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Neighborhood-level Influences on Delays in Diagnostic Follow-up from Mammography Screening in African-American Women: A Systematic Review

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Abstract

Although there has been a steady decrease in breast cancer deaths among all women (pooled data) age 40 to 65 years during the past two decades in the United States, breast cancer deaths remain substantially higher among African-American women than White women (32.4% vs. 23.9%), resulting in an overall lower five-year survival rate (78.4% vs. 91.2%). These differences are primarily due to delays in diagnostic follow-up from mammography screening (MS) (ACS, 2012). Following the secondary research data methods by analyzing the popular medical databases and articles published in the peer-reviewed medical journals in US during 2004-2014 the author would like to explore the Neighborhood-level Influences in Delays in Diagnostic and Follow-up in the Mammography Screening among the African-American Women.

Keywords: Mammography screening; Breast cancer; Breast carcinomas

Introduction

In a national cohort study using tumor registry records of 247 African-American and White women with pathology-confirmed first primary in situ and invasive breast carcinomas with no known previous cancer diagnosis [1], Williams et al. [2] found that diagnostic treatment delays were significantly higher in African-American women than White women (34% vs. 17%). Richards et al. [3] review of several meta-analysis studies confirmed these findings and concludes that the excess burden of increased tumor size, advanced disease stage and poorer long-term survival were exacerbated when delays in diagnostic follow-up persisted for 3 to 6 months.

Previous research has found that race/ethnicity, age ≥ 40 years, lower levels of education and median household income, and lack of insurance, solely or in combination, were predictors of delays in diagnostic follow-up from abnormal MS in African-American women [4-7]. In Fair et al. study of 76 medically-underserved women age >40 years with inadequate follow-up imaging or biopsy (≥ 6 months since mammogram results), 48% of African-American women perceived low benefits and high barriers to follow-up from screening and care, and reported a decrease in internal health locus of control. Gullatte et al. [8] and Lannin et al. [9] reported that African-American women held fatalistic views, coupled with fears of finding cancer accounted for delays in follow-up from abnormal MS. Several researchers found that "wait time' in ambulatory settings prohibited follow-up from abnormal MS in African-American women [4,10,11]. Similar to the previous findings, Jones et al. [12] found that 'wait time' was much longer for racial and ethnic minority patients being served in public-hospitals than private hospitals with the majority White patients (94 days vs. 77 days). Furthermore, perceptions of racial discrimination in healthcare systems negatively affected interactions with primary care providers and therefore, decreased diagnostic follow-up in African-American women [11,13,14].

In recent years, there has been a significant increase in studies exploring relationships between neighborhood-level factors of concentrated poverty levels and crowding, spatial separation of two or more race/ethnicities, location of MS facilities, number of primary care providers and radiologists, higher commuter intensity and travel time via public transportation and automobile, safety/crime and delays in diagnostic follow-up from abnormal MS or late-diagnosis of breast cancer [terms were used interchangeable] in lower-income women, particularly in African-American women. Despite research displaying consistent findings that poor neighborhoods have a negative effect on delays in diagnostic follow-up for these women, no published studies exist which integrates these findings into one study.

The aim of this systematic, rigorous review is to provide a concise and exhaustive summary of the evidence on how and to what extent does neighborhood-level factors affect late-diagnosis of breast cancer in African-American women age 40 to 65 years with disturbing higher mortality and poorer survival rates.

Methods

Search strategies and inclusion criteria

An initial review of electronic literature databases of CINAHL, Medline, My NCBI (National Center for Biotechnology Information at the U.S. National Library of Medicine), PubMed, EMBASE, the Cochrane Library, Eric and Google Scholar, and Web of Science were conducted along using key words of African-American or Black women, delays in diagnostic follow-up from abnormal MS and neighborhood-level factors. The evidence was reviewed for the inclusion criteria: (1) specified neighborhood-level factors and delays from diagnostic follow-up from abnormal MS or late-diagnosis of breast cancer in the title of the study or abstract and index terms used to describe relevant studies; (2) were published in English-language in a scientific peer-reviewed journal in the U.S. in the last 10 years, 2004-2014; and (3) were retrieved from national university library depositories (interlibrary loan). Two searches were conducted. In the first search, 30 articles were

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located, of which six articles were not retrievable through interlibrary loan. Of the remaining 24 articles, 11 did not meet the inclusion criteria because outcome measures reported were different than the topic area under investigation, were not reported in English-language or scientific peer-reviewed journal, and did not include Black or African-American women, Leaving only 13 articles study was available for review from this search.

The second search using the Medical Subject Headings (MeSH) terms: 'breast neoplasms' AND 'delayed diagnoses' OR 'breast neoplasms' AND 'delayed diagnosis' AND 'African-American women' was undertaken by the main author to ensure that all available studies published since 2004 were reviewed. This review resulted in four additional studies for a total of 17 articles which met the inclusion criteria and were available for review. Thus, 57% of all articles reviewed (17 out of 30) were included in this analysis. When disagreement occurred between the authors' independent reviews; consultation with another reviewer familiar with conducting systematic reviews resolved the issue. The review of the literature used Moher et al. [15] modified Prism flowchart below displays the criteria for identifying and selecting relevant studies in the literature review (Figure 1).

Data retrieval and analyses

This systematic review included multi-level measures that analyzed population-based studies from nationally-representative data, such as SEER (Surveillance Epidemiology End Results) cancer registry summary files and geocoded data extracted from the U.S. Census, and Census Tract (CT) zip code using spatial analysis software. Of these studies, one abstracted data from medical records and conducted follow-up telephone interviews [16], two were cross-sectional designs [17,18], and another was an exploratory, retrospective cohort study [19]. Odds ratios (OR) and weighted means were calculated at the 95% Confidence Interval (CI) with multivariate analysis calculating relative risk. Twelve of the 17 studies (67%) examined relationships between residence in disadvantaged neighborhoods and Socio-Economic Status (SES) (age ≥ 45 years, lower education and median household income, and lack of insurance) and delays in diagnostic follow-up from abnormal MS or late-diagnosis of breast cancer [17,20-28]. Three studies examined racial segregation on delays in diagnostic follow-up [18,21,29]; while two studies examined relationships between racially-segregated neighborhoods and lack of primary care providers and radiologists on later-stage diagnosis of breast cancer. The remaining studies investigated public transportation travel time (commuter intensity), location of MS facilities, safety/crimes, and late-diagnosis of breast cancer between racial/ethnic groups [18,19,24,28].

Given the multiplicity of data, researchers used various statistical methods and procedures to analyze these data. Chi-square tests were used for categorical variables. Confidence Intervals (CI) estimates the range of values that are likely to be included in an unknown population, whereas bivariate Odds Ratios (OR) indicates the likelihood of an event occurring in one or more groups. Logistic Regression (LR) computes the effect of the independent variable on the dependent variable. Finally, Relative Risk (RR) discerns the risk of an event occurring in comparison groups relative to the exposure [30].

Criteria for presenting findings

Whittemore and Knafl's criteria for completing the systematic review was used [31].

Results

Socio-demographic status of women and neighborhood-level determinants

Research investigations across racial/ethnic categories (African-American, Asian/Pacific Islanders, Hispanic/Latina, Mixed-race, Native American, and White) included women age 19 to 104 years with a mean age of 61.5 years in primarily, urban metropolitan cities with the exception of Higginbotham et al. [32] study in rural Mississippi. Three studies did not report mean or median age of the study population [27].Two studies compared data in metropolitan suburbs with a higher concentration of minority population [27]. One study comprised a large populace of women in 11 heterogeneous states [18], while another study consisted of several states as part of the Cancer Research Network (Table 1) [33].

Several studies found that female-headed households or single status with less education and/or living in neighborhoods described as crowded, disadvantaged, economically-distressed or medically-underserved area with higher levels of unemployment and working-class Black residents influenced late-diagnosis of breast cancer across race/ethnicities [20-24,29].

Disadvantage neighborhoods

In a retrospective chart review examining seven multi-city healthcare plans and SEER tumor registries, Taplin et al. [33] analyzed the relationship between breast cancer diagnosis, SES, absence of MS, and history of breast cancer in women age >50 years. The SEER tumor registry located 1347 cases of potential late-stage of breast cancer and 1347 cases of early-stage of breast cancer consisting of White (82.1%
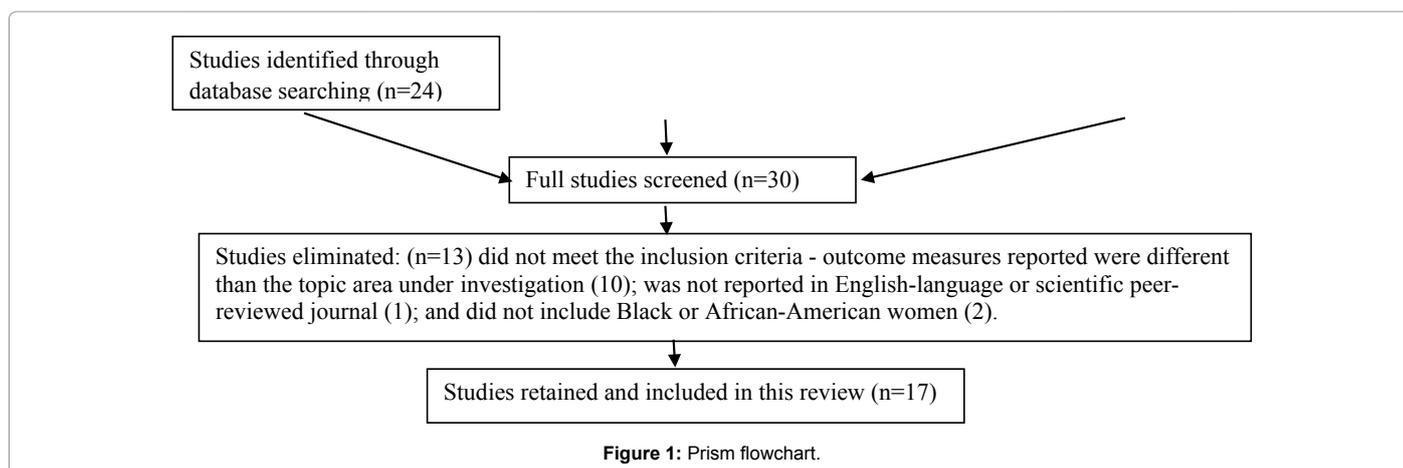

Figure 1: Prism flowchart.

vs. 82.5%), Black (9.7% vs. 8.5%), and Asian women (7.9% vs. 8.8%). They found that the odds of having late-stage breast cancer were higher in unmarried women age >75 years with an absence of MS, negative history of breast cancer, and living in CTs with low levels of education

and median household income across different race/ethnicity (Table 2).

In 2005, Barry and Breen extracted race/ethnicity, age, and

Study	Sample Characteristics and Setting
1. Barry and Breen [20]	13,398 African-American (AA), Asian/Pacific Islander, Hispanic, and White women age 50-64 in Atlanta, GA, Detroit, MI, and San Francisco, CA
2. Dailey et al. [21]	1,229 AA and White women age 40-79 years in Connecticut
3. Dajun	3,595 Black women age (not stated) in 3 metropolitan suburbs of Detroit, MI (Pontiac, Ecorse & Inkster)
4. Davidson et al.	112, 471 AA, Asian/Pacific Islander, Hispanic, and White women age <40 to >65 years in California
5. Echeverria et al. [22]	4,589 AA, Hispanic and White women 20-80 years in New Jersey
6. Flores et al. [23]	39.533 AA, Asian/Pacific Islander, Hispanic and White women age 40-64 years in California
7. Gumpertz et al. [24]	24,933 AA, Asian/Pacific Islander, Hispanic, and White women age 19-103 (median age = 61 years) in Los Angeles, CA
8. Higginbotham et al. [32]	5,732 AA and White women age (not stated) in Mississippi
9. McKinnon [17]	18,683 AA and White women age 24-85+ in Florida
10. Mobley et al. [18]	3,805 AA, Asian/Pacific Islander, Hispanic, Native American, and White women age >64 years in 11 heterogeneous states
11. Russell et al. [25]	22,088 AA and White women age 40-85 years in Atlanta, GA
12. Schootman et al. [26]	2,580 AA and White women age 50-64 years in Missouri
13. Taplin et al. [33]	1,347 AA, Asian/Pacific Islander, Native-American, and White women age >50 years participating in the Cancer Network in Hawaii, California, Colorado, Northwest Oregon, Michigan, and Washington state
14. Tarlov et al. [19]	4,533 AA, Hispanic, and White women age ≥45 years in Chicago, IL
15. Tian et al. [27]	44,515 cases (AA, Hispanic, and White women age (not stated) in 3 metropolitan areas of Texas (Houston, Dallas, and Austin-San Antonio)
16. Warner and Gomez [29]	124,009 AA and White women age < 40 to 70+ years in California
17. Zenk et al. [28]	4,533 AA, Hispanic, and White women age >45 years in Chicago, IL

Table 1: Comparison of Studies by Sample Characteristics and Setting.

Study	Research Design/Method and Data Retrieval	Data Analyses	Major Findings
1. Barry and Breen [20]	SEER cancer cases; 1990 U.S. Census – neighborhood level indices of underclass, extreme poverty, and medical underserved	Logistic regression (LR); Confidence Interval (CI)	Delayed diagnosis of breast cancer was linked to ages 50-64 years (1.007, 1.017), unmarried status (1.241, 1.641), and income below the poverty level (1.042, 1.847) in African-American (AA) women (1.243, 1.835) and Asian-Pacific Islander women in economically distressed neighborhoods.
2. Dailey et al. [21]	SEER cancer registry data; Neighborhood-level factors.	Multivariate LR measures; SES Index; (CI 95%); OR	Neighborhood-level factors (crowding (% households without a car, and housing units boarded up) affected non-adherence to mammography (MS) for AA women (3.56, 95% CI: 1.34-9.47); marginally for White women (1.72 (CI: 1.07-2.74).
3. Dajun	Cancer Surveillance - breast cancer data geocoded to zip code of residence (age, stage at diagnosis, and year of diagnosis). Reference USA provided data set of primary care physician and location). Isolation index measured Black segregation	ArcGIS network analyst tool simulated travel through the network; bivariate correlation and multiple regression	Risk for later-stage diagnosis of breast cancer (LSDBC) were increased in Black female-head of households with low education, high unemployment, and poverty in segregated adjacent metropolitan suburbs (p<0.049). Furthermore, lack of primary care access (p<0.05) and spatial accessibility to MS facilities influenced risk for LSDBC (p<0.067).
4. Davidson et al. [23]	Community-and-county-level risk factors from CT data.	Multivariate LR; Relative Risk; (CI 95%); OR	Risk for LSDBC was greater in female-headed households of AA women (RR=0.82) and Hispanic women (RR=0.85) less than 50 years (RR=0.64), never married (RR=0.95), living below the poverty level (OR=1.006), and less educated (OR=0.996, p. ≤ 0.001). Decreased number of primary care providers (RR = 1.014) and radiologists (RR=1.010 also increased risk for LSDBC in both groups.
5. Echeverria et al. [22]	SEER Summary data (breast cancer staging); CT data	LR models; OR	Black and White women had comparable significance for living in poorer areas (OR, 1.8; CI: 1.2-2.6, p<0.01) and (OR, 1.6; CI: 1.0-2.5, p<0.06); these trend data did not hold for Hispanic/Latina women.
6. Flores et al. [23]	California Cancer Registry from 1990 & 2000 U.S. Census	x^2.	Lower income (0.0013, p<0.05) and lower education (0.0005, p<0.01) was linked to advanced breast disease (ABD) in Black and White women.
7. Gumpertz et al. [24]	SEER Summary data (breast cancer cases); CT data	OR	ABD was higher in CTs with lower median household incomes for Black and White women (p=0.02 and 0.03). The % working class (p=0.02), % households without cars (p=0.005) for all women. Higher commuter distance to the nearest MS facility was linked to ABD in Hispanic (p=0.002) and White women (p=0.01) ONLY.
8. Higginbotham et al. [32]	Mississippi State Department of Health Central Cancer Registry & State Department of Health Division of Vital Statistics	OR	AA women in urban vs. rural areas had higher age-adjusted breast cancer mortality rates (41.1 vs. 39.9); these trends did not hold for White women in urban vs. rural areas (25.1 vs. 27.1, p<0.05). Later staging at first diagnosis of breast cancer was higher in urban vs. rural women (4.9% vs. 5.3%, p<0.05). No distinction made between race/ethnicity.
9. McKinnon [17]	Cross-sectional research design; Spatial analysis of neighborhood-block level data	SaTScan cluster detection software; CI 95%)	Black women were more likely to be uninsured (12.3% vs. 4.7%), receive Medicaid (11.2% vs. 3.3%), and live in areas of severe (OR=2.6, 95%, CI: 1.9-3.4) or near severe poverty level (OR=1.4; 95%, CI: 1.0-2.2) than White women (24% vs. 7.5%).

10. Mobley et al. [18]	Cross-sectional research design; SEER cancer registries linked to Medicare-eligible women; Geocoded zip codes	Regression models estimated pooled data across 11 heterogeneous states.	This cross-sectional design showed that higher commuter intensity (-14%), violent crime rates (-1%), (urbanicity) (-6%) and more segregated communities (-3%) affected utilization of MS across race/ethnicities.
11. Russell et al. [25]	Georgia Comprehensive Cancer Registry; CT data (% of segregation, poverty and racial/ethnicity)	RR; (CI 95%)	Segregation and below the poverty level (p. <0.001) affected breast cancer mortality in AA women (RR=1.77; 95% CI: 1.50-2.09, p<0.001).
12. Schootman et al. [26]	Hierarchical logistic method estimated the geographic scale of the variation in adequacy of diagnostic follow-up (ADFU) after abnormal MS in the *Show Me Healthy* cancer detection program.	Multilevel logistic model; RR; OR (CI 95%)	ADFU was lower in AA women vs. White women (92.2% vs. 76.8%, p<0.001); not married vs. married (83.3% vs. 73.9%, p<0.001); no insurance vs. insurance (80.3 vs. 76.1%, p=0.006, and residence in metropolitan areas vs. rural counties (92.3% vs. =69.2%, p<0.001). Higher poverty rates was linked to ADFU (OR=0.65) (race/ethnicity was not specified). Urban sprawl negatively affected ADFU (OR: 0.65).
13. Taplin et al. [33]	Retrospective review of medical records; SES factors.	OR (CI 95%)	LSDBC was higher with an absence of MS (OR=2.17, 95%, CI: 1.84-2.56; p=001); less education (58.5% vs. 49.4%); p=.003, lower median income (54.4% vs. 42.9%; p=.003); age $\geq$ 75 years (OR=2.77, 95%, CI: 2.10, 3.65); unmarried (1.78, CI: 1.41, 2.24); and without family history of breast cancer (1.84, CI: 1.45, 2.34) across race/ethnicities.
14. Tarlov et al. [19]	Exploratory (retrospective cohort design); Illinois State Cancer Registry; CT data using GIS software.	OR (CI 95%)	The number of homicides in areas nearest MS facilities was associated with increased odds of LSDBC across race/ethnicity (OR=1.05 (95% CI: 1.00-1.11, p<0.025), but AA women ONLY had LSDBC (p<0.005).
15. Tian et al. [27]	Texas Cancer Registry; SEER Summary Staging Coding Scheme; CT data.	Geographically weighted LR analysis using ArcInfo software, (CI 95%)	LSDBC and mortality rates were higher in poorest CTs for AA (18.35, CI: 10.35-32.52) and Hispanic women (46.89, CI: 23.07-95.30).
16. Warner and Gomez [29]	Cancer registry data (stage at diagnosis); geocoded CT data; 5 dimensions of racial-residential segregation.	Cox proportional hazards regression; (CI 95%)	Segregated neighborhoods had higher odds of distant stage of breast cancer for Black (OR=2.11, 95% CI: 1.05-4.27) and White women (OR = 1.31, 95% CI: 1.01-171).
17. Zenk et al. [28]	Spatial access measures of public transportation, crime rates, distance, and travel time to MS facilities.	Mean, median and interquartile range	AA women in high poverty neighborhoods vs. low poverty neighborhoods had longer travel distances via automobile (20 vs. 10.7) and public transportation travel time (37 vs. 16.8).

Chi square (x^2) = compares or counts the categorical response between 2 or more independent groups
Confidence Interval (CI) = estimate range of values that are likely to be included in an unknown population
Odds ratio (OR) = ratio of odds or probability of an odds occurring
Logistic regression (LR) = used to model dichotomous outcome variables
Relative risk (RR) = refers to risk of an event in comparison groups relative to the exposure

Table 2: Comparison of Studies by Research Design or Method, Data Retrieval, Data Analyses, and Major Findings.

marital status using CT and SEER cancer registry data to test whether residing in neighborhoods where 40% of the population lived below the Federal poverty threshold or medically-underserved areas for three metropolitan cities across the U.S. were linked to staging of breast cancer in 1,257 women age 20 to 80 years (mean age = 60.9 years) classified as un-stage (n=233) or in situ stage (n=1,024). The majority of their sample consisted of White women (59%), with about a quarter being African-American (25.5%), and less than a quarter being (15.5%) Asian/Pacific Islander and Hispanic/Latina (combined due to small sample size). Similar to the previous findings, significant differences were found in advanced stage breast cancer in older unmarried women living in more deprived neighborhoods than older women living in more SES advantage neighborhoods (p<0.05).

A comparative study conducted by Davidson et al. [23] examined the relationship between community-level risk factors and resources on breast cancer stage at diagnosis for 112,471 African-American and Hispanic women less than 40 years to greater than 75 years from cancer registry data. Within this study, community-level risk factors were: (1) greater percentage of female-headed households; (2) persons living below the Federal poverty level; (3) less educated; (4) unmarried status; and (5) greater percentage of females age $\geq$ 65 years. Resources included: ever had a mammogram, insurance status in the past 12 months, and hospital's reporting record of caring for less than 40 patients with breast cancer. Black and Hispanic single or never married women without insurance receiving services at hospitals delivering annual care to less than 40 patients with breast cancer were diagnosed at a later stage of breast cancer. Similarly, women dwelling in neighborhoods with higher percentage of female-headed households and women residents >65 years compared to women living in higher median income communities or in counties with greater percentage of

women reporting ever having a mammogram and more radiologists were linked to late-stage of breast cancer.

Gumpertyz et al. [24] found significant relationships between advanced breast cancer in depressed neighborhoods with lower median household incomes for Black and White women age 19 to 108 years (median age = 61 years) (p=0.02 and 0.03, respectively). In further analysis adjusting for SES variables, the predicted odds of advanced breast cancer remained slightly elevated for Black women, but were reduced for Asian/Pacific Island women. Age and marital status, and distance within three miles radius of MS facilities were statistically significant for advanced breast cancer for Hispanic and White women, but not for Black women (p<0.05). Davidson et al. and Tian et al. [23,27] found similar results in late-diagnosis of breast cancer for Hispanic women, but not for Asian or White women.

In a related study, Schootman led a team of researchers examining whether geographic clustering, personal characteristics, and area poverty rate affected the Adequacy of Diagnostic Follow-Up (ADFU) in Black (12.7%), White (84.9%), and Mixed-race (2.4%) low-income women age 50-64 years with abnormal breast cancer screening results while enrolled in the 'Show Me Healthy Women' program [26]. Women residing in areas with the highest poverty rate were less likely to receive ADFU. When comparing residence in metropolitan counties with rural counties (p<0.001), African-American women vs. White women (p<0.001), not married vs. married (p<0.001), and having no insurance vs. having insurance (p<0.006) were strongly associated with delays in diagnostic follow-up of abnormal MS. Although 'urban sprawl', which has been used in urban development in building (or rebuilding), the infrastructure in neighborhoods supporting new housing, roads for travel into and out of neighborhoods, and job opportunities, it had a

negative effect on ADFU for lower-income African-American women (OR: 0.65). McKinnon et al. [17] study corroborated the previous findings and emphasized that Black women were three times more likely to be uninsured (12.3% vs. 4.7%), receive Medicaid insurance (11.2% vs. 3.3%), and to live in areas of severe or near severe poverty than White women (24% vs. 7.5%). These findings provide definitive evidence that income is a critical factor affecting late-diagnosis of breast cancer in African-American women.

Using data from a prospective study, Dailey et al. [21] examined the effects of neighborhood-level SES predictors on non-adherence to regular MS guidelines in 1,451 African-American and White women age 40 to 79 years who had obtained an "index" MS at one of five urban hospitals. After the initial screening, 85% or 1,229 women participated in a 45-minute baseline and follow-up telephone interview (average 29.4 months later). A distinct comparison could not be made between neighborhood-level SES predictors and non-adherence to regular MS in the study population. However, self-report data from two independent telephone interviews reveal that African-American and White women reported negative experiences from living in disadvantaged neighborhoods. African-American women related to interviewers that the decaying of their neighborhoods as established by boarded up or abandoned housing and the percentage of households without a car diminished adherence to regular MS guidelines. Comparatively, White women reported overcrowding and decreased neighborhood-level assets measured by the percent of owner-occupied homes valued at $300,000 or more delayed non-adherence to regular MS guidelines.

Racially-segregated neighborhoods

Three studies provided strong support for racially-segregated neighborhoods on late-diagnosis of breast cancer across race and ethnicity. In 2010, Dajun measured isolation dimension and isolation index to determine whether a relationship existed between residential segregation, disparities in spatial access to MS facilities, and late-diagnosis of breast cancer in predominantly African-American neighborhoods. The sample included 12,413 cases from Michigan Cancer Surveillance data between 1998 and 2002 and matched by population-weighted block group level zip codes and divided into cases classified as early and late-diagnosed breast cancer (8,817 vs. 3,595), respectively. Regression models and ArcGIS 9.3 software were used to simulate the shortest distance time through the network where speed limits serve as travel impediments. The results of this analysis displayed that African-American women in three highly segregated adjacent suburbs of Detroit (Pontiac, Ecorse, Inkster) with higher rates of female-headed households, lower education levels, high unemployment rates and poverty levels coupled with poor access to MS facilities increased the likelihood of late-diagnosis of breast cancer. Regression models showed strong correlations between African-American segregation (p<0.049) and segregation combined with the social disadvantage of lack of access to MS facilities (p<0.033).

In the second study, Warner and Gomez [29] explored the effects of neighborhood composition and contextual factors on breast cancer survival in Black and White women age less than 40 to 70+ years using cancer registry data collected on cancer cases diagnosed between 1996 and 2004 and U.S. census data which corresponded with CT data. The majority of the women were Black (88%); had a younger mean age at diagnosis (not stated), and were more likely to be diagnosed with regional and distant stage and histologically poorly differentiated tumors. Segregated metropolitan neighborhoods correlated with higher odds of distant stage of breast cancer for Black and White women. Russell et al. study contradicted the previous findings indicating that different race/ethnicities were equally affected by racially-segregated neighborhoods.

Public transportation, mammography facilities, and safety issues

Mobley et al. [18] cross-sectional study compared predictors of enabling, pre-disposing and need characteristics from a hybrid conceptual framework, environmental factors (higher commuter intensity, higher violent crime rates, and segregation) on breast cancer diagnosis in 70,129 African-American, Hispanic, Native-American, and White women age ≥ 64 years using SEER cancer registry data with a convenience sample of women (same age group) from traditional Medicare fee-for-service coverage for MS across 11 heterogeneous states. Results showed that women receiving a 'flu shot' and diagnosed with breast cancer were more likely to use MS facilities than women without breast cancer. In contrast, living in areas with higher commuter intensity to MS facilities, higher violent crime rates, higher population of elderly in poverty, and residence in more segregated communities negatively affected diagnosis of breast cancer in lower-income women across race/ethnicities.

Tarlov et al. and Zenk et al. [19,28] conducted similar studies exploring relationships between location of MS facilities and staging of breast cancer in 4,553 African-American, Hispanic, and White women age ≥ 45 years in urban metropolitan neighborhoods in Chicago and its surrounding areas. In the first study, African-American women in high poverty neighborhoods characterized by lower education and lower median household income compared to low poverty neighborhoods had longer travel time in automobile and public transportation restricting access to primary care providers and radiologists and therefore affecting late-diagnosis of breast cancer. Using the same sample, Tarlov et al. [19] exploratory study examined the association between neighborhood-level characteristics and breast cancer stage at diagnosis. Factors such as travel distance (commuter intensity) and public transportation service, safety of neighborhoods surrounding MS facilities, and the degree to which those neighborhoods are socially and economically similar to one's own neighborhood influenced the likelihood of utilizing the service and, accordingly, stage of breast cancer at the time of diagnosis. Additionally, safety/crimes (homicides) were significant barriers to utilization of MS facilities across racial/ethnicities, but there was no relationship between stage at breast cancer diagnosis and the number of robberies, aggravated assaults, or sexual assaults. Ross and Mirowsky [34] household survey using self-reported measures from Chicago residents found that social disorder brought on by situations beyond one's control (crowding, safety, environmental exposure, and decay in neighborhoods) had a larger negative effect on health than does physical disorder (-226 - (-0.203)/-226 = 0.899), p=0.001.

Discussion

This systematic review is the first synthesis of the available evidence from 17 distinctly different population-based studies examining the relationship between neighborhood-level factors and delays from diagnostic follow-up from an abnormal MS, despite a disturbing increase in late-diagnosis of breast cancer and poorer survival rates affecting African-American women age 40 to 65 years disproportionately. These investigations were grounded in an empirical analysis of neighborhood as a "place" where African-American women and other racial/ethnic groups reside and healthcare services, including primary care providers and radiologists are located. Although neighborhood-level factors were examined differently, they

provided substantive and consistent evidence that disadvantaged SES status in poor neighborhoods explained delays in diagnostic follow-up from abnormal MS across race/ethnicities. Researchers found causal relationships between neighborhood decay (as evidenced by boarded up or abandoned housing), living in close proximity in urban metropolitan neighborhoods, and late-diagnosis of breast cancer across racial/ethnic groups, but greater effects for African-American women were found. Additionally, studies confirmed that the geographic distribution of racial/ethnic groups in low-income neighborhoods and increased segregation via spatial patterns (separation of two or more racial/ethnic groups with limited interactions) influenced late-diagnosis of breast cancer for all race/ethnicities.

Even more disturbing were conclusions drawn from these studies that low-income women who are adversely affected by lifestyle circumstances, (e.g., female-headed households, unmarried status, and lower levels education and median household income below the poverty level) were affected by dwelling in disadvantaged neighborhoods with higher risk factors for late-diagnosis of breast cancer. Along with these lifestyle circumstances, low-income women encountered multiple difficulties in accessing or utilizing MS facilities due to lack of insurance, higher commuter intensity and reliance on public transportation in unsafe neighborhoods with higher incidences of homicides. When access to MS facilities was limited, women did not receive the necessary counseling or advising from primary care providers to follow-up after an abnormal MS. These findings indicate that "high neighborhood poverty is especially detrimental to African-Americans and other race/ethnicities' chances of better outcomes" [35].

Neighborhoods characterized as hyper-segregated or populated primarily by African-American residents study in three metropolitan suburbs in Detroit) increased barriers to interact with other racial/ethnicities and systematically limited access to or utilization of MS facilities and primary care providers resulting in late-diagnosis of breast cancer. The most powerful hypothesis is that the social and economic situation of poverty and living in racially-segregated neighborhoods may be the most profound and pervasive determinant to delays in follow-up from an abnormal MS and late-diagnosis of breast cancer for low-income women regardless of racial/ethnicities. Flores et al. [23] conclude that the broader issue may not be race/ethnicity alone, but that poverty is a persistent problem for individuals experiencing discrimination in housing and segregation in poor neighborhoods as shown in these studies, and exert a powerful negative effect on disparities for advanced stage of breast cancer in different race/ethnicities.

Given the high likelihood that African-American women are at greater risk for late-diagnosis of breast cancer, community-based interventions specifically aimed at the reduction of late-diagnosis of breast cancer are urgently needed in disadvantaged neighborhoods. The ultimately challenge facing primary care providers in poor neighborhoods is to implement tailored, culturally-sensitive interventions that will become particularly beneficial to lower-income women regardless of racial/ethnic background. To address these problems, nurses and colleagues in the social sciences are in an excellent position to work collaboratively with community leaders and providers in practice settings and community stakeholders in non-traditional settings (e.g., churches/places of worship, beauty salons, barber shops, and employment search/placement agencies) to bring about social change in these neighborhoods and to push for equitable access to and utilization of MS facilities in safe neighborhoods. In doing so, this will increase access to follow-up of diagnostic MS for all women. Furthermore, a high priority should be to remove conditions encouraging segregated or separate housing, which correlates with late-diagnosis of breast cancer in women.

Limitations of the Data

Although empirical evidence from this systematic review confirm that neighborhood-level factors negatively affected delays in diagnostic follow-up from abnormal MS in different race/ethnicities, several limitations were noted. There was little standardization of measures and levels of aggregation used to ascertain neighborhood-level factors on delays in diagnostic follow-up from an abnormal MS or late-diagnosis of breast cancer between different race/ethnicities, thus making comparisons across studies difficult. Meta-analysis was unable to be performed due to differences in the methods and data analyses procedures used. Another limitation of the extensive findings is that the neighborhoods themselves were not randomly selected, despite using CT or block level analysis, irrespective of the broad range of race/ethnicities living in those neighborhoods. Only one study used a longitudinal research design to study neighborhood-level factors on late-diagnosis of breast cancer across race/ethnicities [12]. With the exception of Mobley et al. [18] and Flores et al. [23] study, researchers did not include a conceptual or theoretical framework for the study. This omission does not compromise the overall findings, but it does limit the theoretical basis for guiding the study. The studies had sufficient numbers of participants to detect significant differences in the study variables; however, they did not include research designs or methods with experimental and control groups.

The studies in this systematic review from nationally-recognized data-sets are highly credible in population-based research; however, they were limited in the ability to capture the 'nuances' of the personal experiences or reflections of a diverse population of women living in those neighborhoods. This is a critical issue, especially since little is known about the lived experiences of low-income women, regardless of race/ethnicity that may protect them and ultimately provide the social norms which shape their beliefs to follow-up from an abnormal MS within the context of residence in disadvantaged or racially-segregated neighborhoods described in this systematic review. We recommend qualitative research approach to develop a data-driven theory that will better capture the 'lived experiences' and 'social context/processes' of decisions made regarding diagnostic follow-up from an abnormal MS, thus reducing late-diagnosis of breast cancer in different race/ethnicities, but especially in African-American women who are more likely to experience lower mortality and poorer survival rates linked to late-diagnosis of breast cancer.

Conclusions

The need for and benefit of neighborhood-level studies are well established in this systematic review, showing that neighborhood-level factors (e.g., racial segregation or separation of two or more groups, crimes/violence and high commuter intensity via public transportation and automobile) to the nearest MS facility greatly influences late-diagnosis of breast cancer among lower-income women. This systematic review can be used to monitor progress toward meeting the national goals of *Healthy People 2020* [36] (U.S. Department of Health and Human Services) of reducing the disturbing breast cancer deaths in minority women. Furthermore, this review is needed to inform policy-makers on the need to reduce the extreme poverty levels of female-headed households that were affected by dwelling in disadvantaged neighborhoods with higher risk factors for late-diagnosis of breast cancer. Particularly important for policy-makers is higher government spending, attributed to advanced stage breast cancer must be averted

by reducing delays from diagnostic follow-up. Of utmost importance, policy development should be directed at national and state-level funding to improve safe neighborhoods and reliable and safe public transportation enhancing adherence to follow-up of abnormal MS. Each of these changes will require sustained policy initiatives, driven by 'active neighborhood voices', supporting capacity-building to improve ill-health or health outcomes associated with overcrowding and crimes/safety. Investments in neighborhoods in reducing problems associated with poverty (substandard housing, environmental threats, pollution, and high rates of unemployment) are not only important now, but will improve public health overall [37]. Furthermore, 'human capital' involving a diverse pool of providers working in partnership with community stakeholders is needed to remove problems that impact the health and well-being of citizens [38].

The recent passage of the national *Affordable Health Care Act of 2010* is urgently needed to increase the numbers of primary care providers in safe and convenient community settings. The new *Affordable Health Care* legislation has been designed to combat issues such as these in urban metropolitan and rural communities through improved outreach that informs residents that preventive care, along with follow-up from abnormal MS, through a plethora of information venues such as ambulatory settings and hospital electronic message boards, brochures, videos, commercials *(AARP, Health Care and You 2013)*, and face-to-face interaction with primary care providers and other professionals in familiar neighborhoods.

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