Published in final edited form as:
J Am Board Fam Med. 2009 ; 22(3): 272–279. doi:10.3122/jabfm.2009.03.080153.

Diffusion of Breast Cancer Risk Assessment in Primary Care

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Abstract

Background—Physicians who provide primary care to women have the opportunity to identify patients at high risk for breast cancer who are candidates for risk reduction strategies.

Objective—To determine the prevalence and determinants of adoption of breast cancer risk assessment by primary care physicians.

Design—A cross-sectional survey

Participants—A nationally representative random sample of 351 internists, family practitioners and obstetricians-gynecologists.

Measures—A questionnaire that assessed knowledge, attitudes, discussion of breast cancer risk, use of software to calculate breast cancer risk and ordering of *BRCA1/2* testing.

Results—88% of physicians reported discussing breast cancer risk at least once in the prior 12 months, 48% had ordered or referred a patient for *BRCA1/2* testing and 18% had used a software program to calculate breast cancer risk. Physicians who had used *BRCA1/2* testing or discussed breast cancer risk factors were more likely to be obstetrician-gynecologists and not in solo practice; whereas use of risk software was also more common among obstetrician gynecologists but was also associated with having a family member with breast cancer and a greater knowledge about breast cancer risk. Having patients ask for risk information was associated with discussion of risk factors but not with the other risk assessment strategies.

Conclusions—Diffusion of breast cancer risk assessment is occurring in primary care practices, with a greater adoption of *BRCA1/2* testing than of risk assessment software. Adoption of these strategies appears to be related to the salience of breast cancer personally and in the practice and the size of the practice, rather than attitudes about thee risk assessment methods.

Keywords

Physician's practice patterns; risk assessment; knowledge; attitudes; breast neoplasms; BRCA1/2

INTRODUCTION

In the United States, an estimated 180,510 new cases of breast cancer will be diagnosed and 40,910 women will die of the disease in 2007. [1] For women at average risk for breast cancer,

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None of the authors has a financial conflict of interest related to the subject of the study.

the lifetime risk of being diagnosed with breast cancer is 13%.[2] However, breast cancer risk varies substantially among women with five-year risk ranging from less than 0.5% for a low risk woman in her 40s to over 6% for a high-risk woman in her seventies. [3]

Breast cancer risk assessment has become increasingly relevant to physicians who provide primary care to women in the last ten years for several reasons.[4, 5] The identification of women at high risk of breast cancer has taken on new importance with the FDA approval of tamoxifen for breast cancer risk reduction in high risk women in 1998 and the growing data supporting the effectiveness of prophylactic mastectomy among women at very high risk.[6–8, 8–10] Since the validation of the Gail model for individual breast cancer risk prediction, [11] additional software programs for risk prediction have been developed including the Claus, Couch, Shattuck-Eidens, Frank, and BRCAPRO models. [12–16] The development of testing for mutations in the major breast cancer susceptibility genes, *BRCA1* and *BRCA2*, has created a risk assessment tools that can both identify women at high risk of breast cancer, but also provide information about ovarian cancer risk and cancer risk information for family members.[17, 17] Finally, evidence continues to link a woman's absolute risk of breast cancer to the risk/benefit ratio of many common decisions, including the use of postmenopausal hormone replacement therapy, the age at which to start mammography screening and appropriateness for high-risk screening programs including magnetic resonance imaging. [18, 19]

The U.S. Preventive Services Task Force recently issued guidelines for genetic risk assessment and *BRCA 1/2* testing in women with breast and ovarian cancer susceptibility.[20] These guidelines, given a level B recommendation, state that referral for genetic counseling and consideration for BRCA screening is recommended for women at increased risk of having BRCA mutations. It is estimated that 2% of adult women in the general population meet a relatively strict definition of increased risk (2 first-degree relatives with breast cancer, 1 diagnosed at age 50 or younger; or a combination of 3 or more first- or second-degree relatives with breast cancer; or a combination of both breast and ovarian cancer among first- and second-degree relatives, or a first-degree relative with bilateral breast cancer; or a combination of 2 or more first- or second-degree relatives with ovarian cancer; or a first- or second-degree relative with both breast and ovarian cancer; or a history of breast cancer in a male relative). [18–20] However, an additional 5–6% of women are considered moderate risk for carrying a mutation, where *BRCA1/2 testing* of 1,200 women is estimated to prevent one case of breast cancer and three cases of ovarian cancer.[21]

Despite the recent developments in breast cancer risk assessment, little is known about primary care physician use of these new tools for risk assessment or their general discussion of breast cancer risk with their patients. One previous survey of primary care physicians in California investigated the use of tamoxifen and raloxifene and found that 86% of physicians said they initiate breast cancer risk reduction discussions at least half the time and 45% had referred a patient for genetic evaluation, but did not measure use of risk calculation software or ordering genetic tests. [22, 23] Thus, the objective of this study was to assess the use of breast cancer risk assessment strategies among primary care physicians and to determine whether the use of *BRCA1/2* testing and risk prediction software was associated with the provider's personal characteristics, knowledge about breast cancer risk factors, or attitudes about breast cancer risk assessment. We hypothesized that use of these new strategies for risk assessment would be greatest among primary care physicians where breast cancer risk was most salient (physicians who had a family history of breast cancer or who saw a greater proportion of women patients) and who had greater knowledge of breast cancer risk factors and more positive attitudes about breast cancer risk assessment.

METHODS

A cross-sectional, nationwide survey of a random sample of 1000 primary care physicians was conducted between June 2002 and June 2004.

Participants

A random sample of 1,000 primary care physicians from obtained from the American Medical Association (AMA) Masterfile. The sample was stratified by primary specialty as reported in the AMA Masterfile to include an equal number of physicians whose primary practice was Internal Medicine, Obstetrics/Gynecology or Family Medicine.

Procedures

The Institutional Review Board of the University of Pennsylvania approved this study. Study subjects were mailed the questionnaire, a cover letter, and a reply envelope with prepaid postage. In the first mailing, subjects were randomized to receive either a handwritten note, a five dollar incentive, or a handwritten note and a five dollar incentive. Two subsequent mailings, including the questionnaire, cover letter and a five-dollar incentive, were mailed to non-responders. Physicians who had not responded to any of the mailings were called and offered a chance to complete the survey by phone or fax or to be mailed another packet if they agreed to complete it through the mail.

Survey Instrument

The PRECEDE model of health behavior, where behaviors are influenced by the presence or absence of predisposing, enabling and reinforcing factors, was used to guide survey development.[24, 25, 26, 27] The content areas of the questionnaire consisted of four sections: 1. Physician demographics and practice characteristics; 2. Knowledge about breast cancer risk; 3. Attitudes about breast cancer risk assessment; and 4. Physician behavior related to breast cancer risk assessment. The results of an additional survey content area related to primary care physician prescribing of tamoxifen for breast cancer prevention have been previously published. [28]

Independent Variables

To assess knowledge of breast cancer risk factors, physicians were provided seven pairs of clinical scenarios of women over 40 years of age and asked to identify the woman with the greater risk of developing breast cancer in her lifetime. Knowledge score was the proportion of the seven cases where the physician correctly identified the higher risk case in the pair. To assess attitudes about breast cancer risk assessment, the questionnaire included five items assessing beliefs that risk assessment was too time consuming, that risk assessment could increase patient anxiety, that available methods of risk assessment were not accurate enough, that many patients asked for risk information, and that risk information might make low risk women less likely to adhere to mammography screening. Response scales consisted of a 5-point Likert scale from “Strongly Agree” to “Strongly Disagree.”

Items adapted from other physician surveys were used to assess sociodemographic and practice characteristics including the number of primary care physicians in the practice, the average number of patients seen a week by the physician responding to the survey, medical school affiliation, and the year of graduation from medical school.[29] We also asked whether any family member had been diagnosed with breast cancer and if so, which family member.

Outcome Variables

The questionnaire measured the frequency at which physicians had used any software programs to calculate breast cancer risk, ordered or referred a patient for *BRCA1/2* testing and discussed breast cancer risk factors in the previous 12 months. Response scales for frequency of use questions were on a 5-point numerical scale that consisted of 0, 1–6, 7–12, 12–24 and >24 times. Because very few physicians had performed these behaviors multiple times, these responses were collapsed into zero vs one or more.

Statistical Analysis

STATA SE version 8.0 was used to conduct all the statistical analyses. Descriptive statistics were calculated for physician and practice characteristics. Bivariate statistics using chi-square and t-tests were calculated to determine the relationship between physician characteristics, practice characteristics, physician knowledge of and attitudes towards breast cancer risk assessment and each of the three outcome variables: discussion of breast cancer risk factors, use of software program to calculate breast cancer risk, and use of *BRCA1/2* testing. Logistic regression was used to adjust the associations between independent variables and the outcome variables (as dichotomous variables) for potential confounding and effect modification. Separate regression models were fit for each of the outcome variables. Covariates were selected based on *a priori* hypothesis deduced from our theoretical model or on a significant bivariate relationship. Each model adjusted for the known physician demographic and practice characteristics.

RESULTS

Of the original sample of 1,000 physicians, 248 physicians who had incorrect addresses, were no longer practicing, were not a primary care physician, had no female patients, or had died and were excluded. Twenty-six subjects refused to participate. Of the remaining 726 questionnaires, 383 surveys were received after all attempts to recover the surveys. After excluding 32 incomplete surveys, a total of 351 questionnaires were available for analysis. The response rate was therefore 48.3%. Responders did not differ significantly from non-responders in gender, region of the country, specialty or type of degree (MD vs. DO). However, responders had graduated from medical school more recently than non-responders ($p< 0.01$).

The demographic and practice characteristics of the participating physicians are listed in Table 1. The mean age was 45.6 years and just over two-thirds were male. Forty-one percent practiced family practice, 39% internal medicine, and 19% obstetrics and gynecology. The mean number of years since graduating from medical school was 17.2. Approximately half had an affiliation with an academic medical center. Twelve percent of physicians had a close family member (parent, sister, spouse, daughter) who was diagnosed with breast cancer. Physician use of methods of breast cancer risk assessment in the last 12 months revealed that 88% of physicians had discussed breast cancer risk with a patient in the last 12 months (26% 1–6 times, 13% 7–12 times, 13% 12–24 times and 37% >24 times), 18% of physicians had used software to calculate breast cancer risk (11% 1–6 times, 3% 7–12 times, 1% 12–24 times and 3% >24 times) and 48% of physicians had ordered or referred a patient for genetic testing for *BRCA 1/2* mutations (33% 1–6 times, 8% 7–12 times, 4% 12–24 times and 3% >24 times) in the last 12 months (Table 1). No physicians had used software to calculate breast cancer risk without discussing breast cancer risk and only 5 physicians had ordered or referred for genetic testing without reporting have discussed breast cancer risk factors.

The associations between physician and practice characteristics and breast cancer risk assessment strategies are shown in Table 1. Physician specialty was significantly associated with use of risk software and use of *BRCA1/2* testing with higher rates among obstetrician

gynecologists than internists or family practitioners. Physician specialty was also correlated with discussion of risk factors however the association did not reach statistical significance. The number of primary care providers in the practice was significantly associated with discussion of breast cancer risk factors and there was a trend towards an association with use of *BRCA1/2* testing. In addition, having a family member with breast cancer was associated with use of software to calculate risk. Not surprisingly, use of each of these breast cancer risk assessment strategies increased with the average number of patients seen per week.

Knowledge of breast cancer risk factors was significantly higher among physicians who had used risk assessment software (mean knowledge score 0.71 for users vs. 0.65 for non-users; $p<0.01$), but was not associated with having discussed breast cancer risk or with having ordered genetic testing for *BRCA 1/2* mutations (Table 2). The belief that many patients asked for risk information was higher among physicians who had discussed breast cancer risk ($p<0.01$), but was not significantly associated with use of software. None of the other attitudes were associated with use of the breast cancer risk assessment strategies.

The results of the multivariate logistic regression models are shown in Table 3. Physician specialty remained strongly associated with each of the breast cancer risk assessment strategies, with greater odds among obstetrician-gynecologists than internists or family practitioners (OR 3.35; 95%CI 1.01–11.13 for discussion of risk factors; OR 5.37; 95% CI 2.54–11.55 for use of software and OR 2.36 95% CI 1.24–4.49 for use of *BRCA1/2* testing). Being in solo practice was inversely associated with discussion of risk factors and use of *BRCA1/2* testing use (OR 0.14; 95%CI 0.04–0.56 for discussion of risk factors; OR 0.27; 95% CI 0.07–0.96 for use of *BRCA1/2* testing). There was a trend to an inverse association with use of risk software but it did not meet statistical significance. In addition, use of breast cancer risk software was associated with greater knowledge of breast cancer risk factors (OR 4.57; 95% 1.17–17.08) and having a family member with breast cancer (OR 2.49, 95% CI 1.27–6.32), while discussion of breast cancer risk factors was associated with having patients who asked for information about breast cancer risk (OR 24.60, 95% CI 3.23–188.94).

DISCUSSION

Primary care physicians play a critical role in the identification of women at high risk for breast cancer and can provide a bridge to interventions that estimate and reduce risk. [22, 23, 28, 29] The tools and rationale for breast cancer risk assessment in primary care have grown substantially over the last ten years. However, relatively little is currently known about the practice of breast cancer risk assessment in primary care. This study has several important new findings that have implications for breast cancer control.

First, diffusion of breast cancer risk assessment strategies varies substantially. The great majority of primary care physicians have discussed breast cancer risk with patients in the past year, half have ordered or referred a patient for *BRCA1/2* testing and fewer than a fifth have used software programs to calculate risk. Diffusion studies have shown that the distribution of individuals, based on the time of adoption of an innovation, generally follows a normal bell curve and can be separated into five categories: innovators (the first 2.5% of individuals to adopt an innovation), early adopters (the next 13.5%), early majority (the next 34%), late majority (the next 34%) and laggards (the last 16% to adopt, if the innovation successfully diffuses through the population). [30] Based upon our data, it appears that use of risk software in women's health remains confined to innovators and early adopters, whereas use of *BRCA1/2* counseling and testing has diffused to the early majority. Diffusion theory suggests that the probability that these technologies will eventually diffuse throughout primary care physicians depends, in part, on whether the early adopters take on the role of opinion leaders

in this area as well as the intrinsic value and characteristics of these technologies and local environmental characteristics. [30–34]

While diffusion theory can provide some guidance in interpreting these data, it is important to recognize that consideration of *BRCA1/2* testing is currently recommended for a relatively small proportion of women and that patient preferences are an important determinant of appropriate testing use. As many more physicians discuss risk than refer for genetic testing, it is possible that the relatively lower rate of referral for genetic testing is related to patient decisions following risk discussions. Furthermore, providers may be making trade-offs between the different strategies for risk assessment, preferring to discuss risk factors in the office without incurring additional cost to undertaking the cost and potential complications of genetic testing. While it is likely that most full time primary care providers will have patients in their panels who meet criteria for *BRCA1/2* testing, decisions about genetic testing are complex and there is no gold standard for the desired rate of testing among high risk women.

Second, physicians who have adopted novel breast cancer risk assessment strategies differ in several ways from their peers. Obstetrician gynecologists appear to have adopted these strategies more rapidly than either internists or family practitioners, perhaps because a greater proportion of their care is related to women's health making breast cancer more salient in their decision making. Early adopters of risk software are more likely to have a family member with breast cancer, another factor that may increase the salience of breast cancer to the individual physician. This finding echoes an earlier survey of California primary care providers that found physicians were more likely to have referred a woman for genetic counseling if they had more cases of breast cancer in their practice. [23, 35]

The strengths of this study are that it sampled a nationally representative sample of primary care physicians. The limitations of this study include the relatively low response rate of 49%, despite multiple mailings and reminders. Although this response rate is close to the average response rate of 54% (standard deviation of 17%) found in a 1997 review of physician surveys published in medical journals, non-responders may have differed from responders in ways that may have influenced our results. [37–39] While this overestimation is likely to be lower for breast cancer risk assessment behaviors because there are no mandates for its performance in primary care practice (in contrast to cancer screening), we did not have the means to confirm physician practice patterns. Several factors that may have influenced adoption were not included in our survey and their influence on the use of risk assessment could not be determined. In particular, the availability of computers and use of an electronic medical record may be important determinants of the use of software programs to calculate risk. Finally, the measures used in this study were developed specifically for this study and we lack of formal psychometric information for the instrument.

Despite these limitations, this study provides new insights into the use of breast cancer risk assessment by primary care physicians. As tools for breast cancer prevention continue to be developed, the diffusion of breast cancer risk assessment into primary care has gained increasing clinical importance.[40] This study demonstrates that current adoption appears to be largely related to the personal salience of breast cancer and practice characteristics, rather than attitudes about the strengths and limitations of current risk assessment methods. Strategies to increase the use of breast cancer risk assessment may need to focus on increasing the salience of breast cancer risk in primary care practice and on developing tools and systems that can support the use of these tools among diverse practice sites. Ongoing research into better methods of breast cancer screening and prevention as well as the identification of new genetic and environmental risk factors are likely to change the paradigm of breast cancer risk reduction in primary care. These developments may serve to increase the salience of breast cancer risk assessment to the average primary care provider but they must also be accompanied by

strategies and tools to facilitate their efficient incorporation into primary care practice if they are to reach their full potential in reducing breast cancer mortality.

Acknowledgments

Dr. Guerra acknowledges the National Cancer Institute (Grant K01-CA97925) and the Robert Wood Johnson Foundation Amos Medical Faculty Development Award (Grant 051895). Dr. Armstrong acknowledges the Robert Wood Johnson Foundation Generalist Physician Faculty Scholar Award and the American Cancer Society Research Scholar Grant (Grant 104351). The sponsors did not play a role in the design or conduct of this study or preparation of this manuscript. Drs. Guerra and Armstrong had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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Table 1

Physician and practice characteristics and use of methods of breast cancer risk assessment strategies in last 12 months

		Discussed breast cancer risk factors			Used software to calculate breast cancer risk			Ordered or referred for BRCA1/2 testing		
	Overall N (%)	Yes N=312 (88%)	No N=39 (12%)	p-value	Yes N=63 (18%)	No N=288 (82%)	p-value	Yes N=168 (48%)	No N=182 (52%)	p-value
Physician Characteristics										
Age, mean (SD)	45.6 (11.7)	45.5 (11.4)	45.5 (13.7)	0.99	46.1 (11.0)	45.3 (11.8)	0.63	46.0 (11.8)	44.9 (11.5)	0.14
Male	240 (68)	207 (66)	31 (80)	0.10	63 (46)	288 (45)	0.20	112 (67)	126 (69)	0.64
Specialty				0.08			<0.01			0.01
Family Practice	144 (41)	132 (42)	12 (31)		17 (27)	127 (44)		66 (39)	78 (43)	
Internal Medicine	140 (39)	118 (38)	22 (56)		17 (27)	123 (43)		59 (35)	80 (44)	
OB/Gyn	67 (19)	62 (20)	5 (13)		29 (46)	38 (13)		43 (26)	24 (13)	
Years since medical school graduation, mean (SD)	17.2 (12.0)	17.1 (11.7)	17.1 (13.9)	0.99	19.1 (11.7)	16.7 (12.0)	0.15	17.6 (12.0)	16.6 (11.9)	0.41
Affiliated with medical school	160 (48)	140 (47)	20 (56)	0.33	33 (55)	127 (46)	0.22	81 (48)	79 (43)	0.21
Family member with breast cancer	42 (12)	39 (13)	3 (8)	0.38	13 (22)	29 (10)	0.01	23 (14)	19 (10)	0.35
Practice Characteristics										
Number of other PCPs in Practice				<0.01			0.55			0.06
0	16 (5)	10 (4)	6 (19)		1 (2)	15 (6)		4 (3)	12 (8)	
1	57 (18)	53 (19)	4 (13)		8 (14)	48 (19)		82 (54)	74 (47)	
2 to 5	100 (32)	98 (35)	2 (7)		20 (36)	80 (32)		33 (22)	31 (31)	
6 to 10	64 (21)	56 (20)	8 (26)		11 (20)	53 (21)		12 (8)	6 (4)	
≥11	73 (24)	63 (23)	10 (32)		16 (29)	57 (22)		20 (13)	35 (21)	
Proportion of patients covered by managed care plans				0.20			0.28			0.10
<25%	63 (23)	53 (22)	10 (39)		11 (21)	52 (24)		31 (18)	32 (24)	
25–49%	62 (23)	59 (24)	3 (12)		8 (15)	54 (25)		35 (21)	27 (25)	
50–74%	96 (36)	88 (36)	8 (31)		20 (39)	76 (35)		51 (30)	45 (32)	
75–100%	48 (18)	43 (18)	5 (19)		13 (25)	35 (16)		22 (13)	26(19)	

	Overall N (%)	Discussed breast cancer risk factors			Used software to calculate breast cancer risk			Ordered or referred for BRCA1/2 testing		
		Yes N=312 (88%)	No N=39 (12%)	p-value	Yes N=63 (18%)	No N=288 (82%)	p-value	Yes N=168 (48%)	No N=182 (52%)	p-value
Average # patients per week				0.04			0.08			0.04
<75	116 (35)	95 (33)	21 (62)		15 (25)	101 (37)		45 (27)	71 (39)	
75–99	81 (24)	78 (26)	3 (9)		15 (25)	66 (24)		41 (24)	40 (22)	
100–139	107 (32)	98 (33)	9 (27)		27 (45)	80 (30)		63 (38)	44 (24)	
≥140	28 (8)	27 (9)	1 (3)		3 (5)	25 (9)		11 (7)	7 (9)	

Table 2

Physician knowledge, attitudes and use of methods of breast cancer risk assessment strategies in last 12 months. For attitudes, the table shows the n and proportion of physicians who agree or strongly agree with the attitude statement.

		Discussed breast cancer risk factors			Used software to calculate breast cancer risk			Ordered or referred for BRCA1/2 testing		
	Overall N (%)	Yes N=312 (88%)	No N=39 (12%)	p-value	Yes N=63 (18%)	No N=288 (82%)	p-value	Yes N=168 (48%)	No N=182 (57%)	p-value
Mean knowledge score (SD)*	0.63 (0.24)	0.63 (0.26)	0.63 (0.22)	0.10	0.71 (0.25)	0.65 (0.26)	<0.01	0.65 (0.27)	0.61 (0.26)	0.20
Many patients ask for risk information	124 (35)	121 (39)	1 (3)	<0.01	17 (27)	105 (37)	0.15	65 (39)	57 (31)	0.20
Information about risk creates unnecessary anxiety for many women	48 (14)	43 (14)	5 (13)	0.39	9 (14)	39 (14)	0.98	27 (16)	21 (12)	0.21
Available methods of predicting risk are not accurate enough	46 (13)	44 (14)	2 (5)	0.09	9 (14)	37 (13)	0.53	22 (13)	24 (13)	0.99
Too time consuming to evaluate and discuss risk	37 (11)	31 (10)	6 (15)	0.20	8 (13)	29 (10)	0.70	21 (13)	15 (8)	0.17
Reluctant to use breast cancer risk assessment because a woman at low risk of breast cancer might decide not to undergo screening mammography	22 (6)	20 (6)	2 (5)	0.56	3 (5)	19 (7)	0.74	12 (7)	10 (5)	0.51

*Mean knowledge score is the mean of the proportion of correct responses.

Table 3

Adjusted association between physician demographics, attitudes, knowledge and physician's use of methods of breast cancer risk assessment. Models include all the variables in the table as well as physician age, gender and number of patients seen per week.

	Discussed breast cancer risk factors		Used software to calculate breast cancer risk		Ordered or referred for BRCA1/2 testing	
	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Specialty						
Internal Medicine (ref)	1.00		1.00		1.00	
Family Practice	1.47 (0.58 – 3.71)	0.44	0.83 (0.37 – 1.81)	0.88	0.95 (0.57 – 1,59)	0.86
OB/GYN	3.35 (1.01 – 11.13)	0.04	5.37 (2.49 – 11.55)	<0.01	2.36 (1.24– 4.49)	0.009
Solo practice	0.14 (0.04–0.56)	0.005	0.16 (0.02–1.36)	0.09	0.27 (0.07–0.96)	0.04
Family member with breast cancer	1.63 (0.41 – 6.39)	0.53	2.76 (1.27 – 5.30)	0.03	1.19 (0.59 – 2.47)	0.63
Attitudes						
Many patients ask for information about their risk of breast cancer	24.60 (3.44–195.82)	<0.01	0.83 (0.42 – 1.61)	0.37	1.52 (0.95 – 2.44)	0.08
Knowledge						
Accuracy score (one point increase)	1.23 (0.26 – 5.69)	0.77	4.57 (1.17 – 17.08)	0.03	1.82 (0.73 – 4.55)	0.20