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Breast Cancer Screening Among Women with Medicaid, 2006–2008: a Multilevel Analysis

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Abstract

Introduction—Nationally, about one third of women with breast cancer (BC) are diagnosed at late stage, which might be reduced with greater utilization of BC screening. The purpose of this paper is to examine the predictors of BC mammography use among women with Medicaid, and differences among Medicaid beneficiaries in their propensity to use mammography.

Methods—The sample included 2,450,527 women drawn from both fee-for-service and managed care Medicaid claims from 25 states, during 2006–2008. The authors used multilevel modeling of predictors at person, county, and state levels of influence and examined traditional factors affecting access and the expanded scope of practice allowed for the nurse practitioner (NP) in some states to provide primary care independent of physician oversight.

Results—Black [OR = 0.87; 95 % CI (0.87–0.88)] and American Indian women [OR = 0.74; 95 % CI (0.71–0.76)] had lower odds ratio of mammography use than white women, while Hispanic [OR = 1.06; 95 % CI (1.05–1.07)] had higher odds ratio of mammography use than white women. Living in counties with higher Hispanic residential segregation [OR = 1.16; 95 % CI (1.10–1.23)] was associated with a higher odds ratio of mammography use compared to areas with low Hispanic residential segregation, whereas living among more segregated black [OR = 0.78; 95 % CI (0.75–0.81)] or Asian [OR = 0.19; 95 % CI (0.17–0.21)] communities had lower odds ratio compared to areas with low segregation. Holding constant statistically the perceived shortage of MDs, which was associated with significantly lower mammography use, the NP regulatory variable [OR = 1.03; 95 % CI (1.01–1.07)] enhanced the odds ratio of mammography use among women in the six states with expanded scope of practice, compared with women residing in 19 more restrictive states.

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Compliance with Ethical Standards

The research does not involve human participants or animals and did not require informed consent.

The authors have no potential conflicts of interest to disclose.

Conclusions—Racial and ethnic disparities exist in the use of mammography among Medicaid-insured women. More expansive NP practice privileges in states are associated with higher utilization, and may help reduce rural disparities.

Keywords

Breast cancer screening; Medicaid; Multilevel analysis; Racial or ethnic disparities; Racial or ethnic residential segregation; Nurse practitioner regulation

Introduction

Lower breast cancer screening rates have been associated with later stage cancer at diagnosis, and greater morbidity and mortality among underserved populations, including Medicaid enrollees [1, 2]. Recent studies have further reinforced the growing evidence of geographic disparities in access to care and preventive services, such as cancer screening [3, 4]. Various factors are associated with cancer screening disparities, including density of or distance to the closest provider, residential segregation, literacy, education, and socioeconomic status [5–11].

Racial disparities in breast cancer survival that demonstrate a significant disadvantage for black women have persisted, as relative gains have been made in improving breast cancer survival for other groups across the USA during 1990–2009 [12]. This paper studies factors associated with Medicaid-eligible women's access to breast cancer screening from 2006 to 2008. An in-depth examination of differences among them in the odds of using mammography is provided, including both fee-for-service (FFS) and managed care Medicaid claims from 25 states with good quality data.

A unique feature of this study is the multilevel model, which includes factors at three levels: person, county, and state. One unique state factor being considered is the regulation of scope of practice for nurse practitioners (NP), who help meet the demand for primary care services in underserved states [13]. A unique contribution of this study is an evaluation of the role of NPs in promoting screening for breast cancer among women with Medicaid insurance among other key predictors of breast cancer screening in this population.

Methods

Data and Sample

Three years of annual state Medicaid claims and enrollment files were analyzed from 25 states during 2006 to 2008. Both FFS claims and encounter data from the Centers for Medicare & Medicaid Services were used [14]. Inclusion of the entire eligible population in a state Medicaid program is desirable to limit bias in spatial analysis. A recent study showed that encounter data quality has improved and, therefore, these data are useful for research in several states. The Health Maintenance Organization (HMO) enrollment was included to control for any potential differences in access and utilization patterns [15]. Independent assessments were also performed to ensure that reported HMO mammography rates were not significantly lower than FFS rates, which could indicate incomplete HMO records.

The 25 states included in the analysis had good-quality managed care data based on the above assessment of completeness, as well as states with only FFS adult enrollees. Twenty-five states were excluded from the analysis: Maine was excluded because of the lack of FFS claims; Alaska and Hawaii were excluded as they did not have county-level information; the remaining 22 states were excluded because of uncertainty about the quality of the managed care data. Six of the 25 included states had unregulated nurse practitioners (IA, MT, NH, NM, OR, WY), and 19 of the 25 included states had regulated nurse practitioners (AR, CA, GA, IN, KS, KY, LA, MI, MN, NC, NE, NJ, NY, RI, SD, TN, TX, VA, VT).

Women were included in the study if they were Medicaid enrollees aged 40 to 64 years, as the US Preventive Task Force recommended mammography beginning at age 40 during the study period [16]. Women were excluded from the study if they were:

- Previously diagnosed with cancer or pregnant
- Residing in long-term care facilities
- Dual Medicare/Medicaid enrollees
- Enrollees with restricted benefits because of alien status, pregnancy-related services, substance abuse/medically needy/other services, and family planning services

The study population consisted of 2,450,527 women. The RTI Institutional Review Board (IRB) approved this study.

Outcome Variable (Mammography Use)

For the outcome variable, a personal indicator was created for whether a woman had ever had a mammogram claim paid by Medicaid during the 3-year period. The recommended screening interval is every 2 years, but the study design allowed for some delays in repeat screens. The wider time frame ensures that the number of women ever using mammograms paid for by Medicaid in the period was not undercounted. Mammography codes were identified by using Current Procedural Terminology (CPT) codes, the Healthcare Common Procedure Coding System (HCPCS) codes, and the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes (see Appendix).

Conceptual Framework

The conceptual framework for the multilevel modeling is provided in Fig. 1. The conceptual framework includes person, county, and state-level factors. Spatial interaction between the levels, represented by the blue arrows in the figure, is modeled using interaction terms in the empirical specification.

Person-Level Factors

The person factors are characteristics of the study population, and these include age, race or ethnicity, type of insurance (FFS or managed care), length of coverage (number of months insured and enrolled in Medicaid), and disability status. It is expected that disparities among minorities relative to whites may exist in this population, that managed care enrollees may have higher utilization due to managed care's emphasis on prevention, that people with

shorter enrollment periods will have lower probability of utilization, and that disabled persons will have greater difficulty and exhibit lower probability of utilization.

County-Level Factors

County-level factors were area socioecological supply and demand factors. The supply factors were represented by the proportion of the county population living in rural areas and the average distance (in miles) to the closest mammography provider from ZIP codes in the county. These average distances are based on the residences of 100 % FFS Medicare populations to the closest provider of mammography services within their county of residence and are the most comprehensive measure of spatial accessibility to mammography available. Data for the above two supply factors was abstracted from the RTI Spatial Impact Factor Database (SIFD) [17].

Demand factors included a persistent poverty indicator for the county's status during the past 25 years, residential segregation indices (by several race or ethnicity groups relative to whites), community growth, and the percentage of uninsured persons (data were obtained from the RTI SIFD) [17]. Persistent poverty was used as a measure of deprivation, rather than poverty rates *per se*, because it was observed that cross-sectional poverty rates exhibited very little variability across the communities where these Medicaid-insured women resided. To increase the variance in the poverty measure, we focused on the degree of persistent poverty over time, as a measure of more extreme poverty. For the segregation (isolation) index, we used the approach developed by Massey and Denton [18], which measured the propensity for people of minority status to reside among minorities, rather than more evenly mixed among white populations. Community growth reflects economic opportunities manifested by in-migration, measured as the proportion of residents who moved into the county from another state during the past 5 years. Communities may grow due to attractive economic potential as well as resettlement of retirees. Communities with proportionately higher new population growth are expected to have higher demand for medical services such as mammography. The percentage uninsured reflects the non-elderly population who lack health insurance, which depresses demand for medical services.

State-Level Factors

A key factor in a woman's motivation to use mammography is better access to a primary care provider, whether it is a traditional medical doctor or a NP. The impact of shortages in primary care physicians on the utilization of preventive care services has been well established in the literature [20]. Evidence suggests that when states allow NPs and non-physician clinicians to practice and prescribe medicine independently, adults obtain routine checkups at a higher frequency, perhaps easing the impacts from shortage of primary care physicians [21–24]. The prevalence of NPs varies widely as do regulations that govern their practices. In 2006, 12 states allowed NPs to practice independently (without physician involvement), and 6 of these states (Iowa, Montana, New Hampshire, New Mexico, Oregon, and Wyoming) are included in this study. Other states allowed NPs to practice only with physician collaboration or supervision [13, 22–26]. Data on NP regulatory environment were provided by the National Conference of State Legislatures [13], who has cataloged the laws and regulations regarding NP practice scope latitude across a multi-year time series. NP

independent practice authority was defined as the absence of statutory or regulatory requirements for physician collaboration, delegation, direction, or supervision.

Because NP regulation is driven by need and may be confounded by physician shortages, we control statistically for perceived MD shortage in the state as an additional state-level variable. Primary care physician shortage was measured as the percentage of people in the state who perceived such a shortage; this information was obtained from the American Association of Retired Persons' compilation of major health system characteristics for each state [27]. In modeling, both primary care physician shortage and NP scope-of-service laws were controlled, along with rural population settlement, to assess the independent effects of these three potentially confounded variables.

The state regulation of NP scope of practice is a binary variable, reflecting two different regulatory environments. Because NPs may be especially important in rural areas, where access to primary care physicians is sparser [23, 24], we included the interaction of the state's NP regulatory environment with the proportion of county population living in rural areas. Thus, in addition to including multilevel constructs, spatial interaction is brought into the modeling by including the cross-level interaction between the state NP regulatory regime and county rural extent variable. Using spatial interaction models when warranted improves the modeling of the spatial heterogeneity among states.

Statistical Analysis

The statistical model was a random-intercepts specification with a binary mammography use variable defined at the individual level, estimated using SAS GLIMMIX. One of the main advantages of this random-intercepts specification of the statistical model was that the standard errors were robust to heteroskedasticity caused by variability in the size of populations across counties [28].

NP status and the degree of rural settlement, as well as their interaction, were included as necessary to examine the combined or net effect of their interaction. These net effects were then used to derive empirical estimates of policy effects. To enhance translation of these findings, predicted probabilities of utilization were calculated from the statistical model by using the quartiles of the rural distribution and the binary aspect of the NP regulation variable (Table 3).

Results

The variables used in the final empirical specification, along with descriptions and sample statistics, are provided in Table 1. The mean age was about 48 years. The mean time covered by Medicaid insurance during the 3-year study was 21 months. White non-Hispanic women comprised 38 % of the sample, followed by Hispanics (24 %), Black non-Hispanics (22 %), and Asian/Pacific Islanders (9 %). Table 1 also provides descriptive statistics for county and state-level variables.

The results from the multilevel model estimation are provided in Table 2. For the outcome variable, approximately 29 % of the Medicaid beneficiaries had at least one mammogram

during the study period (results not shown in the table). After controlling for potential confounding factors, as women aged, they were more likely to get a mammogram [OR = 1.02; 95 % CI (1.01–1.02)]. Women with disabilities had lower odds ratio [OR = 0.98; 95 % CI (0.98–0.99)] of having a mammogram compared to women without disabilities, and Black non-Hispanic women [OR = 0.87; 95 % CI (0.87–0.88)] and American Indian or Alaska Native women (AI/AN) [OR = 0.74; 95 % CI (0.71–0.76)] were less likely to have a mammogram than white non-Hispanic women. By contrast, Hispanic women [OR = 1.06; 95 % CI (1.05–1.07)] had higher odds ratio of mammography use than white women. Women with HMO coverage had higher odds ratio [OR = 2.13; 95 % CI (2.11–2.15)] of having a mammogram than women in FFS.

Living in counties with greater segregation for Asian [OR = 0.19; 95 % CI (0.17–0.21)] or black [OR = 0.78; 95 % CI (0.75–0.81)] residents was associated with lower mammography use for all women of all races or ethnicities living in those counties. By contrast, living in counties with greater segregation for Hispanic residents [OR = 1.16; 95 % CI (1.10–1.23)] was associated with higher mammography use for all women of all races or ethnicities living in those counties.

Medicaid-insured women living in counties where there was more new population growth [OR = 1.32; 95 % CI (1.21–1.44)] had higher odds of mammography use. Although a small effect, the further a woman lived from a mammogram facility, the less likely she was to have a mammogram [OR = 0.99; 95%CI (0.99–0.99)]. Women were also less likely to have a mammogram if they lived in a state with a greater perceived shortage of primary care providers [OR = 0.97; 95 % CI (0.95–0.98)]. Women who lived in counties with persistent poverty status over the past 25 years were more likely to get a mammogram than women living in other counties [OR = 1.10; 95 % CI (1.07–1.13)].

Table 3 shows predicted probabilities of mammography use across the urban-rural continuum in NP-unregulated versus NP-regulated states, where Q1 is less rural and Q3 is more rural. Mammography use was consistently higher across all quantiles of the urban-rural continuum in the unregulated states, where NPs have greater practice latitude, than in the regulated states. For example, in the completely urban areas, the predicted probability of mammography use was 28.05 % in the unregulated states and 24.24%in the regulated states. In the completely rural areas, the predicted probability of mammography use was 26.04 % in the unregulated states and 24.81% in the regulated states. Among the unregulated states, mammography use is lowest in the most rural areas and highest in the most urban ones. The regulated states exhibit a fairly constant probability of mammography across the urban-rural continuum, which appears slightly higher in rural areas than in urban ones (24.81 % in rural versus 24.24 % in urban counties).

Discussion and Summary

Three factors associated with higher odds ratio of mammography use at the individual level included being Asian or Hispanic (relative to whites), or having HMO rather than FFS coverage. By contrast, being of AI/AN or black race relative to whites was associated with lower odds ratio of mammography use. Thus, significant racial or ethnic disparities exist in

the Medicaid-insured population. Having HMO coverage rather than FFS coverage in Medicaid more than doubled the odds ratio of mammography use [OR = 2.13, 95 % CI (2.11–2.150)] which is consistent with a large literature that finds that HMOs and other forms of managed care promote utilization of preventive care services.

The ecological factors with the largest negative effects on the odds of use of mammography services were for women living in more highly segregated Asian or black communities. By contrast, women living in more highly segregated Hispanic communities had a higher odds of mammography utilization. Previous studies on the association between living in residentially segregated areas and health behaviors/outcomes have found either protective (positive) or harmful (negative) associations, which have varied by type of racial or ethnic segregation, consistent with the findings in this study [2, 29–37]. Some researchers have hypothesized that the negative aspects of segregation can become positive when there is a high degree of clustering into enclaves [38, 39]. It is important to note here that the segregation estimates reflect the ecological effect of anyone living in a place with higher segregation of these specific minorities, and do not reflect the effect of living in a more segregated place of one's own race or ethnicity. Living moreso in enclaves of similar people may confer aspects of social cohesion or support that warrant further study, but are beyond the scope of the present study.

Living in counties with higher in-migration of new population reflects conditions of economic opportunity and growing demand for medical services. Such places were found to be associated with a higher odds of use of mammography services, while distance to provider had a small negative relationship with use of mammography services. Because poverty rates were relatively uniform among all counties in the study, we examined the persistence of poverty over the past 25 years to more starkly delineate places with greater economic vulnerability. Somewhat surprisingly, we found that individuals living in counties with persistent poverty had higher odds of obtaining mammograms than persons living in other counties. Although all women in the study are low income, those living in these persistently poor counties seem to have a comparative advantage in terms of mammography utilization. Perhaps these persistently poor counties have better established Medicaid programs, stronger community health advocacy, or perhaps they have seen greater focus by health policy interventions (such as free screening events). This is another area where further research would be informative.

Two state-level ecological variables were examined for relationships with mammography utilization. First, greater perceived shortages of primary care providers were associated with lower likelihood of mammography use. Second, living in states with unregulated NPs was associated with higher odds of mammography use across the urban-rural continuum. These unregulated states (IA, MT, NH, NM, OK, WY) tend to have more of their land mass in rural areas; thus, the interaction between rural status and NP regulation was needed to reduce confounding between these two variables. Holding constant the rural aspect of population settlement, we were interested in the association between unregulated NPs and mammography use. We used the model to produce predicted mammography use in regulated versus unregulated states, at the quartiles of the rural settlement distribution. Contrasting the predicted probabilities across quartiles of the urban-rural continuum in regulated NP versus

unregulated NP states, the results indicate that the probability of use was higher for every quartile in the unregulated states compared with the regulated states. Thus, greater practice latitude for NPs (lack of regulation) was associated with higher use of mammography among Medicaid-insured women, regardless of rural extent in their county of residence.

Prior studies have examined several dimensions of NP practice on health outcomes. One study found that primary care services utilization is more responsive to supply factors in states with greater NP autonomy [21]. Another study found that health status, treatment practices, and prescribing behavior were consistent between nurse practitioners and physicians, leading to the conclusion that receiving primary care and having a usual source of care are more important than who it was that provided these services [22]. A third study found that scope-of-practice laws did not appear to limit what primary care services patients could receive from nurse practitioners, but requirements for documented physician supervision impacted both where and how NPs could practice [23]. A fourth study found that, by 2010, states with the least restrictive regulations of NP practice had a 2.5-fold greater likelihood of patients' receiving their primary care from NPs than did the most restrictive states [24]. Thus, the evidence suggests that availability of NPs with greater autonomy to provide services was associated with better utilization of primary care.

Avery recent study examined 100 % of BC cases in cancer registry data from 40 states to determine whether NP regulations were significantly associated with the likelihood of late-stage diagnosis of BC [40]. Women under age 65 were found significantly more likely to have late-stage diagnosis of BC than older women. However, the higher rate among younger women was modified (decreased) when living in a state with expansive NP privileges as compared to other states (OR 1.17 in state with expansive NP privileges vs OR 1.24 in other states). For women over age 65, living in states with expansive NP privileges had lower odds of late-stage BC diagnosis than women living in other states (OR 0.94 in state with expansive NP privileges vs OR 1.00 in other states) [40]. It is logical that the pathway through which NP practice latitude reduced late-stage BC diagnosis for these women was through their effect on mammography utilization; however, mammography utilization was not examined. The study presented here is the first to examine mammography utilization and find that increasing practice scope of NPs is associated with higher mammography utilization rates among Medicaid-insured women.

The study is timely, as many states now allow NPs to independently practice medicine, and others are considering this to help meet the demand for primary care services that expanded with implementation of the Affordable Care Act (ACA). Prior studies have found that health status, treatment practices, and prescribing behavior were consistent between NPs and physicians but NP regulation to ease shortages in primary care physicians remains a topic of policy debate [21–24].

The six states with unregulated NPs had relatively higher mammography utilization across the rural-urban continuum than the regulated states. However, these utilization rates were low, with the highest rate of about 28 % in the urban areas of the unregulated states and the lowest of about 24 % in the urban areas of the regulated states. When less than 1 of 4 women use mammography regularly, the risk of late-stage cancer at first diagnosis increases,

portending a significant burden of disease for this low-income, albeit insured, population. Therefore, it is essential that screening rates are increased among the Medicaid population to improve outcomes and reduce disparities.

The strength of the present study was that comprehensive data on all Medicaid beneficiaries in each state analyzed were included, and both fee-for-service and managed care enrollees were included. Some limitations are noted. The findings may not be generalizable across all states because only half of the states were analyzed. Both Medicaid fee-for-service and managed care claims may have incomplete records, and free screenings may have been offered and utilized in some communities, thus the true utilization of mammograms may have been underestimated. In addition, screening mammograms and diagnostic mammograms could not be differentiated on the basis of the information available in the claims and encounter data.

Racial or ethnic disparities exist in the use of mammography in the Medicaid program, at the individual level and at the county level where minorities are most concentrated. Interventions at the individual, county, and state levels are needed to address these disparities in mammography use. Facilitating or encouraging use in rural areas remains a challenge. Findings from this study indicate that relaxing NP scope-of-practice laws may be a promising lever to increase mammography rates among Medicaid-insured women across the urban-rural continuum. Additional interventions at the person level should also be investigated to reduce racial disparities in breast cancer death by increasing compliance with mammography screening.

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This manuscript has not been submitted to more than one journal for simultaneous consideration. This manuscript has not been published previously (partly or in full). This study has not been split up into several parts to increase the quantity of submissions and submitted to various journals or to one journal over time. No data have been fabricated or manipulated (including images) to support our conclusions. No data, text, or theories by others are presented as if they were the author's own. Proper acknowledgements to other works have been given. Consent to submit has been received explicitly from all co-authors, as well as from the responsible authorities—tacitly or explicitly—at the institute/organization where the work has been carried out. Authors whose names appear on this manuscript have contributed sufficiently to the scientific work and therefore share collective responsibility and accountability for the results.

Appendix

Table 4

Codes used to identify mammography

CPT/HCPCS	ICD-9
76082, 76083, 76090, 76091, 76092, 76093, 76094, 76498, 76499, 76645, 77051, 77052, 77055, 77056, 77057, 77058, 77059, C8903, C8904, C8905, C8906, C8907, C8908, 0159T, G0202, G0204, G0206, C8903, C8904, C8905, C8906, C8907, C8908	v761, v7610, v7611, v7612, v7619

Source: RTI and CDC review of the literature and consultation with expert advisors

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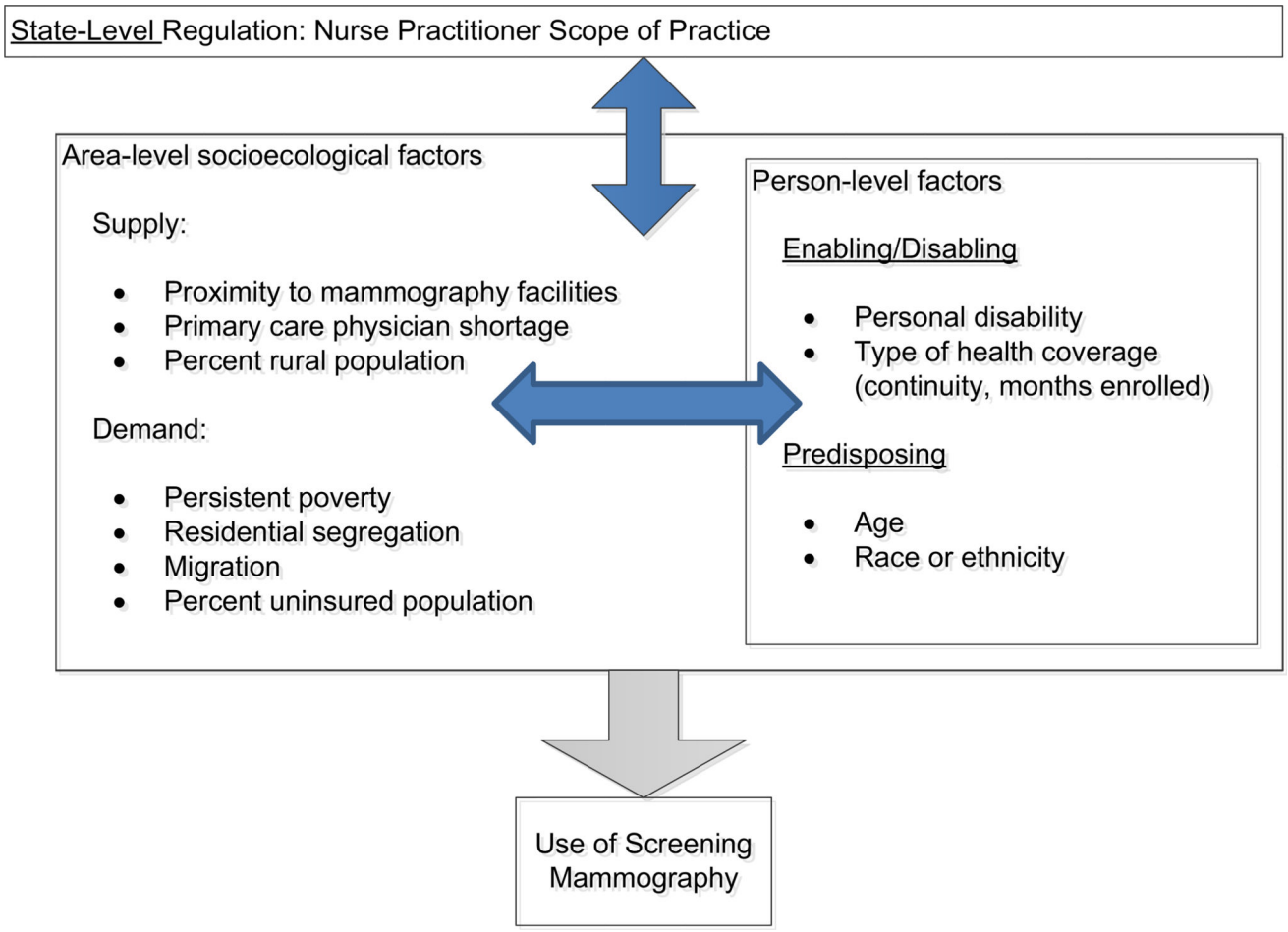

Fig. 1.
Spatial interaction model of mammography use among low-income, Medicaid-insured women

Table 1

Sample statistics for women with Medicaid in 25 states, 2006–2008

	Mean/ proportion	Standard deviation
Person level (n = 2,450,527)		
Age (years)	48.2	0.3
Number months enrolled (months)	21.0	0.6
Proportion with disability	0.3	0.0
Proportion with HMO coverage	0.5	0.1
Race		
White, non-Hispanic (%)	37.6	5.1
Black, non-Hispanic (%)	21.7	2.1
Hispanic (%)	23.5	7.0
Asian/PI, non-Hispanic (%)	8.7	1.9
AI/AN, non-Hispanic (%)	1.1	0.2
Other (%)	7.4	5.2
County level (n = 1715)		
Segregation index, Asian 2005–2009 (American Community Survey)	0.025	0.043
Segregation index, Black 2005–2009 (American Community Survey)	0.134	0.176
Segregation index, Hispanic 2005–2009 (American Community Survey)	0.123	0.164
Percent of population who moved into the county from another state 2005–2009 (American Community Survey)	9.9	8.2
Average distance in miles to the closest mammography facility in 2006[a]	16.9	14.6
Percent non-elderly population uninsured in 2005[a]	18.3	6.4
Percent of counties with persistent poverty 1979–2005[a]	8.8	28.3
Percent population living in rural areas in 2000[a]	60.6	31.4
State level (n = 25)		
Percent of states which allow NP to practice independent of physician oversight (six states: Iowa, Montana, New Hampshire, New Mexico, Oregon, and Wyoming)[b]	24	44
Percent of total population who perceive shortage of primary care providers, 2003[c]	11.5	4.7

[a] Source: RTI Spatial Impact Factor Database (https://rtispatialdata.rti.org) [22]

[b] Source: NCSL 2013 [13]

[c] Source: AARP 2003 [23]

Table 2

Multilevel modeling results: Medicaid mammography use, 2006–2008

Variable	Odds ratio	95 % CI	*P* value
Person level			
Age	1.02	1.01–1.02	*<0.001*
Number months enrolled	1.08	1.07–1.08	*<0.001*
Has disability	0.98	0.98–0.99	*<0.001*
Had HMO coverage	2.13	2.11–2.15	*<0.001*
Black, non-Hispanic[a]	0.87	0.87–0.88	*<0.001*
Hispanic[a]	1.06	1.05–1.07	*<0.001*
Asian/PI, non-Hispanic[a]	1.41	1.39–1.42	*<0.001*
AI/AN, non-Hispanic[a]	0.74	0.71–0.76	*<0.001*
Other[a]	1.27	1.25–1.29	*<0.001*
County level			
Segregation index, Asian 2005–2009	0.19	0.17–0.21	*<0.001*
Segregation index, Black 2005–2009	0.78	0.75–0.81	*<0.001*
Segregation index, Hispanic 2005–2009	1.16	1.10–1.23	*<0.001*
Proportion of population who moved to county from another state, 2005–2009	1.32	1.21–1.44	*<0.001*
Average distance in miles to the closest mammogram facility in 2006	0.99	0.99–0.99	*<0.001*
Percent of population uninsured in 2005	1.00	0.99–1.00	0.7790
Live in a county with persistent poverty, 1979–2005	1.10	1.07–1.13	*<0.001*
State level			
Percent of population who perceive shortage of primary care providers	0.97	0.95–0.98	*<0.001*
Cross-level interaction			
Unregulated NP scope of practice × proportion rural	0.90	0.83–0.99	*<0.05*
Regulated NP scope of practice × proportion rural	1.03	1.01–1.07	*<0.05*

Italicized *P* value indicates statistical significance

[a]The reference group is white, non-Hispanic

Table 3

Predicted probabilities of mammography use across the urban-rural continuum, in nurse practitioner regulated and unregulated states

Quartiles of the proportion rural population distribution	Predicted probabilities of mammography use, NP-unregulated states[a]	Predicted probabilities of mammography use, NP-regulated states[a]
Minimum (completely urban)	28.05 %	24.24 %
Q1(less rural)	28.03 %	24.25 %
Q2	27.98 %	24.26 %
Q3 (more rural)	27.64 %	24.36 %
Maximum (completely rural)	26.04 %	24.81 %

[a]Nurse practitioner unregulated in six states; nurse practitioner regulated in 19 states