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Disparities in Routine Breast Cancer Screening for Medicaid Managed Care Members with a Work-Limiting Disability

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Objective: Examine disparities in routine mammography for women who qualify for Medicaid, because of a work-limiting disability.

Methods: Individual-level data were obtained for women enrolled in Massachusetts Medicaid Managed Care plans who met the 2007 Healthcare Effectiveness Data and Information Set (HEDIS) criteria for the breast cancer screening measure (n=35,171). Disability status was determined from Medicaid eligibility records. Mammography screening was modeled using multivariate logistic regression. Separate models for women with and without a disability were also estimated.

Results: Although unadjusted breast cancer screening rates were roughly equal for women with and without disability, after adjusting for confounders disability status had a significant negative association with screening mammography (OR=0.74; p<0.0001). Living farther from a mammography facility or having a diagnosis of domestic violence reduced the odds of screening for women with disabilities, but not for other women. Having a higher illness burden was more detrimental to screening for women with a disability than for those without. Both groups benefited similarly from the first 26 ambulatory care visits, but the impact of additional visits on screening was much larger among women with disabilities.

Conclusion: Nationwide, rates of routine mammography for Medicaid managed care plans averaged below 50% in 2006. Given that a majority of eligible women served by Medicaid have disabilities, and studies have shown that women with disabilities are more likely to be diagnosed with late stage disease, a focus on improving rates of screening for women with disabilities is overdue.

Keywords: Disability, Breast Cancer, Routine Mammography, and Medicaid

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Introduction

Breast Cancer ranks as the second most deadly cancer among women after lung cancer. The American Cancer Society estimated that 192,370 U.S. women would receive a breast cancer diagnosis and another 40,170 would die from the disease in 2009 (Jemal et al., 2009). Mammography—though not without controversy—is currently the gold standard for early detection of breast cancer. Routine screening has been associated with significantly lower risk of being diagnosed with late stage disease (Taplin et al., 2004), and evidence from randomized controlled trials (RCTs) show statistically significant, substantive long-term reductions in breast cancer mortality owing to mammography screening (Nelson et al., 2009).

Despite evidence supporting the effectiveness of breast cancer screening, rates of routine mammography for Medicaid managed care plans averaged only 49.1% nationwide in 2006 (National Committee for Quality Assurance, 2007). Across insurers and socioeconomic strata, data from the Behavioral Risk Factor Surveillance System (BRFSS) showed a small, but significant, decline in rates of biennial screening among U.S. women between 2000 and 2005 (Centers for Disease Control, 2007). Improving rates of breast cancer screening among publicly-insured women against this recent downward trend may depend upon overcoming disparities in screening rates experienced by subgroups of vulnerable women.

A large body of research has examined socioeconomic, demographic, and cultural factors—including income, education, race/ethnicity, immigration history, and primary language spoken—affecting breast cancer screening and outcomes. Some studies have reported a reversal in screening disparities among women belonging to particular racial and ethnic minority groups, suggesting that efforts to reduce inequity in screening rates among particular groups have been successful. Others report similar or relatively greater importance of insurance status/type compared with other, less readily modifiable socioeconomic and demographic characteristics (Bigby & Holmes, 2005; Jones, Caplan & Davis, 2003; and Meersman, Breen, Pickle, Meissner & Simon, 2009). Though the literature has grown in recent years, fewer studies exist on another potential source of disparity of importance to Medicaid populations: disability.

A substantial percentage of women ages 40 and older, who are insured by Medicaid, qualify for coverage owing to a disability as determined by Massachusetts Disability Evaluation Services (DES), the Social Security Disability Insurance (SSDI) program, or the Supplemental Security Income (SSI) program (title II or title XVI, respectively, of the Social Security Act). A person is considered disabled under the law if (a) a physical or mental impairment renders them unable to engage in "substantial gainful activity" (SGA) and (b) the impairment is expected either to result in death or to last for a minimum of 12 months (Social Security Administration, 2008). Massachusetts DES use similar criteria for evaluation of disability. Approximately 1% of

women in our data who qualify for Medicaid owing to a disabling condition, are determined by other, less stringent, criteria for disability.

This study examines the association between disability and routine mammography using Medicaid administrative (encounter and enrollment) data, along with information collected by Medicaid managed care plans for reporting the National Committee on Quality Assurance's (NCQA) 2007 Healthcare Effectiveness Data and Information Set (HEDIS) measure of breast cancer screening. The use of population-based data permits separate analyses of barriers to screening for women who qualify for Medicaid owing to a disability and for other women insured by Medicaid. Linking to health care claims data facilitates an examination of the roles of chronic conditions, illness burden, and prior health care utilization in screening behavior. This permits a more in depth analysis of differences in barriers to screening across population subgroups than is usually feasible with survey data.

Methods

With permission from the Massachusetts Medicaid agency (MassHealth) and approval of the University of Massachusetts Medical School's Institutional Review Board, individual-level HEDIS 2007 data were obtained from the five health plans that served the MassHealth managed care population during calendar year 2006. Included in this dataset was a measure of breast cancer screening. We used MassHealth member identifiers to link individual-level HEDIS data to MassHealth enrollment and claims files to obtain information on demographic characteristics, clinical diagnoses, health services utilization, and geographic location for each member of the study sample. Together, these data enabled us to examine disparities in the provision of breast cancer screening in a vulnerable population.

Study Sample and Measures

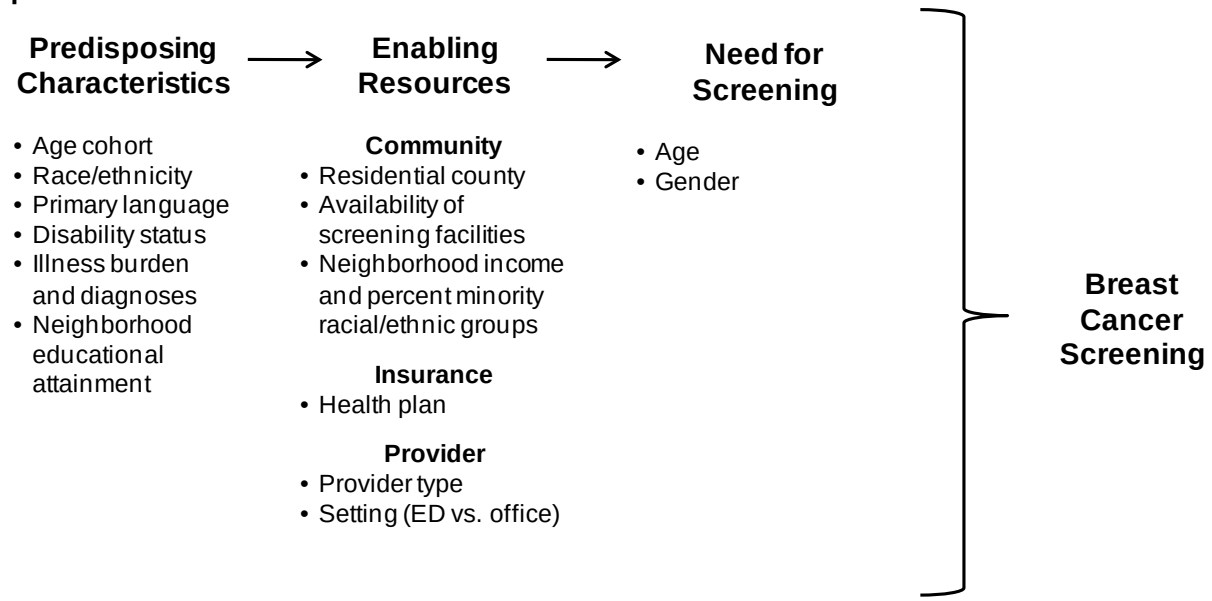
Eligibility criteria for the HEDIS breast cancer screening measure were assessed by each of the MassHealth managed care plans and included being female, between the ages of 42 and 69 as of the end of the two-year measurement period (December 31, 2006), and being continuously enrolled in a particular managed care organization (MCO) during 2005 and 2006 with, at most, one gap in enrollment of no more than 45 days during each calendar year (CY). A woman was deemed to be in compliance with the HEDIS breast cancer screening measure if she had at least one claim for a mammogram during CY2005 or CY2006. The HEDIS 2007 breast cancer screening measure reflects clinical guidelines in effect during the study period. The national guidelines, issued by the American Cancer Society (ACS) and the U.S. Preventative Services Task Force (USPSTF), recommended routine mammograms (i.e., annually for ACS and every 1-2 years for USPSTF) for women of average risk beginning at age 40 (USPSTF, 2002; Smith et al., 2003).

A total of 36,536 women met the eligibility criteria for the mammography measure, as reported by the plans. However, 658 members (1.8% of the eligible population) were excluded, because of missing or erroneous data on one or more of the analysis variables (nearly all of these were missing valid residential ZIP Code information, which is needed to identify geographic effects). In addition, women who were enrolled in Medicare at any time during the study period or were ages 65 and above were excluded from the analysis, for a final sample of 35,878.

Conceptual Model

We posited that meeting HEDIS criteria for the breast cancer screening measure was influenced by individual clinical, socioeconomic, and demographic characteristics, as well as access to healthcare, and the actions taken by health care providers and health plans to encourage mammography. Individuals contributed by initiating contact with a health care provider and following up on referrals for screening. Providers contributed by staying abreast of current guidelines and making appropriate and timely referrals. Health plans contributed by covering the cost of mammography and perhaps by providing incentives both to patients and providers. Local availability of screening facilities, defined in terms of convenience in both location and hours of operation, was also expected to play a role.

Figure 1. Conceptual model of breast cancer screening behavior (adapted from Andersen), with variables used to operationalize the model



† Andersen considered past medical history to be a 'predisposing' factor and current symptoms and diagnoses as 'need' (Andersen & Newman, 1973; Andersen, 1995). Our data on illness burden and specific (generally, chronic) diagnoses were collected during the study period. However, since need for routine breast cancer screening is largely determined by age cohort, we have adapted the model to include illness burden and diagnoses as characteristics predisposing women to seek care..

We adapted the Andersen model of health care utilization in developing a conceptual framework for our analysis of the specific factors affecting breast cancer screening (Andersen, 1995; Figure 1). This model suggests that utilization depends upon predisposing factors (including clinical, demographic and socioeconomic characteristics), enabling factors (including location, income, health insurance and usual source of care), and need (as perceived by the patient or evaluated by providers). In this case, since perceived/evaluated need for screening is based primarily on age and gender, and secondarily on factors that are largely or wholly unobservable, such as body mass index and family history, we have assumed that need is based on age and include current chronic condition diagnoses and illness burden as predisposing characteristics influencing care seeking behavior in general.

Independent Variables

Our data on age, race/ethnicity, primary language, county of residence, and disability status were derived from individual-level Medicaid enrolment records as of December 31, 2006. A woman was classified as 'disabled' if she qualified for Medicaid on the basis of disability, as recorded in the enrollment eligibility category. Classifications of race and ethnicity were based on the MassHealth categories: White/non-Hispanic; Black/non-Hispanic; Hispanic; American Indian; Asian/Pacific Islander; other race/ethnicity; and unspecified race/ethnicity. We grouped American Indian and Asian/Pacific Islander members with those in the 'other' race/ethnicity category owing to small cell sizes. Members who were missing race/ethnicity data were classified as 'unknown race/ethnicity.' Primary language data were grouped into three categories: English, Spanish, and 'other' (comprised of 22 other language categories available in the MassHealth data). As a proxy for individual socioeconomic characteristics and to capture location effects, we included Census ZIP Code-level data on household income, education levels, and minority race/ethnicity. We also included county of residence in the regression to control for wider regional effects.

Illness burden was estimated as the score from the Chronic Illness and Disability Payment System (CDPS) software, version 2.5 (C DPS, 2005; Kronick & Dreyfus, 1996; Kronick, Gilmer, Dreyfus, & Lee, 2000). The CDPS uses ICD-9-CM diagnoses, from claims incurred during the study period, to identify chronic conditions and assign a cumulative score for each individual relative to others in the same population. Each chronic condition has an exogenously determined weight, and multiple conditions increase the risk score additively. Scores are normalized so that the average for the study population is 1.0. Scores higher than 1.0 indicate a higher-than-average illness burden. For instance, a person with a score of 1.5 has an illness burden 50% above the mean.

Diagnosis and procedure codes from claims data were used to identify individuals with substance use disorders, behavioral health conditions, a history of tobacco use, and/or a clinical record of domestic violence. Two indicators of usual source of care: emergency department (ED) use (excluding visits tied to an inpatient admission) and number of ambulatory care visits

during CY2005-2006, were also derived from Medicaid claims data. Visiting the ED may indicate a weak or nonexistent relationship with a physician practice site for routine care. Having more ambulatory care visits, on the other hand, does not guarantee a consistent usual source of care, but does provide more opportunities for physicians to address routine preventive care needs, such as mammography screening.

We were unable to identify unique physicians or practice sites using our data, but we did have information on provider type. Our model included a variable indicating whether or not the woman's primary care doctor was working in a solo practice setting, a group practice, a community health care center, or another type of facility. We computed the distance between the population centroid of each woman's residential ZIP Code and the nearest mammography center (obtained from a list of current licensed MA mammography facilities maintained by the Radiation Control Program of the MA Department of Public Health) as a proxy for the availability of screening. Finally, we controlled for the impact of belonging to a particular MCO by including 'health plan' as a fixed effect in the analysis.

Analyses

Multivariate logistic regression was used to assess the odds of breast cancer screening associated with a set of individual characteristics, provider type, and health plan, as described in the conceptual model. The model was first run on all women in the dataset and then separate regressions were run for women with and without a work-limiting disability. All three regressions contain the same set of explanatory variables. The full sample model enabled us to assess the effect of disability status on the adjusted odds of receiving a mammogram, controlling for other predisposing and enabling characteristics. Running separate regressions for women with and without a disability allowed the slope coefficients to vary by disability status permitting a comparison of factors influencing mammography for the two subgroups of women in the data.

Where explanatory variables were specified as continuous variables (i.e., ambulatory office visits and CDPS scores), we allowed for non-linearity in the association between the variable and the receipt of routine mammography by including the nth-order polynomial form that was found to best approximate the relationship (e.g., a second order polynomial with a positive coefficient on the variable and negative coefficient on the squared term indicates an inverted-U shaped relationship, whereby the odds of screening rise at a decreasing rate with the variable).

Model goodness of fit was assessed using the Hosmer-Lemeshow test. Owing to the sensitivity of the Hosmer-Lemeshow test to sample size (Kramer & Zimmerman, 2007), we also examined the percentage of observations correctly classified, so as to better understand whether the models discriminate adequately between members who did and did not receive routine mammography screening. Standard errors were adjusted using the robust Huber-White

sandwich estimator of variance. Statistical significance of independent predictors was evaluated at the $\alpha \leq 0.05$ level. All analyses were conducted using STATA, version 9.2 (STATA, 2007).

Results

The main model and model on the subset of members with a disability both passed the Hosmer-Lemeshow goodness-of-fit test; the model for members without a disability did not pass. Nonetheless, all three models correctly classified approximately 70 percent of members in terms of their probability of receiving a mammogram.

Overall, 63% of eligible women received at least one mammogram in the two-year analysis period, CY2005-2006. Characteristics of the analysis group are given in Table 1. Two-thirds of women in our data qualified for Medicaid because of disability. They were older (53 vs. 48 years of age, on average), and had higher rates of substance abuse/dependence (17% vs. 8%), smoking (16% vs. 10%), domestic violence (1% vs. 0.7%), and severe mental illness (45% vs. 15%) than other women. However, there was no difference between women with and without disability in the raw percentage who had a mammogram in the past two years.

Table 1. Characteristics of breast cancer screening measure analysis data set by population (all women, women who qualified for Medicaid because of a work-limiting disability, and others)

	All	Women with Disability	Women without a Disability
Number of observations	35,171	23,511	11,660
n (%)	(100.0%)	(66.8%)	(33.2%)
DEPENDENT VARIABLE			
Mammogram within 2 year period	22,111	14,778	7,333
n (%)	(63.0%)	(63.0%)	(62.9%)
INDEPENDENT VARIABLES	Mean	Mean	Mean
Predisposing/Need			
Demographics, Medicaid Eligibility			
Age, years	51.4	53.3	47.6
42 <= Age <= 51	55.5%	42.3%	82.2%
52 <= Age <= 69	44.5%	57.7%	17.8%
White race	67.7%	84.4%	34.1%
Black race	9.9%	9.8%	10.0%
Hispanic ethnicity	6.6%	2.1%	15.8%
Other race/ethnicity	2.9%	0.7%	7.5%
Unknown race/ethnicity	12.8%	3.0%	32.6%
English primary language	58.0%	48.1%	78.1%
Spanish primary language	5.3%	2.0%	11.9%

Table 1 (cont)

	All	Women with Disability	Women without a Disability
Other primary language	36.7%	49.9%	10.0%
Medicaid eligible owing to disability	66.8%	100.0%	0.0%
Overall Illness Burden, Diagnoses			
CDPS illness burden score	1.0	1.0	0.9
Alcohol/drug abuse	13.9%	16.8%	7.9%
Tobacco use	14.1%	16.1%	10.2%
Severe mental illness[a]	35.3%	45.3%	15.2%
Other mental illness[b]	49.5%	56.7%	35.0%
Domestic violence	0.9%	1.1%	0.7%
Neighborhood Characteristics			
High school grad ≥ 75th percentile	24.8%	21.1%	32.3%
College grad ≥ 75th percentile	25.9%	23.1%	31.6%
Enabling			
Health Care Utilization			
≥ 1 ED visit	56.1%	61.0%	46.2%
Ambulatory office visits	16.9	19.7	11.3
Provider: group practice	57.4%	54.6%	63.0%
Provider: Community Health Center	19.9%	21.0%	17.7%
Provider: solo practice	9.7%	9.9%	9.4%
Provider: other type	13.0%	14.5%	10.0%
Access to Screening Facilities			
Distance to mammography center, miles	1.3	1.2	1.6
Neighborhood Characteristics			
Household income <25th percentile	24.8%	27.9%	18.7%
Household income 25-50th percentile	25.2%	26.7%	22.0%
Household income >50-75th percentile	24.8%	24.2%	26.0%
Household income ≥ 75th percentile	25.2%	21.1%	33.4%
Minority race/ethnicity <75th percentile	75.7%	74.1%	79.0%
Minority race/ethnicity ≥ 75th percentile	24.3%	25.9%	21.0%

[a] Severe mental illness included diagnoses of: major depression, schizophrenia and other paranoid states, and bipolar disorder.
[b] Other mental illness included diagnoses of: other depression, anxiety disorders, and other mental illness.

Table 2 presents adjusted odds ratios from multivariate logistic regression of compliance with the HEDIS breast cancer screening measure as a function of individual characteristics, provider type, and neighborhood-level variables. Although unadjusted breast cancer screening rates were roughly equal for women with and without disability, after adjusting for confounders

disability status had a statistically significant and substantive negative association with screening mammography (OR=0.74; p<0.001).

Several variables were important predictors regardless of disability status. Women with alcohol or drug use disorders had substantially lower odds of screening, as did those who

Table 2. Multivariate adjusted odds ratios (OR) for measures predicting breast cancer screening among women who did and did not qualify for Medicaid because of a work-limiting disability

	All		Women with a Disability		Women without a Disability	
Predisposing/Need						
Demographics, Medicaid Eligibility						
52 <= Age <= 69	1.38	***	1.45	***	1.22	***
Black race	0.92	*	0.94		0.95	
Hispanic ethnicity	1.40	***	1.31	*	1.58	***
Other race/ethnicity	1.61	***	1.13		1.93	***
Unknown race/ethnicity	1.33	***	1.26	**	1.35	***
Spanish primary language	1.64	***	1.56	**	1.72	***
Other primary language	1.24	***	1.23	***	1.10	
Medicaid eligible owing to disability	0.74	***				
Overall Illness Burden						
CDPS illness burden score	1.44	***	1.27	*	1.76	**
CDPS illness burden score, squared	0.80	***	0.82	***	0.80	**
CDPS illness burden score, cubed	1.02	***	1.02	***	1.02	
Diagnoses						
Alcohol/drug abuse	0.52	***	0.52	***	0.53	***
Tobacco use	0.85	***	0.85	***	0.83	**
Severe mental illness[a]	1.11	***	1.18	***	0.91	
Other mental illness[b]	1.01		1.04		0.90	*
Domestic violence	0.65	**	0.58	***	1.03	
Neighborhood Characteristics						
High school grad ≥ 75th percentile	0.92		0.87	*	>1.00	
College grad ≥ 75th percentile	1.06		1.03		1.11	

Table 2. (cont)	All		Women with a Disability		Women without a Disability	
Enabling						
Health Care Utilization						
≥ 1 ED visit	0.77	***	0.78	***	0.75	***
Ambulatory office visits	1.17	***	1.17	***	1.21	***
Ambulatory office visits, squared	<1.00	***	<1.00	***	0.99	***
Ambulatory office visits, cubed	>1.00	***	>1.00	***	>1.00	**
Provider: Community Health Center	0.96		1.07		0.74	***
Provider: solo practice	0.90	**	0.91		0.90	
Provider: other type	1.27	***	1.44	***	1.01	
Access to Screening Facilities						
Dist. to nearest mammography ctr (mi)	0.98	*	0.97	**	<1.00	
Neighborhood Characteristics						
Household income 25-50th percentile	0.96		0.97		1.03	
Household income >50-75th percentile	0.96		0.92		1.13	
Household income ≥ 75th percentile	1.04		1.02		1.18	
Minority race/ethnicity ≥ 75th percentile	>1.00		0.98		0.98	
Pseudo-R^2	0.11		0.12		0.10	
Hosmer-Lemeshow goodness of fit (*p-value*)	0.07		0.32		0.00	
Percent of cases correctly classified	70.0	%	70.4	%	69.7	%
Number of observations	35,171		23,511		11,660	

Note. Reference groups for odds ratios in the table are: for age cohort, 42-51 years old; for race/ethnicity, White; for primary language, English; for neighborhood high school education: <75th percentile with high school completed; for neighborhood college education: <75th percentile with college completed; for provider type, group practice; for neighborhood income: <25th percentile of median household income; for neighborhood minority race/ethnic status: <75th percentile in terms of minority race/ethnicity. All equations are adjusted for county of residence and health plan (odds ratios not shown).

[a] Severe mental illness included diagnoses of: major depression, schizophrenia and other paranoid states, and bipolar disorder.

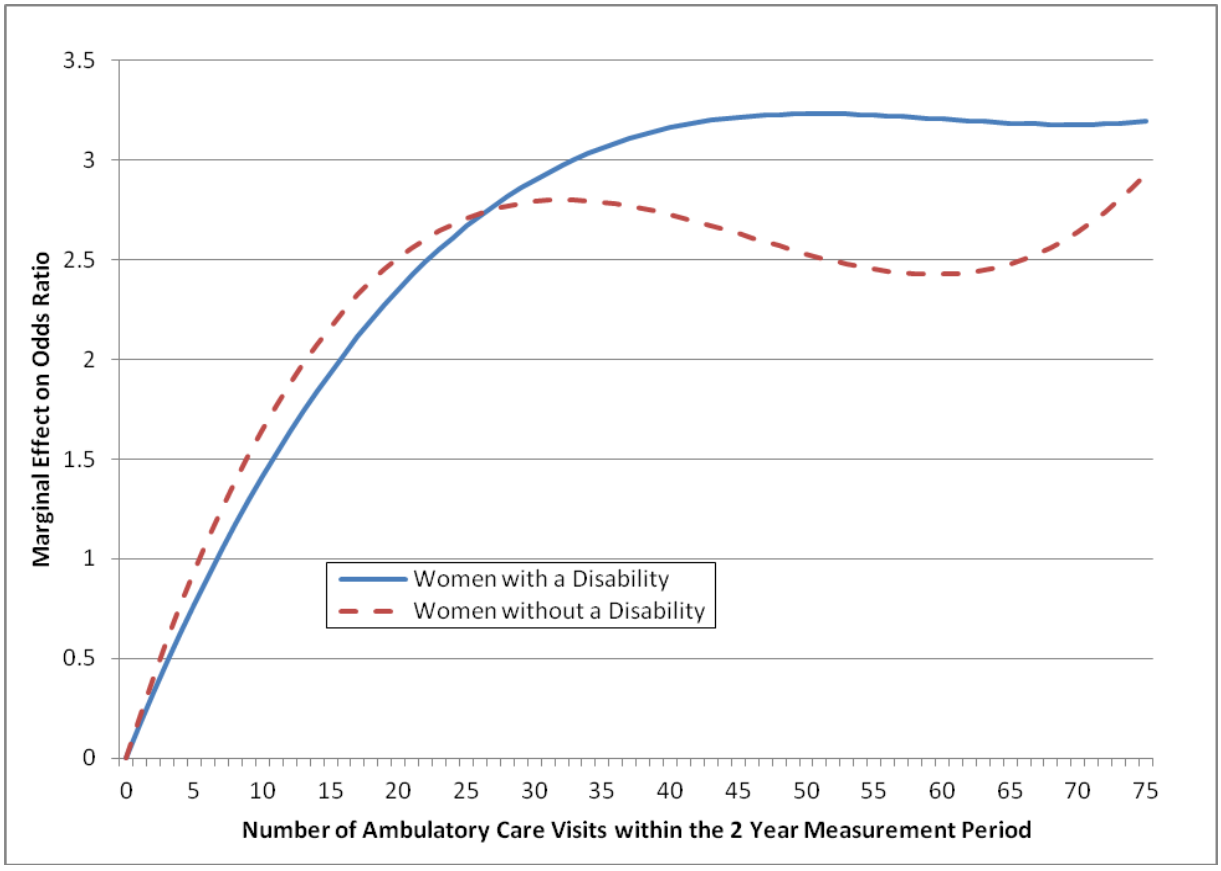
[b] Other mental illness included diagnoses of: other depression, anxiety disorders, and other mental illness.

* p<0.05 ** p<0.01 *** p<0.001

smoked or had at least one emergency department visit. Women ages 50 and older at the start of the measurement period had higher odds of screening than did women in their 40s. We found that a third order (or cubic) polynomial of ambulatory care visits best approximated the

relationship between visits and likelihood of screening. Figure 2 simulates the total effect of ambulatory care contacts for women with and without disabilities using the estimated coefficients on the number of ambulatory visits and the squared and cubed terms over the range of 0 to 75 visits during 2 years (99.2% of women in our data had 75 or fewer visits). The association between ambulatory care visits and mammography was similarly positive for both groups of women, if a bit stronger for women without a work-limiting disability, up to 26 visits. Beyond that point, the impact of physician office contacts on the odds of receiving a mammogram are greater for women with a disability than for women without disability.

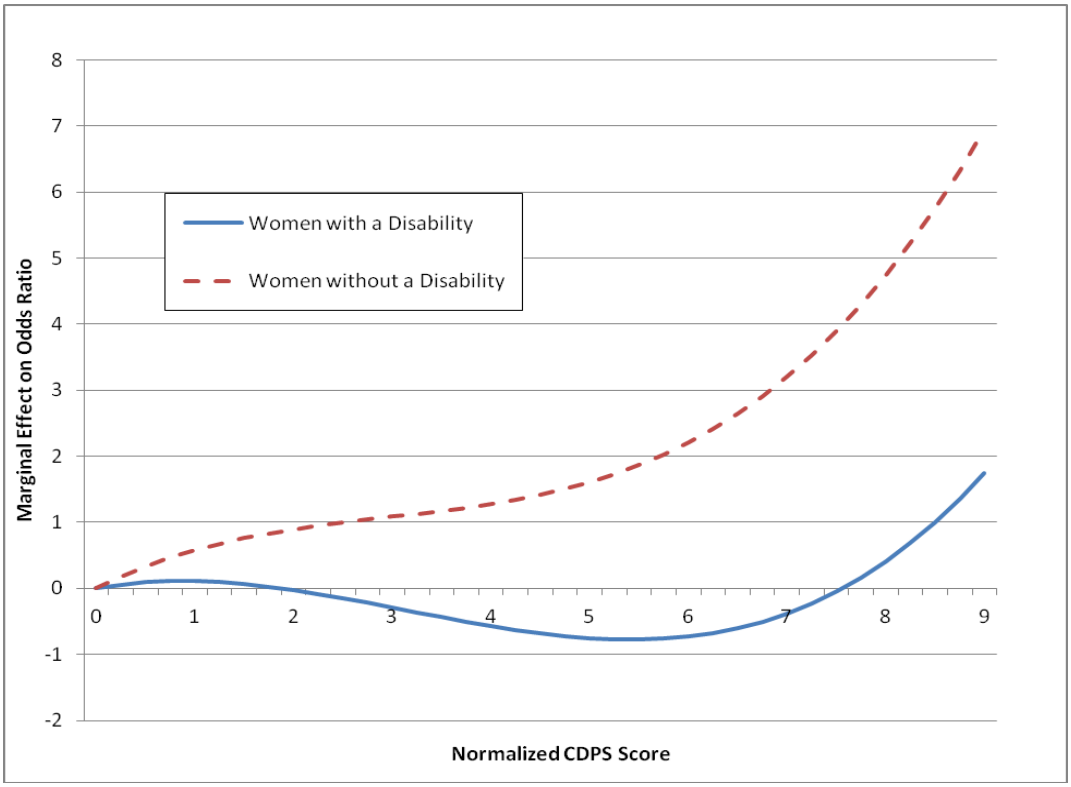
Figure 2. Marginal effect of ambulatory care visits on the odds of mammography screening, women with and without a disability.



We also modeled the association of illness burden and probability of mammography using a cubic polynomial specification (see Figure 3). Among women with a disability, there is a fairly flat association of CDPS score and mammography for those who are relatively healthy, decreasing likelihood of mammography over a middle range of CDPS scores, and gradually increasing likelihood in the higher range of relative illness burden. Among women without a disability, the odds of mammography first rise modestly with illness burden before leveling off and later rising again. The odds of receiving a mammogram are lower for women with a

disability than for those without a disability across the observed range of illness burden scores, other things being equal.

Figure 3. Marginal effect of CDPS score on the odds of mammography screening, women with and without a disability.



Having farther to travel to reach a mammography center or having a recorded diagnosis of domestic violence reduced the odds of screening for women with a disability, but not for non-disabled women.

Discussion

After controlling for confounders, women who qualified for Medicaid because of a work-limiting disability were found to have much lower odds of getting a mammogram than other women. This supports prior research which has tended to show that women with various disabling physical and intellectual conditions are less likely to receive recommended routine breast cancer screening than women without disabilities (Smeltzer, 2006 and Wilkinson & Cerreto, 2008).

The literature is somewhat mixed on whether women with disabilities are diagnosed at later stages and treated less aggressively. Two studies found later stage at diagnosis for women with disabling conditions (Nelson et al., 2009 and Roetzheim & Chirikos, 2002), while another did not (McCarthy et al., 2007). One very small study found clinically meaningful, but

statistically non-significant, differences in treatment received (Caban, Nosek, Graves, Esteva, & McNeese, 2002), while two much larger studies using the Surveillance, Epidemiology and End Results (SEER) Program tumor registry data, merged with Medicare claims for women younger than age 65, found significant differences in use of breast conserving surgery and radiation therapy for women with disabilities than for those without (Iezzoni et al., 2008; McCarthy et al., 2006).

The reasons for lower screening in women with disabilities are undoubtedly multiple, varied, and complex, in keeping with the variation in the nature of the disabling conditions that may prevent individuals from working. Women with developmental or intellectual disabilities face different barriers to care than do women with mobility limitations, for example. Nevertheless, across subgroups of women with disabilities, a common experience of preventive medicine may reflect an underlying hierarchy of needs, wherein both providers and patients focus primarily on sequelae of the disabling condition. Treatment of comorbid conditions and screening for preventive health are secondary considerations (Iezzoni, 2009; Iezzoni, McCarthy, Davis, & Siebens, 2000; Lawthers, Pransky, Peterson, & Himmelstein, 2003).

Our findings on the importance of additional ambulatory care visits for women with disability are relevant here. In general, having a regular provider or usual source of care has been found to be a highly significant predictor of routine breast cancer screening and other preventive services across women of diverse racial and ethnic backgrounds and age groups (Jones et al., 2003; O'Malley, Forrest, & Mandelblatt, 2002). Women who make frequent outpatient visits to a provider are more likely to participate in routine screening (Jones et al., 2003; Ostbye, Greenberg, Taylor & Lee, 2003) and less likely to be diagnosed with advanced stage breast cancer (Keating, Landrum, Ayanian, Winer, & Guadagnoli, 2005). Women who receive a recommendation from their physician or health care provider are significantly more likely to undergo routine mammography than women who receive no recommendation (Levy-Storms, Bastani, & Reuben, 2004), and survey data suggests that women with disabilities are less likely to receive such a recommendation (Yankaskas et al., 2010). However, our simulation showed that the marginal benefit of additional ambulatory care visits eventually falls—particularly in the non-disabled population—beyond a certain point.

Although the association between the number of ambulatory care visits and the odds of receiving routine mammography screening are similar for women with and without disability over approximately the first 26 visits in a two year period, the relationship between visits and screening appears to be more positive for women with disabilities over the full range of visits observed. Since we controlled for illness burden, computed in relative terms across the entire study population, we were able to rule out the explanation that women who visit their physician's office more frequently are more likely to be screened simply because they have more complex chronic needs. Indeed, among women with disabilities, we found that higher illness burden was an impediment to screening over much of the observed range of relative CDPS scores.

Studies have found that logistical barriers, such as distance to mammography facilities or difficulties with transportation, influence women's adherence to routine breast cancer screening (Levy-Storms et al., 2004 and Meersman et al., 2009). Our research suggests that each additional mile between a woman's home and the nearest screening facility is associated with a small, but significant, reduction in the odds of screening. However, this applies only to women with a disability. Our findings may differ from those based on other states and/or populations, since fewer than five percent of women in our data live more than 5 miles from a mammography center.

There are several other limitations of this study. Firstly, our findings may not be generalizable outside of the MassHealth Managed Care population to states with differing benefit structures or population characteristics. The HEDIS criteria, limiting analysis to women who were continuously enrolled, further limits generalizability of findings within Massachusetts Managed Care Organizations, since women with short periods of enrolment may differ from those enrolled for extended periods in ways that are not fully captured by controlling for factors such as age, illness burden, health services utilization, and diagnoses.

Healthcare administrative data have several additional limitations. Domestic violence, smoking, and substance use disorders were likely to be under-reported. Hence, our measures can be viewed as representing diagnosed instances rather than all existing occurrences of these conditions. Significant amounts of missing data for race and ethnicity may have limited our ability to fully detect disparities in care, and selective reporting by individuals could have introduced bias. We lacked data on individual circumstances and type of disability to better understand our findings of lower odds of screening for women who qualify for Medicaid because of a disability. Moreover, since disability was primarily defined by a work-limiting impairment, it may exclude people who are able to work, but who may nonetheless have motor or sensory impairments that affect the probability of receiving routine mammography screening.

Nonetheless, claims and enrolment data do offer several advantages. Since Medicare and Medicaid data are population based, rare events may be detected. Unlike self-reported data, administrative data are not subject to social desirability and recall biases. This allows for relatively long look back periods and more accurate estimates of screening rates. Indeed, studies that measure breast cancer screening adherence have demonstrated the tendency of self-reported rates to overestimate adherence (Caplan et al., 2003 and Armstrong, Long & Shea, 2004). Of particular relevance to this study, HEDIS median breast cancer screening rates, calculated for commercial health plan participants using a combination of administrative claims and medical records data, were approximately nine percentage points lower than survey-based Behavioral Risk Factor Surveillance System rates, which measure self-reported screening (Bloom, Harris, Thompson, Ahmed, & Thompson, 2000). Moreover, claims data contain rich information on comorbid diagnoses, usual source of care, and other variables that may drive results.

Conclusion

Nationwide, rates of routine mammography for Medicaid managed care plans average below 50%. Given that a majority of eligible women served by Medicaid have disabilities—and studies have shown that women with disabilities are more likely to be diagnosed with late stage disease—a focus on improving rates of screening for women with disabilities is overdue.

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