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Original article

Breast and Cervical Cancer Screening Disparities Associated with Disability Severity

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A B S T R A C T

Background: Prior research has noted disparities between women with and without disabilities in receipt of timely screening for breast and cervical cancer. Some studies suggest greater disparities for women with more severe disabilities, but the research to date has yielded inconsistent findings. Our purpose was to further examine differences in receipt of breast and cervical cancer screening in relation to severity of disability.
Methods: We analyzed Medical Expenditure Panel Survey annual data files from 2002 to 2008. Logistic regression analyses examined whether Pap smears and mammograms had been received within the recommended timeframe according to U.S. Preventive Services Task Force Guidelines. We compared four groups of women aged 18 to 64 years, categorized by presence and complexity of disability: 1) No limitations, 2) basic action difficulties only, 3) complex activity limitations only, and 4) both basic and complex activity limitations.
Findings: Women both with and without disabilities fell short of *Healthy People 2020* goals for breast and cervical cancer screening. Overall, women with disabilities were less likely to be up to date with both mammograms and Pap tests. The magnitude of disparities was greater for women with complex limitations. Disparities in Pap testing, but not mammography, remained significant when controlling for demographic, geographic, and socioeconomic factors.
Conclusions: Women with more complex or severe disability were less likely to be up to date with breast and cervical cancer screenings. Targeted efforts are needed to reduce barriers to breast and cervical cancer screening for women with significant disabilities, especially those who also experience other socioecological disadvantages.
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A growing body of research indicates disparities between women with and without disabilities in timely receipt of breast and cervical cancer screening (Armour, Thierry, & Wolf, 2009; Courtney-Long, Armour, Frammartino, & Miller, 2011; Wei, Findley, & Sambamoorthi, 2006; Weir et al., 2011; Wisdom et al., 2010). Further, some studies have found screening disparities related to severity of disability. For example, Chan and colleagues (1999) found decreasing receipt of mammograms and Pap smears with increasing numbers of activity limitations among Medicare patients. Similarly, Altman and Berstein (2008) found that women with more complex activity limitations were less likely to receive regular Pap smears and mammograms than women with less complex disabilities and women with no disabilities. However, a recent review of literature examining breast and cervical cancer screening by disability severity among working age women found inconsistent results (Andresen et al., 2013). The inconsistency was due in large part to variations in the way both presence and severity of disability were defined.

Additionally, Andresen et al. (2013) noted that studies on disability severity as a risk factor for reduced screening have been inconsistent in controlling for other factors associated with breast and cervical cancer incidence and screening. Research in the general population has highlighted factors including age, race and ethnicity, marital status, geographic location, socioeconomic status, and insurance (Benard, Coughlin, Thompson, & Richardson, 2007; Calle, Flanders, Thun, & Martin, 1993; Cook et al., 2010; Klabunde et al., 2012; Rauscher, Allgood, Whitman, & Conant, 2012; Sabatino et al., 2008; Shi, Lebrun,

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Zhu, & Tsai, 2011; Soni, 2007b). People with disabilities tend to be older and poorer than those without (Houtenville & Ruiz, 2012), and such characteristics may account for some of the disparities in screening.

The purpose of this paper was to examine the relationship of disability severity to receipt of mammography and Pap smears in a nationally representative sample, and to assess the extent to which other variables account for any differences between disability groups. We evaluated the following hypotheses:

1. Compared with women without disabilities, women with basic or complex activity limitations would be less likely to be up to date with screening recommendations.
2. The magnitude of the disparity would be greatest for women with the most complex limitations.
3. Controlling for other demographic and socioeconomic characteristics would reduce the magnitude of the apparent disparity.

Methods

Data Source

We analyzed annual data files from the household component of the Medical Expenditure Panel Survey (MEPS) pooled across 2002 through 2008. The MEPS is conducted by the Agency for Healthcare Research and Quality to obtain nationally representative data on health care use and expenditures. The MEPS sample is based on in-person interviews with households selected from households participating in the previous year's National Health Interview Survey. The survey uses an overlapping panel design, with each panel enrolled for 2 years (Cohen, Cohen, & Banthin, 2009; Ezzati-Rice, Rohde, & Greenblatt, 2008).

Sample

Within the 2002 through 2008 MEPS sample of 120,147 women, our analyses focused on women ages 18 to 64 years for Pap testing. We selected age 18 as the youngest age at which women would likely need Pap testing under U.S. Preventive Services Task Force (USPSTF) recommendations in effect during the majority of the data collection period (USPSTF, 2003). Routine Pap testing is not recommended over age 65. Within our target age range, we excluded 4,225 women with missing data for variables of interest, resulting in an analytic sample of 67,030. For mammography, we further limited analyses to 34,738 women aged 40 to 64, per USPSTF recommendations for the study period regarding age at which to begin routine mammograms (USPSTF, 2002). Most adults 65 years and older have Medicare and their health care access issues differ from those of younger adults; therefore, we excluded women over 64 years of age (n = 15,734) from mammography as well as Pap analyses.

Measures

Dependent variables

The USPSTF recommendation during the study period was triennial Pap testing starting within 3 years of sexual debut or at age 21, whichever came first (USPSTF, 2003). We created a binary variable coded as 0 (>3 years since last Pap test) or never (not up to date) or 1 (3 years or less since last Pap test; up to date). During the data collection period, the USPSTF recommendation for mammography was biennial beginning at age 40. Therefore, we coded receipt as 0 (>2 years since last mammogram or never; not up to date) or 1 (≤2 years since last mammogram; up to date).

Primary independent variable

To describe disability severity, we created a single variable indicating presence of basic action difficulties and/or complex activity limitations, based on categories defined by researchers at the U.S. Centers for Disease Control and Prevention and previously used in studies with National Health Interview Survey data (Altman & Bernstein, 2008). Basic action difficulties are limitations in movement, sensory, cognitive, or emotional functioning (Altman & Bernstein, 2008). However, the most comparable MEPS data are from questions about difficulties with movement, sensory, and cognitive functions only; thus, we did not include limitations in emotional functioning. Complex activity limitations are restrictions in ability to participate in social roles or self-care activities (Altman & Bernstein, 2008), and were based on responses to MEPS items about need for assistance with basic and instrumental activities of daily living, and limitations in work, housework, social, or recreational activities. Our disability severity variable was coded as 1 (no limitations; none); 2 (basic action difficulties only); 3 (complex activity limitations only); and 4 (basic action difficulties and complex activity limitations; both). The "no limitations" group served as the reference category.

Covariates

We included the following sociodemographic variables in our analyses: Age, race/ethnicity (non-Hispanic White, non-Hispanic Black, non-Hispanic American Indian/Alaskan Native, non-Hispanic Asian/Native Hawaiian/Pacific Islander, non-Hispanic multiple races, Hispanic of any race), marital status (married, widowed/divorced/separated, never married), U.S. region (Northeast, Midwest, South, West), urban/rural residence as indicated by metropolitan statistical area (yes or no), education (bachelor's degree and higher, other degree, General Educational Development (GED)/high school diploma (HS), no GED/HS), family income as percent of the federal poverty level, and health insurance type or status (privately insured all year, publicly insured all year, privately insured part of year and publicly insured part of year, uninsured part of year, uninsured all year).

Statistical analysis

We conducted cross-sectional analyses of the combined annual MEPS data files. We performed logistic regression with Stata version 12.1 to account for the complex survey design of MEPS (StataCorp, 2011). Given the large sample size, we computed p-values of both $p < .05$ and $p < .01$ for all analyses. Although estimates were obtained for a subset of the full dataset, all observations were used to calculate variance and standard errors, thus retaining the nationally representative nature of the data. First, we examined unadjusted associations of disability severity with Pap testing and mammography, modeling the odds of being up to date. We then added each covariate to the model in a stepwise manner to observe how the above associations were affected with each addition.

Results

Most of our Pap analytic sample reported no limitations (Table 1). Similar proportions reported either basic only or basic and complex limitations, whereas very few reported complex

Table 1
Demographic Characteristics of Medical Expenditure Panel Survey Household Component 2002–2008 Women Age 18–64 Years

Characteristic	Basic Action Difficulties and/or Complex Activity Limitations, n (%*)				
	None	Basic	Complex	Both	Total
Pap test					
>3 y	7,575 (13.2)	1,228 (16.0)	231 (17.1)	1,602 (22.5)	10,636 (14.4)
Mammogram					
>2 y	6,392 (24.5)	1,467 (26.1)	218 (28.7)	1,744 (29.8)	9,821 (25.6)
Age (y)					
18–29	14,997 (28.6)	1,210 (16.1)	292 (24.0)	585 (9.4)	17,084 (25.3)
30–39	13,042 (24.0)	1,186 (14.0)	256 (19.0)	974 (13.3)	15,458 (21.8)
40–49	11,917 (23.6)	2,062 (27.6)	313 (23.6)	1,834 (25.4)	16,126 (24.2)
50–59	8,496 (17.7)	2,141 (29.7)	327 (23.6)	2,548 (34.6)	13,512 (20.8)
60–64	2,686 (6.1)	853 (12.6)	109 (9.8)	1,202 (17.3)	4,850 (7.9)
Race/ethnicity†					
White	25,300 (66.7)	4,260 (71.6)	698 (68.5)	3,952 (68.5)	34,210 (67.5)
Black	8,243 (12.0)	1,274 (12.3)	277 (14.7)	1,693 (16.5)	11,487 (12.5)
AIAN‡	250 (0.5)	49 (0.6)	16 (1.4)	86 (1.3)	401 (0.6)
AHPI	2,748 (5.4)	242 (3.2)	30 (2.6)	124 (1.9)	3,144 (4.8)
Multi-race	568 (1.1)	138 (1.8)	23 (1.9)	230 (3.3)	959 (1.4)
Hispanic	14,029 (14.2)	1,489 (10.5)	253 (11.0)	1,058 (8.6)	16,829 (13.2)
Marital status					
Married	28,868 (58.2)	3,868 (53.8)	572 (46.9)	2,729 (42.5)	36,037 (56.0)
Separated‡	8,142 (15.1)	2,014 (25.7)	325 (22.6)	2,889 (36.6)	13,370 (18.4)
Never married	14,128 (26.7)	1,570 (20.5)	400 (30.5)	1,525 (20.9)	17,623 (25.5)
Region of U.S.					
Northeast	7,928 (19.2)	989 (15.6)	216 (19.3)	1,065 (16.7)	10,198 (18.6)
Midwest	9,858 (22.2)	1,648 (24.4)	254 (20.6)	1,388 (21.4)	13,148 (22.3)
South	19,618 (35.7)	3,056 (37.8)	505 (36.0)	3,120 (39.8)	26,299 (36.4)
West	13,734 (22.8)	1,759 (22.3)	322 (24.1)	1,570 (22.1)	17,385 (22.7)
Resides in MSA	42,687 (84.4)	5,950 (81.5)	1,027 (81.4)	5,423 (79.1)	55,087 (83.5)
Education					
≥Bachelor's	11,506 (29.6)	1,380 (23.2)	191 (20.9)	760 (14.1)	13,837 (27.3)
Other degree	3,989 (9.0)	669 (10.1)	71 (6.4)	515 (8.1)	5,244 (9.0)
GED/HS	24,520 (48.0)	3,944 (54.4)	660 (51.7)	3,770 (56.4)	32,894 (49.6)
No GED/HS	11,123 (13.3)	1,459 (12.4)	375 (21.0)	2,098 (21.4)	15,055 (14.1)
Family income (% FPL)					
≥400	16,783 (43.5)	2,301 (39.7)	277 (30.1)	1,139 (23.7)	20,500 (41.0)
200–400	15,053 (31.2)	2,229 (31.7)	301 (25.9)	1,601 (25.9)	19,184 (30.6)
125–200	8,053 (11.7)	1,125 (12.3)	232 (16.2)	1,204 (15.6)	10,614 (12.2)
100–125	2,804 (3.4)	416 (4.1)	84 (4.3)	556 (6.3)	3,860 (3.8)
<100	8,445 (10.2)	1,381 (12.3)	403 (23.5)	2,643 (28.6)	12,872 (12.5)
Insurance status					
Private all year	28,892 (67.2)	4,139 (64.3)	481 (46.8)	2,196 (40.3)	35,708 (64.0)
Public all year	4,506 (5.8)	766 (7.0)	433 (26.8)	3,078 (34.7)	8,783 (9.0)
Mixed types during year	646 (1.1)	104 (1.3)	24 (1.7)	94 (1.4)	868 (1.2)
None part of year	6,935 (11.9)	1,016 (12.6)	163 (11.6)	808 (11.1)	8,922 (11.9)
None all year	10,159 (14.0)	1,427 (14.7)	196 (13)	967 (12.5)	12,749 (13.9)
Total	51,138 (77.3)	7,452 (11.4)	1,297 (1.8)	7,143 (9.5)	67,030 (100)

Abbreviations: AHPI, Asian, Hawaiian, Pacific Islander; AIAN, American Indian, Alaskan Native; FPL, Federal Poverty Level; GED, General Education Development test; HS, high school diploma; MSA, Metropolitan Statistical Area.

* Survey weighted percent (%).

† Except for Hispanic, all categories are ethnically non-Hispanic.

‡ Separated, widowed, divorced.

limitations only. This distribution was similar in our mammography analytic sample (no limitations, 77.3%; basic, 11.4%; complex, 1.8%; both, 9.5%). Generally, as age increased so did disability severity. Roughly 14% of women age 18 to 64 years had gone longer than 3 years without a Pap test and one quarter of those 40 to 64 years had gone longer than 2 years without a mammogram. For both cancer screening methods, the proportion of women who were out of date increased as disability severity increased.

Pap Testing

Compared with the reference group with no limitations, all three limitation groups had significantly lower odds of having had a Pap test within the last 3 years in the unadjusted model (Table 2). In particular, those with both basic and complex activity limitations had substantially lower odds. These associations were mostly consistent across successive models as covariates were added. However, those with complex limitations only were no less likely to be up to date when education was added to the model; this trend continued when family income and insurance status were added. The odds ratios for the complex limitation group did not differ substantially in magnitude from the basic limitation group; the lack of significance for the former is likely a result of the comparatively small number of women reporting a complex limitation alone (1.8% of the Pap analytic sample).

Mammography

In the unadjusted model, those with complex activity limitations only or with both basic and complex limitations had significantly lower odds than women with no limitations of

Table 2
Stepwise Logistic Regression Models, Odds of Having Had a Pap Test Within the Last 3 Years–Medical Expenditure Panel Survey Household Component 2002–2008 Women Age 18–64 Years (n = 67,030)

Characteristic	Logistic Regression Model (Odds Ratios)								
	1	2	3	4	5	6	7	8	9
Limitations									
None	Ref.								
Basic	0.79*	0.82*	0.79*	0.83*	0.84*	0.84*	0.88†	0.89†	0.89†
Complex	0.73*	0.75†	0.72*	0.78†	0.78†	0.79†	0.88	0.91	0.84
Both	0.52*	0.54*	0.51*	0.57*	0.58*	0.58*	0.69*	0.71*	0.65*
Age (y)									
18–29		Ref.							
30–39		2.17*	2.20*	1.51*	1.5*	1.49*	1.20*	1.21*	1.21*
40–49		1.68*	1.67*	1.06	1.05	1.04	0.89†	0.87†	0.88†
50–59		1.20*	1.19*	0.74*	0.73*	0.72*	0.60*	0.58*	0.57*
60–64		0.96	0.95	0.58*	0.57*	0.57*	0.50*	0.48*	0.47*
Race/ethnicity‡									
White			Ref.						
Black			1.48*	1.80*	1.85*	1.80*	2.10*	2.21*	2.17*
AIAN			0.85	0.87	0.91	0.96	1.04	1.08	1.11
AHPI			0.47*	0.46*	0.45*	0.43*	0.41*	0.41*	0.42*
Multi-race			0.78	0.84	0.85	0.84	0.90	0.93	0.94
Hispanic			0.79*	0.79*	0.8*	0.77*	1.07	1.13†	1.31*
Marital status									
Married				Ref.					
Separated§				0.64*	0.64*	0.64*	0.68*	0.71*	0.72*
Never married				0.39*	0.38*	0.37*	0.38*	0.39*	0.38*
Region of country									
Northeast					Ref.				
Midwest					0.83†	0.86†	0.89	0.89	0.92
South					0.75*	0.77*	0.79*	0.8*	0.88
West					0.82*	0.82*	0.83†	0.84†	0.87
Resides in MSA									
MSA						Ref.			
Non-MSA						0.72*	0.81*	0.83*	0.84*
Education									
≥Bachelor's							Ref.		
Other degree							0.55*	0.57*	0.59*
GED/HS							0.44*	0.47*	0.49*
No GED/HS							0.25*	0.27*	0.29*
Family income (% FPL)									
≥400								Ref.	
200–400								0.79*	0.84*
125–200								0.66*	0.81*
100–125								0.73*	0.91
<100								0.82*	1.03
Insurance status									
Private all year									Ref.
Public all year									1.01
Mixed types during year									1.56*
Uninsured part of year									0.86*
Uninsured all year									0.39*

Abbreviations: AHPI, Asian, Hawaiian, Pacific Islander; AIAN, American Indian, Alaskan Native; FPL, Federal Poverty Level; GED, General Education Development test; HS, High School (HS) diploma; MSA, Metropolitan Statistical Area.

* $p < .01$.

† $p < .05$.

‡ Except for Hispanic, all categories are ethnically non-Hispanic.

§ Separated, widowed, divorced.

having had a mammogram within the preceding 2 years (Table 3). When we adjusted for age, all three disability groups had lower odds than the reference. These associations remained significant with the addition of race/ethnicity and marital status. However, when region was added to the model, women with only basic action difficulties no longer differed significantly from the reference group. When education was added, the difference between the reference group and women with complex limitations only also became nonsignificant. Women with both basic and complex limitations continued to have significantly lower odds of being up to date, and this association persisted when education was added to the model. However, with the addition of income, there were no longer any associations between disability and recent mammogram; this continued to be the case when insurance status was added as well.

Discussion

Overall, women both with and without disabilities fell short of *Healthy People 2020* goals for breast and cervical cancer screening (U.S. Department of Health and Human Services, 2013). However, women with disabilities were less likely to be

Table 3
Stepwise Logistic Regression Models, Odds of Having Had a Mammogram Within the Last 2 Years–Medical Expenditure Panel Survey Household Component 2002–2008 Women Age 40–64 Years (n = 34,738)

Characteristic	Logistic Regression Model (Odds Ratio)								
	1	2	3	4	5	6	7	8	9
Limitations									
None	Ref.								
Basic	0.92	0.86*	0.85*	0.89†	0.91	0.91	0.95	0.98	0.99
Complex	0.81†	0.76†	0.75*	0.80†	0.80†	0.81†	0.87	1.02	0.97
Both	0.77*	0.68*	0.68*	0.75*	0.76*	0.77*	0.87†	1.07	0.98
Age (y)									
40–49		Ref.							
50–59		1.78*	1.77*	1.79*	1.80*	1.80*	1.80*	1.71*	1.71*
60–64		2.04*	2.01*	2.05*	2.05*	2.07*	2.15*	2.06*	2.05*
Race/ethnicity‡									
White			Ref.						
Black			1.03	1.17*	1.20*	1.15*	1.29*	1.49*	1.49*
AIAN			0.58†	0.60†	0.65†	0.69	0.74	0.76	0.80
AHPI			0.66*	0.64*	0.64*	0.61*	0.62*	0.67*	0.69*
Multi-race			0.61*	0.65*	0.66*	0.66*	0.67†	0.70†	0.73†
Hispanic			0.72*	0.75*	0.77*	0.73*	0.95	1.11	1.31*
Marital status									
Married				Ref.					
Separated§				0.64*	0.64*	0.63*	0.65*	0.80*	0.84*
Never married				0.64*	0.62*	0.61*	0.59*	0.70*	0.71*
Region of country									
Northeast					Ref.				
Midwest					0.67*	0.70*	0.71*	0.70*	0.72*
South					0.61*	0.64*	0.64*	0.65*	0.71*
West					0.63*	0.64*	0.64*	0.63*	0.66*
Resides in MSA									
MSA						Ref.			
Non-MSA						0.69*	0.74*	0.81*	0.83*
Education									
≥Bachelor's							Ref.		
Other degree							0.72*	0.80*	0.81*
GED/HS							0.60*	0.73*	0.77*
No GED/HS							0.39*	0.57*	0.66*
Family income (%FPL)									
≥400								Ref.	
200–400								0.60*	0.66*
125–200								0.43*	0.57*
100–125								0.39*	0.54*
<100								0.35*	0.50*
Insurance status									
Private all year									Ref.
Public all year									0.86†
Mixed types during year									0.65†
Uninsured part of year									0.57*
Uninsured all year									0.30*

Abbreviations: AHPI, Asian, Hawaiian, Pacific Islander; AIAN, American Indian, Alaskan Native; FPL, Federal Poverty Level; GED, General Education Development test; HS, High School (HS) diploma; MSA, Metropolitan Statistical Area.

* $p < .01$.

† $p < .05$.

‡ Except for Hispanic, all categories are ethnically non-Hispanic.

§ Separated, widowed, divorced.

up to date with mammograms and Pap tests compared with women with no disabilities. This finding supported our first hypothesis and is consistent with several previous studies that have found similar disparities (Armour et al., 2009; Courtney-Long et al., 2011; Wei et al., 2006; Weir et al., 2011; Wisdom et al., 2010). Our second hypothesis was also supported, in that the magnitude of disparities was greater for women with complex limitations—and especially those with both basic and complex limitations—than for women with limitations in basic functions only. Previous findings regarding disability severity in relation to breast and cervical cancer screening have been mixed, in part owing to different ways of defining disability severity in different studies. Our approach was based on that of Altman and Bernstein (2008); a similar grouping is currently used in annual National Healthcare Disparities Reports (Agency for Healthcare Research and Quality, 2013). Last, as hypothesized, the magnitude of disparity diminished when controlling for other factors associated with screening. In the case of mammography, the full set of covariates was able to account for all significant differences between disability groups and women with no disabilities. However, for Pap testing, significant differences remained even with all covariates in the model.

All covariates were significant. Women aged 30 to 39 years were most likely to be up to date with Pap testing and compliance generally diminished as age increased; the converse was true for mammography. Higher educational attainment corresponded with greater odds of recommended cancer screening. Women who were not currently married and those who were

uninsured for all or part of the year were far less likely to achieve compliance with recommended screening. These findings mirror those of MEPS analyses in the general population (Chu, 2003a, 2003b; Soni, 2007a, 2007b). When controlling for other variables in the model, Asian/Native Hawaiian/Pacific Island women were less likely to achieve compliance with both cancer screenings and Multiple Race women were less likely to have had a mammogram. On the other hand, non-Hispanic Black and Hispanic women were more likely than non-Hispanic Whites to be up to date with both Pap testing and mammography. Although others have made similar observations (Cook et al., 2010; Sabatino et al., 2008; Yu, Chou, Johnson, & Ward, 2010), there is evidence that overreporting of cancer screening is greater among Black and Hispanic women, which may obscure true disparities (Rauscher et al, 2008). Consistent with prior research (Calle et al., 1993; Sabatino et al., 2008), we found that higher family income was associated with greater odds of biennial mammography, although results were less consistent for Pap testing. Women who resided in a metropolitan statistical area or the Northeast had higher odds of both types of screening. Other studies have found some evidence of urban/rural disparities, as well as lower screening and higher cancer incidence and mortality in the South compared with the Northeast (Benard et al., 2007; Calle et al., 1993; Schootman & Fuortes, 1999; Watson et al., 2008). Additionally, some studies of screening for breast cancer among women with disabilities have found, as we did, that mammography use was highest in the Northeast (Courtney-Long et al., 2011; Schootman & Jeffe, 2003). This may reflect easier access to screening in the Northeast, but specific contributors to regional differences bear further investigation.

Limitations

Although the MEPS is a rich data source for analyses of health care use at a population level, there are some limitations. Specific to this study, data on receipt of breast and cervical cancer screening are based on respondent report rather than medical records. As noted, these reports may be susceptible to bias such that some demographic groups overestimate their receipt of screening relative to other groups (Rauscher et al., 2008). We also note that recommendations regarding age at which mammography should begin were changed in 2009 from age 40 to age 50 (USPSTF, 2009), and screening for cervical before age 21 is no longer recommended (USPSTF, 2012). For sample size reasons, we focused our analyses on the time period before the 2009 update. As more years of data become available, subsequent analyses should examine disparities according to more recent recommendations.

Implications for Practice and/or Policy

Disparities not attributable to covariates may be related to lack of physician training and mistaken assumptions that women with disabilities are not sexually active and do not need screening for cervical cancer (Armour et al., 2009). In an effort to address such myths and build greater disability competency in the health workforce, Section 5307 of the Affordable Care Act calls for educating health care professionals on working with individuals with disabilities. Such training might include materials on how best to provide pelvic exams for women with disabilities (e.g., Ferreyra & Hughes, 2001), and training for mammography technicians on assisting women with disabilities in proper positioning (e.g., Marr, 2010). Women with complex disabilities may also have numerous other health care needs that can displace routine care such as cancer screening. Prior research supports use of computer-generated reminders as a way to help clinicians ensure that preventive exams are not overlooked (Atlas et al., 2012; Ornstein, Garr, Jenkins, Rust, & Arnon, 1991; Yabroff et al., 2011). Additionally, educational programs such as The Right to Know Campaign (Centers for Disease Control and Prevention, 2012; Thierry, Agin, & Hurtado, 2008) and PATHS: Promoting Access to Health Care (Peterson, Suzuki, Walsh, Buckley, & Krahn, 2012) can raise women's awareness of the need for regular screening and help them communicate with their doctors about routine screenings.

Physical access barriers, including lack of adjustable height exam tables and mammography machines, are another impediment to screening (Armour et al., 2009). Requirements in Section 4203 of the Affordable Care Act pertaining to accessible exam equipment may help reduce some of these barriers. There is a need for ongoing tracking using population-based data to determine whether compliance with recommended screening schedules improves for women with disabilities following implementation of Affordable Care Act requirements. Further, it is important for research to continue examining subgroups of women with disabilities, including those with differing levels of severity. Using definitions of disability presence and severity that are as standardized as possible given variations in data sources will facilitate data synthesis to determine whether there is consistent evidence of screening disparities related to disability severity (Andresen et al., 2013).

Conclusion

Women with more complex or severe disability were less likely to be up to date with breast and cervical cancer screening. Although disparities in receipt of mammography were accounted for by demographic, socioeconomic, and insurance variables, this was not the case for Pap testing. Targeted efforts are needed to reduce barriers to breast and cervical cancer screening for women with significant disabilities. These may be especially important for lower income, less educated, minority women living in less populous areas of the country.

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