering screening TVU or CA-125 or both).

Results: Twenty-eight percent (95% CI, 24.5% to 32.9%) of physicians reported nonadherence to screening recommendations for women at low risk for ovarian cancer; 65.4% (CI, 61.1% to 69.4%) did so for women at medium risk for ovarian cancer. Six percent (CI, 4.4% to 8.9%) reported routinely ordering or offering ovarian cancer screening for low-risk women, as did 24.0% (CI, 20.5% to 28.0%) for medium-risk women ($P \leq 0.001$). Thirty-three percent believed TVU or CA-125 was an effective screening test. In adjusted analysis, actual and physician-perceived patient risk, patient request for ovarian cancer screening, and physician belief that TVU or CA-125 was an effective screening test were the strongest predictors of physician-reported nonadherence to published recommendations.

Limitation: The results are limited by their reliance on survey methods; there may be respondent–nonrespondent bias.

Conclusion: One in 3 physicians believed that ovarian cancer screening was effective, despite evidence to the contrary. Substantial proportions of physicians reported routinely offering or ordering ovarian cancer screening, thereby exposing women to the documented risks of these tests.

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No professional organization or government agency currently recommends routine ovarian cancer screening in the general population (1–4). Ovarian cancer screening tests have high false-positive rates (8.4%) and low positive predictive values (1.0% for transvaginal ultrasonography [TVU] and 3.7% for cancer antigen 125 [CA-125]) (5, 6). In addition, the incidence of ovarian cancer is low (age-adjusted incidence, 12.2 per 100 000 women in the general population) (7). No studies have shown that screening, even in high-risk populations, affects the morbidity or mortality of ovarian cancer (6, 8–22).

The potential harms of ovarian cancer screening are substantial. The British Health Technology Assessment program estimated that if 10 000 women aged 50 to 64 years were screened for ovarian cancer, 300 (using annual CA-125) or 350 (using TVU every 2 years) without ovarian cancer would be recalled each year for further assessment and 20 (using CA-125) or 65 (using TVU) would undergo surgery each year (23). At most, this screening would detect 4 additional cases of cancer per year and result in 1.5 additional 5-year survivors for each year of screening. In reports from the Prostate, Lung, Colorectal and Ovarian Cancer Screening Trial, which randomly assigned patients to annual CA-125 testing for 6 years and TVU for 4 years or to have no screening, 0.5% of participants in the intervention group had a true-positive result and 8.4% had a false-positive result. Of those with false-positive test results who underwent surgery for establishing a diagnosis, 15% had significant complications (6). Given the results of such studies, the U.S. Preventive Services Task Force (USPSTF) has assigned routine screening for ovarian cancer a "D" grade (fair evidence that routine screening is ineffective or that harms outweigh benefits) (1). Even among women with family histories that put them at high risk for ovarian cancer (>20% risk for a deleterious genetic mutation; of those with *BRCA1*, a 46%

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lifetime risk; and of those with *BRCA2*, a 12% lifetime risk for ovarian cancer) (24), professional organizations, such as the USPSTF and the American Congress of Obstetricians and Gynecologists (ACOG), recommend only referral for genetic counseling and evaluation for BRCA testing (25), not ovarian cancer screening. If a woman has a *BRCA1* or *BRCA2* genetic mutation, the Society of Gynecologic Oncologists suggests that she is an appropriate candidate for risk-reducing surgery rather than screening because no evidence suggests that screening these women reduces mortality (26).

Little has been published about how frequently ovarian cancer screening is offered to women in the general population. One small study of women seeking assessment of genetic cancer risk suggests that women without an indication for ovarian cancer screening tests are frequently being screened (27, 28). Given physicians' enthusiasm for some cancer screening tests before benefits have been proven (for example, prostate-specific antigen testing), a sizable number of women in the United States may be exposed to the potential harms of ovarian cancer screening (28–30).

Our study uses data from a women's health survey of 3200 family physicians, general internists, and obstetrician-gynecologists to develop nationally representative estimates of physicians' reported nonadherence to recommendations against routine ovarian cancer screening (31, 32). By examining the predictors of reported nonadherence to recommended screening practices, we provide results that can help professional organizations, training programs, and government agencies best target their educational efforts related to ovarian cancer screening.

Context

No professional body recommends routine screening of asymptomatic women for ovarian cancer, regardless of their risk.

Contribution

By using case vignettes, physicians providing primary care were surveyed for their use of ovarian cancer screening tests in asymptomatic patients. Physicians commonly offered such testing and were more likely to do so for women at higher-than-average risk or for those who requested testing. Physicians with a personal history of cancer, in solo practice, and with longer time in practice were more likely to offer testing.

Caution

Nonphysician primary care providers were not surveyed.

Implication

Physicians may commonly not adhere to ovarian cancer screening guidelines, leading to patient harm and incurring significant cost.

—The Editors

METHODS

Study Sample

Our study sample consisted of 3200 physicians aged 64 years or younger practicing in office or hospital-based settings in the United States. Of these, 200 participated in the survey's pilot test and 3000 in the final survey. Roughly equal numbers of physicians (about 1067) were randomly sampled from the 72 241 family physicians, 77 007 general internists, and 28 929 obstetrician-gynecologists listed in the August 2008 American Medical Association (AMA) Physician Masterfile. This research study was approved by the University of Washington Human Subjects Division and the Centers for Disease Control and Prevention Institutional Review Board.

Survey Instrument

We developed a 12-page mail survey booklet examining physicians' care for women's health. The survey booklet itself and the cover letter explained to physicians that we were seeking to understand the care that physicians provide women in the United States. We designed the survey instrument with the intention of examining physicians' cancer screening practices for women overall and ovarian cancer screening, detection, and management in particular. Each questionnaire included 3 vignettes: The first asked about physicians' management of persistent abdominal and genitourinary symptoms, the second about provision of preventive care services at an annual examination, and the third about management of a pelvic mass; the vignettes always appeared in that order. The questionnaire also asked about physician demographic characteristics, practice characteristics, attitudes toward risk, malpractice concerns, beliefs about cancer screening tests, sources of information about cancer screening, and cancer experience (**Supplement**, available at www.annals.org).

In this study, we used data from the vignette of a woman presenting for an annual examination only. Different versions of the vignette varied the woman's age (35 or 51 years); race (African American or white); insurance (Medicaid or private); and, to examine ovarian cancer screening practices, level of ovarian cancer risk based on epidemiologic studies (low [roughly 1.5% lifetime ovarian cancer risk]—mother with breast cancer at age 70 years, medium [4.0% to 5.0% lifetime ovarian cancer risk]—mother who died of ovarian cancer at age 65 years, and high [>20% risk for a deleterious genetic mutation; of those with *BRCA1*, a 46% lifetime risk for ovarian cancer; of those with *BRCA2*, a 12% lifetime risk for ovarian cancer (24)]—woman who had breast cancer at age 30 years, paternal grandmother with ovarian cancer, and paternal first cousin with premenopausal breast cancer). The vignette also varied whether the patient requested ovarian cancer screening (request: "She requests cancer screening, especially for ovarian cancer"; no request: "She wants to be

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sure she is up to date on all appropriate cancer screening tests"). We created 48 vignette variations based on these 5 patient characteristics. We asked physicians whether they would offer or order a series of studies or tests "almost never," "sometimes," or "almost always" at the visit portrayed in the vignette.

We conducted cognitive interview testing of the survey with all 3 specialties and asked physicians at professional meetings to complete the questionnaire with written feedback. On the basis of feedback from these activities, we refined the questionnaire and improved its clarity and face validity. We also conducted a pilot test by mailing 200 questionnaires to physicians to determine whether an 8-page rather than a 12-page questionnaire would increase the response rate. The 8-page vignette included only 2 vignettes (1 of which was the annual examination vignette) and omitted the questions on risk-taking and fear of malpractice. Response rates did not differ, so we used the full 12-page questionnaire for the final survey.

Survey Administration

The 3000 physicians for the final survey were randomly assigned equally to the 48 vignette versions. To optimize response, we conducted the survey using a modified Total Design Method, with two 2-day priority mailings, a midpoint reminder postcard/thank-you card, a $20 bill with the first mailing, and an encouraging handwritten note from the primary investigator with the second mailing (33).

Study Variables

Outcome Variable

The vignette asked physicians whether they would "almost always," "sometimes," or "almost never" offer or order TVU or CA-125 for the woman presenting for an annual examination. Physicians who reported that they almost never offered or ordered both tests were defined as adherent to ovarian cancer screening recommendations. Physicians who reported that they sometimes or almost always offered or ordered TVU or CA-125 or both were defined as nonadherent to ovarian cancer screening recommendations.

Independent Variables

Patient Characteristics. We included, as independent variables, several patient characteristics that have been associated with receipt of cancer screening services, including age, race, insurance, level of risk, and request for ovarian cancer screening.

Physician Characteristics. The Theory of Reasoned Action and the Theory of Planned Behavior guided our choice of physician characteristics that might predict ovarian cancer screening practices (34–36). According to these theories, a physician's intention to engage in a particular practice (for example, reported nonadherence to ovarian cancer screening recommendations) is influenced by the physician's attitude toward the practice, perceived pressure to conduct the practice, and perceived ability to conduct the practice. Beliefs about TVU or CA-125 being clinically effective screening tests for ovarian cancer among average-risk women, physicians' estimation of the woman's ovarian cancer risk, and modified published measures of attitude toward risk-taking and malpractice concern (37, 38) assessed attitudes. We measured perceived pressure to adhere to ovarian cancer screening recommendations, with variables indicating whether physicians listed the USPSTF, the ACOG, and the American Cancer Society among the top 3 organizations influencing their cancer screening recommendations. Perceived ability to adhere to ovarian cancer screening recommendations was measured by physician practice factors that might serve as barriers or supports: geographic location (urban, large rural, or small/isolated small rural area [based on Rural Urban Commuting Area codes linked by physician mailing ZIP code]) (39, 40), census division, primary practice setting (for example, office practice, community health center), group/solo practice, involvement in clinical teaching, average number of outpatients seen weekly, and board certification. We also included other physician characteristics that have been associated with cancer screening (that is, age, sex, years in practice, and specialty) and that we hypothesized might be associated with screening (that is, nonprofessional cancer experience: none, experience in a family member/close friend/coworker only, or the physician's own cancer experience). The AMA Physician Masterfile provided age and sex; the questionnaire provided race and ethnicity. We used the primary physician specialty recorded on the survey unless 2 specialties were reported, in which case we used the one that agreed with the AMA Physician Masterfile specialty.

Development and Weighting of Sample

From the 3200 surveyed physicians, we sequentially excluded 33 duplicates; 95 undeliverable surveys; 19 retired, disabled, or deceased respondents; and 11 respondents not practicing or on leave. This resulted in 3042 sample physicians. Of these, 1878 (61.7%) responded. We further excluded 200 physicians not providing outpatient care to women, 71 working in non–outpatient/primary care settings (such as emergency departments), 10 reporting other specialties, and 23 in residency or fellowship training. The resulting overall study sample consisted of 1574 respondents. We used SUDAAN 10.0 (RTI International, Research Triangle Park, North Carolina) to weight the responses of the 591 family physicians, 414 general internists, and 569 obstetrician-gynecologists to their representative number in the practicing U.S. physician population, applying AMA Physician Masterfile counts proportionately reduced to 63 418 family physicians, 62 573 general internists, and 26 676 obstetrician-gynecologists based on the exclusions noted above. For this study, we excluded the 466 respondent physicians who received vignettes with patients classified at high risk for ovarian cancer (woman with breast cancer at age 30 years, paternal

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grandmother with ovarian cancer, paternal first cousin with premenopausal breast cancer) because both the USPSTF and the ACOG recommend genetic counseling and testing for these women, and the ACOG suggests they may be candidates for screening if they have a deleterious genetic mutation (41). We also excluded the 20 physicians with missing outcome variable data. Our final study sample consisted of 1088 physicians (408 family physicians, 291 general internists, and 389 obstetrician-gynecologists).

We compared respondents and nonrespondents on variables available through the AMA Physician Masterfile (physician specialty, sex, age, and present employment) and found differences by "present employment" type only ($P = 0.02$). Respondents and nonrespondents were distributed across the different present employment categories as follows: group practice, 69.3% versus 63.6%; self-employed, 17.7% versus 22.2%; government, 6.9% versus 7.0%; and other, 6.1% versus 7.2%.

Statistical Analysis

We first described demographic, practice, and other characteristics of the physician population. We used SUDAAN 10.0 to compare physicians' unadjusted rates of reported nonadherence to ovarian cancer screening recommendations overall and by patient, physician, and practice characteristics, using a P value of 0.01 or less to denote significance due to multiple comparisons. We stratified our unadjusted analysis by patient risk because risk was strongly associated with nonadherence to screening recommendations. Stepwise multivariate logistic regression analysis identified the patient, physician, and practice characteristics that were independently and significantly associated with recommendation nonadherence at the $P \leq 0.05$ level. We combined the regression models for physicians with low- and medium-risk patient vignettes because their findings were similar. Because nonadherence to ovarian cancer screening recommendations is a common outcome, we calculated risk ratios within SUDAAN based on predicted marginals (42). SUDAAN uses the covariate values for each physician respondent to calculate individual predicted risk for nonadherence to screening recommendations, then averages these predicted risks in computing the risk ratios.

Role of the Funding Source

Collaborators from the Centers for Disease Control and Prevention participated in all aspects of this study, including analysis and interpretation of the data and preparation, review, and approval of the manuscript. This manuscript was reviewed at the Centers for Disease Control and Prevention before submission to the journal.

RESULTS

Of the study physicians (adjusted by using weights so that the specialty distribution was representative of the practicing U.S. physician population), 41.3% were family physicians, 41.5% were general internists, and 17.2% were obstetrician-gynecologists (**Table 1**). Nearly half (45.4%) had been in practice for more than 20 years. Nearly one fourth (22.6%) of the physicians were in solo practice. Just over one half (53.4%) used the USPSTF, 33.4% the National Institutes of Health/National Cancer Institute, 65.9% the American Cancer Society, and 30.6% the ACOG as 1 of the top 3 organizations that influenced their cancer screening recommendations. About one third of physicians (33.4%) believed that TVU or CA-125 is an effective screening test for ovarian cancer. Approximately one quarter overestimated ovarian cancer risk among women at low risk for ovarian cancer; one third overestimated the risk among women at medium risk for ovarian cancer.

Overall, 65.4% of physicians reported ovarian cancer screening practices that were not adherent with current recommendations (that is, they "sometimes" or "almost always" offered or ordered ovarian cancer screening tests) for the medium-risk woman; 28.5% did so for the low-risk woman (**Table 2**). About one fourth (24.0% [95% CI, 20.5% to 28.0%]) of physicians would order or offer ovarian cancer screening routinely ("almost always") for medium-risk women, and 6.3% (CI, 4.4% to 8.9%) would do so for low-risk women (findings not shown; $P \leq 0.001$). Physicians were more likely to report ovarian cancer screening practices that were nonadherent to recommendations when the patient in the vignette requested screening (**Table 2**). For medium-risk patients, 78.4% of physicians reported nonadherent ovarian cancer screening practices if the patient requested screening and 49.4% reported such practices if the patient did not request screening. For the low-risk patient, 36.7% of physicians reported nonadherent ovarian cancer screening practices if the patient requested screening and 20.2% did so if the patient did not. Ovarian cancer screening practices did not differ significantly by the woman's age, race, or insurance status.

In unadjusted analyses (**Table 3**), the oldest physicians (aged 55 to 64 years) were the most likely to report ovarian cancer screening practices that did not adhere to recommendations for women with both low and medium risk for ovarian cancer, although no statistically significant differences were seen between the age groups. For women at low ovarian cancer risk, obstetrician-gynecologists had the highest rate of nonadherence to recommendations and general internists had the lowest. Physicians in solo practice were some of the most likely to report screening practices that did not adhere to recommendations, although this was a statistically significant finding only for women at low ovarian cancer risk (42.8% in solo practice and 24.4% in group practice; $P \leq 0.01$). For medium-risk women only, physicians who were not involved in clinical teaching were more likely to report nonadherent screening practices than those involved in teaching (70.7% vs. 57.8%; $P \leq 0.01$). Physicians with a history of having cancer themselves reported among the highest rates of screening practices that did not adhere to recommendations. Notably, physicians'

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Table 1. **Characteristics of Physician Respondents and Their Practices, by Ovarian Cancer Risk of Woman in Annual Examination Vignette***

Physician and Practice Characteristic	All Physicians (n = 1088), %	Physicians With Woman at Low Ovarian Cancer Risk in Vignette (n = 503), %	Physicians With Woman at Medium Ovarian Cancer Risk in Vignette (n = 585), %
Age			
30–39 y	22.7	22.8	22.6
40–49 y	34.1	34.9	33.4
50–64 y	43.2	42.3	44.0
Race/ethnicity other than Hispanic			
White	71.6	71.1	71.9
Asian/Pacific Islander	15.9	16.0	15.9
African American	5.0	4.9	5.1
Other, including American Indian/Alaska Native, mixed race, and missing race/ethnicity	7.5	8.0	7.1
Hispanic ethnicity	4.9	4.5	5.3
Women	40.3	41.7	39.2
Primary specialty			
Family medicine	41.3	43.1	39.8
General internal medicine	41.5	38.7	43.8
Obstetrics-gynecology	17.2	18.2	16.3
Board certification (yes)	92.0	91.1	92.7
Time in practice			
0–10 y	17.8	18.4	17.3
11–20 y	36.8	36.9	36.7
≥21 y	45.4	44.7	46.0
Primary practice setting			
Office practice or freestanding clinic	78.5	81.1	76.3
Urgent care center	1.9	1.8	1.9
Hospital outpatient department	5.2	4.7	5.6
HMO or other prepaid practice	2.4	1.1	3.4
Community health center, non–federal government clinic, tribal health center/Indian Health Service	4.2	3.7	4.6
Federal government–operated clinic	2.9	2.6	3.1
Other (including institutional setting, family-planning clinic, and missing primary practice setting)	5.0	4.9	5.1
Practice type			
Solo practice	22.6	23.7	21.7
Group practice	73.2	72.3	74.0
Other, including missing practice type	4.2	4.0	4.3
Weekly average number of patients			
1–60	27.2	28.1	26.5
61–90	29.2	30.1	28.5
≥91	43.5	41.8	45.0
Involved in clinical teaching (yes)	40.6	40.7	40.4
Nonprofessional experience with cancer			
Family (immediate or extended), close friend, coworker	79.6	80.3	78.9
Self	4.5	4.0	4.9
None	15.9	15.6	16.2
Geographic location			
Urban	84.8	82.3	86.8
Large rural	8.7	9.5	8.0
Small/remote rural	6.5	8.2	5.1

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Table 1—**Continued**

Physician and Practice Characteristic	All Physicians (n = 1088), %	Physicians With Woman at Low Ovarian Cancer Risk in Vignette (n = 503), %	Physicians With Woman at Medium Ovarian Cancer Risk in Vignette (n = 585), %
Census division			
New England	5.3	3.9	6.4
Middle Atlantic	13.6	14.7	12.8
East North Central	16.6	17.0	16.3
West North Central	7.8	7.3	8.3
South Atlantic	15.6	15.4	15.8
East South Central	5.7	6.7	4.9
West South Central	10.0	8.3	11.5
Mountain	7.3	8.0	6.8
Pacific	18.0	18.8	17.3
Level of risk-taking†			
Low (6–17)	58.9	59.4	58.5
Medium (18–24)	33.4	33.7	33.1
High (≥25)	7.7	6.8	8.4
Fear of malpractice‡			
Low (2–4)	13.6	11.2	15.6
Medium (5–7)	28.4	31.0	26.0
High (≥8)	58.1	57.8	58.4
Organization listed among top 3 influencing cancer screening recommendations			
USPSTF	53.4	53.5	53.4
NIH/NCI	33.4	34.7	32.4
ACOG	30.6	32.3	29.2
ACS	65.9	64.8	66.8
Reported beliefs about ovarian cancer screening tests			
TVU is clinically effective	29.8	27.9	31.4
CA-125 is clinically effective	18.0	18.5	17.6
Both TVU and CA-125 are clinically effective	14.4	14.8	14.0
Either TVU or CA-125 is clinically effective	33.4	31.4	35.0
Physician-perceived ovarian cancer risk compared with general population			
Same	37.0	73.0	7.1
Somewhat higher	44.7	25.7	60.6
Much higher	18.3	1.3	32.3

ACOG = American Congress of Obstetricians and Gynecologists; ACS = American Cancer Society; CA-125 = cancer antigen 125; NCI = National Cancer Institute; NIH = National Institutes of Health; TVU = transvaginal ultrasonography; USPSTF = U.S. Preventive Services Task Force.

* Missing data (absolute numbers of respondents): race, 36; Hispanic ethnicity, 19; board certification, 7; primary setting, 16; practice type, 14; weekly average number of patients, 19; involved in clinical teaching, 7; nonprofessional experience with cancer, 17; level of risk-taking, 56; fear of malpractice, 52; listed USPSTF, NIH/NCI, ACOG, or ACS, 14; believed TVU clinically effective, 17; believed CA-125 clinically effective, 16; believed both TVU and CA-125 clinically effective, 17; believed either TVU or CA-125 clinically effective, 13; and physician-perceived ovarian cancer risk, 16. Missing data for race, primary setting, and practice type are included in the "other" category for these variables. For all other variables, missing data are excluded from the analysis. Study results were adjusted by using weights to represent the specialty distribution of the practicing U.S. physician population.

† Level of risk-taking was measured by using a published 6-item attitude-toward-risk scale (38). We asked respondents how strongly they agreed with 6 statements using a 6-point Likert scale ranging from strongly disagree to strongly agree. An individual's score could vary from 6 to 36.

‡ Fear of malpractice was measured by using 2 items from a published 6-item fear-of-malpractice scale (37). We asked respondents how strongly they agreed with 2 statements using a 5-point Likert scale ranging from strongly disagree to strongly agree. An individual's score could vary from 2 to 10.

fear of malpractice and level of risk-taking were not associated with reported ovarian cancer screening practices.

For low- and medium-risk patients, physicians who listed the USPSTF among the top 3 organizations that influenced their cancer screening recommendations were among the least likely to report nonadherent screening practices, although this was a significant finding only for women at low risk for ovarian cancer. Listing other organizations (National Institutes of Health, ACOG, and American Cancer Society) among the top 3 organizations influencing their cancer screening recommendations was not associated with adherence to screening recommendations. An additional analysis (data not shown) found that the physicians who listed the USPSTF as a top organization influencing their cancer screening recommendations were less likely than those who did not list this group to believe that TVU or CA-125 or both were effective ovarian cancer screening tests. There was no association between listing the ACOG or the American Cancer Society as top influential organizations and beliefs about the effectiveness of TVU or CA-125 or both as ovarian cancer screening tests, whereas physicians who listed the National Institutes of Health as a

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Table 2. **Rates of Physician-Reported Nonadherence to Ovarian Cancer Screening Recommendations, by Ovarian Cancer Risk of Woman in Annual Examination Vignette and by Patient Characteristics***

Characteristic	Nonadherence Among Physicians With Woman at Low Ovarian Cancer Risk in Vignette (n = 503) (95% CI), %	Nonadherence Among Physicians With Woman at Medium Ovarian Cancer Risk in Vignette (n = 585) (95% CI), %
All women	28.5 (24.5–32.9)	65.4 (61.1–69.4)
Patient characteristics		
Race		
White	29.3 (23.6–35.6)	63.3 (56.7–69.5)
African American	27.7 (22.2–33.9)	67.0 (61.3–72.3)
Age		
35 y	28.2 (22.6–34.6)	60.9 (54.3–67.1)
51 y	28.7 (23.2–34.9)	69.0 (63.3–74.2)
Insurance		
Medicaid	23.7 (18.5–29.9)	65.8 (59.9–71.3)
Private	32.6 (26.9–38.9)	64.9 (58.6–70.8)
Request for ovarian cancer screening		
Yes	36.7 (30.6–43.2)†	78.4 (73.3–82.9)†
No	20.2 (15.4–26.1)	49.4 (42.9–55.9)

* Study results were adjusted by using weights to represent the specialty distribution of the practicing U.S. physician population.
† $P \leq 0.001$.

top influential organization were more likely than those who did not to believe that they were effective screening tests.

Physicians who overestimated the ovarian cancer risk of both low- and medium-risk women were most likely to report screening practices that did not adhere to recommendations, although this was a significant finding only for women at medium risk. Physicians who believed that TVU or CA-125 or both were effective ovarian cancer screening tests were significantly more likely to report nonadherent screening practices than were those who did not believe that either or both of these tests were effective. Even so, a substantial proportion of physicians who did not believe TVU or CA-125 or both were effective ovarian cancer screening tests still reported sometimes or almost always ordering or offering these tests—for low-risk patients, 17.7% of physicians; for medium-risk patients, 55.1% of physicians. Patient request influenced these rates—for low-risk patients, 23.7% of physicians who believed that TVU or CA-125 or both were effective screening tests sometimes or almost always offered or ordered 1 or both of these tests if the patient requested testing, compared with 12.0% of physicians if the patient did not (data not shown; $P \leq 0.01$). However, patient request had a similarly powerful effect on the screening rates among physicians who did not believe TVU or CA-125 or both were effective screening tests—63.7% of these physicians sometimes or almost always ordered 1 or both of these tests if the patient requested screening, compared with 39.5% of physicians if the patient did not (data not shown; $P \leq 0.001$).

Adjusted analysis largely confirmed the unadjusted results (**Table 4**). The patient's actual level of risk was strongly associated with reported nonadherent screening practices. Physicians who received the vignette of a woman at medium risk for ovarian cancer were 1.54 (CI, 1.32 to 1.79) times more likely to report nonadherent screening practices than physicians who received the low-risk vignette. Physicians also had a higher likelihood of reporting nonadherent screening practices if the vignette included a woman who requested ovarian cancer screening (risk ratio [RR], 1.54 [CI, 1.39 to 1.72]) versus one who did not. Physicians who had had cancer themselves were more likely to report nonadherent screening practices than physicians who had not had cancer themselves (RR, 1.51 [CI, 1.02 to 2.22]). Other physician and practice characteristics initially associated with higher likelihood of reporting nonadherent ovarian cancer screening practices included being in solo rather than group practice (RR, 1.21 [CI, 1.02 to 1.43]), not using the USPSTF recommendations as one of the top 3 organizations influencing their cancer screening recommendations (RR, 1.20 [CI, 1.06 to 1.35]), being in practice more than 10 years, and not being involved in clinical teaching (RR, 1.14 [CI, 1.02 to 1.28]). The influences of the USPSTF recommendations, length of time in practice, and practice type (group, solo) on screening practices were mediated by physicians' beliefs about the effectiveness of TVU and CA-125 as ovarian cancer screening tests. Physicians who believed that TVU or CA-125 or both were effective screening tests were more likely to report nonadherent screening practices than were those without this belief (RR, 1.85 [CI, 1.59 to 2.22]). Even after adjustment for all other factors, the physicians' estimation of the patient's level of ovarian cancer risk was also strongly associated with reported nonadherent screening practices. Physicians who perceived that the woman was at much higher risk for ovarian cancer than the general population were more likely (RR, 1.79 [CI, 1.35 to 2.33]) to report nonadherent screening practices than physicians who believed that the woman had the same risk as the general population.

DISCUSSION

Physicians report that they routinely offer ovarian cancer screening to substantial numbers of women—6.3% of women whom we classified as having low risk for ovarian cancer (roughly 1.5% lifetime ovarian cancer risk) and 24.0% of women whom we classified as having medium risk for ovarian cancer (4.0% to 5.0% lifetime ovarian cancer risk), despite the conclusions of multiple professional societies and the USPSTF that screening incurs more risk than benefit in both of these groups. If screening were routinely offered or ordered for this 6.3% of the roughly 16 million women aged 35 to 54 years in the United States at low risk for ovarian cancer and the 24.0% of the roughly 800 000 women aged 35 to 55 years at medium risk for

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Table 3. **Rates of Physician-Reported Nonadherence to Ovarian Cancer Screening Recommendations, by Ovarian Cancer Risk of Woman in Annual Examination Vignette and by Physician and Practice Characteristics***

Characteristic	Nonadherence Among Physicians With Woman at Low Ovarian Cancer Risk in Vignette (n = 503) (95% CI), %	Nonadherence Among Physicians With Woman at Medium Ovarian Cancer Risk in Vignette (n = 585) (95% CI), %
Total	28.5 (24.5–32.9)	65.4 (61.1–69.4)
Physician and practice characteristic		
Age		
30–39 y	21.3 (14.4–30.2)	60.0 (51.0–68.4)
40–49 y	27.5 (20.9–35.3)	60.9 (53.2–68.1)
55–64 y	33.1 (26.8–40.1)	71.6 (65.2–77.1)
Sex		
Female	26.3 (20.4–33.1)	66.6 (59.8–72.7)
Male	30.1 (24.8–35.9)	64.6 (59.0–69.9)
Specialty		
Family medicine	27.5 (21.6–34.2)†	65.6 (59.0–71.6)
General internal medicine	24.4 (17.6–32.7)	64.9 (57.4–71.7)
Obstetrics-gynecology	39.6 (32.9–46.7)	66.3 (59.6–72.5)
Board certification		
Yes	27.3 (23.2–31.8)	65.1 (60.6–69.3)
No	41.7 (27.0–58.1)	70.2 (54.8–82.0)
Time in practice		
0–10 y	24.8 (16.7–35.1)	54.7 (44.5–64.6)
11–20 y	27.9 (21.4–35.5)	65.2 (57.9–71.7)
≥21 y	30.5 (24.6–37.1)	69.6 (63.3–75.3)
Practice type		
Solo practice	42.8 (33.5–52.7)†	69.4 (60.0–77.4)
Group practice	24.4 (20.1–29.4)	64.5 (59.5–69.2)
Other, including missing practice type	16.6 (5.4–41.1)	61.0 (40.1–78.5)
Weekly average number of patients		
1–60	23.3 (16.6–31.8)	59.6 (50.8–67.9)
61–90	24.4 (17.8–32.6)	64.8 (56.4–72.4)
≥91	35.2 (28.8–42.2)	68.3 (61.9–74.0)
Involved in clinical teaching		
Yes	27.0 (21.2–33.8)	57.8 (50.9–64.4)†
No	29.7 (24.4–35.6)	70.7 (65.2–75.6)
Nonprofessional experience with cancer		
Family (immediate or extended), close friend, coworker	30.4 (25.8–35.4)†	66.3 (61.5–70.8)
Self	39.3 (20.9–61.3)	81.2 (62.6–91.8)
None	14.0 (7.5–24.7)	60.1 (48.9–70.4)
Geographic location		
Urban	27.7 (23.4–32.5)	65.1 (60.5–69.5)
Large rural	31.0 (19.1–46.0)	63.4 (47.5–76.8)
Small rural/remote rural	33.2 (20.0–49.8)	73.0 (54.3–86.1)
Census division		
New England	40.6 (20.5–64.5)	66.5 (48.2–80.8)
Middle Atlantic	34.5 (23.7–47.1)	66.5 (54.2–76.9)
East North Central	18.9 (11.6–29.4)	60.5 (49.4–70.7)
West North Central	35.2 (20.9–52.6)	64.8 (49.4–77.6)
South Atlantic	23.8 (15.9–33.9)	70.3 (59.5–79.2)
East South Central	32.0 (18.2–49.8)	50.0 (31.0–69.0)
West South Central	36.2 (22.5–52.6)	72.3 (59.8–82.1)
Mountain	35.8 (21.3–53.4)	60.8 (44.4–75.0)
Pacific	23.4 (15.4–33.9)	66.1 (55.6–75.3)
Level of risk-taking		
Low (6–17)	28.3 (24.3–32.7)	63.5 (57.5–69.1)
Medium (18–24)	28.3 (21.5–36.3)	65.8 (58.0–72.9)
High (≥25)	28.3 (15.3–46.2)	62.1 (46.6–75.5)
Fear of malpractice		
Low (2–4)	26.0 (15.7–39.7)	55.7 (43.7–67.2)
Medium (5–7)	23.6 (17.3–31.3)	60.7 (51.8–68.9)
High (≥8)	31.4 (26.0–37.5)	68.0 (62.2–73.3)
USPSTF among top 3 organizations influencing cancer screening recommendations		
Yes	20.4 (15.6–26.3)‡	61.9 (55.8–67.7)
No	37.7 (31.5–44.3)	70.9 (64.9–76.3)

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Table 3—**Continued**

Characteristic	Nonadherence Among Physicians With Woman at Low Ovarian Cancer Risk in Vignette (n = 503) (95% CI), %	Nonadherence Among Physicians With Woman at Medium Ovarian Cancer Risk in Vignette (n = 585) (95% CI), %
NIH/NCI among top 3 organizations influencing cancer screening recommendations		
Yes	34.1 (27.2–41.9)	69.1 (61.7–75.7)
No	25.4 (20.7–30.8)	64.6 (59.3–69.6)
ACOG among top 3 organizations influencing cancer screening recommendations		
Yes	32.6 (26.5–39.3)	65.0 (58.3–71.2)
No	26.5 (21.4–32.2)	66.5 (61.1–71.6)
ACS among top 3 organizations influencing cancer screening recommendations		
Yes	29.8 (24.7–35.4)	68.7 (63.5–73.4)
No	26.0 (19.9–33.2)	60.9 (53.2–68.2)
TVU or CA-125 or both are clinically effective in screening for ovarian cancer		
Agree	51.9 (43.3–60.3)‡	84.9 (78.7–89.5)‡
Disagree	17.7 (13.9–22.3)	55.1 (49.6–60.4)
Physician-perceived ovarian cancer risk compared with general population		
Same	24.8 (20.5–29.7)	31.7 (20.1–46.2)‡
Somewhat higher	37.4 (28.5–47.1)	63.7 (58.1–69.0)
Much higher	68.4 (25.6–93.2)	76.0 (68.5–82.2)

ACOG = American Congress of Obstetricians and Gynecologists; ACS = American Cancer Society; CA-125 = cancer antigen 125; NCI = National Cancer Institute; NIH = National Institutes of Health; TVU = transvaginal ultrasonography; USPSTF = U.S. Preventive Services Task Force.
* Missing data: race, 36; Hispanic ethnicity, 19; board certification, 7; primary setting, 16; practice type, 14; weekly average number of patients, 19; involved in clinical teaching, 7; nonprofessional experience with cancer, 17; level of risk-taking, 56; fear of malpractice, 52; listed USPSTF, NIH/NCI, ACOG, or ACS, 14; believed TVU clinically effective, 17; believed CA-125 clinically effective, 16; believed both TVU and CA-125 clinically effective, 17; believed either TVU or CA-125 clinically effective, 13; and physician-perceived ovarian cancer risk, 16. Missing data for practice type are included in the "other" category for this variable. For all other variables, missing data are excluded from the analysis. Study results were adjusted by using weights to represent the specialty distribution of the practicing U.S. physician population.
† $P \leq 0.01$.
‡ $P \leq 0.001$.

ovarian cancer who have a preventive examination each year (based on 90% of women being at low risk, 5% being at medium risk, and 38.6% of both groups having a preventive examination annually) (43, 44), approximately 1.2 million women in the United States would be at risk for undergoing potentially harmful ovarian cancer screening tests (not including those offered screening at other types of visits). If we assume that only half of these women actually have the test and we estimate the average cost of a CA-125 test at $80 and TVU at $600 (with reimbursement by Medicare estimated at $30 and $200, respectively), the cost of this potentially harmful testing is conservatively estimated at $18 million to $360 million annually, depending on the reimbursement rate.

The nearly 4-fold rate of almost always offering or ordering ovarian cancer screening tests for medium-risk compared with low-risk patients demonstrates that physicians, as expected, include patient risk as they assess patients' screening needs. However, as the literature on the psychology of risk perception suggests (45), such factors, as misinterpretation of numeric rates or judging risk according to their own experiences may lead some physicians to attribute a higher level of ovarian cancer risk than is warranted to these medium-risk women. Indeed, this study found that sizable proportions of physicians estimated women's ovarian cancer risk as higher than their true risk. Alternately, the higher rate of offering or ordering ovarian cancer screening tests for medium- compared with low-risk women may be due to some physicians believing that screening is warranted for these medium-risk women regardless of the recommendations.

The sizable proportion of physicians who believed that TVU or CA-125 or both were effective screening tests was significantly more likely to report nonadherence to recommendations against ovarian cancer screening. Research is needed to better understand why nearly one third and one fifth of physicians believed that TVU and CA-125, respectively, are clinically effective in ovarian cancer screening despite evidence-based reviews documenting harms that outweigh benefits (1).

Physicians were significantly more likely to offer or order ovarian cancer screening tests if patients requested screening. This finding was consistent regardless of a physician's beliefs in the effectiveness of TVU or CA-125 or both as ovarian cancer screening tests. This result also is consistent with literature suggesting that patient request influences the ordering of inappropriate medical tests (46–51). Physicians may honor patients' requests for inappropriate tests to maintain their relationship with their patients or because they lack confidence in explaining why the test is unnecessary. Decision aids for patients about genetic testing for breast cancer susceptibility have succeeded in reducing low-risk women's intention to test for *BRCA1* and *BRCA2*. Such tools also might play an important role in promoting appropriate cancer screening practices (52).

Physicians in practice for 10 or more years were more likely to report nonadherent screening practices than phy-

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sicians in practice for less than 10 years. Physicians in solo practice were more likely to report nonadherent screening practices than those in group practice, consistent with research associating group practice with the delivery of recommended preventive services (53). Both findings were mediated by physician beliefs. Physicians in practice for less than 10 years and physicians in group practice were less likely to believe that TVU or CA-125 or both were effective screening tests than physicians in practice 10 or more years and physicians in solo practice. Physicians in practice

Table 4. **Adjusted Risk Ratios of Physician-Reported Nonadherence to Ovarian Cancer Screening Recommendations, by Patient, Physician, and Practice Characteristics***

Characteristic	Risk Ratio (95% CI)		
	Base Model (n = 1039)	Base Model Plus Belief in Effectiveness of Ovarian Cancer Screening Variable (n = 1039)	Base Model Plus Belief in Effectiveness of Ovarian Cancer Screening and Physician-Perceived Ovarian Cancer Risk Variables (n = 1039)
Patient characteristic			
Age			
35 y	Reference	Reference	Reference
51 y	1.07 (0.95–1.20)	1.06 (0.95–1.19)	1.05 (0.94–1.17)
Request for ovarian cancer screening			
No	Reference	Reference	Reference
Yes	1.61 (1.41–1.84)†	1.59 (1.40–1.81)†	1.59 (1.40–1.80)†
Race			
White	Reference	Reference	Reference
African American	1.00 (0.89–1.12)	1.01 (0.90–1.12)	0.99 (0.89–1.11)
Insurance			
Medicaid	Reference	Reference	Reference
Private	1.08 (0.96–1.21)	1.12 (1.00–1.25)†	1.12 (1.00–1.24)†
Level of ovarian cancer risk			
Low	Reference	Reference	Reference
Medium	2.25 (1.93–2.63)†	2.20 (1.90–2.55)†	1.60 (1.34–1.91)†
Physician and practice characteristic			
USPSTF among top 3 organizations influencing cancer screening recommendations			
Yes	Reference	Reference	Reference
No	1.20 (1.06–1.36)†	1.08 (0.97–1.21)	1.08 (0.97–1.22)
Nonprofessional experience with cancer			
None	Reference	Reference	Reference
Family (immediate or extended), close friend, coworker	1.25 (1.04–1.49)†	1.25 (1.05–1.49)†	1.24 (1.05–1.47)†
Self	1.50 (1.11–2.01)†	1.53 (1.14–2.06)†	1.49 (1.12–2.00)†
Involved in clinical teaching			
Yes	Reference	Reference	Reference
No	1.16 (1.02–1.31)	1.14 (1.01–1.28)	1.13 (1.00–1.26)
Practice type			
Group	Reference	Reference	Reference
Solo	1.19 (1.03–1.36)†	1.06 (0.92–1.22)	1.07 (0.93–1.23)
Other	0.84 (0.55–1.28)	0.87 (0.60–1.27)	0.85 (0.60–1.21)
Time in practice‡			
10 y	Reference	Reference	Reference
20 y	1.08 (1.00–1.16)†	1.05 (0.98–1.13)	1.03 (0.97–1.10)
30 y	1.16 (1.01–1.33)†	1.11 (0.97–1.26)	1.06 (0.94–1.21)
TVU or CA-125 or both are clinically effective in screening for ovarian cancer			
Disagree	—	Reference	Reference
Agree	—	1.76 (1.56–1.97)†	1.70 (1.52–1.91)†
Physician-perceived ovarian cancer risk			
Same as general population			Reference
Somewhat higher than general population			1.40 (1.16–1.68)†
Much higher than general population			1.73 (1.39–2.15)†

CA-125 = cancer antigen 125; TVU = transvaginal ultrasonography; USPSTF = U.S. Preventive Services Task Forces.
* The numbers of participants are lower than those in **Table 3** because of missing values for ≥1 variable for 49 physicians. Study results were adjusted by using weights to represent the specialty distribution of the practicing U.S. physician population.
† Risk ratios for which the confidence interval does not include 0.0 and thus are statistically significant predictors of nonadherence to ovarian cancer screening recommendations.
‡ The regression model used the continuous rather than categorical time in practice variable because it improved the fit of the model to a greater degree. For interpretation purposes, we present risk ratios for 20 and 30 y vs. 10 y of practice.

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for 10 or more years may have seen more women with ovarian cancer, and their assessment of the risks and benefits of screening could have been influenced by these experiences. Group practices may be more likely to include a mix of more and less recently trained physicians and to facilitate sharing of practice patterns across group members, which could provide these physicians with greater opportunity to adopt the most up-to-date medical practices.

Physicians' sources of cancer screening information were also associated with their level of adherence to ovarian cancer screening guidelines. Physicians who listed the USPSTF as one of the top 3 organizations influencing their cancer screening recommendations were less likely to report nonadherent ovarian cancer screening and less likely to believe that TVU or CA-125 or both are effective ovarian cancer screening tests. This was not true for other organizations that publish ovarian cancer screening recommendations, even though none recommend ovarian cancer screening (1–3). The USPSTF, sponsored by the Agency for Healthcare Research and Quality, uses rigorous standards to assess the scientific evidence for the effectiveness of clinical preventive services. The standards and processes used by other organizations in formulating their guidelines, recommendations, and consensus statements are less transparent. In addition, the USPSTF presents its recommendations against ovarian cancer screening with more declarative language than other organizations. Our study findings suggest that the USPSTF may communicate its recommendations more effectively or that physicians using the USPSTF as a top influential organization are more likely to follow guidelines. These findings suggest that such interventions as 1) disseminating the USPSTF recommendations more widely and effectively and 2) ensuring that organizations present their recommendations against ovarian cancer screening using consistent, declarative language may increase adherence to recommendations against ovarian cancer screening, and should be tested. Notably, the American Cancer Society is the organization that physicians report most often as a top influence on cancer screening recommendations. Although several American Cancer Society Web pages intended for lay readers discuss the lack of evidence for ovarian cancer screening tests and note that CA-125 and TVU are not recommended for ovarian cancer screening among women at average risk (4, 54), the site does not publish ovarian cancer screening guidelines as it does for other cancer types (55). Clear American Cancer Society–published guidelines on ovarian cancer screening might have an important influence on physician ovarian cancer screening practices and decrease the harms associated with this testing.

This study's results are limited by their reliance on survey methods. Although the rate of response to this questionnaire (62%) was similar to or higher than that for many other physician surveys, the results may not generalize to the nonrespondents. This would be particularly true if the survey incentive stimulated responses from physicians who were less committed to completing the survey accurately. It is encouraging that the respondents appeared to represent the sample from which they were drawn, although respondents were slightly more likely to be in group practice. In addition, although anonymous, the results are based on physician self-report of their practices rather than more direct methods, such as chart review, recording of patient encounters, or standardized patients. However, vignettes have been compared with standardized patients and been shown to be a valid method of measuring quality of clinical care, including cancer screening (56–58).

The survey instrument included 3 vignettes, the first with a woman presenting with abdominal or genitourinary symptoms, the second with an asymptomatic woman presenting for an annual examination. It is possible that the first vignette and its questions influenced physicians' answers to the second vignette, for example by raising their awareness of possible missed diagnoses. However, a secondary analysis determined that the results of this study did not change according to the type of symptoms (abdominal or genitourinary) presented in the first vignette, suggesting that the physicians responded to these vignettes independently. In addition, the vignette asked physicians whether they would offer or order various tests but did not allow us to differentiate offering from ordering these tests. The survey method also did not allow us to examine the frequency with which physicians screen women for ovarian cancer. Despite these limitations, the use of vignettes was an efficient method of systematically examining physician-reported ovarian cancer screening practices among patients with a variety of characteristics, such as age, race, insurance, level of risk, and test request.

Another limitation is that we cannot be certain of the reliability of the responses for ovarian cancer screening tests because we did not measure the vignette's test–retest reliability. Finally, this study surveyed only physicians, not advanced practice nurses and physician assistants, who are important providers of preventive care, including cancer screening services.

A substantial proportion of physicians reported offering or ordering ovarian cancer screening for women at low and medium risk for ovarian cancer, despite evidence-based recommendations to the contrary, particularly if the patient requests screening. This unwarranted screening is putting many women at risk for false-positive test results and their consequences at an estimated cost of tens of millions of dollars annually. That one third of physicians believe ovarian cancer screening tests are effective and that many physicians overestimate women's risk for ovarian cancer illuminate critical knowledge gaps among physicians providing primary care to women in the United States. Physician-level predictors of ovarian cancer screening suggest that interventions that encourage interaction between physician colleagues of all ages and that promote

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the use of the USPSTF may have the greatest chance of success in promoting adherence to screening recommendations.

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References

1. **U.S. Preventive Services Task Force.** Screening for ovarian cancer, topic page. Rockville, MD: Agency for Healthcare Research and Quality; 2004. Accessed at www.ahrq.gov/clinic/uspstf/uspsovar.htm on 10 June 2010.
2. **ACOG Committee on Gynecologic Practice.** ACOG Committee Opinion No. 356: routine cancer screening. Obstet Gynecol. 2006;108:1611-3. [PMID: 17138803]
3. **Gladstone CQ.** Screening for ovarian cancer. In: Canadian Task Force on the Periodic Health Examination. Canadian Guide to Clinical Preventive Health Care. Ottawa, Ontario, Canada: Health Canada; 1994:870-81.
4. **American Cancer Society.** Ovarian cancer. Accessed at www.cancer.org/Cancer/OvarianCancer/DetailedGuide/ovarian-cancer-detection on 22 May 2011.
5. **Buys SS, Partridge E, Greene MH, Prorok PC, Reding D, Riley TL, et al; PLCO Project Team.** Ovarian cancer screening in the Prostate, Lung, Colorectal and Ovarian (PLCO) cancer screening trial: findings from the initial screen of a randomized trial. Am J Obstet Gynecol. 2005;193:1630-9. [PMID: 16260202]
6. **Eichorn J.** Study results show ovarian cancer deaths are not reduced by early-detection screening methods. OncLive. 18 May 2011. Accessed at www.onclive.com/conference-coverage/asco-2011/Study-Results-Show-Ovarian-Cancer-Deaths-Are-Not-Reduced-by-Early-Detection-Screening-Methods on 3 June 2011.
7. **Centers for Disease Control and Prevention.** National Program of Cancer Registries (NPCR). United States cancer statistics (USCS). 2007 top ten cancers. Accessed at http://apps.nccd.cdc.gov/uscs/toptencancers.aspx on 10 June 2011.
8. National Institutes of Health Consensus Development Conference Statement. Ovarian cancer: screening, treatment, and follow-up. Gynecol Oncol. 1994;55:S4-14. [PMID: 7835809]
9. **Fishman DA, Cohen L, Blank SV, Shulman L, Singh D, Bozorgi K, et al.** The role of ultrasound evaluation in the detection of early-stage epithelial ovarian cancer. Am J Obstet Gynecol. 2005;192:1214-21. [PMID: 15846205]
10. **Goff BA, Muntz HG.** Screening and early diagnosis of ovarian cancer. Women's Health in Primary Care. 2005;8:262-8.
11. **Jacobs I, Davies AP, Bridges J, Stabile I, Fay T, Lower A, et al.** Prevalence screening for ovarian cancer in postmenopausal women by CA 125 measurement and ultrasonography. BMJ. 1993;306:1030-4. [PMID: 8490497]
12. **Jacobs IJ, Menon U.** Progress and challenges in screening for early detection of ovarian cancer. Mol Cell Proteomics. 2004;3:355-66. [PMID: 14764655]
13. **Liede A, Karlan BY, Baldwin RL, Platt LD, Kuperstein G, Narod SA.** Cancer incidence in a population of Jewish women at risk of ovarian cancer. J Clin Oncol. 2002;20:1570-7. [PMID: 11896106]
14. **Menon U, Jacobs IJ.** Ovarian cancer screening in the general population. Curr Opin Obstet Gynecol. 2001;13:61-4. [PMID: 11176234]
15. **Olivier RI, Lubsen-Brandsma MA, Verhoef S, van Beurden M.** CA125 and transvaginal ultrasound monitoring in high-risk women cannot prevent the diagnosis of advanced ovarian cancer. Gynecol Oncol. 2006;100:20-6. [PMID: 16188302]
16. **Paley PJ.** Ovarian cancer screening: are we making any progress? Curr Opin Oncol. 2001;13:399-402. [PMID: 11555720]
17. **Partridge E, Kreimer AR, Greenlee RT, Williams C, Xu JL, Church TR, et al; PLCO Project Team.** Results from four rounds of ovarian cancer screening in a randomized trial. Obstet Gynecol. 2009;113:775-82. [PMID: 19305319]
18. **Petricoin EF, Ardekani AM, Hitt BA, Levine PJ, Fusaro VA, Steinberg SM, et al.** Use of proteomic patterns in serum to identify ovarian cancer. Lancet. 2002;359:572-7. [PMID: 11867112]
19. **Skates SJ, Horick N, Yu Y, Xu FJ, Berchuck A, Havrilesky LJ, et al.** Preoperative sensitivity and specificity for early-stage ovarian cancer when combining cancer antigen CA-125II, CA 15-3, CA 72-4, and macrophage colony-stimulating factor using mixtures of multivariate normal distributions. J Clin Oncol. 2004;22:4059-66. [PMID: 15381683]
20. **van der Velde NM, Mourits MJ, Arts HJ, de Vries J, Leegte BK, Dijkhuis G, et al.** Time to stop ovarian cancer screening in BRCA1/2 mutation carriers? Int J Cancer. 2009;124:919-23. [PMID: 19035463]
21. **van Nagell JR Jr, DePriest PD, Reedy MB, Gallion HH, Ueland FR, Pavlik EJ, et al.** The efficacy of transvaginal sonographic screening in asymptomatic women at risk for ovarian cancer. Gynecol Oncol. 2000;77:350-6. [PMID: 10831341]
22. **Woodward ER, Sleightholme HV, Considine AM, Williamson S, McHugo JM, Cruger DG.** Annual surveillance by CA125 and transvaginal ultrasound for ovarian cancer in both high-risk and population risk women is ineffective. BJOG. 2007;114:1500-9. [PMID: 17903229]
23. **Bell R, Petticrew M, Luengo S, Sheldon TA.** Screening for ovarian cancer: a systematic review. Health Technol Assess. 1998;2:i-iv, 1-84. [PMID: 9561894]
24. **ACOG Committee on Practice Bulletins.** Hereditary breast and ovarian cancer syndrome. Gynecol Oncol. 2009;113:6-11. [PMID: 19309638]
25. **U.S. Preventive Services Task Force.** Genetic risk assessment and BRCA mutation testing for breast and ovarian cancer susceptibility: recommendation statement. Ann Intern Med. 2005;143:355-61. [PMID: 16144894]
26. **Schorge JO, Modesitt SC, Coleman RL, Cohn DE, Kauff ND, Duska LR, et al.** SGO White Paper on ovarian cancer: etiology, screening and surveillance. Gynecol Oncol. 2010;119:7-17. [PMID: 20692025]
27. **MacDonald DJ, Sarna L, Uman GC, Grant M, Weitzel JN.** Cancer screening and risk-reducing behaviors of women seeking genetic cancer risk assessment for breast and ovarian cancers. Oncol Nurs Forum. 2006;33:E27-35. [PMID: 16518435]
28. **Schwartz LM, Woloshin S, Fowler FJ Jr, Welch HG.** Enthusiasm for cancer screening in the United States. JAMA. 2004;291:71-8. [PMID: 14709578]
29. **Chan EC, Barry MJ, Vernon SW, Ahn C.** Brief report: physicians and their personal prostate cancer-screening practices with prostate-specific antigen. A national survey. J Gen Intern Med. 2006;21:257-9. [PMID: 16637825]
30. **Fowler FJ Jr, Bin L, Collins MM, Roberts RG, Oesterling JE, Wasson JH, et al.** Prostate cancer screening and beliefs about treatment efficacy: a national survey of primary care physicians and urologists. Am J Med. 1998;104:526-32. [PMID: 9674714]
31. **Goff BA, Matthews B, Andrilla CH, Miller JW, Trivers KF, Berry D, et al.** How are symptoms of ovarian cancer managed? A study of primary care physicians. Cancer. 2011;117:4414-23. [PMID: 21413001]

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MONDAY, FREBRUARY 6, 2012

32. **Trivers KF, Baldwin LM, Miller JW, Matthews B, Andrilla CH, Lishner DM, et al.** Reported referral for genetic counseling or BRCA 1/2 testing among United States physicians: A vignette-based study. Cancer. 2011;117:5334-43. [PMID: 21792861]
33. **Dillman DA.** Mail and Internet Surveys: The Tailored Design Method. 2nd ed. Hoboken, NJ: J Wiley; 2007.
34. **Fishbein M, Ajzen I.** Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research. Reading, MA: Addison-Wesley; 1975.
35. **Ajzen I.** Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. J Appl Soc Psychol. 2002;32:665-83.
36. **Ajzen I.** Theory of planned behavior. Accessed at http://people.umass.edu/aizen/tpb.html on 10 June 2011.
37. **Katz DA, Williams GC, Brown RL, Aufderheide TP, Bogner M, Rahko PS, et al.** Emergency physicians' fear of malpractice in evaluating patients with possible acute cardiac ischemia. Ann Emerg Med. 2005;46:525-33. [PMID: 16308068]
38. **Franks P, Williams GC, Zwanziger J, Mooney C, Sorbero M.** Why do physicians vary so widely in their referral rates? J Gen Intern Med. 2000;15:163-8. [PMID: 10718896]
39. **Morrill R, Cromartie J, Hart LG.** Metropolitan, urban, and rural commuting areas: toward a better depiction of the US settlement system. Urban Geography. 1999;20:727-48.
40. **Economic Research Service.** Measuring rurality: Rural-Urban Commuting Area Codes. Accessed at www.ers.usda.gov/briefing/Rurality/RuralUrbanCommutingAreas/ on 11 June 2010.
41. **American College of Obstetricians and Gynecologists.** ACOG Practice Bulletin No. 103: hereditary breast and ovarian cancer syndrome. Obstet Gynecol. 2009;113:957-66. [PMID: 19305347]
42. **Bieler GS, Brown GG, Williams RL, Brogan DJ.** Estimating model-adjusted risks, risk differences, and risk ratios from complex survey data. Am J Epidemiol. 2010;171:618-23. [PMID: 20133516]
43. **Mehrotra A, Zaslavsky AM, Ayanian JZ.** Preventive health examinations and preventive gynecological examinations in the United States. Arch Intern Med. 2007;167:1876-83. [PMID: 17893309]
44. **U.S. Census Bureau.** The 2012 Statistical Abstract. Population: estimates and projections by age, sex, race/ethnicity. Accessed at www.census.gov/compendia/statab/cats/population/estimates_and_projections_by_age_sex_raceethnicity.html on 7 October 2012.
45. **Klein WM, Stefanek ME.** Cancer risk elicitation and communication: lessons from the psychology of risk perception. CA Cancer J Clin. 2007;57:147-67. [PMID: 17507441]
46. **White DB, Bonham VL, Jenkins J, Stevens N, McBride CM.** Too many referrals of low-risk women for BRCA1/2 genetic services by family physicians. Cancer Epidemiol Biomarkers Prev. 2008;17:2980-6. [PMID: 18990739]
47. **Wideroff L, Freedman AN, Olson L, Klabunde CN, Davis W, Srinath KP, et al.** Physician use of genetic testing for cancer susceptibility: results of a national survey. Cancer Epidemiol Biomarkers Prev. 2003;12:295-303. [PMID: 12692103]
48. **Sifri R, Myers R, Hyslop T, Turner B, Cocroft J, Rothermel T, et al.** Use of cancer susceptibility testing among primary care physicians. Clin Genet. 2003;64:355-60. [PMID: 12974741]
49. **Keitz SA, Stechuchak KM, Grambow SC, Koropchak CM, Tulsky JA.** Behind closed doors: management of patient expectations in primary care practices. Arch Intern Med. 2007;167:445-52. [PMID: 17353491]
50. **Kravitz RL, Bell RA, Azari R, Kelly-Reif S, Krupat E, Thom DH.** Direct observation of requests for clinical services in office practice: what do patients want and do they get it? Arch Intern Med. 2003;163:1673-81. [PMID: 12885682]
51. **Murray E, Lo B, Pollack L, Donelan K, Lee K.** Direct-to-consumer advertising: physicians' views of its effects on quality of care and the doctor-patient relationship. J Am Board Fam Pract. 2003;16:513-24. [PMID: 14963078]
52. **Green MJ, Peterson SK, Baker MW, Harper GR, Friedman LC, Rubinstein WS, et al.** Effect of a computer-based decision aid on knowledge, perceptions, and intentions about genetic testing for breast cancer susceptibility: a randomized controlled trial. JAMA. 2004;292:442-52. [PMID: 15280342]
53. **Pham HH, Schrag D, Hargraves JL, Bach PB.** Delivery of preventive services to older adults by primary care physicians. JAMA. 2005;294:473-81. [PMID: 16046654]
54. **American Cancer Society.** Ovarian cancer: common questions about symptoms and screening. 30 August 2010. Accessed at www.cancer.org/cancer/news/features/ovarian-cancer-why-screening-isnt-routine on 9 June 2011.
55. **American Cancer Society.** American Cancer Society guidelines for the early detection of cancer. 23 June 2011. Accessed at www.cancer.org/Healthy/FindCancerEarly/CancerScreeningGuidelines/american-cancer-society-guidelines-for-the-early-detection-of-cancer on 9 June 2011.
56. **Peabody JW, Luck J, Glassman P, Dresselhaus TR, Lee M.** Comparison of vignettes, standardized patients, and chart abstraction: a prospective validation study of 3 methods for measuring quality. JAMA. 2000;283:1715-22. [PMID: 10755498]
57. **Peabody JW, Luck J, Glassman P, Jain S, Hansen J, Spell M, et al.** Measuring the quality of physician practice by using clinical vignettes: a prospective validation study. Ann Intern Med. 2004;141:771-80. [PMID: 15545677]
58. **Dresselhaus TR, Peabody JW, Luck J, Bertenthal D.** An evaluation of vignettes for predicting variation in the quality of preventive care. J Gen Intern Med. 2004;19:1013-8. [PMID: 15482553]

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