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Assessment of and interventions for women at high risk for breast or ovarian cancer: A survey of primary care physicians

Goli Samimi¹, Brandy M. Heckman-Stoddard¹, Christine Holmberg², Bethany Tennant³, Bonny Bloodgood Sheppard³, Kisha I. Coa³, Shelley S. Kay³, Leslie G. Ford¹, Eva Szabo¹, Lori M. Minasian¹

¹Division of Cancer Prevention, National Cancer Institute, Bethesda, MD 20892, USA

²Institute of Social Medicine and Epidemiology, Brandenburg Medical School Theodor Fontane, Brandenburg, Havel, Germany

³ICF, Fairfax, VA 22031, USA

Abstract

As clinical guidelines for cancer prevention refer individuals to primary care physicians (PCPs) for risk assessment and clinical management, PCPs may be expected to play an increasing role in cancer prevention. It is crucial that PCPs are adequately supported to assess an individual's cancer risk and make appropriate recommendations. The objective of this study is to assess use, familiarity, attitude and behaviors of PCPs regarding breast and ovarian cancer risk and prevention, to better understand the factors that influence their prescribing behaviors. We conducted a cross-sectional, web-based survey of PCPs in the United States, recruited from an opt-in healthcare provider panel. Invitations were sent in batches until the target sample size of 750 respondents (250 each for OB/GYN, internal medicine and family medicine) was met. Self-reported use of breast/ovarian cancer risk assessments was low (34.7%-59.2%) compared with discussion of cancer family history (96.9%), breast exams (87.1%) and mammograms (92.8%). While most respondents (48.0-66.8%) were familiar with cancer prevention interventions, respondents who reported to be less familiar were more likely to report cautious attitudes. When presented with hypothetical cases depicting patients at different breast/ovarian cancer risks, up to 34.0% of respondents did not select any of the clinically recommended course(s) of action. This survey suggests that PCP use of breast/ovarian cancer risk assessment tools and ability to translate the perceived risks to clinical actions is variable. Improving implementation of cancer risk assessment and clinical management guidelines within primary care may be necessary to improve the appropriate prescribing of cancer prevention interventions.

Keywords

cancer prevention; risk assessment; primary care physicians

Corresponding Author: Goli Samimi, National Cancer Institute, 9609 Medical Center Drive, Bethesda, MD 20892 USA, Phone: (240) 276-6582, Fax: (240) 276-7828, goli.samimi@nih.gov.

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Introduction

Risk assessment for breast and ovarian cancer include assessment of hereditary and demographic factors including age, family history, genetic testing results (self/relatives) and ancestry (1, 2) (National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®), https://www.nccn.org/professionals/physician_gls/default.aspx). Breast cancer screening recommendations for women at average risk include mammography, although guidelines are inconsistent in terms of starting age and frequency (3-5) (Susan G. Komen Breast Cancer Screening for Women at Average Risk, <https://ww5.komen.org/BreastCancer/BreastCancerScreeningforWomenatAverageRisk.html>). For women deemed at high risk for breast cancer (e.g. 5-year risk 1.67% or lifetime risk of 20% (6)), screening recommendations begin at a younger age (Susan G. Komen Breast Cancer Screening for Women at Higher Risk, <https://ww5.komen.org/BreastCancer/BreastCancerScreeningForWomenAtHigherRisk.html>), and suggested risk reduction interventions include lifestyle behaviors, increased mammography screening, chemopreventive agents and/or mastectomy (1, 7, 8). Selective estrogen receptor modulators (SERMs) and aromatase inhibitors (AIs) have shown to provide a 50-65% relative risk reduction in women at high risk of breast cancer (6, 9-16).

For ovarian cancer, screening is not recommended for women who are not known to have a high-risk hereditary cancer syndrome (17). The strongest ovarian cancer risk factor is family history and/or the presence of a *BRCA1* or *BRCA2* germline mutation, with a lifetime risk of 39% (95% CI 18-54%) and 11% (95% CI 2.4-19%) risk, respectively (18). Risk reduction interventions for ovarian cancer are mainly surgical (i.e. salpingo-oophorectomy) but may also include use of oral contraceptives (19, 20). Large epidemiologic studies have demonstrated that women who have reported use of oral contraceptives have a reduced lifetime ovarian cancer risk ranging from 35-80%, with longer use being associated with increased risk reduction (21, 22). The American College of Obstetricians and Gynecologists (ACOG) and the Society of Gynecologic Oncology (SGO) have published recommendations that women with increased risk for ovarian cancer consider use of oral contraceptives (19, 23). The most effective intervention for ovarian cancer is risk-reducing bilateral salpingo-oophorectomy, which reduces the risk of ovarian and associated cancers by 80% in women with *BRCA1/2* mutations (24).

Primary Care Physicians (PCPs) play an increasing role in cancer risk assessment and prescribing of preventive interventions (25). Patients rely on their PCPs to identify their cancer risk and provide recommendations for risk reduction (26-28). The willingness of a PCP to recommend a cancer preventive intervention is associated with their familiarity with the intervention (29, 30). However, PCPs face barriers of evolving guidelines and lack of recognition of evolving risk factors (31), while high-risk women are reluctant or skeptical of cancer risk reduction, all of which contribute to limited uptake of most cancer preventive interventions (32-35).

As PCPs are the first referral for individuals concerned with cancer risk and prevention, it is imperative that they receive the necessary support to adequately assess an individual's cancer risk and make appropriate recommendations. We undertook a large survey-based

study to explore the knowledge, use, familiarity and behaviors of PCPs with respect to breast/ovarian cancer risk and prevention for high-risk women (31). We previously reported a set of results from this survey, which evaluated recognition of risk factors, recommendation and prescribing behaviors. These results demonstrated that perception of importance and recommendations of cancer screening and prevention significantly differed by provider type, reflecting the demographics of the populations seen by the respective PCPs. In addition, survey responses showed that PCPs were less likely to recognize clinical or epidemiologic cancer risk factors, and prescribing behaviors of PCPs were related to familiarity, with physicians more likely to reinforce a specialist's recommendation for breast/ovarian cancer prevention rather than prescribe an intervention (31).

This current study expands on our previous results, evaluating use of risk assessment tools, familiarity and attitudes towards cancer prevention interventions and behaviors of PCPs in response to patient scenarios, to better understand the factors that influence their prescribing behaviors.

Methods

Study Design

Survey design was previously published (31). We recruited a cross-sectional sample of PCPs from an online healthcare provider panel hosted by a healthcare market research firm, M3 Global Research (<https://www.m3global.com/>). M3 validates their panel members' registration information against the American Medical Association's (AMA) database. M3 Global Research follows the rules, regulations and standards of Market Research industry and is ISO certified. The survey was reviewed and approved by the ICF Institutional Review Board (IRB).

Survey invitations were emailed to random samples of panel members between June 8-14, 2018. To be eligible, respondents were required to: (1) be a physician specializing in family medicine, internal medicine, or obstetrics/gynecology (OB/GYN); (2) interact with patients on a weekly or daily basis; (3) reside and practice medicine in the United States; and (4) be able to read and understand English to provide informed consent and complete the survey. Participants meeting all inclusion criteria reviewed and electronically provided written (digital) informed consent before completing the online survey. Multiple survey completions were avoided by use of a unique URL for each survey. Invitations were sent daily in batches until the target sample size of 750 respondents [250 for each physician type—family medicine, internist and obstetrics/gynecology (OB/GYN)] was met.

A total of 6,148 panel members were invited, of whom 953 responded, and 750 completed the survey within one week. Respondents who completed the survey were provided with a link to a National Cancer Institute (NCI) webpage with information and resources about breast and gynecologic cancer prevention, and received remuneration for their participation.

Survey Instrument

The survey was developed to evaluate self-reported cancer prevention perceptions, cancer risk assessment and prescribing behaviors of PCPs. We collected physician demographics,

use of cancer risk assessment tools/resources, attitude towards cancer prevention interventions, and familiarity with breast and ovarian cancer prevention interventions. The survey required a response to all items. The entire survey, respondent demographics and preliminary analyses were previously published (31).

The survey included four hypothetical clinical case vignettes describing female patients presenting with varying demographic, family history and clinical characteristics associated with breast and/or ovarian cancer risk. Using a set of preselected responses, the survey asked PCPs to select recommended course(s) of action for each hypothetical patient.

Statistical Analysis

All analyses were conducted using SPSS version 22 (SPSS Inc., Chicago, IL). Descriptive statistics [frequency counts and percentages, means with standard deviations (SDs)] were calculated for all variables. Chi-squared tests were used for comparisons between all the physician types and, for those comparisons that were found to differ, t-tests were performed to compare frequencies of responses between the different physician type pair combinations.

Logistic regression models assessed the associations between physician demographics and familiarity and attitude toward cancer prevention interventions. Independent variables were selected according to their *a priori* importance and from bivariate analyses. The potential independent variables were first examined for multicollinearity. To summarize the respondents' familiarity and attitude with a single variable, we developed *post hoc* scales for each of the options. The scales had good internal consistency (Cronbach α 0.92 for familiarity and Cronbach α 0.80 for attitude). The variables were then categorized by visual binning of equal percentiles on scanned cases (less and more familiar or less and more cautious attitude, for those attitudes that leaned towards risk-averse).

Because of the structure of some of the questions, some responses were categorized. To explore differences between physician specialties, we categorized physician use of breast and/or ovarian cancer risk assessment and screening tools into "used" (including "often" and "occasionally"), "not used" (including "rarely" and "never") and "not familiar with this assessment"; dichotomized self-reported ratings of familiarity with cancer preventive interventions into "familiar" (including "extremely familiar and "moderately familiar") and "not as familiar" (including "somewhat familiar", "slightly familiar" and "not at all familiar"). To explore physician attitudes regarding cancer prevention interventions, we categorized agreement levels into "agree" (including "strongly agree" and "somewhat agree") and "disagree" (including "strongly disagree" and "somewhat disagree") as well as "no opinion" and "don't know/unsure". A p-value<0.05 was considered to be statistically significant.

Results

Use of Breast and Ovarian Cancer Risk Assessment Tools and Resources

Our previous findings showed that PCPs recognized genetic factors but were less likely to recognize epidemiologic risk factors (31). Respondents were asked about their use of various breast and ovarian cancer assessments in asymptomatic patients to determine cancer risk

(Table 1). Most respondents reported discussing cancer family history (96.9%), performing breast exams (87.1%) and ordering mammograms (92.8%) to assess breast/ovarian cancer risk, with no significant difference between provider types. Other risk assessments were less likely to be utilized, such as breast cancer risk assessment tools (*e.g.*, Gail Model, BOADICEA, Claus, BRCAPRO, Cuzick-Tyrer) (50.9%), genetic testing for *BRCA1* or *BRCA2* (59.2%) and multi-gene testing (34.7%). Self-reported use of these risk assessments significantly differed by provider type: OB/GYN physicians, compared to both family medicine physicians and internists, were significantly more likely to report using breast cancer risk assessment tools (p-value<0.001), genetic testing for *BRCA1* or *BRCA2* (p-value<0.001), and multi-gene testing (p-value<0.001). For example, 80.8% of OB/GYN physicians but only 45.6% and 51.2% of family medicine physicians and internists, respectively, reported using *BRCA1/2* genetic testing. No significant differences were found between family medicine physicians and internists for utilization of any of the risk assessment tools.

Familiarity with Cancer Prevention Interventions

Because our and other studies have demonstrated that familiarity is associated with prescribing behaviors, respondents were asked about their familiarity with breast and ovarian cancer preventive intervention options (Table 2). Overall, most respondents were familiar with cancer prevention intervention options (51.5-66.8%), with less familiarity with aromatase inhibitors (48.0%). Familiarity significantly differed by provider type. OB/GYN physicians, compared to family medicine physicians, were significantly more likely to report being familiar with tamoxifen (p-value<0.001), raloxifene (p-value<0.001), aromatase inhibitors (p-value<0.001), prophylactic mastectomy (p-value=0.001), oophorectomy (p-value<0.001), and risk-reducing salpingo-oophorectomy (p-value<0.001). OB/GYN physicians, compared to internists, were significantly more likely to report being familiar with tamoxifen (p-value<0.05), oophorectomy (p-value<0.001), and risk-reducing salpingo-oophorectomy (p-value<0.001). For example, 93.6% of OB/GYN physicians but only 42.0% and 47.6% of family medicine physicians and internists, respectively, reported being familiar with risk-reducing salpingo-oophorectomy. Internists compared to family medicine physicians, were significantly more likely to report being familiar with tamoxifen (p-value<0.05), raloxifene (p-value<0.05), and aromatase inhibitors (p-value<0.001). For example, 57.6% of OB/GYN physicians and 51.2% of internists but only 35.2% of family medicine physicians reported being familiar with aromatase inhibitors.

Attitudes Regarding Cancer Prevention Interventions

Respondents were asked to respond with their level of agreement regarding various statements related to breast or ovarian cancer prevention (Table 3). Most respondents agreed that benefits of cancer prevention outweigh the risks; however, attitudes significantly differed by provider type. OB/GYN physicians, compared to family medicine physicians and internists, were significantly more likely to agree that the benefits of preventive agents in breast cancer outweigh the risks (p-value<0.05 and p-value<0.001, respectively), and were less likely to agree that the evidence that they significantly reduce breast cancer risk is controversial (p-value<0.001 and p-value<0.05, respectively), the risk of endometrial cancer is too great to prescribe tamoxifen for breast cancer reduction (both p-value<0.05), risk of

thromboembolic disease is too great to prescribe preventive agents for breast cancer reduction (both p -value <0.001), and evidence that preventive surgery significantly reduces breast cancer risk is controversial (both p -value <0.05). For example, 74.4% of OB/GYN physicians but only 40.0% and 38.8% of family medicine physicians and internists, respectively, reported disagreeing that the risk of endometrial cancer is too great to prescribe tamoxifen for breast cancer reduction. OB/GYN physicians, compared to family medicine physicians and internists, were also more likely to agree that it is easy for them to determine who is eligible to take preventive agents for breast cancer reduction (p -value <0.001 and p -value <0.05 , respectively).

Similar differences in attitudes were seen regarding preventive surgery in ovarian cancer, as OB/GYN physicians were significantly more likely than family medicine physicians or internists to agree the benefits of preventive surgery in ovarian cancer outweigh the risks (both p -value <0.001), and less likely to agree that the evidence that preventive surgery significantly reduces ovarian cancer risk is controversial (both p -value <0.001). For example, 84.8% of OB/GYN physicians but only 55.6% and 56.8% of family medicine physicians and internists, respectively, reported agreeing that benefits of preventive surgery in ovarian cancer outweigh the risks.

Association Between Familiarity and Attitudes

Among all participants, there was a significant association between familiarity with cancer prevention interventions and attitude toward cancer prevention interventions (p -value $<.0001$). Logistic regression models explored the familiarity predictor variables with cancer prevention interventions and attitude toward cancer prevention interventions (Table 4). Family medicine respondents and internal medicine physicians were less likely to be familiar with cancer prevention interventions than OB/GYN physicians (odds ratio [OR] 0.20, 95% CI 0.13-0.31; 95% CI 0.23-0.57 respectively), and almost 4 times more likely to have cautious attitudes towards cancer prevention interventions than OB/GYN physicians (OR 4.43, 95% CI 2.86-6.85; OR 3.57, 95% 2.29-5.56 respectively).

In addition, as shown in Table 4, self-reporting of being more familiar with cancer prevention interventions was associated with practicing in a suburban setting compared to an urban location (OR 1.87, 95% CI 1.25-2.79), and seeing 26 or more patients on average per day compared to seeing 1-15 an average daily (OR 2.34, 95% CI 1.32-4.13). Being less familiar with cancer prevention interventions was associated with practicing in a single specialty group compared to a solo practice (OR 0.54, 95% CI 0.31-0.94). Age, gender, and years in a specialty practice were not significantly associated with familiarity or attitude toward cancer prevention interventions.

Course of Action for Patients at Risk

To determine PCPs' understanding and ability to recognize women at various degrees of breast/ovarian cancer risk (average risk, family history, genetic predisposition, or presence of precursor), and apply the appropriate recommendation guidelines (1-5, 7) (National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) https://www.nccn.org/professionals/physician_gls/default.aspx; Susan G.

Komen Breast Cancer Screening for Women at Higher Risk; <https://ww5.komen.org/BreastCancer/BreastCancerScreeningForWomenAtHigherRisk.html>; Susan G. Komen Breast Cancer Screening for Women at Average Risk, <https://ww5.komen.org/BreastCancer/BreastCancerScreeningforWomenatAverageRisk.html>), respondents were presented with hypothetical cases depicting women with breast/ovarian cancer risk factors, and asked to select course(s) of action (Table 5). Figure 1 depicts the breakdown of responses for the clinically recommended course(s) of action for each case. A more detailed text description of the results presented in Table 5 and Figure 1 can be found in Supplementary Data.

Discussion

We assessed PCP understanding of breast and ovarian cancer risk management by querying use of risk assessment tools, familiarity with cancer preventive interventions, and knowledge/understanding of clinical guidelines via hypothetical case studies.

Our results show that while PCPs are familiar with and reported use of common cancer risk assessments (*i.e.* family history and breast exam), the specialized tools aimed at identifying high risk populations (*e.g.* breast cancer risk assessment tools, genetic testing) are less utilized. Physicians' familiarity with cancer prevention interventions was significantly associated with their attitudes towards risks/benefits, such that respondents who reported to be less familiar were more likely to report cautious attitudes towards cancer prevention interventions. In general, OB/GYN physicians were more likely to report using and/or being familiar with the breast/ovarian cancer risk assessment tools and cancer preventive intervention agents, which likely reflects the female patient population managed by OB/GYN physicians, in which breast and cancer risk assessment is more commonly practiced.

The American Society for Clinical Oncology (ASCO) (36), National Comprehensive Cancer Network (NCCN) (37), and the National Institute for Health and Care Excellence (NICE) (38), have released recommendations that PCPs consider and discuss the use of chemopreventive agents with women at increased risk of breast cancer, including asymptomatic women age ≥ 35 years, with previous diagnoses of benign breast lesions (*e.g.* atypical ductal or lobular hyperplasia and lobular carcinoma *in situ*). However, these professional societies represent oncologists and therefore these recommendations and guidelines may not be effectively reaching the primary care setting. The United States Preventive Services Task Force (USPSTF), which includes primary care, released a statement recommending (B rating) that clinicians offer to prescribe tamoxifen, raloxifene, AIs for prevention in this increased risk population (7). However, uptake of these recommendations remains low, in part due to reluctance of PCPs, and reluctance by women to use these medications due to perceived side effects, cost and/or skepticism of efficacy (6, 26).

The hypothetical cases represent the types of patients who may seek risk management from their PCPs, and are meant to determine their knowledge/understanding of clinical management guidelines. For Patient 1, who is not necessarily at increased risk of breast or ovarian cancer, 100% of the responses selected at least one of the clinically recommended

courses of action. The difference between responses from OB/GYN physicians regarding ordering a screening mammogram likely reflects inconsistent mammography guidelines related to patient age, with the OB/GYN professional society ACOG recommending mammograms starting at age 40 whereas other guidelines recommend mammograms starting at later ages (3-5, 39). As expected risk in the vignettes increased due to family history (Patients 2 and 3), genetic mutation (Patient 3) or a precancerous lesion (Patient 4), such that their clinical management goes beyond routine care, up to 34.0% of the total responses did not select any of the clinically recommended courses of action (Figure 1).

As clinical management guidelines recommend at-risk individuals to seek guidance from their PCPs, it is clear that PCPs may be expected to take on a greater role in cancer risk assessment and management. For example, the USPSTF recently released a recommendation (A rating) that PCPs apply familial risk assessment tools to women with a personal or family history of breast or ovarian/tubal/peritoneal cancers, or who have an ancestry indicative of *BRCA1/2* gene mutations (2). This reliance on PCPs could provide a challenge considering that cancer risk models continuously evolving to include additional etiologic and genetic risk factors (1, 40) and these updated models may not be effectively incorporated into primary care practices. Previous studies have shown that guideline dissemination is not necessarily adequate to change practice behavior (41, 42). Integration of cancer risk assessment and clinical management guidelines within routine primary care workflow, including reminder systems (chart-based or computerized) (43, 44), cancer risk and prevention-related decision support tools (30, 45, 46) (<https://clinicaltrials.gov/ct2/show/NCT02986230>), and provider assessment and feedback (which have been successful for improving screening rates for breast, cervical and colon cancer) (47), is imperative for widespread implementation and to make an impact on prescribing behaviors of PCPs (42, 48).

The survey study design, while assessing the understanding and knowledge of a large sample size, carries some limitations. The identification of respondents via a database of physicians who have previously agreed to participate in scientific research studies and the limited response rate pose the risk of sample bias, such that findings may not be applicable to the overall PCP population. To overcome this limitation, we aimed for a large sample size representing three specialties. Also, the survey study design limits further exploration and/or clarification of responses. Based on the results of this survey, we plan to conduct working group discussions with relevant stakeholders to not only further evaluate the responses, but also to explore potential opportunities to provide more robust and useful resources to the primary care community.

Clinical management guidelines reinforce patients' reliance on their PCPs to provide risk assessment and management recommendations. In order to ensure that both physicians and patients receive updated comprehensive care, cancer prevention resources must be more readily integrated into primary care, such that PCPs become more familiar and therefore comfortable applying cancer risk assessments and prescribing cancer preventive interventions to their patients.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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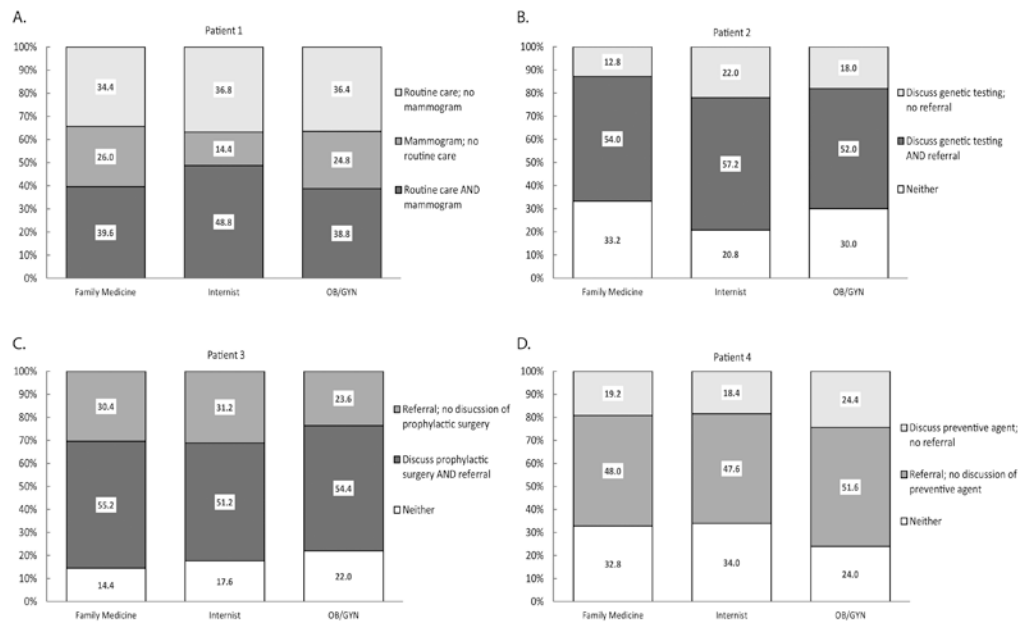


Figure 1.

Breakdown of physician responses for clinically recommended course of action for case vignettes presented in Table 5. A) Patient 1 (40 years old; no personal history of breast cancer; no personal history of DCIS; no personal history of LCIS; no first-degree relative with breast cancer); B) Patient 2 (35 years old; no personal history of breast cancer; no personal history of DCIS; no personal history of LCIS; one first-degree relative with breast cancer, diagnosed before age 50; one first-degree relative with ovarian cancer); C) Patient 3 (35 years old; no personal history of breast cancer; no personal history of DCIS; no personal history of LCIS; two first-degree relatives with breast cancer; found to carry a pathogenic *BRCA1* mutation); D) Patient 4 (65 years old; no personal history of breast cancer; no personal history of DCIS; no personal history of LCIS; no first-degree relatives with breast cancer; one breast biopsy showing atypical hyperplasia). Light gray bars: percentage of physicians who selected the specified clinically recommended course of action; dark gray bars: percentage of physicians who selected both clinically recommended courses of actions; white bars: percentage of physicians who selected neither of the clinically recommended specified courses of action.

Table 1.

Physician use of breast and/or ovarian cancer risk assessment and screening tools.

	Family Medicine n (%)	Internist n (%)	OB/GYN n (%)	Total n (%)
Discussion of Cancer Family History				
Used	246 (98.4%)	235 (94.0%)	246 (98.4%)	727 (96.9%)
Not used	4 (1.6%)	13 (5.2%)	3 (1.2%)	20 (2.7%)
Not familiar with this assessment	0 (0%)	2 (0.8%)	1 (0.4%)	3 (0.4%)
Breast Exam				
Used	212 (84.8%)	200 (80.0%)	241 (96.4%)	653 (87.1%)
Not used	38 (15.2%)	48 (19.2%)	7 (2.8%)	93 (12.4%)
Not familiar with this assessment	0 (0%)	2 (0.8%)	2 (0.8%)	4 (0.5%)
Mammogram				
Used	248 (99.2%)	240 (96.0%)	238 (95.2%)	696 (92.8%)
Not used	2 (0.8%)	9 (3.6%)	7 (2.8%)	18 (2.4%)
Not familiar with this assessment	0 (0%)	1 (0.4%)	1 (0.4%)	2 (0.3%)
Breast Cancer Risk Assessment Tool (e.g., Gail Model, BOADICEA, Claus, BRCAPRO, Cuzick-Tyrer) *				
Used	110 (44.0%)	104 (41.7%)	168 (67.2%)	382 (50.9%)
Not used	88 (35.2%)	97 (38.8%)	59 (23.6%)	244 (32.5%)
Not familiar with this assessment	52 (20.8%)	49 (19.6%)	23 (9.2%)	124 (16.5%)
Genetic Testing for <i>BRCA1</i> or <i>BRCA2</i> *				
Used	114 (45.6%)	128 (51.2%)	202 (80.8%)	444 (59.2%)
Not used	133 (53.2%)	119 (47.6%)	48 (19.2%)	300 (40.0%)
Not familiar with this assessment	3 (1.2%)	3 (1.2%)	0 (0%)	6 (0.8%)
Multi-Gene Testing *				
Used	62 (24.8%)	68 (27.2%)	130 (52.0%)	260 (34.7%)
Not used	146 (58.4%)	153 (61.2%)	101 (40.4%)	400 (53.3%)
Not familiar with this assessment	42 (16.8%)	29 (11.6%)	19 (7.6%)	90 (12.0%)

* Indicates significant difference between provider types (p < 0.05)

Table 2.

Physician familiarity with breast and/or ovarian cancer preventive intervention options.

	Family Medicine n (%)	Internist n (%)	OB/GYN n (%)	Total n (%)
Tamoxifen*				
Familiar	130 (52.0%)	153 (61.2%)	182 (72.8%)	465 (62.0%)
Not as familiar	120 (48.0%)	97 (38.8%)	68 (27.2%)	285 (38.0%)
Raloxifene*				
Familiar	103 (41.2%)	133 (53.2%)	150 (60.0%)	386 (51.5%)
Not as familiar	147 (58.8%)	117 (46.8%)	100 (40.0%)	364 (48.5%)
Aromatase inhibitors*				
Familiar	88 (35.2%)	128 (51.2%)	144 (57.6%)	360 (48.0%)
Not as familiar	162 (64.8%)	122 (48.8%)	106 (42.4%)	390 (52.0%)
Prophylactic mastectomy*				
Familiar	146 (58.4%)	161 (64.4%)	180 (72.0%)	487 (64.9%)
Not as familiar	104 (41.6%)	89 (35.6%)	70 (28.0%)	263 (35.1%)
Oophorectomy*				
Familiar	128 (51.2%)	143 (57.2%)	230 (92.0%)	501 (66.8%)
Not as familiar	122 (48.8%)	107 (42.8%)	20 (8.0%)	249 (33.2%)
Risk-reducing salpingo-oophorectomy*				
Familiar	105 (42.0%)	119 (47.6%)	234 (93.6%)	458 (61.1%)
Not as familiar	145 (58.0%)	131 (52.4%)	16 (6.4%)	292 (38.9%)

*Indicates significant difference between provider types (p < 0.05)

Table 3.

Physician attitudes regarding breast or ovarian cancer prevention interventions.

	Family Medicine n (%)	Internist n (%)	OB/GYN n (%)	Total n (%)
The benefits of preventive agents in breast cancer outweigh the risks.*				
Agree	148 (59.2%)	143 (57.2%)	180 (72.0%)	471 (62.8%)
Disagree	24 (9.6%)	25 (10.0%)	19 (7.6%)	68 (9.1%)
No Opinion	60 (24.0%)	57 (22.8%)	45 (18.0%)	162 (21.6%)
Don't know/Unsure	18 (7.2%)	25 (10.0%)	6 (2.4%)	49 (6.5%)
The evidence that preventive agents significantly reduces breast cancer risk is controversial.*				
Agree	94 (37.6%)	85 (34.0%)	57 (22.8%)	236 (31.5%)
Disagree	65 (26.0%)	85 (34.0%)	137 (54.8%)	287 (38.3%)
No Opinion	72 (28.8%)	56 (22.4%)	47 (18.8%)	175 (23.3%)
Don't know/Unsure	19 (7.6%)	24 (9.6%)	9 (3.6%)	52 (6.9%)
The risk of endometrial cancer is too great to prescribe tamoxifen for breast cancer reduction.*				
Agree	46 (18.4%)	47 (18.8%)	37 (14.8%)	130 (17.3%)
Disagree	100 (40.0%)	97 (38.8%)	186 (74.4%)	383 (51.1%)
No Opinion	75 (30.0%)	76 (30.4%)	27 (10.8%)	178 (23.7%)
Don't know/Unsure	29 (11.6%)	30 (12.0%)	0 (0%)	59 (7.9%)
The risk of thromboembolic disease is too great to prescribe preventive agents for breast cancer reduction.*				
Agree	65 (26.0%)	62 (24.8%)	27 (10.8%)	154 (20.5%)
Disagree	104 (41.6%)	112 (44.8%)	181 (72.4%)	397 (52.9%)
No Opinion	62 (24.8%)	58 (23.2%)	42 (16.8%)	162 (21.6%)
Don't know/Unsure	19 (7.6%)	18 (7.2%)	0 (0%)	37 (4.9%)
It is easy for me to determine who is eligible to take preventive agents for breast cancer reduction.				
Agree	56 (22.4%)	70 (28.0%)	100 (40.0%)	226 (30.1%)
Disagree	138 (55.2%)	126 (50.4%)	111 (44.4%)	375 (50.0%)
No Opinion	46 (18.4%)	41 (16.4%)	37 (14.8%)	124 (16.5%)
Don't know/Unsure	10 (4.0%)	13 (5.2%)	2 (0.8%)	25 (3.3%)
The benefits of preventive surgery in breast cancer outweigh the risks.				
Agree	146 (58.4%)	142 (56.8%)	163 (65.2%)	451 (60.1%)
Disagree	33 (13.2%)	40 (16.0%)	36 (14.4%)	109 (14.5%)
No Opinion	61 (24.4%)	51 (20.4%)	47 (18.8%)	159 (21.2%)
Don't know/Unsure	10 (4.0%)	17 (6.8%)	4 (1.6%)	31 (4.1%)
The evidence that preventive surgery significantly reduces breast cancer risk is controversial.*				
Agree	92 (36.8%)	89 (35.6%)	60 (24.0%)	241 (31.1%)
Disagree	88 (35.2%)	98 (39.2%)	144 (57.6%)	330 (44.0%)
No Opinion	51 (20.4%)	51 (20.4%)	20 (16.0%)	142 (18.9%)
Don't know/Unsure	19 (7.6%)	12 (4.8%)	6 (2.4%)	37 (4.9%)
The benefits of preventive surgery in ovarian cancer outweigh the risks.*				

	Family Medicine n (%)	Internist n (%)	OB/GYN n (%)	Total n (%)
Agree	139 (55.6%)	142 (56.8%)	212 (84.8%)	493 (65.7%)
Disagree	29 (11.6%)	28 (11.2%)	27 (10.8%)	84 (11.2%)
No Opinion	61 (24.4%)	58 (23.2%)	10 (4.0%)	129 (17.2%)
Don't know/Unsure	21 (8.4%)	22 (8.8%)	1 (0.4%)	44 (5.9%)
The evidence that preventive surgery significantly reduces ovarian cancer risk is controversial.*				
Agree	84 (33.6%)	79 (31.6%)	56 (22.4%)	219 (29.2%)
Disagree	71 (28.4%)	82 (32.8%)	171 (68.4%)	324 (43.2%)
No Opinion	70 (28.0%)	65 (26.0%)	21 (8.4%)	156 (20.8%)
Don't know/Unsure	25 (10.0%)	24 (9.6%)	2 (0.8%)	51 (6.8%)

* Indicates significant difference between provider types (p = 0.05)

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Table 4.

Logistic regression models of physician demographics, familiarity and attitudes toward chemoprevention interventions.

	Familiar with Cancer Prevention Interventions		Attitude toward Cancer Prevention Interventions	
	Odds Ratio (OR)	95% CI	Odds Ratio (OR)	95% CI
Gender				
Female	1	[Reference]	1	[Reference]
Male	0.97	[.67, 1.42]	1.41	[.97, 2.03]
Age				
	1.00	[.96, 1.05]	1.00	[.90, 1.05]
Medical Specialty				
OB/GYN	1	[Reference]	1	[Reference]
Family medicine	0.20 *	[.13, .31]	4.43 *	[2.86, 6.85]
Internist	0.36 *	[.23, .57]	3.57 *	[2.29, 5.56]
Geographic location				
Urban	1	[Reference]	1	[Reference]
Suburban	1.87 *	[1.25, 2.79]	0.72	[.49, 1.08]
Rural/remote	0.97	[.53, 1.77]	0.63	[.35, 1.12]
Years practicing specialty				
	1.01	[.96, 1.07]	1.00	[.95, 1.05]
Type of practice				
Solo practice	1	[Reference]	1	[Reference]
Single Specialty Group*	0.54 *	[.31, .94]	1.30	[.75, 2.25]
Multi-Specialty Group	0.68	[.38, 1.21]	1.29	[.73, 2.28]
Direct hospital employee	0.54	[.27, 1.11]	1.40	[.70, 2.82]
Faculty practice plan	0.51	[.18, 1.41]	0.74	[.27, 2.07]
Average number of patients				
1-15	1	[Reference]	1	[Reference]
16-25	1.53	[.96, 2.43]	0.82	[.52, 1.29]
26 or more	2.34 *	[1.32, 4.13]	0.73	[.43, 1.27]

* Indicates significant difference between provider types (p < 0.05)

Table 5.

Recommended course of action for vignettes featuring patients at various levels of risk for breast and/or ovarian cancer.[†]

	Family Medicine n (%)	Internist n (%)	OB/GYN n (%)	Total n (%)
Patient 1 is 40 years old and has: No personal history of breast cancer; No personal history of DCIS; No personal history of LCIS; and no first-degree relative with breast cancer.				
Continue routine care.	202 (80.8%)	188 (75.2%)	197 (78.8%)	587 (78.3%)
Order a screening mammogram for this patient.*	149 (59.6%)	136 (54.4%)	196 (78.4%)	481 (64.1%)
Talk with the patient about her lifestyle behaviors.	110 (44.0%)	112 (44.8%)	113 (45.2%)	335 (44.7%)
Discuss the pros and cons of getting genetic testing with this patient.*	19 (7.6%)	16 (6.4%)	5 (2.0%)	40 (5.3%)
Discuss the pros and cons of using a preventive agent with this patient.	10 (4.0%)	16 (6.4%)	7 (2.8%)	33 (4.4%)
Discuss the pros and cons of getting prophylactic surgery with this patient.*	10 (4.0%)	14 (5.6%)	1 (0.4%)	25 (3.3%)
Refer the patient to a specialist.	14 (5.6%)	17 (6.8%)	6 (2.4%)	37 (4.9%)
Patient 2 is 35 years old and has: No personal history of breast cancer; No personal history of DCIS; No personal history of LCIS; One first-degree relative with breast cancer, diagnosed before age 50; and one first-degree relative with ovarian cancer.				
Continue routine care.*	116 (46.4%)	90 (36.0%)	77 (30.8%)	283 (37.7%)
Order a screening mammogram for this patient.	146 (58.4%)	139 (55.6%)	132 (52.8%)	417 (55.6%)
Talk with the patient about her lifestyle behaviors.	139 (55.6%)	124 (49.6%)	120 (48.0%)	383 (51.1%)
Discuss the pros and cons of getting genetic testing with this patient.*	168 (67.2%)	161 (64.4%)	211 (84.4%)	540 (72.0%)
Discuss the pros and cons of using a preventive agent with this patient.	44 (17.6%)	57 (22.8%)	56 (22.4%)	157 (20.9%)
Discuss the pros and cons of getting prophylactic surgery with this patient.	33 (13.2%)	34 (13.6%)	45 (18.0%)	112 (14.9%)
Refer the patient to a specialist.	143 (57.2%)	139 (55.6%)	126 (50.4%)	408 (54.4%)
Patient 3 is 35 years old and has: No personal history of breast cancer; No personal history of DCIS; No personal history of LCIS; Two first-degree relatives with breast cancer; and was found to carry a pathogenic <i>BRCA1</i> mutation.				
Continue routine care.*	71 (28.4%)	71 (28.4%)	45 (18.0%)	187 (24.9%)
Order a screening mammogram for this patient.	148 (59.2%)	158 (63.2%)	165 (66.0%)	471 (62.8%)
Talk with the patient about her lifestyle behaviors.	117 (46.8%)	122 (48.8%)	114 (45.6%)	353 (47.1%)
Discuss the pros and cons of using a preventive agent with this patient.*	73 (29.2%)	102 (40.8%)	132 (52.8%)	307 (40.9%)
Discuss the pros and cons of getting prophylactic surgery with this patient.*	112 (44.8%)	122 (48.8%)	169 (67.2%)	402 (53.6%)
Refer the patient to a specialist.	207 (82.8%)	203 (81.2%)	205 (82.0%)	615 (82.0%)
Patient 4 is 65 years old and has: No personal history of breast cancer; No personal history of DCIS; No personal history of LCIS; No first-degree relatives with breast cancer; and one breast biopsy showing atypical hyperplasia.				
Continue routine care.*	127 (50.8%)	113 (45.2%)	85 (34.0%)	325 (43.3%)

	Family Medicine n (%)	Internist n (%)	OB/GYN n (%)	Total n (%)
Order a screening mammogram for this patient.	181 (72.4%)	170 (68.0%)	161 (64.4%)	512 (68.3%)
Talk with the patient about her lifestyle behaviors.	105 (42.0%)	109 (43.6%)	110 (44.0%)	324 (43.2%)
Discuss the pros and cons of getting genetic testing with this patient.	36 (14.4%)	46 (18.4%)	40 (16.0%)	122 (16.3%)
Discuss the pros and cons of using a preventive agent with this patient.*	36 (14.4%)	50 (20.0%)	69 (27.6%)	155 (20.7%)
Discuss the pros and cons of getting prophylactic surgery with this patient.	21 (8.4%)	34 (13.6%)	31 (12.4%)	86 (11.5%)
Refer the patient to a specialist.*	105 (42.0%)	121 (48.4%)	142 (56.8%)	368 (49.1%)

[†] Responses are not mutually exclusive; respondents could select one or more course of action.

* Indicates significant difference between provider types (p < 0.05)

Grey shading indicates the clinically recommended courses of action.

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