ORIGINAL ARTICLE

Challenges With Identifying Indication for Examination in Breast Imaging as a Key Clinical Attribute in Practice, Research, and Policy

Julie E. Weiss, MS[a,b], Martha Goodrich, MS[a,b], Kimberly A. Harris, MM[c], Rachael E. Chicoine, BS[d], Marie B. Synnestvedt, PhD[e], Steve J. Pyle, MSE[a], Jane S. Chen, ScB[c], Sally D. Herschorn, MD[d,f], Elisabeth F. Beaber, PhD[g], Jennifer S. Haas, MD, MS[c,i,j], Anna N. A. Tosteson, ScD[b,h], Tracy Onega, PhD, MA, MS[a,b,h], on behalf of the PROSPR (Population-based Reseach Optimizing Screening through Personalized Regimens) consortium

Abstract

Purpose: To assess indication for examination for four breast imaging modalities and describe the complexity and heterogeneity of data sources and ascertainment methods.

Methods: Indication was evaluated among the Population-based Research Optimizing Screening through Personalized Regimens (PROSPR) breast cancer research centers (PRCs). Indication data were reported overall and separately for four breast imaging modalities: digital mammography (DM), digital breast tomosynthesis (DBT), ultrasound (US), and magnetic resonance imaging (MRI).

Results: The breast PRCs contributed 236,262 women with 607,735 breast imaging records from 31 radiology facilities. We found a high degree of heterogeneity for indication within and across six data sources. Structured codes within a data source were used most often to identify indication for mammography (59% DM, 85% DBT) and text analytics for US (45%) and MRI (44%). Indication could not be identified for 17% of US and 26% of MRI compared with 2% of mammography examinations (1% DM, 3% DBT).

Conclusions: Multiple and diverse data sources, heterogeneity of ascertainment methods, and nonstandardization of codes within and across data systems for determining indication were found. Consideration of data sources and standardized methodology for determining indication is needed to assure accurate measurement of cancer screening rates and performance in clinical practice and research.

Key Words: Indication for examination, data source, digital mammography, digital breast tomosynthesis, ultrasound, magnetic resonance imaging

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INTRODUCTION

Indication for examination is a key clinical attribute used to differentiate screening examinations (for asymptomatic patients) from diagnostic examinations (for patients with symptoms or needing additional workup) to measure cancer screening rates, measure provider performance, and optimize clinical care and resource use [1,2]. Four primary imaging modalities are currently used for both breast

[a]Department of Biomedical Data Science, Geisel School of Medicine at Dartmouth, Lebanon, New Hampshire.

[b]Norris Cotton Cancer Center, Geisel School of Medicine at Dartmouth, Lebanon, New Hampshire.

[c]Division of General Medicine and Primary Care, Brigham and Women's Hospital, Boston, Massachusetts.

[d]University of Vermont and Vermont Cancer Center, Burlington, Vermont.

[e]Division of General Internal Medicine, Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania.

[f]Department of Radiology, University of Vermont, Burlington, Vermont.

[g]Division of Public Health Sciences, Fred Hutchinson Cancer Research Center, Seattle, Washington.

[h]The Dartmouth Institute for Health Policy and Clinical Practice, Geisel School of Medicine at Dartmouth, Lebanon, New Hampshire.

[i]Harvard Medical School, Boston, Massachusetts.

[j]Harvard T.H. Chan School of Public Health, Boston, Massachusetts.

Corresponding author and reprints: Julie Weiss, MS, Department of Biomedical Data Science, Geisel School of Medicine at Dartmouth, 46 Centerra Parkway, Suite 105, Lebanon, NH 03766; e-mail: julie.weiss@dartmouth.edu.

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cancer screening and diagnostic examinations: digital mammography (DM), digital breast tomosynthesis (DBT), ultrasound (US), and breast MRI. When evaluating these modalities, it is important to be able to determine if the purpose (indication) of an examination was for cancer screening or for diagnosis of a problem. Indication influences the imaging protocol used for each of the above imaging modalities and may change the radiologist's pretest probability of finding pathology [3,4]. Therefore, performance outcomes (sensitivity, specificity, positive predictive value, and cancer detection rate) are all dependent on indication.

Accurate categorization of indication has implications for research and clinical practice. Both research and clinical domains share the common need for measurement—such as imaging performance measures and screening rates—that ultimately informs national policies regarding recommendations and guidelines [5]. The ACR requires incorporating the indication to establish benchmarks and best practices [6]. Screening US is increasingly performed for dense breast tissue [7] as well as for some women with moderately elevated lifetime cancer risk [8]. Evaluation of screening US should be different from that performed for diagnostic purposes (complete or targeted) [9-11]. However, Current Procedural Terminology (CPT) codes found in billing claims for breast US and MRI do not permit discrimination between screening and diagnostic indications.

Indication data are captured using a variety of sources, including clinical data systems, billing codes, medical records, and patient intake forms. For example, radiology information systems (RIS) are routinely used in clinical practice and contain data related to specific examinations. Additionally, clinical notes—typically in text format—may capture indication. Furthermore, validated algorithms using CPT codes found in Medicare claims have been developed to determine indication for mammography, but not for other imaging modalities [12,13].

The objectives of this study were to (1) identify the data sources and indication ascertainment methods used across different health care settings with multiple facilities using a variety of clinical data systems; (2) describe the heterogeneity and complexity of indication ascertainment; and (3) report indication data by imaging modality (DM, DBT, US, and MRI). Understanding indication data sources and ascertainment will provide insight into developing consensus on standardized algorithms and inform strategies to ensure the integrity of utilization of clinical data for quality research and clinical practice.

METHODS

Study Population and Setting

This study was conducted as part of the National Cancer Institute–funded consortium Population-based Research Optimizing Screening through Personalized Regimens (PROSPR). The overall aim of PROSPR is to conduct multisite, coordinated, transdisciplinary research to evaluate and improve cancer screening processes. The PROSPR Research Centers (PRCs) reflect the diversity of United States delivery system organizations. Data used were from women undergoing breast imaging at a facility affiliated with three breast PRCs: (1) Dartmouth-Hitchcock (DH) health in the state of New Hampshire and Brigham and Women's Hospital (BWH) and affiliated practices in the state of Massachusetts; (2) the University of Pennsylvania (UPenn), located in Philadelphia, Pennsylvania; and (3) the Vermont Breast Cancer Surveillance System (VT) in Burlington, Vermont. Data were submitted to PROSPR's Statistical Coordinating Center (SCC) in September 2015.

Our descriptive study was based on a systematic review of processes used by three breast PRCs for mapping clinical data to the defined SCC indication data element. This project involved the PROSPR breast study population of those individuals who are associated with clinical provider networks eligible for screening. We described the complexity of capturing and mapping indication from a variety of data sources and systems to determine if there are common keywords/terms/codes that may characterize indication and assessed if the process and/or data used for capturing indication was global, efficient, and standardized.

The PROSPR cohort inclusion criteria and settings differed by PRC. DH-BWH included women between the ages of 30 and 89 years with a qualifying primary care visit within Brigham and Women's Primary Care Practice-Based Research Network or within Dartmouth-Hitchcock health from January 1, 2011 through September 30, 2014. DH-BWH PRC was composed of 25 primary care facilities (DH: 9; BWH: 16) and 10 radiology imaging facilities (DH: 3; BWH: 7). UPenn's inclusion criteria included women between 18 and 89 years of age with a breast cancer screening examination at one of their seven radiology imaging facilities, or women