Improving Work-Up of the Abnormal Mammogram Through Organized Assessment: Results From the Ontario Breast Screening Program

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Abstract

Purpose: Women with an abnormal screening mammogram should ideally undergo an organized assessment to attain a timely diagnosis. This study evaluated outcomes of women undergoing work-up after abnormal mammogram through a formal breast assessment affiliate (BAA) program with explicit care pathways compared with usual care (UC) using developed quality indicators for screening mammography programs.

Methods: Between January 1 and December 31, 2007, a total of 320,635 women underwent a screening mammogram through the Ontario Breast Screening Program (OBSP), of whom 25,543 had an abnormal result requiring further assessment. Established indicators assessing timeliness, appropriateness of follow-up, and biopsy rates were compared

between women who were assessed through either a BAA or UC using χ^2 analysis.

Results: Work-up of the abnormal mammogram for patients screened through a BAA resulted in a greater proportion of women attaining a definitive diagnosis within the recommended time interval when a histologic diagnosis was required. In addition, use of other quality measures including specimen radiography for both core biopsies and surgical specimens and preoperative core needle biopsy was greater in BAA facilities.

Conclusion: These findings support future efforts to increase the number of BAAs within the OBSP, because the pathways and reporting methods associated with them result in improvements in our ability to provide timely and appropriate care for women requiring work-up of an abnormal mammogram.

Introduction

An estimated 23,400 Canadian women were diagnosed with breast cancer in 2011, of whom 5,100 will ultimately die as a result of the disease.¹ Screening mammography has been shown to reduce mortality from breast cancer in several randomized controlled trials,²⁻⁵ which has led to the development of organized breast screening programs around the world. Current Canadian guidelines recommend women age 50 to 69 years participate in an early detection program operated through a dedicated screening center. Although the majority of women participating in screening mammography will have a normal result, approximately 10% of these women will have an abnormal test requiring further diagnostic work-up or assessment.^{6,7} It is also recommended that an abnormal mammogram be followed up through an effective referral system or organized pathway.^{8,9} Typically, the patient and her primary care physician are notified of the abnormal result, and the primary care physician subsequently organizes any referrals and recommended tests to achieve a diagnosis. More recently, there has been evidence to suggest organized assessment through facilitated referral operating independently from the primary care provider can lead to improved and timely follow-up.¹⁰

The need for measurement of quality in mammography screening programs is well established.⁷ After a 1997 national workshop on organized breast cancer screening in Canada, the Working Group on the Integration of Screening and Diagnosis was convened to assess the patterns and timeliness of diagnosis

after an abnormal breast screening result. The findings from this work revealed wide variation in the diagnostic interval (time from the abnormal screen to resolution) across the country.⁹ On the basis of these findings and a review of the evidence around the physical and psychosocial implications of a delay in diagnosis,¹¹⁻¹⁴ the working group proposed a set of timeliness targets that were adopted by the Canadian Breast Cancer Screening Initiative in 1999⁹ and included benchmark targets for diagnostic intervals. For example, 90% of women who are found to have an abnormal screening mammogram should have a final diagnosis at 5 weeks, or 7 weeks if an open biopsy is needed.¹⁵

Although organized assessment to work-up cases of women with an abnormal mammogram is clearly recommended, the benefits of such assessment on quality indicators (eg, wait times) remains unclear. A Canadian study compared wait times of fast-track work-up with usual care (UC), but it has never been shown that organized assessment is superior to UC in attaining other quality indicator targets.¹⁶

The Ontario Breast Screening Program (OBSP) is an organized provincial screening program established in 1990 that screens asymptomatic women 50 years of age and older with bilateral two-view mammography through self or physician referral. In 2004, the OBSP introduced the Breast Assessment Initiative, which provides incentives for the establishment of breast assessment affiliates (BAAs) to coordinate care during the diagnostic interval through a formal, defined pathway. The OBSP, in collaboration with the Ontario Breast Assessment

Collaborative Group (OBACG), recognized the need for evidence-based quality indicators for breast assessment as a reference for a high-quality screening program.¹⁵ The purpose of this study, therefore, was to measure performance of the OSBP for women undergoing work-up after an abnormal mammogram through the BAA program compared with UC using developed quality indicators for timeliness, appropriateness of follow-up, and biopsy rates.

Methods

Quality Indicator Development

The OBACG was established in February 1998 to achieve an effective, coordinated multidisciplinary approach to breast assessment and comprises a larger stakeholder group including clinicians (surgery, pathology, radiology, nursing, family physicians), administrators, clinical managers, representatives from Cancer Care Ontario, and other stakeholders. To ensure quality assurance and high standards for the delivery of breast assessment after screening mammography, a working group of the OBACG met and developed evidence-based quality indicators that reflected best evidence from the screening literature and, when none was available, consensus from the expert group. The working group included a radiologist, epidemiologist, information system personnel, administrator, surgeon, and pathologist. Ten indicators were established to evaluate the quality of screening and assessment of women receiving mammograms through the OSBP. The final list of indicators was grouped into evaluation of timeliness, appropriateness of follow-up, and biopsy ratio measures. The precise definitions of numerator, denominator, and source of evidence for each indicator are listed in Tables 1, 2, and 3, respectively. The indicators fell under three domains:

- Timeliness indicators: time to first assessment, diagnostic interval without pathologic assessment, diagnostic interval with core biopsy, diagnostic interval with core or open biopsy/definitive surgery.
- Appropriateness of follow-up indicators: rate of diagnostic imaging, benign to malignant surgical ratio.
- Biopsy indicators: image-guided core biopsy malignancy rate, specimen radiography for needle localized surgery, specimen radiography rate for stereotactic core biopsies of microcalcifications, rate of fine-needle aspiration/core biopsy use in breast cancer cases.

Study Population

The study population included all women age 50 to 69 years who attended the OSBP between January 1, 2007, and December 31, 2007, for a screening mammogram and had an abnormal result. A woman is eligible for screening if she is an Ontario resident, has no acute breast symptoms, has no history of breast cancer, and does not currently have breast implants. A complete description of the details of the operation of the OSBP has been previously published.⁶

In 2004, the OSBP, with guidance from the OBACG, introduced the Breast Assessment Initiative, which provided in-

centives for facilities to establish care during the diagnostic interval according to Canadian Association of Radiologist standards, in addition to offering multidisciplinary expertise (radiologic biopsy and surgical support) and patient navigation to facilitate the patient's experience through her work-up. Facilities that qualify are designated BAAs and serve to provide work-up of an abnormal mammogram through a formal, defined pathway without requiring a specific referral from the patient's primary care physician, with the aim of providing high-quality timely care during the diagnostic interval. Results and outcomes of the work-up are relayed to the primary care provider throughout the process.

Any center with a BAA designation must meet established criteria for high-quality breast assessment in addition to availability of radiologists and facilities for core biopsy, including a designated patient navigator and an agreement to report results of assessment according to set standards. Each BAA may either perform all the services required for breast work-up or establish pathways with other facilities to provide the additional services as necessary. One of the primary goals of the BAA process is seamless organization of additional tests without the need for re-referral for the recommended investigations from the primary care physician. Work-up of abnormal mammograms outside of BAAs occurred through the UC pathway; results of the abnormal screening mammogram are sent to the patient's primary care physician, who then initiates and coordinates further arrangement of appropriate tests or consultations. During the study period, there were 125 OSBP screening centers providing screening mammography and 25 designated BAAs.

Data Collection

Data used in this study were obtained from the Integrated Client Management System, a database maintained by Cancer Care Ontario of routinely collected data on all women screened within the OSBP as reported by each OSBP screening center. Details of the assessment procedures and their outcomes after abnormal mammograms are collected through copies of reports provided to the screening centers or obtained from family physicians. Variables collected include additional tests (recall mammograms, ultrasounds), any procedures (core or fine-needle biopsy, surgical biopsy), and final results of assessment (negative, recall imaging, or histology). Information on the total number of abnormal screening mammograms, total number of screen-detected cancers, and total number of benign or non-breast cancer malignancies was also collected for the study period. After an abnormal mammogram, further evaluation of the patient occurred by one of two methods: organized assessment through a BAA or UC organized by the patient's primary care provider.

Statistical Analysis

Quality indicators of abnormal mammogram work-up from BAA and UC were compared using the χ^2 test. All analyses were performed using SAS 9.1 (SAS Institute, Cary, NC). A *P* value less than .05 was considered statistically significant for all tests.

Table 1. Timeliness Indicators

Indicator	Definition	Target	Purpose
Time to first assessment	Total duration from abnormal screen to first assessment	≥ 90% within 3 weeks (first assessment date to screening date ≤ 21 days)	Time to first assessment can be an indicator of communication and facilitated referral from the screening center to assessment center; it is the initial part of a desired expeditious work-up
Diagnostic interval without histologic tissue biopsy (without core biopsy)	Total duration from abnormal screen to resolution of abnormal screen	≥ 90% within 5 weeks without histologic tissue biopsy (diagnosis to screening date ≤ 35 days)	An abnormal screen result can induce morbidity, given the negative psychologic impact it can have on a client, even if follow-up is ultimately negative; work-up should be completed expeditiously
Diagnostic interval with core biopsy	Total duration from abnormal screen to diagnosis	≥ 90% within 6 weeks with core biopsy (diagnosis to screening date ≤ 42 days)	An abnormal screen result can induce morbidity, given the negative psychologic impact it can have on a client, even if follow-up is ultimately negative; work-up should be completed expeditiously
Diagnostic interval with core or surgical biopsy (excludes treatment/re-excision surgery or nodal assessment)	Total duration from abnormal screen to diagnosis	≥ 90% within 7 weeks with core or surgical biopsy (diagnosis to screening date ≤ 49 days)	An abnormal screen result can induce morbidity, given the negative psychologic impact it can have on a client, even if follow-up is ultimately negative; work-up should be completed expeditiously

Table 2. Appropriateness of Follow-Up Indicators

Indicator	Definition	Numerator	Denominator	Target	Purpose
Rate of diagnostic imaging	Percentage of abnormal screening mammograms that are followed by diagnostic breast imaging	Abnormal screens referred by the screening radiologist that had either an ultrasound or special views performed in assessment; assessment imagery was not necessarily performed on the referred breast	Total abnormal screens referred by the screening radiologist	> 95%	When an abnormality is detected on screening mammography, radiologic work-up is needed to determine its significance; diagnostic mammograms and ultrasounds clarify the abnormalities
Benign-to-malignant surgical biopsy ratio (excludes treatment surgery, re-excision surgery, and nodal assessment [sentinel or axillary])	Among breast surgeries, the ratio of the number of benign patient cases to the number of malignant cancers*	Benign cases are those involving surgery in which the final result is benign or other cancer (any cancer that is not a primary malignant breast cancer)	Malignant cancer cases are those involving surgery in which the final result is primary malignant breast cancer	≤ 1:1	Benign-to-malignant surgical ratios provide an indication of the quality of presurgical assessment; diagnostic specificity and sensitivity are reciprocal; thus, there is a limit to the extent to which core biopsy ratios can be improved; this indicator is most meaningful when considered in relation to the underlying breast cancer incidence and post-screen-detected cancer rates

* Abnormal screens with a final result of lost/unknown are not included.

Results

A total of 320,635 eligible women were screened during the study period, of whom 25,543 (8%) had an abnormal mammogram and comprised the final study cohort. Of these 25,543 patients, 10,011 (39%) underwent their work-up through a BAA, and work-up for the remaining 15,532 (61%) women was initiated and organized by their primary care physician (UC). Overall, during the study time period, a total of 1,537 cancers were detected; 1,278 were invasive, and 289 were non-invasive.

Timeliness Indicators

There was no difference between BAA and UC for the percentage of patients undergoing their first recall examination within 3 weeks (72.1% *v* 71.4%; *P* = .2). A greater percentage of patients (83.0%) undergoing their work-up through UC obtained a final diagnosis within the target timeframe of 5 weeks if a biopsy was not required (ie, recall imaging resolved the abnormality) compared with BAA patients (78.8%). For patients requiring a core or surgical biopsy, those evaluated through a BAA (59.9%) were significantly more

likely to have achieved a diagnosis within 7 weeks compared with UC patients (50.6%).

Appropriateness of Follow-Up Indicators

The percentage of abnormal screening mammograms followed by diagnostic breast imaging was similar between groups (99.8% *v* 99.6%; *P* = .02). The benign-to-malignant ratios for either open surgical or image-guided core biopsy (65.9% *v* 65.8%; *P* = .9 and 33.8% *v* 34.8%; *P* = .48) were the same.

Biopsy Indicators

Specimen radiography rates for stereotactic core biopsies of calcifications as well as surgical biopsies requiring wire localization were higher for BAA patients (93.5% and 79.7%, respectively) compared with UC patients (71.5% and 73.4%, respectively). The use of preoperative needle biopsy (core or fine-needle aspiration) among patients with malignancy was also significantly greater for patients undergoing work-up through a BAA (92.2% *v* 88.6%; *P* = .016; Table 2).

Table 3. Biopsy Indicators

Indicator	Definition	Numerator	Denominator	Target	Purpose
Image-guided core biopsy malignancy rate	Percentage of image-guided core biopsies found to have primary malignant breast cancer	Number of ultrasound- or stereotactic-guided core biopsies in which the procedure result was primary malignant breast cancer	Number of ultrasound- or stereotactic-guided core biopsies (all core biopsies included)	25% to 45%	This image-guided core biopsy malignancy rate is desirable to minimize the number of unnecessary biopsies while still detecting early cancers
Specimen radiography rate for needle localized surgeries	Percentage of specimens radiographed when needle localization is used for surgery (surgical biopsy, treatment surgery, re-excision surgery, or nodal assessment [sentinel or axillary])	Number of surgeries that used needle localization in which the tissue was radiographed	Total number of surgeries that used needle localization	≥ 85%	High specimen radiography rate for needle localized surgeries on nonpalpable breast lesions is required to confirm that the imaged abnormality in question has been removed; for mammographically guided needle localizations, 100% is expected
Specimen radiography rate for stereotactic core biopsies or microcalcifications	Percentage of specimens radiographed for stereotactic core biopsies for abnormal mammograms with microcalcifications	Number of stereotactic core biopsy procedures performed on a breast referred by the reading radiologist for microcalcifications in which the tissue was radiographed	Number of stereotactic core biopsy procedures performed on a breast referred by the reading radiologist for microcalcifications	100%	All specimens resulting from such biopsies should be radiographed to ensure the diagnosis is accurate, and there has not been a sampling error; presence of calcifications in the specimen should be indicated to the pathologist
Rate of fine-needle aspirations/core biopsy use in breast cancers	Among primary malignant breast cancers, percentage of fine-needle aspirations/core biopsies performed before surgery (surgical biopsy, treatment surgery, re-excision surgery, or nodal assessment [sentinel or axillary])	Screens with a fine-needle aspiration or core biopsy before any surgery in which the final result was primary malignant breast cancer	Screens with surgery in which the final result was primary malignant breast cancer	> 90%	An increased use of fine-needle aspirations/core biopsies can help ensure only those women with breast cancer undergo invasive breast surgery and will decrease the number of double surgeries

Discussion

To our knowledge, this article is the first to describe the OBSP experience with organized assessment using BAAs compared with UC using quality indicators developed by the OBACG. Improving the quality and timeliness of assessment after mammographic screening is of paramount importance as increasing emphasis is placed on improvements in cancer diagnosis and treatment. Overall, the quality of care received by patients evaluated through a BAA was greater than those evaluated outside of the program across the three measurement domains of timeliness, appropriateness of follow-up, and biopsy indicators.

Timeliness Indicators

The target of fewer than 3 weeks for the first recall examination after an abnormal mammogram was achieved in approximately three quarters of patients, irrespective of evaluation pathway. Although there was no difference in the percentage of first recall examinations occurring within 3 weeks of the initial screen, women requiring further imaging for diagnosis without a biopsy obtained resolution sooner through UC than through a BAA, by an average of 5 days. This suggests that the processes for recall examination communicated to family physicians through the UC are quite efficient. Some UC facilities have facilitated referral practices that permit the initial subsequent diagnostic imaging examination to be performed as an extension of the initial examination, without formal request by the primary care physician. This may be influential in improving timeliness. In contrast, the Screening Mammography Program of British Columbia fast-track referral resulted in a 9-day reduction in time to first assessment after abnormal screen.¹⁶ The exact reasons for the discrepancy in findings are difficult to

determine, given the variety of methods that the BAAs in our study used to attain a diagnosis. Further evaluation of the specific pathways associated with recall examinations in the UC pathway is warranted to identify key processes in timely resolution of abnormal mammograms. If facilitated referral with preauthorized autonomy given to the radiologists in organizing recommended examinations is an influential factor, this could be advocated provincially to improve timeliness for all UC patients.

Patients requiring a histologic diagnosis (core or surgical biopsy) were more likely to have their biopsy within the recommended 7 weeks through a BAA compared with UC patients (50.6% *v* 59.9%). This diagnostic interval has remained constant through the UC pathway, with 50.2% of patients having a diagnosis within the targeted 7 weeks between 1991 and 2000.⁶ This represents a 20% improvement in achieving more timely resolution of mammographically identified abnormalities requiring biopsy through the BAA pathway compared with UC. Identifying the precise element of the BAA that may be critical in reducing wait times to diagnosis is difficult, given that the BAAs are not restricted in their methods of providing organized assessment; therefore, the reduction in wait times may be attributable to a variety of local patterns and resources. The need for a biopsy adds a layer of complexity that requires the involvement of radiology, pathology, and, in the case of surgical biopsy, surgeon and operating room availability. The difference between assessment through a BAA and UC persisted even when patients requiring surgical biopsy were excluded, with 60.3% of patients obtaining a diagnosis within 6 weeks through BAA compared with 48% through UC (*P* < .001). It is intuitive that direct scheduling of patients for a biopsy after an abnormal mammogram would reduce wait times by eliminating

the time needed for a new requisition to be submitted and an appointment scheduled. Beyond the omission of requiring a separate referral to be provided, a number of other factors inherent to facilities accredited as BAAs are likely to increase the likelihood of timely resolution of mammographic abnormalities. A variety of models exist within the OBSP allowing for adaptation to the local resources and infrastructure within a given community. Some facilities provide comprehensive diagnostic services in addition to image-guided biopsy procedures and surgical consultation at a single site. In one example, urgent biopsy slots are held open each day to allow for timely recall of patients with abnormal screens, mitigating the delay resulting in scheduling a biopsy once deemed necessary. In other models, a network of imaging facilities may funnel recall examinations requiring intervention to a central site that provides biopsy procedures within the same group of radiologists, obviating the need for possible rereading of films performed elsewhere.

The mandate for a relationship with pathology as well as surgical services may be a possible factor in the improved timelines for patients assessed via BAA. Although they involve additional practitioners and more complex organization (specimen processing, access to operating room time), it is likely that these pathways are well established and operationalized more consistently through BAAs, thereby increasing efficiency over UC, which utilizes the same resources but perhaps without the same frequency.

Appropriateness of Follow-Up

As expected, almost all of the patients who had an abnormal mammogram in both the BAA and UC groups had a subsequent diagnostic image performed. Although reaching statistical significance, the practical difference between assessment pathways was negligible (99.8% *v* 99.6%), confirming that essentially all women are receiving a recall examination and that the transfer of information required to initiate the recall examination is occurring. The benign-to-malignant ratio for women undergoing a surgical biopsy was also no different between assessment pathways and was within target, minimizing the number of unnecessary biopsies while still detecting cancers at an early stage.

Biopsy Indicators

The percentage of specimens radiographed by surgeons for needle localized surgical excision was significantly higher for patients assessed at a BAA compared with that for UC patients. This is an important process to ensure retrieval of the abnormality in question and has also been used as a quality indicator in breast surgery.¹⁷ Surgical specimen radiography may increase the negative margin rate associated with excision of biopsy-proven cancers by providing immediate feedback to the surgeon on the proximity of the imaging abnormality to the specimen margins, allowing an immediate re-excision, in addition to confirming that the lesion has indeed been removed. The percentage of core biopsy specimens being radiographed when calcifications were the indication for biopsy was significantly higher through BAAs compared with UC. The documentation of microcalcification retrieval is crucial to ensure a sampling error has not occurred.¹⁸ Reasons for lower rates of specimen radiography both of core biopsy specimens and local-

ized lesions through UC are likely multifactorial and may include lack of communication or knowledge of the importance of the step on either the radiology or surgical side.

Use of core needle as opposed to surgical biopsy has become increasingly important not only to minimize unnecessary surgery for women who ultimately have benign disease but also to facilitate surgical planning for the definitive operation at a single surgery.¹⁹ Like the specimen radiograph, use of preoperative core needle biopsy has been clearly advocated as the preferred diagnostic method of breast lesions.^{20,21} Assessment through BAAs resulted in a higher percentage of women having a preoperative core needle biopsy compared with those evaluated by UC. The mandate of having image-guided core biopsy capability through the BAA is likely a strong contributing factor, eliminating access to the procedure as a possible barrier. A study of core needle biopsy use for diagnosis of breast abnormalities in Ontario found significant variation based on factors unrelated to the indications for biopsy, including geographic region, having a primary care physician, and living in an urban setting.²² Further evaluation of the individual pathways used for each BAA is warranted to help better identify key factors in achieving improved performance measures.

Work-up of the abnormal mammogram for patients screened through a BAA resulted in a greater proportion of women attaining diagnosis within the recommended time interval when histologic diagnosis was required. In addition, use of other quality measures including specimen radiography for both core biopsies and surgical specimens and preoperative core needle biopsy for definitive diagnosis was greater through BAA facilities. Further evaluation of the specific elements responsible for achievement of the improved performance standards is warranted.

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Authors' Disclosures of Potential Conflicts of Interest

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References

1. Canadian Cancer Society: Breast cancer statistics. http://www.cancer.ca/Canada-wide/About%20cancer/Cancer%20statistics/Stats%20at%20a%20glance/Breast%20cancer.aspx?sc_lang=en
2. Kerlikowske K, Grady D, Rubin SM, et al: Efficacy of screening mammography. A meta-analysis. *JAMA* 273: 2:149-154, 1995
3. Miller AB, Baines CJ, To T, et al: Canadian National Breast Screening Study: 2. Breast cancer detection and death rates among women aged 50 to 59 years. *CMAJ* 147: 10:1477-1488, 1992
4. Tabár L, Vitak B, Chen HH, et al: The Swedish two-county trial twenty years later: Updated mortality results and new insights from long-term follow-up. *Radiol Clin North Am* 38: 4:625-651, 2000
5. Nelson HD, Tyne K, Naik A, et al: Screening for breast cancer: An update for the U.S. Preventive Services Task Force. *Ann Intern Med* 151:727-737, W237-W242, 2009
6. Chiarelli AM, Halapy E, Nadalin V, et al: Performance measures from 10 years of breast screening in the Ontario Breast Screening Program, 1990/91 to 2000. *Eur J Cancer Prev* 15:34-42, 2006
7. Paquette D, Snider J, Bouchard F, et al: Performance of screening mammography in organized programs in Canada in 1996: The Database Management Subcommittee to the National Committee for the Canadian Breast Cancer Screening Initiative. *CMAJ* 163:1133-1138, 2000
8. Reducing deaths from breast cancer in Canada. *CMAJ* 141:199-201, 1989
9. Working Group on the Integration of Screening and Diagnosis of the Canadian Breast Cancer Screening Initiative: Waiting for a diagnosis after an abnormal screen in Canada. Ottawa, Ontario, Canada, Minister of Public Works and Government Services Canada, 2000
10. Olivetto IA, Borugian MJ, Kan L, et al: Improving the time to diagnosis after an abnormal screening mammogram. *Can J Public Health* 92:366-371, 2001
11. Olivetto IA, Gomi A, Bancej C, et al: Influence of delay to diagnosis on prognostic indicators of screen-detected breast carcinoma. *Cancer* 94:2143-2150, 2002
12. Rimer BK, Bluman LG: The psychological consequences of mammography. *J Natl Cancer Inst Monogr* 22:131-138, 1997
13. Brett J, Austoker J, Ong G: Do women who undergo further investigation for breast screening suffer adverse psychological consequences? A multi-centre follow-up study comparing different breast screening result groups five months after their last breast screening appointment. *J Public Health Med* 20:396-403, 1998
14. Hislop TG, Harris SR, Jackson J, et al: Satisfaction and anxiety for women during investigation of an abnormal screening mammogram. *Breast Cancer Res Treat* 76:245-254, 2002
15. Evaluation Indicators Working Group: Guidelines for monitoring breast screening performance. Ottawa, Ontario, Canada, Health Canada, 2002
16. Borugian MJ, Kan L, Chu CC, et al: Facilitated "fast track" referral reduces time from abnormal screening mammogram to diagnosis. *Can J Public Health* 99:252-256, 2008
17. Clifford EJ, De Vol EB, Pockaj BA, et al: Early results from a novel quality outcomes program: The American Society of Breast Surgeons' Mastery of Breast Surgery. *Ann Surg Oncol* 17:233-241, 2010 (suppl 3)
18. Canadian Association of Radiologists Standards: Breast interventional. http://www.car.ca/uploads/standards%20guidelines/breast_imaging.pdf
19. McCready D, Holloway C, Shelley W, et al: Surgical management of early stage invasive breast cancer: A practice guideline. *Can J Surg* 48:185-194, 2005
20. Olaya W, Bae W, Wong J, et al: Are percutaneous biopsy rates a reasonable quality measure in breast cancer management? *Ann Surg Oncol* 17:268-272, 2010 (suppl 3)
21. El-Sayed ME, Rakha EA, Reed J, et al: Audit of performance of needle core biopsy diagnoses of screen detected breast lesions. *Eur J Cancer* 44:2580-2586, 2008
22. Holloway CM, Saskin R, Brackstone M, et al: Variation in the use of percutaneous biopsy for diagnosis of breast abnormalities in Ontario. *Ann Surg Oncol* 14:2932-2939, 2007

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