The effects of navigation and types of neighborhoods on timely follow-up of abnormal mammogram among black women

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Abstract

Background—Despite the availability of relatively simple and inexpensive screening tools, minority women are more often diagnosed at a late stage of breast cancer, in part due to delays in follow-up of abnormal screening result. One of the key factors for timely follow-up of abnormal mammogram may be neighborhood characteristics. Patient Navigation (PN) programs aim to diminish barriers, but its differential effects by neighborhood have not been fully examined. The current study examines the effect of types of neighborhoods on time to follow-up of abnormal mammogram, and the differential effects of PN by neighborhood characteristics.

Methods—We examined data from a total of 1,696 randomized patients from a randomized controlled trial, "the Patient Navigation in Medically Underserved Areas" study that explored the effect of navigation on breast health outcomes. We categorized participants' neighborhoods into three categories and compared the effect of navigation between these neighborhood types.

Results—Navigated women in mixed race neighborhoods had a shorter time to follow-up compared with non-navigated women in the neighborhoods. Black women living in mixed neighborhoods had a significant longer time to follow-up of abnormal mammogram, compared with black women living in middle class black neighborhoods.

Conclusion—Patient navigation interventions improve timely follow-up of abnormal mammogram. Patient navigation may be particularly beneficial for minority women who reside in racially heterogeneous neighborhoods which may be less likely to have access to affordable health clinics and social services. Health policies concerning breast cancer early detection for minority women need to pay further attention to those who might potentially be excluded from health services due to the characteristics of neighborhoods. Socioeconomic conditions of neighborhood may affect individual health through multiple interlinked mechanisms. Neighborhood characteristics, such as poverty, segregation, access to resources, and social cohesion, cannot be fully understood with simplistic measures of neighborhood disadvantage.

1. Background

Reducing the black-white disparity in breast cancer-related mortality is a public health priority. Despite having lower incidence rates [1], black women have a higher mortality rate (30.8 per 100,000) compared with white women (22.1 per 100,000) [2]; black women also have a lower five year survival rate compared with their white counterparts [1, 3]. Although the causes of disparities are multifactorial, one modifiable determinant is stage at diagnosis [4]. Screening mammography has been shown to identify breast cancer at an early stage and is associated with a 44% reduction in risk of late-stage disease [5, 6]. Nonetheless, despite

the availability of relatively simple and inexpensive screening tools, racial/ethnic minority women are more often diagnosed at a late stage of breast cancer and, subsequently, face higher mortality rates relative to white counterparts [1, 5, 7–15]. In particular, late stage diagnosis in minority women has been attributed in part due to delays in diagnostic testing after an abnormal screening result relative to their white counterparts [5, 16]. Timely follow-up of abnormal test results can help early detection of abnormal changes, which can significantly reduce the cancer mortality rates, but studies have documented that racial/ethnic minority women were less like to follow-up abnormal mammogram [17–20]. Despite the availability of relatively simple and inexpensive screening tools, racial/ethnic minority women are more often diagnosed at a late stage of breast cancer and, subsequently, face higher mortality rates relative to white counterparts [1, 5, 7–15]. Improving early detection practices among this population and specifically time to diagnostic resolution is thus an effective strategy to address racial disparities in breast cancer related deaths among black women.

1.1. Predictors to timely follow-up: The role of neighborhoods

A myriad of factors including psycho-social, economic, cultural, and systems level barriers may affect timely follow-up in diagnostic testing [21–23]. Notably, the majority of work has focused on patient-level factors. For example, under or uninsured women were less likely to follow-up abnormal test results [24]. Women with less education and/or being poor were less likely to complete follow-up of abnormal mammogram [22, 24, 25]. Younger women were also less likely to follow-up abnormal findings than older women [25].

Studies have documented that neighborhood characteristics affect a myriad of health outcomes [26–31], including breast health. Dailey and colleagues explored neighborhood level predictors for breast cancer screening outcomes [29, 32–40], and a few other studies examined contextual level factors affecting breast cancer screening behavior [33, 41–45]. These studies indicate that neighborhood level poverty, racial residential segregation, and/or overall structural disadvantage were associated with poor breast cancer screening [29, 46–50].

The negative effects of racial residential segregation on cancer screening, care, and mortality have been well documented [51–53]. However, studies have also documented that minorities living in areas with a higher proportion of their own racial/ethnic group report better health [54–58]. These studies argue that, once controlling for socioeconomic disadvantages due to racial segregation, a high "ethnic density" provides social cohesion and sense of belonging which have protective and buffering effects against discrimination and social exclusion that minorities may experience when they live in predominantly white areas [54, 57]. Black women living in more racially heterogeneous neighborhoods may experience more social isolation and have less social support, which may affect their adherence to recommended breast cancer care [59, 60]. Such mechanisms may underlie other work that has indicated a protective effect on breast cancer mortality from black women living in racially homogeneous neighborhoods [61].

Very little is known about neighborhood characteristics and follow-up of abnormal mammogram results. There is a need to evaluate both the influences of neighborhood

disadvantage and ethnic density on this outcome. Women living in racially segregated and poor neighborhoods may lack access to quality health care facilities, which may affect timely follow-up of abnormal mammogram results. Conversely, women living in racially heterogeneous neighborhoods may experience a greater level of psychosocial barriers, which may influence their adherence and timely follow-up.

1.2. Patient navigation, neighborhoods, and timely follow-up

Interventions that address barriers to timely follow-up should address the myriad of psychosocial, economic, and contextual determinants influencing early breast cancer detection practices [62–65]. Patient Navigation (PN) represents such an effective, multi-stage approach for both routine screening and timely follow-up of abnormal screening results [19, 66–69] through reducing psychosocial, economic, and contextual barriers [65, 70–72]. Implemented in various settings, including safety-net clinics, urban hospitals and community health centers, and academic medical facilities [67, 70, 72–74], the majority of PN breast cancer-related care programs have been implemented to support women who are living in underserved areas [19, 65, 75–78]. The majority of work to date has largely focused on how PN addresses with patient-level barriers; little is known about how PN may buffer or diminish the influence of contextual barriers on routine screening and timely follow-up, although PN programs have been implemented in various disadvantaged and underserved geographic regions and neighborhood effects have been studied in these populations [46].

Understanding if and how PN may mitigate the influence of neighborhood effects on breast cancer-related outcomes however needs to be examined. Given the goals and objectives of PN are to diminish barriers, such as those experienced by living in disadvantaged neighborhoods, it may be that neighborhood differences may be attenuated or eliminated among navigated women, in contrast to women who receive standard care. Nonetheless, the four studies that have incorporated neighborhood-level factors have often included them in final models as potential confounders or other predictors of interest, but have not formally examined interactive effects or examined the relationship of these factors on outcomes across different study arms within PN programs [46, 65, 68, 77].

The current study addresses this gap in the literature by examining the effect of types of neighborhoods on time to follow-up of abnormal mammogram, and the differential effects of PN by neighborhood characteristics concerning time to follow-up of abnormal mammogram result. In particular, we examine the outcome differences among black women living in poor black neighborhoods, middle class black neighborhoods, and middle class mixed race neighborhoods to tease out the effects of neighborhood poverty and racial/ethnic composition, while paying attention to potential demographic, social, and economic barriers at the individual level.

2. Methods

2.1. Procedures

We examined data collected between 2010 and 2011 as part of the Patient Navigation in Medically Underserved Areas study, a randomized controlled trial conducted to explore the

effect of navigation on breast health outcomes. The study was approved by the University of Illinois at Chicago Institutional Review Board. The study recruited female patients, age 18 or older, who were not pregnant with an initial referral from a primary care provider for a screening mammography or for a diagnostic mammography based on an abnormal clinical breast exam from community hospitals situated in medically underserved areas. Patients eligible for the study who had screening or diagnostic mammography appointments were randomized into either the navigation group or the control group. All other patients not randomized into either the navigation or active control group were considered the passive control group. Eligible patients were recruited by phone or in-person from the hospital scheduled mammogram appointment list. Patients were contacted about their upcoming mammogram, and asked if they were interested in participating in the study. Patients who agreed to participate in the study completed a series of baseline questionnaires with a navigator via telephone or in-person interview. A total of 1,696 randomized patients completed baseline questionnaires. In addition to questionnaire data, medical records data were retrieved from electronic medical record systems for both the navigated and the control group.

The patient navigation intervention was developed using a lay patient navigator model. Navigators were lay health workers who live in areas from which study population resides and share sociodemographic characteristics with the population. Patients randomized to the intervention group received navigation by a trained navigator. Two days before patient's imaging appointment, the navigator called the patient and used a "teach back" method to ensure the patient understood the instructions for the mammography preparation, answered any questions, assessed any potential barriers to attending the appointment, and problem solved to eliminate these potential barriers. On the day preceding the appointment, the study participants received a reminder call about the appointment and re-assessed any potential barriers to compliance. The navigator then met with the patient at the appointment to assess if the patient had any questions, provided education and information, and discussed how the results of the exam would be communicated to the patient.

The navigator worked with the hospital clinical staff to ensure results were delivered to the patient and that the patient understood the results and the recommended follow-up (annual rescreening, additional diagnostic testing, or treatment initiation). Patients who continued with diagnostic testing or treatment completed an additional questionnaire designed to explore what clinical services were offered, what the patient understood about these services, what services were accepted by the patients and reasons for their decision. Patients randomized to the control group received care as usual at each hospital and did not receive any navigation services. Patients randomized to the control group were followed up with the study questionnaires. No navigation services were offered and no assistance with appointments, barriers or screening results offered. We compared women in the navigated and the control groups for this analysis.

2.2. Measures

Intervention variable was a dichotomous measure which categorized study participants into navigated or control groups. Time to follow-up of abnormal mammogram was calculated

using the initial mammography appointment date and the date of a follow-up diagnostic resolution for women who received an abnormal result. In this analysis, we included mammogram resulted in BI-RADS 0, 4, and 5. The Breast Imaging Reporting and Data System (BI-RADS) is a system that categorized mammogram results [79]. BI-RADS 0 means a possible abnormality may not be clearly seen or defined and more tests are needed. BI-RADS 4 indicates suspicious abnormality and it requires a biopsy. BI-RADS 5 indicates highly suggestive of malignancy and biopsy is strongly recommended for a follow-up. BI-RADS 0, 4, and 5 results are recommended to have a follow-up test done within 180 days. BI-RADS 1 means negative, BI-RADS 2 indicates benign finding, and BI-RADS 3 suggests high chance of benign but a repeat imaging is needed for confirmation.

Individual level socio-demographic characteristics included age, income, education level, employment status, marital status, and household size. For the analysis we dichotomized education level into less than high school education and high school and more. We used household income and household size to determine whether they live below federal poverty level. For example, in 2010, a household size of four with household income less than $22,000, and a household of eight with income below $37,000 were considered to be below poverty level [80]. Marital status was dichotomized into married and other. Employment status was dichotomized into full time employed and other. Insurance status included private, public insurance, and uninsured. Because the majority of study participants had either private or public insurance (over 99%), we compared private insurance with all others for this study. In addition, we calculated distance from home to the hospital where participants received mammogram.

To examine the effect of neighborhood characteristics on time to follow-up, we used census-tract level data, which has been suggested to operationalize neighborhoods and related characteristics better than zip codes [26, 40]. We used the eight neighborhood measures to define type of neighborhood, including % poverty, % black, % white, % Hispanic, % female headed households, % less than HS education, % unemployed, and median household income. Latent class analysis (LCA) was used to classify types of neighborhoods. This is an alternative to the commonly used concentrated disadvantage index, which is a concept that describes the degree of neighborhood economic and social disadvantages [81, 82] and is a continuous variable which implies a linear relationship between the score and neighborhood disadvantage and its negative effects. We argue that the relationships are not necessarily linear between neighborhoods and health outcomes. Qualitatively different types of neighborhoods exist that can be classified into distinct classes. The assumption of LCA is that the relationship among dichotomous indicators can be explained by categorical latent variables [83]. To determine the best model, we compared LCA models up to four classes by examining AIC and BIC statistics for each model with different number of classes. The three-class model fit data best with AIC and BIC values of respectively 65.80 and 164.69 relative to the four class model (AIC = 69.53; and BIC = 203.31). These neighborhoods were identified as poor black (Class 1), middle class black (Class 2) and middle class mixed neighborhoods (Class 3). Table 1 summarizes characteristics of these three types of neighborhoods.

2.3. Analysis

First, we compared characteristics of navigated women and the control using descriptive statistics (Table 2). Second, we then conducted linear regression analysis to examine the effect of navigation on the length of time to follow-up of abnormal mammogram (Table 3). To fully examine potential interaction effects between neighborhood types and navigation status, we introduced interaction terms with navigation status and neighborhood class dummy variables (Model 2). We then ran regression models separately for the navigated and the controls (Model 3). Finally, we controlled for other factors that have been shown to affect the length of time to follow-up (Model 4), and examined the relationships by navigation status (Model 5).

3. Results

Table 2 summarizes the sample characteristics. Navigated women were more likely to be older and unemployed than controls; on the other hand, navigated women were more likely to have private health insurance than the controls. In terms of neighborhood characteristics, navigated women were more likely, compared with the controls, to live father away from the hospital from which they received the mammogram. Although the majority of study participants were from predominantly black communities, navigated women were more likely to live in neighborhoods with a greater proportion of blacks. Overall, navigated women were more likely to live in middle class black neighborhoods and the controls were more likely to live in middle class mixed. In the subsequent analysis, we controlled for these differences between the navigated and controls, because these differences may influence for any main and interactive effects on the time to follow-up as confounders.

Table 3 summarizes the relationships between the time to follow-up, neighborhood type, and the navigation status. When examining main effects, although the length of time to follow-up of abnormal mammogram was longer for the control group, compared with the navigated group, the difference was not statistically significant (Model I). When including interaction terms, navigated women in mixed neighborhoods had a significantly shorter time to follow-up compared with non-navigated women in the neighborhoods (Model II). Black women living in mixed neighborhoods had a significant longer time to follow-up of abnormal mammogram, compared with black women living in middle class black neighborhoods. When we included individual sociodemographic factors in the model using all cases (Model IV), the interaction effect of neighborhood and navigation disappeared.

To further examine the differential effects of neighborhood type for the navigated and the controls, we ran separate regression analysis for those who were navigated and the controls. Model V shows the regression results by navigation status. With regard to patient-level factors, navigated women who had a full time job had a shorter time to follow-up; on the other hand, full time employment was associated with a longer time to follow-up among the controls. In terms of neighborhood type, living in middle class mixed neighborhood was continued to be associated with a longer time to follow-up abnormal mammogram.

4. Discussion

Overall, black women living in racially heterogeneous middle class neighborhoods seem to have a longer time to follow up after an abnormal mammogram compared with black women living in predominantly black middle class neighborhoods. This finding is interesting because it is counterintuitive at first glance, considering well established literature concerning the problem of racial residential segregation. The associations and interactions between neighborhood level disadvantage, poverty, racial residential segregation/homogeneity, and health outcomes may be far more complex due to the multiple mechanisms through which poverty, racial segregation and homogeneity may operate.

Currently, only a few studies have examined the neighborhood effects on follow-up of abnormal mammogram [17, 84]. Some studies examined delayed diagnosis of breast cancer [45, 61, 85], and the findings from these studies indicate that neighborhood disadvantage and racial segregation was associated with delayed diagnosis of breast cancer. From the racial segregation perspective, one might conclude that minority women living in racially mixed neighborhood may have improved outcomes relative to women living in segregated neighborhoods. On the other hand, many studies have documented that minorities living in predominantly minority areas tend to show better health status [55–58]. For example, Warner and Gomez (2010) found that living in a neighborhood with more black residents was associated with lower breast cancer specific and all-cause mortality among black breast cancer patients. Similarly, Russell and colleagues suggested that breast cancer mortality rates were higher in racially mixed tracts that were located in highly segregated metropolitan areas [86]. These studies argue that minorities living in areas with a high "group density" benefit from the sense of belonging and social cohesion that may mitigate the negative effects of discrimination and social exclusion which may be a greater burden for minority living in more racially mixed neighborhoods. Perhaps because these studies hypothesize psychosocial pathways through which racial composition/density may influence individual health outcomes, frequently these studies examine mental health outcomes. Nonetheless, the main argument of these studies is that neighborhood characteristics affect individual health conditions not only through material conditions, but also through interactional social context [57, 58].

Our findings seem to support the buffering effects of group density argument on health. Our study is innovative, in that we were able to separate poor black neighborhoods from middle class black neighborhoods, which allowed us to compare middle class black neighborhoods with middle class mixed neighborhoods. Previous studies have not been able to tease out the effects of racial density from economic disadvantage, in part because highly segregated black neighborhoods are disproportionately more likely to be also economically deprived [87–90]. Our study provided a closer look at the effect of neighborhood racial composition separate from the level of economic deprivation. Our study finding indicates that although there was no difference between middle class black and poor black neighborhoods, but there was a significant difference between middle class black and middle class mixed neighborhoods. This finding suggests that area level racial composition may play a more significant role regarding timely follow-up of abnormal test results among black women. Although our data did not allow us to directly examine the level of social cohesion, we

speculate that black women living in racially mixed neighborhoods in our study may experience a great degree of social isolation, while black women living in predominantly black neighborhoods benefit from a level of social cohesion and support which may be resulted from a high level of racial homogeneity [55–58].

Another potential explanation for the poorer follow-up of abnormal mammogram among black women living in middle mixed neighborhoods compared predominantly black neighborhoods may have to do with health policy associated with resource allocation. For example, by definition, federally qualified health centers are strategically located in underserved areas, which are often minority communities [91]. Consequently, poor women living outside of these neighborhoods may have more difficulty accessing healthcare. Indeed, our additional descriptive comparison between the three types of neighborhoods showed that the average travel time to the closest clinic was significantly longer for women living in middle class mixed neighborhoods compared with the time for women in middle class black neighborhoods (3.8 and 2.9, respectively). Although this is a topic beyond the primary aims of the current study, further research examining the relationship between neighborhood types and access to care among minority women may be beneficial.

Previous studies have documented that PN programs improved breast cancer screening and detection outcomes among minority women living in urban poverty areas [19, 46, 65, 77]. Our findings seem to confirm the effectiveness of PN programs on timely breast cancer follow-up and early detection and indicate that navigation mitigates negative effects of socioeconomic conditions on timely follow-up. Examining the regression relationships for the navigated women and the controls, our findings showed that the effect of neighborhood type was no longer significant for the navigated women.

There are several limitations to the study. First, this was a secondary analysis of a pragmatic trial with a randomization scheme that was set to disproportionately designate women to receive navigation services. As such, there were limited number of controls for our analysis, which may have influenced our findings. Indeed, the navigated and the control groups differ in several sociodemographic characteristics, including age, poverty, employment status, and distance to the hospital. We controlled for these variables in our analysis, however, the problem with the difference in the size of the groups could not be adjusted. The other limitation of our analysis is that because of the high level of missing responses to the income question, we were not able to use direct measure of individual level poverty. Instead, we used education, insurance status, and employment to compare women's economic condition. These variables are reasonable proxy for income/poverty, but this analysis was not able to draw direct comparisons between the effects of neighborhood level and individual level poverty on follow-up of abnormal mammogram. Next, the current study focused on black women, for whom there are unique and striking disparities in breast cancer. Nonetheless, other ethnic/racial minorities with poor cancer outcomes, such as Hispanic women, need further research, and studies such as ours may help examine how neighborhood characteristics affect health outcomes among these populations.

Despite these limitations, however, this study offered unique contributions to better understanding the effects of patient navigation and neighborhood characteristics on follow-

up of abnormal mammogram among black women. Our findings indicate that patient navigation interventions improve timely follow-up of abnormal mammogram which is a key element to early detection of breast cancer. Patient navigation may be particularly beneficial for minority women who reside in relatively well-to-do and racially heterogeneous neighborhoods which may be less likely to have access to affordable health clinics and other social services. Publicly funded health programs, including Medically Underserved Area (MUA) designation, federally qualified health centers (FQHCs), and National Breast and Cervical Cancer Early Detection Program (NBCCED), are targeted to improve access to care for individuals living in underserved, often racially segregated areas. However, health policies concerning breast cancer early detection for minority women need to pay further attention to those who might potentially be excluded from existing health and social services due to the characteristics of neighborhoods where they live.

Socioeconomic conditions of neighborhood may affect individual health through multiple interlinked mechanisms. Neighborhood characteristics, such as poverty, segregation, access to resources, and social cohesion, cannot be fully understood with simplistic measures of neighborhood disadvantage. Our study findings contribute to conceptualizing nonlinear nuanced neighborhood effects on health.

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Table 1

Summary of three latent classes of neighborhoods

Label	Poor black	Middle class black	Middle class mixed race
Neighborhood Class	1	2	3
Latent Class Prevalence	24%	61%	16%
Total N	1,073	3,704	892
Characteristics			
% black	92.60	91.96	17.63
% white	3.26	5.26	52.35
% Hispanic	5.35	2.50	45.90
HH median income	$26,301	$44,496	$45,875
% owned home	35.06	61.64	62.57
% poverty	39.89	18.96	19.79
% unemployed	24.16	16.13	11.62
% less than HS	18.50	10.59	11.43
% female headed HH	29.08	19.28	13.00
% owned home	35.06	61.64	62.57

Table 2

Sample characteristics

	Total	Navigated	Control	P
N=1,608	12.1	11.9	15.5	<.01
Age	60	60	57	<.01
Poverty	23.1	22.4	27.6	n.s.
Income < $30,000	40.6	39.9	45.4	n.s.
Insurance				<.05
Private insurance	73.5	74.0	70.2	
Public insurance	26.4	25.9	28.9	
No insurance	0.2	0.1	0.9	
Marital status				n.s.
Never married	28.4	27.0	35.7	
Married	33.5	33.6	31.5	
Divorced/Separated	21.5	21.7	19.6	
Widowed	16.6	17.1	13.2	
Education				n.s.
< High school	10.5	10.0	13.2	
High school	24.6	24.6	24.3	
>=College	65.0	65.4	62.4	
Employment				<.01
Unemployed	48.8	50.7	37.8	
Part time	6.7	6.7	6.9	
Full time	40.0	38.5	48.5	
Distance to Hospital	8.4	8.5	7.4	<.01
Neighborhood				
% poverty	23.0	22.8	24.4	n.s.
% white	11.0	10.8	12.0	n.s.
% black	82.5	82.9	79.0	<.05
% unemployed	16.9	16.9	17.4	n.s.
% less than HS	12.2	12.1	13.1	n.s.
% female headed HH	20.4	20.2	20.8	n.s.
Median HH income	$41,654	$41,799	$40,457	n.s.

Table 3

Predicting time to follow-up by navigated status and neighborhood type

	Model I	Model II	Model III		Model IV	Model V	
			Navigated	Control		Navigated	Control
Number of cases	695	695	644	51	634	583	51
Navigated	−.56	2.26	–	–	2.59		
Class 1	−1.36	5.82	−1.91	5.82	6.37	−2.92	5.00
Class 2	–	–	–	–			
Class 3	5.48+	26.88**	3.50	26.88*	26.09*	3.47	26.19*
Navigated*Class 1	–	−7.74			−9.29		
Navigated*Class 3	–	−23.38*			−22.53*		
Age	–	–			−0.08	−0.03	−0.55
Married	–	–			−0.28	−0.36	6.57
< HS edu	–	–			−1.53	0.89	−13.95
Private insurance	–	–			−1.64	−0.17	−16.51
Full time employed	–	–			−6.51*	6.34*	−7.81
R2	0.0072	0.0140	0.0033	0.1101	0.0272	0.0165	0.2689