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Demographic and Practice Characteristics of Pathologists Who Enjoy Breast Tissue Interpretation

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Summary

Physician attributes, job satisfaction and confidence in clinical skills are associated with enhanced performance and better patient outcomes. We surveyed 252 pathologists to evaluate associations between enjoyment of breast pathology, demographic/clinical characteristics and diagnostic performance. Diagnostic performance was determined by agreement with patient cases previously reviewed by a panel of experienced pathologists. Eighty-three percent of study participants reported enjoying breast pathology. Pathologists who enjoy breast interpretation were more likely to review 10 cases/week (p=0.003), report breast interpretation expertise (p=0.013), and high levels of confidence interpreting breast pathology (p<0.001). These pathologists were less likely to report that the field was challenging (p<0.001) and that breast cases make them more nervous than other types of pathology (p<0.001). Enjoyment was not associated with diagnostic performance. Millions of women undergo breast biopsy annually, thus it is reassuring that although nearly a

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fifth of practicing pathologists who interpret breast tissue report not enjoying the field, precision is not impacted.

Keywords

Breast; pathology; physician characteristics

INTRODUCTION

Research in many medical specialties has shown correlations between physician attributes, including job satisfaction and confidence in clinical skills, and better patient outcomes. For example, career satisfaction among physicians is associated with better adherence to medical treatments among their patients[1] and to higher patient satisfaction.[2] Radiologists who report high confidence in their ability to interpret mammograms have higher positive predictive values for diagnosing cancer compared to radiologists with lower confidence in their diagnostic abilities.[3] Conversely, a study among medical residency programs reported that depressed physicians had a medication error rate six times higher than their non-depressed peers[4], while physicians with low career satisfaction report more difficulties in caring for patients.[5]

Prior studies have not examined the relationship between pathologists' enjoyment of interpreting breast pathology and diagnostic precision. Diagnostic variation among individual pathologists has been clearly documented[6–8], but little is understood about sources of this variability. Because of the importance that pathologic diagnosis has on treatment decisions and patient outcomes, further investigation into potential causes for diagnostic variation is critical. An estimated 1.6 million breast biopsies are performed annually in the United States alone[9,10] heightening the importance of understanding variability. In this study we explored associations between enjoyment of breast interpretation, pathologists' demographic and clinical characteristics, and diagnostic performance using a sample of test set cases from actual patient breast biopsies. We hypothesized that pathologists who enjoy interpreting breast pathology will have higher diagnostic acumen compared to those who do not enjoy breast interpretation.

METHODS AND MATERIALS

Human Subjects Protections

The Institutional Review Boards at the University of Washington, Dartmouth College, the University of Vermont, Fred Hutchinson Cancer Research Center, and Providence Health & Services of Oregon approved all study activities. We also obtained a study-specific Certificate of Confidentiality to protect study findings from forced disclosure of identifiable information. All procedures were HIPAA compliant and the two BCSC registries that provided tissue samples have a Federal Certificate of Confidentiality and a Memorandum of Understanding to protect the identities of women, physicians, and facilities contributing data to the Breast Cancer Surveillance Consortium (BCSC).[11,12] Women enrolled in the

registries provided prior consent allowing use of their archived tissue samples in clinical studies and research programs.[11,13,15]

Study population

We invited a geographically diverse sample of pathologists who interpret breast tissue and practice in Alaska, Maine, Minnesota, New Hampshire, New Mexico, Vermont, Oregon and Washington to participate in the study. All pathologists practicing in these states who had been interpreting breast cases for at least one year before the start of the study and who planned to continue interpreting breast tissue for the next year were eligible. We excluded residents and fellows. We identified eligible pathologists through telephone calls to pathology laboratories, membership lists from professional organizations, Internet searches, or through their affiliation with the BCSC or Providence Health & Services Oregon.

Survey Content

The pathologist survey took about 10 minutes to complete and assessed clinical experience, confidence and expertise in breast pathology, professional and academic affiliations, fellowship training in surgical and breast pathology, number of years interpreting breast pathology, and percentage of caseload devoted to breast specimens. Pathologists reported how challenging they find breast cases to interpret on a 6-point scale ranging from 1 ('very easy') to 6 ('very challenging'). Similarly, we assessed confidence in assessments of breast cases using a 6-point scale from 1 ('very confident') to 6 ('not confident at all'). Finally, pathologists rated their level of enjoyment of interpreting breast pathology "Interpreting breast pathology is enjoyable" using a 6-point Likert scale. For this analyses we collapsed the Likert responses into a binary outcome of enjoy breast pathology ('strongly agree,' 'agree,' 'somewhat agree') and do not enjoy breast pathology ('strongly disagree,' 'disagree,' and 'slightly disagree').

Agreement with the reference diagnosis

After completing the survey, participants were randomly assigned to independently interpret a test set of 60 breast cases in glass-slide-only or digital-slide-only format. A 3-member panel of pathologists with expertise in breast pathology previously interpreted each test set case to determine a consensus reference diagnosis.[16] Methods for test set development have been reported elsewhere.[16] In brief, 240 breast biopsy specimens were obtained from two Breast Cancer Surveillance Consortium (BCSC) registries, a collaborative network of five geographically distinct mammography registries with linkages to breast pathology and/or tumor registries.[17] Women aged 40–49 years and women with dense breast tissue were oversampled. There was a higher percentage of atypical ductal hyperplasia (ADH) and ductal carcinoma in situ (DCIS) cases than would ordinarily be seen in routine clinical practice. Four final test sets were developed, each of which contained 60 unique patient cases.

Because the reference diagnoses were based on glass slide reviews only, we excluded the 137 pathologists who were randomized to interpret digital slides. Thus, the study sample for assessment of agreement with the references diagnosis included the 115 pathologists (of 252 or 46%) randomized to interpret glass slides.

Statistical Analysis

Descriptive statistics were used to calculate level of enjoyment, and pathologist and practice characteristics. Each study participant's interpretations of test set cases were compared to the reference diagnosis to calculate under diagnosis, over diagnosis, and misclassification rates (under diagnosis + over diagnosis) as determined by agreement with the diagnosis of the reference standard. Descriptive statistics are presented as frequencies and percentages. Chi-square tests were used to analyze categorical variables pertaining to the characteristics of level of enjoyment. Agreement with a diagnostic reference standard was entered as the dependent variable in a repeated measures generalized estimating equations (GEE) logistic regression using an independent correlation structure to calculate standard errors identifying pathologists as the independent units of analysis. Least squares means (LS-means), expressed as mean rate and 95% CI, corresponding to the level of enjoyment as the primary independent variable were calculated using unadjusted and adjusted models. Significance testing was performed using Wald statistics. Tests were two-tailed and a P-value of 0.05 was considered statistically significant. All statistical analyses were performed with SAS Version 9.3 (SAS Institute Inc., Cary, NC, USA).

RESULTS

Of the 545 pathologists invited into the study, 252 (46%) completed a baseline survey. Respondents and non-respondents did not differ significantly with respect to sex, age group, practice type, or the size of the population served (or <250,000 residents in metropolitan statistical areas).

Pathologists' characteristics and enjoyment of breast pathology

Overall, most study participants were between ages 40 and 59 years of age (70%), male (63%), not affiliated with an academic medical center (73%), and had not received fellowship training in surgical or breast pathology (51%) (Table 1). Eighty-three percent of pathologists reported that they found interpreting breast tissue enjoyable (Figure 1).

Pathologists' age, gender, fellowship training, academic affiliation and years of pathology experience did not differ according to self-reported level of enjoyment interpreting breast pathology. Pathologists who enjoy breast case interpretation were more likely than those who do not to review 10 breast cases per week (38% vs. 13%, p=0.003), report that their colleagues considered them an expert in breast interpretation (24% vs. 7%, p=0.013), and have a higher degree of confidence in interpreting breast pathology (95% vs. 80% for rating scale 1, 2 and 3, p<0.001). Compared to pathologists who do not enjoy breast interpretation, a lower proportion of those who enjoy it reported that the field was challenging (50% vs. 80%, p<0.001), and that breast interpretation makes them more nervous than other types of pathology (35% vs. 82% p<0.001).

Agreement with the reference standard

Enjoyment was not related to diagnostic performance in our study (Table 2). The comparisons of mean rates of accuracy for the under diagnosis, over diagnosis and combined misclassification rate yielded non-significant p values (0.34, 0.14 and 0.82),

respectively. Further adjustment for demographics, training, experience and perceptions about breast pathology in generalized estimating equation (GEE) models did not significantly alter the results (data not shown).

DISCUSSION

A majority of study pathologists, who currently interpret breast tissue, reported that they enjoy breast pathology. Pathologists who enjoy breast tissue interpretation were more likely than those who do not to review more cases per week, report that their colleagues considered them an expert in breast interpretation, and have a higher degree of confidence in interpreting breast cases. Conversely, pathologists who rated their level of enjoyment as lower reported that the field was challenging and that they were more nervous about breast interpretation compared to other types of pathology.

Importantly, we found no differences in diagnostic precision according to level of enjoyment, as measured by diagnostic agreement with a rigorously established reference standard.[16] Given that an estimated 1.6 million breast biopsies are performed annually in the U.S.[9,10] it is reassuring that pathologists who do not enjoy the subspecialty of breast tissue interpretation are as precise as those who enjoy it. This finding resulted in a rejection of our a priori hypothesis that pathologists who enjoyed interpreting breast cases would have higher diagnostic accuracy as measured by correspondence with the reference standard. We based our hypothesis on published literature that indicated physician enjoyment was associated with improved patient outcomes.[4,5] While our study is the first to measure pathologists' enjoyment of breast tissue interpretation, other academic fields such as education[18], cognitive psychology[19] and sports science[20,21] have reported positive links between enjoyment of a task and enhanced performance. Considering this, it seems reasonable to investigate whether enjoyment of breast tissue interpretation is associated with diagnostic performance.

We were encouraged to find that most pathologists who currently interpret breast tissue enjoy it. Yet, as the U.S. population ages and the need for diagnostic assessments of breast cancer increases, a lack of enjoyment among even a small percentage of pathologists has the potential to contribute to future workforce shortages, both by dissuading the next generation of pathologists from specializing in breast pathology and causing current practitioners to leave the field. Workforce shortages are a concern in the field of radiology, where nearly half of radiologists report that they do not enjoy interpreting screening mammograms.[22] Our study, however, suggests that a workforce shortage in breast pathology interpretation may not be problematic. One promising development is the rapid advancement in whole slide imaging digital technology[23] for primary diagnosis. Digital technology is not yet approved by the FDA for breast interpretation, yet in the future this technology may allow individual pathologists or smaller pathology offices who cannot afford to specialize, or do not want to, the ability to outsource breast pathology to more specialized laboratories thereby lessening future work force concerns.

Strengths and Limitations

This study has a number of strengths. First, we enrolled a large study population that included community and academic pathologists in eight diverse geographic locations in the U.S., making our results more generalizeable in the U.S. We used American Medical Association data to confirm that our study population reflected pathologists nationally in regard to sex, age group, practice type, and the size of the population served (or <250,000 residents in metropolitan statistical areas). Second, we had a unique opportunity to link study participants' self-reported survey data with their diagnostic assessment on a breast pathology test set which had the consensus diagnosis of a 3-member panel of experienced breast pathologists.[16] It is difficult to develop a reference standard for a diagnostic field as subjective as breast pathology, but given the rigorous development of this test set, we feel it is as close to a reference standard as possible.[16] Third, our study is the first to measure pathologists' enjoyment of breast tissue interpretation and to the best of our knowledge the first to evaluate enjoyment for any specialty within pathology.

The study has several limitations. Pathologists who enjoy breast pathology may have been more likely to enroll in the study. Conversely, because our study offered individualized feedback and teaching in breast pathology through a tailored Continuing Medical Education (CME), a higher proportion of pathologists who do *not* enjoy breast pathology may have participated. These pathologists may be more concerned about lower performance in this growing and necessary subspecialty and enrolled because of the extra education offered through the study. Second, the assessment of enjoyment was based on one self-reported measure "Do you enjoy interpreting breast pathology." Standardized job and detailed task satisfaction scales were too lengthy for our survey and may have led to different results. However, personal enjoyment of a task is wholly subjective, making the pathologists self-report the most valid measure. Despite these limitations, some potentially important findings emerged regarding physicians' demographic and practice characteristics and their enjoyment of breast pathology.

In conclusion, a majority of pathologists who currently interpret breast cases enjoy this sub-specialty. Several key demographic and clinical characteristics were associated with enjoyment, yet we found no relationship between enjoyment and diagnostic performance. Reassuringly, although nearly a fifth of pathologists who interpret breast tissue do not enjoy it, their performance does not differ from their peers.

Acknowledgments

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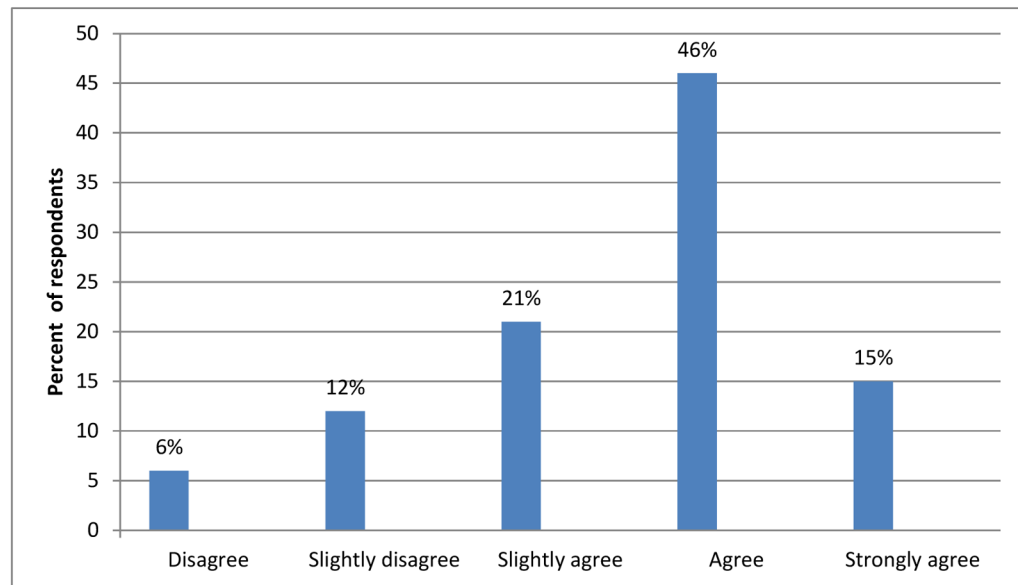
Figure 1. Responses of pathologists (n=252) to the survey question "I enjoy interpreting breast pathology"[a]

[a]No responses in "strongly disagree" category.

Table 1

Characteristics of pathologists responding to the pathologists survey (N=252), by self-reported enjoyment of interpreting breast pathology

	Interpreting breast pathology is enjoyable		
Participant Characteristics	**Agree[a] n (%)**	**Disagree[a] n (%)**	**p-value[b]**
Total	208 (82.5)	44 (17.5)	
Demographics			
Age at Survey(yrs)			
30–39	24 (11.5)	8 (18.2)	0.19
40–49	70 (33.7)	17 (38.6)	
50–59	74 (35.6)	16 (36.4)	
60+	40 (19.2)	3 (6.8)	
Gender			
Male	132 (63.5)	27 (61.4)	0.79
Female	76 (36.5)	17 (38.6)	
Training & Experience			
Fellowship training in surgical or breast			
No	101 (48.6)	28 (63.6)	0.069
Yes	107 (51.4)	16 (36.4)	
Affiliation with academic medical center			
No	150 (72.1)	33 (75.0)	0.70
Yes	58 (27.9)	11 (25.0)	
No. Breast cases (per week)			
< 5	41 (19.7)	16 (36.4)	0.003
5–9	87 (41.8)	22 (50.0)	
10	80 (38.4)	6 (13.6)	
Do your colleagues consider you an expert in breast pathology?			
No	159 (76.4)	41 (93.2)	0.013
Yes	49 (23.6)	3 (6.8)	
Breast pathology experience (yrs)			
< 10	70 (33.7)	20 (45.5)	0.17
10–19	73 (35.1)	16 (36.4)	
20	65 (31.3)	8 (18.2)	
Perceptions about Breast Pathology			
How confident are you interpreting breast			
High confidence (1,2,3)	198 (95.2)	35 (79.5)	<.001
Low confidence (4,5,6)	10 (4.8)	9 (20.5)	
How challenging is breast pathology?			
Easy (0,1,2)	105 (50.5)	9 (20.5)	<.001
Challenging (3,4,5)	103 (49.5)	35 (79.5)	

| **Interpreting breast pathology is enjoyable** | | |
Participant Characteristics	**Agree**[a] **n (%)**	**Disagree**[a] **n (%)**	**p-value**[b]
Breast pathology makes me more nervous than other types of pathology			
No	135 (64.9)	8 (18.2)	<.001
Yes	73 (35.1)	36 (81.8)	

[a]Dichotomized responses for enjoyment are defined as Likert responses 'slightly agree', 'agree' and 'strongly agree' and no enjoyment defined as Likert responses 'strongly disagree', 'disagree' and 'slightly disagree'.

[b]p-value for agree vs disagree from the Chi-square test.

Table 2

Unadjusted over diagnosis, under diagnosis and misclassification rates as measured by agreement with reference standard (n=115).

Interpreting breast pathology is enjoyable[a]			
Agreement with Reference Standard	**Agree (n=93)**	**Disagree (n=22)**	**p-value** [b]
Over Diagnosis[c]	0.09 (0.08 – 0.11)	0.12 (0.09 – 0.15)	0.14
Under Diagnosis[c]	0.15 (0.14 – 0.17)	0.13 (0.10 – 0.17)	0.34
Misclassification Rate[c] [d]	0.25 (0.23 – 0.26)	0.25 (0.22 – 0.29)	0.82

[a]Analyses based on a collapsed 6-point Likert scale. No responses in "strongly disagree" category.

[b]Probability > Chi-square, Wald Statistics for Type 3 GEE Analysis.

[c]Least squares means (LS Means) expressed as mean rate and 95% CI.

[d]Misclassification rate defined as arithmetic sum of under diagnosis + over diagnosis.