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A Statewide Controlled Trial Intervention to Reduce Use of Unproven or Ineffective Breast Cancer Care

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Abstract

Background—Challenged by public opinion, peers and the Congressional Budget Office, medical specialty societies have begun to develop “Top Five” lists of expensive procedures that do not provide meaningful benefit to at least some categories of patients for whom they are commonly ordered. The extent to which these lists have influenced the behavior of physicians or patients, however, remains unknown.

Methods—We partner with a statewide consortium of health systems to examine the effectiveness of two interventions: (i) “basic” public reporting and (ii) an “enhanced” intervention, augmenting public reporting with a smart phone-based application that gives providers just-in-time information, decision-making tools, and personalized patient education materials to support reductions in the use of ten breast cancer interventions targeted by Choosing Wisely® or oncology society guidelines. Our aims are: (1) to examine whether basic public reporting reduces use of targeted breast cancer practices among a contemporary cohort of patients with incident breast cancer in the intervention state relative to usual care in comparison states; (2) to examine the effectiveness of the enhanced intervention relative to the basic intervention; and (3) to simulate cost savings forthcoming from nationwide implementation of both interventions.

Discussion—The results will provide rigorous evidence regarding the effectiveness of a unique all-payer, all-age public reporting system for influencing provider behavior that may be easily exportable to other states, and potentially also to large healthcare systems. Findings will be further relevant to the ACO environment, which is expected to provide financial disincentives for ineffective or unproven care.

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Ethical approval: This study has received ethical approval by the Medical College of Wisconsin/Froedtert Hospital Institutional Review Board #5 as it satisfies requirements of 45 CFR 46.111.

Authors' contributions: LEP and ABN conceived the idea for the study, obtained funding and took primary responsibility for the design, intervention, outcome measures and writing the manuscript. TY and JN participated in the design of the study along with manuscript preparation. PL performed statistical analysis. All authors read and approved the final manuscript.

Trial Registration—ClinicalTrials.gov number pending.

Keywords

Breast cancer; Choosing Wisely®; controlled trial; complex intervention; high-value health care

Background

The Congressional Budget Office estimates that 30% of health care provided is unnecessary, defined as services that do not improve the patient's health ^[1]. Physicians resist the idea that they hold responsibility for rising healthcare costs, with 60% of physicians responding that trial lawyers bear major responsibility for healthcare costs and only 36% responding that practicing physicians bear that responsibility^[1]. In 2009, Dr. Howard Brody challenged specialty societies to develop a Top Five list of relatively expensive procedures that do not provide meaningful benefit to at least some categories of patients for whom they are commonly ordered ^[2]. The Choosing Wisely® campaign was developed by the American Board of Internal Medicine in response, and has been embraced by most of the major medical specialty societies, including the American Society of Clinical Oncology (ASCO).^[3] However, the extent to which the development of these lists has influenced the behavior of physicians or patients is not known. Given the difficulties encountered with engendering physician behavior change in the past, it is likely that supplemental methods will be needed to change the current culture of US healthcare.

Breast cancer care is an attractive model for the study of use of ineffective or unproven interventions for several reasons. It is the most common malignancy in US women, with about 232,000 new cases occurring in 2013, representing 29% of all new female cancer cases. The disease is relatively well-studied, with a strong evidence base regarding the need for initial and follow-up procedures. Two of the five items appearing on the first ASCO Choosing Wisely list focus on breast cancer specifically. Finally, breast cancer presents a particular challenge for the promotion of evidence-based care, because the care is often shared by several different physicians (surgeon, medical oncology, radiation oncology, others), and because care is quite decentralized, rather than being regionalized or provided primarily in academic health centers. For example, we have found that breast cancer operations represent only 4.5% of the total surgeries performed by US general surgeons, who operate on 90% of US breast cancer patients.^[1] The decentralization of breast cancer care implies that methods of changing physician behavior that can target large populations would be preferred.

One method of doing so is public reporting of quality metrics.^[4,5,6] Public reporting systems have proliferated significantly during the past decade. In 2008, Fung et al^[7] published a review of 45 studies of the effects of publicly reported data. It was noted that many of the studies focused on a select few publicly reported systems, and that many existing publicly reported systems had not been evaluated. A subsequent Cochrane Collaboration Review^[8] applied more stringent eligibility criteria, and included only 4 published studies, with only 1 of these studies evaluating the effect of publicly reported data through the change pathway. Despite the extant of systems publicly reporting provider

performance, recent reviews have found few rigorous evaluations^[7-9] and have called for more studies of this promising method of influencing behavior.

Study Goals

The goal of this project is to examine the effectiveness and potential cost savings of two organizational interventions aimed at reducing the use of ineffective or unproven care among women with incident breast cancer. Taking advantage of an unique existing infrastructure, we partnered with the Wisconsin Collaborative for Healthcare Quality (WCHQ), an all-patient, all-payer voluntary collaborative consortium in the state of Wisconsin that enabled us the possibility of testing our interventions in a consistent and cost-effective manner, particularly for reaching providers who are often decentralized.

The two interventions to be tested include (i) a “basic” public reporting intervention summarizing practice-level statistics on WCHQ's website and (ii) an “enhanced” intervention, augmenting public reporting with a smart phone/web-based application (app) that gives providers just-in-time information, decision-making tools, patient education materials and personalized benchmarking. The “App,” a completely innovative aspect of this study, is especially well suited to improving the performance of providers who are generalists with regard to the disease of focus (e.g., surgeons and medical oncologists who are not necessarily specialized in breast cancer.) In addition to being a common form of interactive electronic access to information, the app permits the sending and receiving of information at an individual level and enables instruction to proceed regardless of geographic proximity or time scheduling barriers.

Specifically, our aims are: (1) To examine the extent to which basic public reporting reduces use of targeted breast cancer practices in the intervention state relative to usual care in comparison states; (2) To examine the effectiveness of the enhanced intervention relative to the basic intervention, using both an intent-to-treat and treatment-on-treated approach; and (3) To simulate cost savings forthcoming from nationwide implementation of both interventions (relative to each other and to usual care) and to describe the implications of these findings for reimbursement policy and program initiatives.

Hypotheses

We have formulated hypotheses in two broad areas: 1) provider behavior and 2) organizational or system cost savings. In the realm of provider behavior, we expect that both the basic and enhanced interventions will yield observable and significant reductions in the use of ineffective or unproven breast cancer interventions targeted by the study. We further hypothesize that the more intensive, enhanced intervention will demonstrate greater as well as more sustained reductions in the use of ineffective or unproven breast cancer care relative to those in the basic group. Finally, we expect that both interventions will yield cost-savings relative to usual care.

Research Design and Method

Our specific aims focus on quantifying, empirically, the impact of two information-based interventions aimed at reducing the use of unproven and ineffective breast cancer practices. We will begin by quantifying utilization of unproven or ineffective breast cancer care in the state of Wisconsin and contrast it to neighboring states and nationwide using Marketscan and Medicare data. It is important to recognize that while the WCHQ will determine the rates of use of discouraged interventions according to its customary practice of analyzing local billing data, the source of data used by the investigators to determine effectiveness of the interventions will be the national Marketscan and Medicare data. The use of these datasets provides an effective approach to characterizing “usual care” against which to determine the impact of the basic intervention for a “real world” sample of breast cancer patients of all ages. Having quantified the impact of the basic intervention relative to usual care (Aim 1) and the relative effectiveness of the basic and enhanced interventions relative to each other (Aim 2), we then use parameter estimates generated by these previous analyses to simulate the anticipated cost savings associated with nationwide implementation of the two proposed interventions (Aim 3) for reducing use of unproven and/or ineffective breast cancer care for the large number of women of all ages undergoing breast cancer care in the U.S.

Conceptual Framework

Behavioral approaches to changing provider practices generally rely on a three-part conceptual model that emphasizes the importance of understanding: 1) the antecedents of a given behavior or practice, 2) the context in which the behavior occurs, and 3) its consequences.^[10] Green and Kreuter's^[11] “Precede/Proceed” model is helpful in conceptualizing factors influencing provider practice change. That model emphasizes the influence of “predisposing,” “enabling,” and “reinforcing” factors on practitioner behavior. Predisposing factors include *individual practitioner characteristics* – such as training, knowledge and beliefs – that affect *motivation* to change. Enabling factors include *organizational and structural factors* – such as public reporting, reminders, or information systems – that *facilitate* change. Finally, reinforcing factors include *incentives*, both tangible and intangible, that reward selected behaviors. More recently, Berwick, James and Coye^[12] proposed a framework focused specifically on the pathways whereby public reporting, the basis of our basic intervention, may improve provider performance. According to their framework, providers are driven by a desire to maintain or increase market share. Public reporting therefore encourages providers to change (improve) their practice behavior *directly* by (i) identifying and exposing poor quality providers who are then motivated to change in order to avoid being labeled or sanctioned as such by employers or payers (the reputation effect pathway) or *indirectly* by (ii) empowering patients to be better consumers and avoid providers who practice poor quality care (the patient choice pathway). Figure 1 provides a diagram of the conceptual framework underlying our study emphasizing the dynamic relationship among the key elements of both models.

Unproven/Ineffective Breast Cancer Interventions Targeted by the Study

Table 1 summarizes the ineffective or unproven breast cancer practices evaluated in this study. They have been selected from the Choosing Wisely® campaign as well as existing

national society guidelines (National Comprehensive Cancer Network,^[13] American Cancer Society^[14]) and position statements (American Society of Breast Surgeons,^[15] Society of Surgical Oncology^[16]) and include expensive studies and procedures that are commonly used despite a lack of evidence to support their routine use. These interventions were specifically selected as they are commonly and/or increasingly performed and can be assessed by claims information.

Interventions

The basic intervention will comprise public reporting through the WCHQ website. Individual-level, claims data submitted for billing to third party payers by participating healthsystems will be used to (i) identify cohorts of women with incident breast cancer at the practice-level and (ii) construct the metrics for public reporting and individual benchmarking information. These data are consistent with Medicare and Marketscan claims in both format and content thereby ensuring seamless application of our validated algorithm as well as construction of outcome variables as proposed in Aims 1 and 2 of the study.

In addition to basic public reporting, the enhanced intervention adds an app comprising a decision support tool and patient education and communication information that will be delivering concise, readily accessible information about the main components of that intervention, backed up by a website providing greater details and rationale for each practice targeted for reduction. Specifically, physicians in participating practices will be provided a web- and smartphone-based, point-of-care application that will include i) a list of the unproven/ineffective interventions with specialty group statements about a) scientifically proven appropriate use and b) proven or suspected downsides to inappropriate use; ii) clinical calculators that allow physician to input individual patients' clinical/tumor characteristics for each test (in most cases stage but for some tests will include other characteristics); iii) practice-specific summary of publicly reported results; and iv) printable patient information adapted from the ASCO Choosing Wisely website. The printable patient information will also include testimonials by patients and physician experts as well as communication tips/messaging recommendations (e.g., using normative statements such as “this intervention/test is not recommended for most patients”). The smartphone app will allow printing but will also point to the web version of the application for those without smartphone printing capabilities

The app will be based on principles of academic detailing^[17,18] and will be developed in an iterative process. Apps will be assigned specific codes so that both app downloads and use can be followed by the team. A number of other possible specifications will be tested. For example, frequency of prompts or “nags” will be tested to find the frequency that optimizes use. The app will be disseminated and its use promoted during the enhanced intervention phase in several ways. First, using well-established collaborative strategies for disseminating quality improvement information, the study group will send emails on behalf of each practice leadership containing practice-level results along with an individualized link and passcode for download for several app stores. Second, investigators in the study team will lead educational sessions on initial and surveillance testing for breast cancer focusing on tips on use of the app. Finally an email prompting the download and/or use (as appropriate) of

the app will be sent as a reminder to any physician identified by the team as having ordered one or more unproven or ineffective breast cancer tests targeted for reduction by the intervention.

Study Design

Figure 2 depicts the study design, which accommodates Aims 1 and 2 successively over the study period. In both cases, comparison states will be used to evaluate the interventions in light of possible secular trends in the region and the nation. Our proposed design strategy will enable estimates of the effectiveness of the basic intervention (Aim 1) by comparing (i) the pre-intervention rates to post-intervention rates as well as by comparing (ii) changes between the pre- and post-intervention periods for the “treatment” state (WI) relative to comparison states. A similar approach will be used in Phase II to provide estimates of the enhanced intervention's impact relative to the basic intervention and contemporary usual care provided in control states, thereby enabling us to conduct the cost-savings analyses proposed as part of Aim 3.

Data Sources and Study Population

The study sample will consist of women nationwide identified from MarketScan Commercial Database, Medicare claims, and WCHQ as having had an *incident* early stage breast cancer diagnosis between 2014 to 2017. We carefully considered alternative choices of study population. The SEER-Medicare data base is familiar to our team, and would include tumor registry-derived information on extent of the cancer. However, because the SEER tumor registry data require extensive and labor-intensive processing, there is always a substantial delay from the year a cancer is diagnosed and treated to the year the linked data are available. In addition, SEER excludes the treatment state (WI). Our plan to use MarketScan and Medicare data has a number of advantages. It permits the use of a national sample, without generalizability issues based on age, race, urban residence, or other factors that might bias the analyses. It permits use of information from all 50 states and includes both inpatient and ambulatory data. Importantly, because MarketScan and Medicare data become available with a much shorter time lag (6 months from calendar year's end), it will permit a much more contemporary analysis. Although this plan has the limitation of not permitting individual level control for extent of disease, several studies, including our own, have shown that disease stage does not vary systematically by provider or facility characteristics.^[19-21] Furthermore, since the mechanism by which absence of information on disease stage would bias our results would be via differential mammography screening rates, we will control for small-area ecological measures of mammography rates in all analyses.

Key Control/Covariate Variables

Standard information about the patient and her **socio-demographic** background (such as age, race/ethnicity) will be obtained from MarketScan Commercial Database and Medicare Denominator file supplemented with information from the Medicare Master Database file. Ecological measures of **socio-economic status (SES)** will include: per capita income; proportion of persons in neighborhood belonging to quintiles (or deciles, as needed) of the income distribution corresponding to specific Federal Poverty groups; proportion of persons

living in owner occupied versus rented homes; and population density, measured at the Census tract level, based on geocoding of subjects' addresses. In addition to these ecological measures of SES, we will use individual-level measures of SES available in both datasets such as enrollment in Medicaid and state buy-in low income subsidy programs. Measures of **comorbidities** will be based on inpatient, outpatient and provider/Carrier data for the year preceding the incident breast cancer diagnosis based on the algorithm proposed by Charlson^[22] which is specific for breast cancer patients, supplemented by conditions identified by Elixhauser et al.^[23] **Mammography screening rates**, a proxy for extent of disease at presentation, will be calculated at the zip code-level. Finally, certain key structural characteristics of the **health market and system** will be obtained and used in the analyses including neighborhood characteristics (e.g. urbanicity); and characteristics of the health care financing environment, including number of hospitals by volume of breast cancer care, managed care penetration, and density of surgeons, medical and radiation oncologists.

Analytic Plan—Patient-level multivariate regression techniques will be used to compare Wisconsin state “basic” intervention to (i) neighboring states (IL, MN) and (ii) nationwide usual care outcomes. In addition to concurrent comparisons, all analyses will account for possibly differential temporal trends in performance across states by including pre-intervention data in the intervention state as well as historical data in “control” states. These analyses will also adjust for patient, provider, ecological, and health care system characteristics that might confound the relationship between intervention and outcomes. Multi-level random effects and the GEE method[68-69] will be used to account for both provider-specific time-invariant effects and design clustering (i.e., multiple patient observations for each provider, multiple providers within each state). As all patient-level outcomes are binary, methods with a logit link (logistic regression) will be used. The null hypotheses of equality between treatment and comparison groups will be tested using two-tailed tests at the $\alpha=.05$ significance level. To examine whether the effects vary with certain provider or patient's characteristics, we will re-estimate our models including interaction terms between basic intervention indicators and selected regressors, such as patient's age and provider's size of breast cancer practice. These additional regression analyses will provide important information on the magnitude of possible sub-group effects. In addition, by estimating such variations of the basic models, we will be able to test the sensitivity of our main results to alternative specifications. We hypothesize that the intervention will yield effects in the direction of *reduced* use of unproven and ineffective breast cancer care in all dimensions considered. We anticipate that these reductions will be substantial (>15% relative to WCHQ pre-intervention levels) and consistent across all comparison groups (i.e., both lagged and contemporary usual care in neighboring and other states). Our overarching hypothesis is that reductions in the use of ineffective/unproven breast cancer practices targeted by the intervention among intervention subjects will far outweigh any temporal improvements in outcomes among usual care subjects.

The analytical approach described above will apply to both Aims 1 and 2 of the study. Of note, however, when estimating the impact of the enhanced intervention (public reporting enhanced by the app), we will take advantage of provider-specific information regarding downloading and extent of use of our app, to conduct a secondary analysis among patients

treated by providers in the enhanced intervention group estimating “treatment-on-treated” effects. Following Rubin and Heckman, others,^[26-28] we will estimate outcomes conditional on effective use of the app, adjusting for the endogeneity of that decision (i.e., providers who chose to use the available technology may be systematically different from those who opted not to use it) using provider-specific characteristics (e.g., age, years practicing surgery, volume of breast cancer cases) as potential instrumental variables. These treatment-on-treated estimates will help us put our intent-to-treat impact estimates in the broader context of maximum potential effectiveness of the enhanced intervention.

Our final objective is to estimate the impact of the basic and enhanced interventions on costs associated with breast cancer care and potential savings therein. Given the relatively low marginal cost of operationalizing the two proposed information-based strategies, the principal measures of cost to be used in the study pertain to the resource costs associated with direct (medical) care. Direct medical care costs for the initial diagnosis & evaluation, initial treatment as well as any neoadjuvant, adjuvant and surveillance care received during the first 12 month post-diagnosis will be calculated using MarketScan and Medicare claims data. In order to determine the cost of inpatient care services among Medicare subjects, inpatient claims records for each patient will be used to assign revenue center-specific charges to individual departments within the hospital, using each hospital's Medicare Cost report and CMS crosswalk algorithm. These department-specific costs will then be summed for each patient in the sample. The cost of professional services provided during the initial hospitalization and follow-up care will be calculated by summing Medicare payments for all physicians and other professionals providing health care services (Carrier files). For MarketScan subjects, valuation of both inpatient and professional fee services will be based on payment information available for all subjects (including Truven imputed values for HMO beneficiaries).

Given that cost estimations are generally sensitive to the presence of outliers, we will model all of our cost equations using “robust” regressions techniques (M-estimator). Standard errors in all cost equations will be computed via bootstrapping to account for design clustering and heteroskedasticity effects. In addition to the key variables of interest—membership in the basic intervention or usual care states---cost equations will control for the same set of patient and ecological characteristics hypothesized to affect patterns of care described above.

Having obtained marginal cost effects of (i) basic intervention relative to usual care and (ii) enhanced relative to basic intervention, we will then estimate cost differentials across the three groups by applying parameter estimates to “simulated” populations of patients. Estimates of costs for each alternative configuration (e.g., assuming all patients nationwide received the enhanced intervention, holding all other factors constant at their initial levels) will be computed by summing across individual patient-level predictions generated from these two cost regression models. Along with direct intervention impact estimates, these cost estimates will provide the basis to assess the extent to which efforts to implement our interventions nationwide are warranted. With respect to expected cost, we hypothesize that there will be significant and hierarchical cost savings between our enhanced and basic interventions and usual breast cancer care.

Discussion

Although evidence-based medicine is attractive in concept, the implementation of clinical guidelines and pathways remains problematic.^[29] The literature indicates that didactic, traditional education strategies, as well as passive dissemination of clinical guidelines and protocols, have by and large proved to be ineffective methods for changing clinical practice.^[30-32] In contrast, decision support systems and multifaceted interventions that serve as a model for this study have demonstrated the strongest effects.^[31, 32, 33-36] The focus of most implementation work to date has been promoting a positive change in behavior, i.e., doing something as opposed to foregoing something.

Our study provides an unprecedented opportunity to examine the relative impact of an innovative app intervention relative to basic public reporting and usual care in reducing physicians' use of ineffective and unproven breast cancer practices. A multifaceted intervention that couples public release of all-patient, all-payer performance data with decision support has substantial promise for facilitating behavior change. Positive results could relatively easily be exportable to other settings, and could lead to relatively cost-effective means for addressing the documented overuse of expensive and untested interventions.

The strengths of the study are several, including: (i) our partnership with WCHQ and its commitment to improve the value of breast cancer care in the state; (ii) the emphasis on an evidence-based group of unproven and/or ineffective breast cancer practices as outcome measures; and (iii) the involvement of the investigators at the implementation level to ensure quality data collection. The project is not without its limitations and challenges, however. Given concerns about the feasibility of randomizing participating healthsystems and resulting dilution of statistical power, we opted for relying instead on comparisons relative to concurrent control states as well as pre-post intervention performance as a means to estimate the marginal effect of the basic and enhanced interventions relative to traditional breast cancer care. In addition, some of the targeted breast cancer interventions may, in fact, be appropriate under certain circumstances (e.g. use of radiographic tests in patients with relevant symptoms at presentation) or for patients with certain characteristics (e.g. use of breast MRI among BRCA1/2 mutation carriers). Although a certain degree of measurement error is unavoidable in metrics calculated using billing and claims data, our approach of consistently coding utilization of each targeted practice across all data sources will ensure that our comparison and impact estimates are unbiased.

Despite increasing interest, the approach embodied in our “basic” public reporting intervention is still the rare exception rather than the rule in cancer care, so that adducing evidence of its impact would make a significant contribution to arguments for (or against) broader diffusion throughout the health care system. The nested, enhanced intervention encompassing a decision tool app is completely novel and holds great promise as a means to reduce use of ineffective and unproven breast cancer care. The choice of these two interventions was based both on evidence (albeit scant) of their efficacy in other settings, on the feasibility of implementation and, most importantly, their potential generalizability to community surgeons and physicians providing breast cancer care.

In summary, by leveraging an infrastructure already paved by the statewide consortium and by rigorously evaluating the effectiveness of two novel yet easily generalizable interventions, our study will provide the methodological and empirical underpinnings necessary to “induce physicians and health systems to abandon ineffective interventions or discourage adoption of unproven interventions.”^[37] The results will be important for all interested in the challenges of reducing ineffective or unproven care, including government, policy-makers, payers, health care providers, and consumers. The results will be further relevant to the ACO environment, which is expected to provide financial disincentives for providing ineffective or unproven care.

Trial Status and Results

Recruitment of Wisconsin health systems is ongoing and first public reporting (Phase I) is planned for spring 2016. Results are not yet available.

Acknowledgments

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Abbreviations

WCHQ	Wisconsin Collaborative for Healthcare Quality
ASCO	American Society of Clinical Oncology
SES	socio-economic status

Figure 1. Conceptual Framework

Figure 2. Study Design

Table 1
Breast Cancer Metrics to be Publically Reported

Breast Cancer Metrics	Codes (CPT 2014-2015/HCPCS 2014-2015/ICD-9 2014)	Observation Period
Initial diagnosis and treatment		
1. Needle biopsy done prior to surgery	CPT 10021, 10022, 19000, 19001, 19100, 19081-19086, 19102, 19103, 88321, 88323, 88325 ICD-9 85.11, 85.91	180 days or less prior to date of surgery for Cohort 1. 270 days or less prior to date of surgery for Cohorts 2-5.
2. Axillary lymph node dissection without attempted sentinel lymph node biopsy ALND=1 & SLNB=0	<u>SLNB codes:</u> CPT (surgery codes): 38900, 38500, 38525, 38530 CPT (injection codes): 38790, 38792, 78195 ICD-9 40.23, 40.3 <u>ALND codes:</u> CPT 19162, 19200, 19220, 19240, 19302, 19305-19307, 38740, 38745 ICD-9 40.50, 40.51, 85.43, 85.45-85.48 Denominator - exclude those who received neoadjuvant chemotherapy: Chemotherapy codes: HCPCS J8520, J8521, J8530, J8540, J8560, J8610, J8999, and (J9000 - J9999 <u>excluding</u> J9003, J9165, J9175, J9202, J9209, J9212-J9226, J9240, J9395)	From date of diagnosis to date of surgery (including the dates of diagnosis and surgery) Exclude from denominator if had any of chemotherapy codes during 90-days prior to surgery.
3. Contralateral prophylactic mastectomy	Contralateral prophylactic mastectomy = YES if 1. CPT 19303 OR 19304 with modifier 50 (bilateral) OR 2. ICD-9 codes any claim with 85.35 OR 85.36 OR 85.42 OR 3. ICD-9 codes any two claims separated by 1 day with 85.33 OR 85.34 OR 85.41 OR 85.43 OR 85.45 OR 85.47, EXCLUDING two 85.45 OR two 85.47 OR 85.45 AND 85.47 Denominator - any mastectomy code excluding those who had code for genetic predisposition/counseling/testing, or family history: Any mastectomy codes: CPT 19303-19307 ICD-9 codes 85.33-85.36, 85.41-85.48 Any genetic predisposition/counseling/testing, family history codes: CPT 96040, 81211-81217 HCPCS S0265 ICD-9 V84.01, 759.6, V26.31, V26.34, V16.3	Date of ipsilateral mastectomy surgery plus 1 day Exclude from denominator if had any genetic predisposition counseling, testing, or family history codes within 180-days prior to surgery.
4. Intensity modulated radiation therapy (IMRT) for whole breast radiation therapy after breast conserving surgery	CPT 77418, 77385, 77386, 77387	Date of surgery plus 180 days
Surveillance		
5. Tumor biomarker (TBm) blood testing (CA 15-3, CA 27.29, CEA)	CPT 82378 (CEA) ; 86300 (CA 15-3)	From 181 days post-date of surgery to end of study period
6. PET scan or PET-CT scan	CPT 78811-78816 ; HCPCS G0235, G0252, S8085	From 181 days post-surgery to end of study period
7. CT (chest/abdomen/pelvis) scan	CPT 71250, 71260, 71270, 72192-72194, 74150, 74160, 74170, 74176-74178	From 181 days post-surgery to end of study period
8. Bone scan	CPT 78306	From 181 days post-surgery to end of study period
9. Breast MRI	CPT 77058, 77059; HCPCS C8903-8908	From 181 days post-surgery to end of study period
10. Follow-up mammograms being performed more frequently than	CPT 77051, 77052, 77055-77057, 77061-77063 (effective 1/1/2015) HCPCS G0202, G0204, G0206	From surgery to 545 days post-surgery

Breast Cancer Metrics	Codes (CPT 2014-2015/HCPCS 2014-2015/ICD-9 2014)	Observation Period
annually among women with BCS & radiotherapy	Denominator - women with BCS who had any radiation code (Table 4 of algorithm document) within 12 months after surgery. Numerator - 2 or more mammograms within the first 18 months after BCS surgery	

Note: Except for #2, a metric will be coded as 1 if any of the CPT/HCPCS/ICD9 codes are observed for a given patient during the observation period. Specifications for the published, validated algorithm for identifying incident breast cancer cases, which also determines the date of diagnosis and date of surgery for each patient can be found in the accompanying file WCHQ_Algorithm_IncidentBreastCancer.docx.