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Neighborhood and Individual Level Socioeconomic Variation in Perceptions of Racial Discrimination

Abstract

In approaching the study of racial discrimination and health, the neighborhood and individual-level antecedents of perceived discrimination need further exploration. We investigated the relationship between neighborhood and individual-level socioeconomic position (SEP), neighborhood racial composition, and perceived racial discrimination in a cohort of African-American and White women age 40-79 from Connecticut, USA.

Design. The logistic regression analysis included 1249 women (39% African-American and 61% White). Neighborhood-level SEP and racial composition were determined using 1990 census tract information. Individual-level SEP indicators included income, education, and occupation. Perceived racial discrimination was measured as lifetime experience in seven situations.

Results. For African-American women, living in the most disadvantaged neighborhoods was associated with fewer reports of racial discrimination (odds ratio (OR) 0.44; 95% confidence interval (CI) 0.26, 0.75), with results attenuated after adjustment for individual-level SEP (OR 0.54, CI: 0.29, 1.03), and additional adjustment for neighborhood racial composition (OR 0.70, CI: 0.30, 1.63). African-American women with 12 years of education or less were less likely to report racial discrimination, compared with women with more than 12 years of education (OR 0.57, CI: 0.33, 0.98 (12 years); OR 0.51, CI: 0.26, 0.99 (less than 12 years)) in the fully adjusted model. For White women, neither neighborhood-level SEP nor individual-level SEP was associated with perceived racial discrimination.

Conclusion. Individual and neighborhood-level SEP may be important in understanding how racial discrimination is perceived, reported, processed, and how it may influence health. In order to fully assess the role of racism in future studies, inclusion of additional dimensions of discrimination may be warranted.

Keywords

African-Americans, discrimination, socioeconomic factors

Disciplines

Other Medicine and Health Sciences

Authors

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Neighborhood- and individual-level socioeconomic variation in perceptions of racial discrimination

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Objective. In approaching the study of racial discrimination and health, the neighborhood- and individual-level antecedents of perceived discrimination need further exploration. We investigated the relationship between neighborhood- and individual-level socioeconomic position (SEP), neighborhood racial composition, and perceived racial discrimination in a cohort of African-American and White women age 40–79 from Connecticut, USA.

Design. The logistic regression analysis included 1249 women (39% African-American and 61% White). Neighborhood-level SEP and racial composition were determined using 1990 census tract information. Individual-level SEP indicators included income, education, and occupation. Perceived racial discrimination was measured as lifetime experience in seven situations.

Results. For African-American women, living in the most disadvantaged neighborhoods was associated with fewer reports of racial discrimination (odds ratio (OR) 0.44; 95% confidence interval (CI) 0.26, 0.75), with results attenuated after adjustment for individual-level SEP (OR 0.54, CI: 0.29, 1.03), and additional adjustment for neighborhood racial composition (OR 0.70, CI: 0.30, 1.63). African-American women with 12 years of education or less were less likely to report racial discrimination, compared with women with more than 12 years of education (OR 0.57, CI: 0.33, 0.98 (12 years); OR 0.51, CI: 0.26, 0.99 (less than 12 years)) in the fully adjusted model. For White women, neither neighborhood-level SEP nor individual-level SEP was associated with perceived racial discrimination.

Conclusion. Individual- and neighborhood-level SEP may be important in understanding how racial discrimination is perceived, reported, processed, and how it may influence health. In order to fully assess the role of racism in future studies, inclusion of additional dimensions of discrimination may be warranted.

Keywords: African-Americans; discrimination (psychology); prejudice; residence characteristics; socioeconomic factors

Introduction

Racial discrimination remains pervasive – existing, for example, in mortgage lending, housing, hiring practices, and the criminal justice system, as well as interpersonal experiences (Essed 1991, Clark *et al.* 1999, Smedley *et al.* 2003). There has been increased attention given to examining the linkages between stigma, prejudice,

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discrimination, and health, among many disciplines (Stuber *et al.* 2008). While we do not fully understand the health consequences of racism, some studies, as reviewed by Williams *et al.* (2003), have reported associations between perceived racial discrimination and mental health outcomes, such as psychological distress, depression, and anxiety. Physical health outcomes, e.g., self-rated health, days spent unwell in bed, blood pressure, cardiovascular outcomes, and low birth weight have also been associated with perceived racial discrimination (Williams *et al.* 2003).

Similarly, neighborhood socioeconomic conditions have also been shown to be associated with physical and mental health outcomes (Pickett and Pearl 2001). While the mechanisms by which neighborhoods influence health are not entirely understood, neighborhood-level variables have increasingly been included in research as important constructs in understanding discrimination and disparities in health (Mays *et al.* 2007). Bernard *et al.* (2007) have proposed a theoretical framework that includes five domains by which neighborhoods can shape health, including physical, economic, institutional, local sociability, and community organization domains (Bernard *et al.* 2007). We will focus on socioeconomic conditions of neighborhoods, using the term socioeconomic position (SEP), referring to the social and economic factors that influence the positions that individuals and groups hold within a society (Galobardes *et al.* 2007). Although SEP on multiple levels (i.e., individual, household, and neighborhood) and neighborhood racial composition are influenced by institutional racism (Williams and Collins 2004), little is known about the relationship between neighborhood conditions and individual-level perceived racial discrimination.

While few studies have examined the relationship between neighborhood SEP and discrimination, previous studies have reported that perceived racial discrimination varies by individual-level SEP, often showing that persons of high individual-level SEP report experiences of racial discrimination more frequently than persons of low SEP (Kessler *et al.* 1999, Borrell *et al.* 2006, 2007, Taylor *et al.* 2007, Kelaher *et al.* 2008). One possible reason for socioeconomic variation in reports of racial discrimination is underreporting by persons of low individual-level or neighborhood-level SEP (Ruggiero and Taylor 1995, Krieger 2000). It has also been suggested that African-Americans with higher education have more interaction with Whites and thus have increased opportunity to experience racial discrimination (Sigelman and Welch 1991). Neighborhood racial composition, a measure closely related to racial residential segregation, may also influence perceived racial discrimination. Welch *et al.* (2001) reported that African-Americans living in equally racially mixed neighborhoods in Detroit were most likely to report discrimination. Hunt *et al.* (2007) reported a linear inverse relationship between neighborhood racial composition (percent black) and perceived discrimination, with a significantly stronger inverse association within the lower median household income strata. In a recent literature review, Pickett and Wilkinson (2008) evaluate how ethnic group density may be related to prejudice and stigma, discussing that while members of ethnic minorities who live in areas where there are few like themselves are likely to have increased material resources, they may also experience increased psychosocial stigma associated with belonging to a low status minority group within a majority community. While these studies have examined the association between racial/ethnic composition and perceived discrimination, little is known about the role of other

contextual neighborhood-level socioeconomic factors, while controlling for the effects of racial/ethnic composition.

Given the increased interest in the social determinants of health, such as SEP, discrimination, and neighborhoods, it is important to evaluate the relationships between these variables to facilitate a better understanding of the pathways by which these social phenomena could lead to poor health. In this study we sought to determine: (1) the relationship between perceived racial discrimination and individual- and neighborhood-level SEP and (2) whether neighborhood racial composition mediated the relationships. As the impetus for studying the effects of racial/ethnic discrimination on health in the United States (USA) is often to explain racial/ethnic disparities between African-Americans and Whites, we included both African-Americans and Whites in our study. In previous analyses of factors that influence adherence to mammography screening guidelines, we found that neighborhood SEP was a significant predictor of cancer screening behavior for African-American women, but not for White women (Dailey *et al.* 2007a), yet perceived racial discrimination did not have a significant influence on the outcome (Dailey *et al.* 2007b). In order to more fully understand potential racial/ethnic differences in the role that neighborhood factors may have on health, we explored whether perceived racial discrimination was influenced by neighborhood characteristics and determined whether the relationship differs by race/ethnicity. We examined these relationships in a cohort of African-American and White women living in Connecticut (USA), using data from the *Race Differences in the Screening Mammography Process Study*.

Methods

Study population, procedures, and participation

The data were derived from a community-based study of mammography screening of healthy women, between the ages of 40 and 79, from October 1996 to January 1998. While this analysis does not examine mammography-related outcomes, because of the level of detail and breadth of information collected with respect to individual-level SEP, neighborhood-level SEP, and perceived racial discrimination, these data provide an excellent opportunity to investigate the relationship between perceived racial discrimination and neighborhood-level SEP. As African-Americans composed only 9.1% of the Connecticut population, we used US Census data (US Census Bureau n.d. a) and our own 1994 survey of mammography facilities in Connecticut, USA (Jones *et al.* 2001), to identify the mammography facilities that were most likely to provide screening mammograms to African-American women. Thus, study subjects were recruited from hospital-based facilities in the four Connecticut cities with the largest general (and largest African-American) populations. To increase geographic representation, we also included the major hospital facility in a somewhat less-populated urban area, but one that was located in the fourth largest county of Connecticut. Additional study population details and recruitment strategies can be found in previous reports from this data source (Calvocoressi *et al.* 2004, 2005, Jones *et al.* 2005, Dailey *et al.* 2007a, 2007b, 2008). Approvals of the institutional review boards of Yale University School

of Medicine and each participating hospital were maintained throughout the study period.

Of 2359 potentially eligible women identified from mammography facility intake sheets, 1451 completed a baseline interview after excluding ineligible women ($n = 171$), those who could not be contacted or were deceased or ill ($n = 206$), and women who declined participation ($n = 531$). Participation differed across race group (African-American, 69%; White, 77%; $P < 0.001$) as well as by age (ages 40–49, 76%; age 50 and over, 72%; $P = 0.052$). The 45-minute baseline telephone interview was administered approximately 1 month after the index screening mammogram (mean time to baseline interview, 1.5 months; standard deviation (SD) ± 0.85 month). A follow-up interview was arranged at a minimum of 26 months after the index screening. The time interval between baseline and follow-up interview averaged 29.4 months (SD ± 1.42 months), with a range of 27–41 months. Of the 1451 women who participated in the baseline interviews, 1249 (86%) completed follow-up interviews. Women included in the analysis differed significantly from those lost to follow-up by race (African-American, 78%; White, 93%; $P < 0.001$), but not by age.

Measures

Racial discrimination

Perceived racial discrimination was assessed during the follow-up interview, with a measure adapted from Krieger and used in the Coronary Artery Risk Development in Young Adults Study (CARDIA) (Krieger 1990, Krieger and Sidney 1996). Participants were asked whether they had ever experienced discrimination because of their gender, race or color, or SEP or social class in any of the following seven situations: (1) at school; (2) getting a job; (3) at work; (4) at home; (5) getting medical care; (6) on the street or in a public setting; and (7) from the police or in the courts. While questions were worded the same as the Krieger measure cited above, we excluded questions on sexual orientation, religion, and the global questions on responding to unfair treatment. This analysis includes the responses from the race-based discrimination questions. Participants responded yes or no to each of the seven situations and the positive responses were summed for a total score of 0–7. For the logistic regression modeling with perceived racial discrimination as the outcome, the variable was coded dichotomously (none/any). To stay true to the original intention of the measure (Krieger *et al.* 2005), and because cell sizes became small when spread across the seven situations, we analyzed the discrimination variable as the seven-item combined score, rather than by specific situations. Although we only presented data using the dichotomous response collapsed over the seven items in our results, we also examined results using a three-level categorization (0 situations, 1–2 situations, 3 or more situations) for African-American women (there were too few White women who responded 3 or more situations to conduct the same analysis for White women). The results using the three-level outcome did not provide any additional insight with respect to the association between SEP and experiences of discrimination; we observed the same general trend of less reporting of discrimination in the most disadvantaged neighborhoods, regardless of the categorization of racial discrimination.

Neighborhood-level socioeconomic factors

Baseline residential addresses (97.8%; $n = 1420$) were geocoded to obtain 1990 census tracts. Census tract-level variables were downloaded from the US Census (US Census Bureau n.d. c) and linked to the study records. A composite neighborhood socioeconomic measure, the Socioeconomic Position Index (SEP Index) developed by Krieger *et al.* (2002), was calculated using a standardized z -score combining data on percent working class, percent unemployed, percent below the US poverty line, percent without a high-school education, percent of expensive homes, and median household income, where a higher score indicated a higher degree of disadvantage. Neighborhood racial composition was measured as percentage of Blacks living in the census tract.

In the absence of a-priori category considerations, quartiles of the neighborhood SEP Index were used for initial total study population analyses. Because of major differences in SEP distributions by race, race-specific quartiles were also created to enable race-stratified analyses. Diez Roux *et al.* (2001, 2003) and Borell *et al.* (2004) used this analytic strategy to address insufficient racial/ethnic overlap in SEP categories. Also following their examples (Diez Roux *et al.* 2003, Borrell *et al.* 2004), race-specific categories for the neighborhood SEP Index were created to mirror the race-specific individual-level income distributions, allowing comparison of the effect of neighborhood-level SEP (Index) and individual-level SEP.

Individual-level socioeconomic measures

Three measures of individual-level SEP were measured: (1) annual family income (<\$14,999, \$15,000–\$29,999, \$30,000–\$49,999, \geq \$50,000); (2) education level (<12 years, 12 years, >12 years); and (3) occupation (combined spouse pair score, adapted from the Duncan Socioeconomic Index (Duncan 1961, Stevens 1981), categorized as quartiles plus a missing data category that included non-respondents and women who reported no occupation for either themselves or a partner).

Statistical analyses

Unadjusted associations were examined and evaluated using the chi-square test ($P < 0.05$). Linear trend was tested using the Mantel–Haenszel chi-square test ($P < 0.05$). Multivariate logistic regression was used to evaluate the adjusted associations between perceived racial discrimination and neighborhood SEP in total population models and race-specific models; adjusted odds ratios (OR) with 95 percent confidence intervals (95% CI) are reported. To account for possible within-area correlations, multilevel models were tested using Monte Carlo Markov Chain methods in MLwiN (Centre for Multilevel Modelling 2004). However, the estimated variance of the neighborhood random effects was negligible and not statistically significant, i.e., models without the random effects essentially remained unchanged from models with random effects included. As such, only fixed effects for neighborhood SEP from logistic regression modeling using Statistical Analysis System 9.1 (The SAS System for Windows, Copyright 2002–2003) are presented. Likelihood ratio tests were calculated to determine which variables contributed

significantly to the fit of the model (Holford 2002). All two-level interactions were tested.

Results

Characteristics of the study population

Characteristics of the study population by race/ethnicity are presented in Table 1. Over 60% of the respondents were aged 50 or older, with no significant difference by race/ethnicity. African-American women were significantly more likely than White women to be single than married/living as married, to have lower annual family incomes, to have less than 12 years of education, and to be in the lowest occupational status quartiles. African-American women were disproportionately represented in the most disadvantaged neighborhoods as measured by the SEP Index and significantly more likely to report racial discrimination.

Perceived racial discrimination

As reported in Table 2, over 20% of the total study population reported racial discrimination in at least one situation. As expected, African-American women more commonly experienced racial discrimination. Approximately 41.5% of the African-American respondents reported racial discrimination in at least one situation, compared to 10.2% of White women. The domains in which African-American women reported experiencing discrimination most often included: at work (27.0%), by the police/courts (25.8%), and getting a job (21.5%). For White women, none of the percentages for reported racial discrimination by domain exceeded 4.0%.

Unadjusted results

Neighborhood-level socioeconomic position (SEP) and perceived racial discrimination

Table 3 shows unadjusted associations between perceived racial discrimination and selected measures of neighborhood SEP, stratified by race. For African-American women, living in the most disadvantaged neighborhoods was significantly associated with fewer reports of racial discrimination. For White women, the association between neighborhood SEP and reports of racial discrimination did not reach statistical significance.

Neighborhood racial composition

Also shown in Table 3, neighborhood racial composition, measured as percentage of Blacks living in the census tract, was significantly inversely associated with reports of racial discrimination for African-American women. African-American women living in neighborhoods with the lowest percentages of Blacks were significantly more likely to report experiences of racial discrimination than African-American women living in neighborhoods with the highest percentage of Blacks. The association between neighborhood racial composition and reported racial discrimination was not significant for White women.

Table 1. Characteristics of the study population by race/ethnicity ($n = 1249$), Connecticut, 1996–2000.

Variables	African-American ($n = 492$)		White ($n = 757$)		p -Value ^b
	Number ^a	Percentage (%)	Number ^a	Percentage (%)	
Age					
40–49	168	34.2	276	36.5	0.40
50+	324	65.8	481	63.5	
Marital status					
Married/living as married	164	33.6	545	72.3	<0.01
Single	324	66.4	209	27.7	
Education					
More than 12 years	161	33.0	533	70.7	<0.01
12 years	177	36.3	187	24.8	
Less than 12 years	150	30.7	34	4.5	
Annual family income					
\$50,000+	74	16.6	421	59.0	<0.01
\$30,000–\$49,999	72	16.2	151	21.1	
\$15,000–\$29,999	92	20.6	79	11.1	
<\$15,000	208	46.6	63	8.8	
Occupational status ^c					
Quartile 1 (low)	205	41.7	55	7.2	<0.01
Quartile 2	123	25.0	198	26.2	
Quartile 3	46	9.3	217	28.7	
Quartile 4 (high)	50	10.2	241	31.8	
Missing	68	13.8	46	6.1	
Neighborhood SEP Index ^d					
Quartile 1	27	5.7	268	36.6	<0.01
Quartile 2	47	9.8	260	35.5	
Quartile 3	141	29.5	163	22.2	
Quartile 4 (most disadvantaged)	263	55.0	42	5.7	
Perceived racial discrimination ^e					
No	280	57.9	676	89.8	<0.01
Yes	204	42.1	77	10.2	

^aNumbers for each characteristic may not sum to total because of some missing data.

^b p -Value based on chi-square tests.

^cCombined spouse pair score, adapted from the Duncan Socioeconomic Index (Duncan 1961, Stevens 1981). Missing data included non-respondents as well as women who reported no occupation for either themselves or a partner.

^dComposite SEP Index (Krieger *et al.* 2002) consisting of a standardized z -score combining data on percentage working class, unemployment, percentage below the US poverty line, percentage low education (less than high school), percentage expensive homes (\geq \$300,000), and median household income. Higher category signifies greater disadvantage.

^eRacial discrimination question: 'Have you ever experienced discrimination based on your race or color in the following situations: at school, getting a job, at work, at home, getting medical care, on street/in public, police/courts.' Categories are not mutually exclusive.

Table 2. Perceived discrimination based on race or color reported by situation ($n = 1249$), Connecticut, 1996–2000.

	African-American ($n = 492$)		White ($n = 757$)	
	Number ^a	Percentage (%)	Number ^a	Percentage (%)
Number of situations reported ^b				
None	280	56.9	676	89.3
1 or 2	108	22.0	73	9.6
3 or more	96	19.5	4	0.5
Situation				
At school	90	18.3	19	2.5
Getting a job	106	21.5	18	2.4
At work	133	27.0	24	3.2
At home	6	1.2	2	0.3
Getting medical care	47	9.6	3	0.4
On street/in public	35	7.1	5	0.7
Police/courts	127	25.8	30	4.0

^aNumbers may not sum to total because of some missing data. Categories for discrimination situations are not mutually exclusive (i.e., sum will not equal total).

^bRacial discrimination question: 'Have you ever experienced discrimination based on your race or color in the following situations: at school, getting a job, at work, at home, getting medical care, on street/in public, police/courts.'

Individual-level socioeconomic position (SEP) and perceived racial discrimination

Similar to the results shown for neighborhood SEP, lower individual-level SEP was associated with significantly fewer reports of perceived discrimination for African-American women in unadjusted analyses (Table 3). This association was true for all three measures of individual SEP (income, education, and occupation). Individual-level SEP was not associated with perceived discrimination for white women, although more low-SEP (household income <\$15,000) White women reported racial discrimination than middle or high-SEP White women (not statistically significant).

Multivariable findings

In multivariable models including the total study population, a significant interaction between race and the neighborhood SEP Index ($p = 0.02$) was observed (not presented). In order to elucidate relationships that may be unique to each race group, potentially masked in the total study population models due to the insufficient racial/ethnic overlap in SEP Index categories, race-specific modeling was undertaken (shown in Table 4). African-American women, living in the most disadvantaged neighborhoods (SEP Index with categories that mimic race-specific individual-level income distributions) were less likely to report experiences of racial discrimination independent of age (OR 0.44, 95% CI 0.26, 0.75). After adjustment for the three measures of individual-level SEP the association was attenuated (OR 0.54, 95% CI: 0.29, 1.03 [Category 4 vs. Category 1]). Finally, with additional adjustment for the relative racial homogeneity in their neighborhoods (percentage of Blacks), the association was further attenuated (OR 0.70, 95% CI 0.30, 1.63 [Category 4 vs.

Table 3. Unadjusted associations between perceived racial discrimination and selected measures of individual- and neighborhood-level SEP, stratified by race^a (*n* = 1249), Connecticut, 1996–2000^b.

	African-American (<i>n</i> = 492)										White (<i>n</i> = 757)									
	Perceived discrimination										Perceived discrimination									
	Yes					No					Yes					No				
	Number ^d	Percentage (%)	Number ^d	Percentage (%)	OR ^e	95% CI ^e	<i>p</i> -trend ^f	Number ^d	Percentage (%)	Number ^d	Percentage (%)	OR ^e	95% CI ^e	<i>p</i> -Trend ^f						
Composite Neighborhood SEP Index ^{a,c}																				
Category 1 (least disadvantaged)	42	53.9	36	46.2	1.00	<i>p</i> < 0.01	39	9.0	395	91.0	1.00		<i>p</i> = 0.11							
Category 2	34	47.2	38	52.8	0.77	0.38, 1.53	14	9.3	136	90.7	1.04	0.52, 2.06								
Category 3	49	47.6	54	52.4	0.78	0.41, 1.46	13	16.1	68	84.0	1.94	0.93, 3.99								
Category 4 (most disadvantaged)	71	32.6	147	67.4	0.41	0.24, 0.73	8	12.5	56	87.5	1.45	0.59, 3.43								
Neighborhood Racial Composition ^a (Percentage of Blacks)																				
Quartile 1 (lowest)	63	53.9	54	46.2	1.00	<i>p</i> < 0.01	15	8.2	168	91.8	1.00		<i>p</i> = 0.27							
Quartile 2	53	44.5	66	55.5	0.69	0.40, 1.19	21	11.7	158	88.3	1.49	0.70, 3.16								
Quartile 3	49	41.2	70	58.8	0.60	0.35, 1.04	13	7.2	168	92.8	0.87	0.37, 2.00								
Quartile 4 (highest)	34	28.3	86	71.7	0.34	0.19, 0.60	25	13.3	163	86.7	1.72	0.83, 3.56								

Table 3 (Continued)

	African-American (n = 492)											White (n = 757)				
	Perceived discrimination											Perceived discrimination				
	Yes			No								Yes			No	
	Number ^d	Percentage (%)	Number ^d	Percentage (%)	OR ^e	95% CI ^e	p-trend ^f	Number ^d	Percentage (%)	Number ^d	Percentage (%)	OR ^e	95% CI ^e	p-Trend ^f		
Individual-level annual family income																
<\$15,000	77	37.9	126	62.1	0.45	0.25, 0.80	p = 0.01	11	17.5	52	82.5	1.90	0.86, 4.11	p = 0.32		
\$15,000–\$29,999	43	47.3	48	52.8	0.66	0.34, 1.29		6	7.6	73	92.4	0.74	0.25, 1.83			
\$30,000–\$49,999	30	41.7	42	58.3	0.53	0.26, 1.07		14	9.3	136	90.7	0.92	0.46, 1.81			
Individual-level education																
≥\$50,000	42	57.5	31	42.5	1.00			42	10.0	377	90.0	1.00				
<12 years	44	29.9	103	70.1	0.30	0.18, 0.49	p < 0.01	3	9.1	30	90.9	0.80	0.15, 2.69	p = 0.22		
12 years	65	37.4	109	62.6	0.41	0.26, 0.66		14	7.5	173	92.5	0.65	0.34, 1.23			
Individual-level occupational ranking ^g																
>12 years	94	59.1	65	40.9	1.00			59	11.1	471	88.9	1.00				
Quartile 1 (lowest)	65	31.7	137	66.8	0.36	0.18, 0.71	p < 0.01 ^g	6	10.9	48	87.3	1.03	0.33, 2.75	p = 0.88 ^h		
Quartile 2	60	48.8	61	49.6	0.74	0.36, 1.52		22	11.1	175	88.4	1.03	0.54, 1.97			
Quartile 3	29	63.0	17	37.0	1.28	0.52, 3.17		20	9.2	197	90.8	0.84	0.43, 1.61			

Table 3 (Continued)

	African-American (n = 492)						White (n = 757)					
	Perceived discrimination						Perceived discrimination					
	Yes			No			Yes			No		
	Number ^d	Percentage (%)	OR ^e	95% CI ^e	p-trend ^f	Percentage (%)	Number ^d	Percentage (%)	OR ^e	95% CI ^e	p-Trend ^f	
Quartile 4 (highest)	28	56.0	21	42.0	1.00	26	10.8	214	88.8	1.00		
Missing	22	32.4	44	64.7	0.38	3	6.5	42	91.3	0.59	0.11, 2.06	

^aThe categories/quartiles for neighborhood-level measures reflect race-specific distributions (i.e., categories/quartiles for Whites does not equal categories/quartiles for African-Americans).

^bEach association (odds ratio) reported is unadjusted (separate models for each variable).

^cComposite socioeconomic position index (SEP) (Krieger *et al.*, 2002) consisting of a standardized z-score combining data on percentage working class, unemployment, percentage below the US poverty line, percentage low education (less than high school), percentage expensive homes (\geq \$300,000), and median household income. Greater score signifies greater disadvantage. Categories mirror individual SEP distribution (household income for SEP Index, personal education for neighborhood education) African-American SEP categories: SEP Category 1: 16% living in least disadvantaged, corresponding to the distribution of individuals in the highest individual income category. Likewise, Category 2 represents the next 15%, Category 3 represents the next 21%, and Category 4 represents the 46% living in the most disadvantaged neighborhoods. Respective White SEP categories: Category 1 comprised of 59% (least disadvantaged), Category 2 represents the next 21%, Category 3 represents the next 11%, and Category 4 represents the 9% living in the most disadvantaged neighborhoods.

^dNumbers for each characteristic may not sum to total because of some missing data.

^eOdds ratios and 95% confidence intervals (CI).

^fLinear test for trend using Mantel-Haenszel chi-square test.

^gCombined spouse pair score, adapted from the Duncan Socioeconomic Index (Duncan 1961, Stevens 1981). Missing data included non-respondents as well as women who reported no occupation for either themselves or a partner.

^hLinear test for trend using Mantel-Haenszel chi-square test does not include the 'missing' category.

Table 4. Race-specific multivariate associations between perceived racial discrimination and neighborhood SEP, individual SEP, and neighborhood racial composition, using categories of SEP based on race-specific distributions, Connecticut, 1996–2000.

Indicator	African-American				White				
	Model 1 ^a (n = 471)	Model 2 ^b (n = 427)	Model 3 ^c (n = 427)	Model 1 ^a (n = 729)	Model 2 ^b (n = 690)	Model 3 ^c (n = 690)	Model 1 ^a (n = 729)	Model 2 ^b (n = 690)	Model 3 ^c (n = 690)
	OR (95% CI) ^d								
SEP Index ^e	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Category 1 (least disadvantaged)									
Category 2	0.75 (0.40, 1.44)	0.71 (0.34, 1.51)	0.76 (0.35, 1.66)	1.04 (0.55, 1.98)	1.20 (0.62, 2.35)	1.22 (0.62, 2.40)	1.04 (0.55, 1.98)	1.20 (0.62, 2.35)	1.22 (0.62, 2.40)
Category 3	0.79 (0.44, 1.43)	0.98 (0.50, 1.93)	1.06 (0.50, 2.27)	1.94 (0.98, 3.82)	1.99 (0.92, 4.30)	1.93 (0.86, 4.30)	1.94 (0.98, 3.82)	1.99 (0.92, 4.30)	1.93 (0.86, 4.30)
Category 4 (most disadvantaged)	0.44 (0.26, 0.75)	0.54 (0.29, 1.03)	0.70 (0.30, 1.63)	1.45 (0.64, 3.25)	1.40 (0.51, 3.82)	1.12 (0.38, 3.33)	1.45 (0.64, 3.25)	1.40 (0.51, 3.82)	1.12 (0.38, 3.33)
Individual-level income									
\$50,000 +	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
\$30,000–\$49,999	0.61 (0.30, 1.25)	0.61 (0.30, 1.25)	0.60 (0.29, 1.22)	0.92 (0.46, 1.87)	0.92 (0.46, 1.87)	0.92 (0.45, 1.87)	0.92 (0.46, 1.87)	0.92 (0.46, 1.87)	0.92 (0.45, 1.87)
\$15,000–\$29,999	1.22 (0.60, 2.50)	1.22 (0.60, 2.50)	1.19 (0.58, 2.44)	0.80 (0.30, 2.16)	0.80 (0.30, 2.16)	0.79 (0.29, 2.15)	0.80 (0.30, 2.16)	0.80 (0.30, 2.16)	0.79 (0.29, 2.15)
Less than \$15,000	1.00 (0.49, 2.02)	1.00 (0.49, 2.02)	0.99 (0.48, 2.01)	2.53 (0.98, 6.50)	2.53 (0.98, 6.50)	2.46 (0.94, 6.43)	2.53 (0.98, 6.50)	2.53 (0.98, 6.50)	2.46 (0.94, 6.43)
Individual-level education									
More than 12 years	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
12 years	0.57 (0.33, 0.98)	0.57 (0.33, 0.98)	0.57 (0.33, 0.98)	0.58 (0.29, 1.16)	0.58 (0.29, 1.16)	0.58 (0.29, 1.17)	0.58 (0.29, 1.16)	0.58 (0.29, 1.16)	0.58 (0.29, 1.17)
Less than 12 years	0.53 (0.27, 1.02)	0.53 (0.27, 1.02)	0.51 (0.26, 0.99)	0.46 (0.11, 1.97)	0.46 (0.11, 1.97)	0.45 (0.11, 1.89)	0.46 (0.11, 1.97)	0.46 (0.11, 1.97)	0.45 (0.11, 1.89)
Individual-level Occupation Ranking									
Quartile 1 (lowest)	0.79 (0.34, 1.86)	0.79 (0.34, 1.86)	0.82 (0.35, 1.93)	0.95 (0.29, 3.08)	0.95 (0.29, 3.08)	0.95 (0.28, 3.18)	0.95 (0.29, 3.08)	0.95 (0.29, 3.08)	0.95 (0.28, 3.18)
Quartile 2	1.04 (0.48, 2.28)	1.04 (0.48, 2.28)	1.07 (0.49, 2.36)	1.13 (0.55, 2.31)	1.13 (0.55, 2.31)	1.12 (0.54, 2.32)	1.13 (0.55, 2.31)	1.13 (0.55, 2.31)	1.12 (0.54, 2.32)
Quartile 3	2.42 (0.94, 6.24)	2.42 (0.94, 6.24)	2.37 (0.92, 6.14)	0.88 (0.45, 1.73)	0.88 (0.45, 1.73)	0.87 (0.44, 1.72)	0.88 (0.45, 1.73)	0.88 (0.45, 1.73)	0.87 (0.44, 1.72)

Table 4 (Continued)

Indicator	African-American				White				
	Model 1 ^a (n = 471)	Model 2 ^b (n = 427)	Model 3 ^c (n = 427)	Model 1 ^a (n = 729)	Model 2 ^b (n = 690)	Model 3 ^c (n = 690)	Model 1 ^a (n = 729)	Model 2 ^b (n = 690)	Model 3 ^c (n = 690)
	OR (95% CI) ^d								
Quartile 4 (highest)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Missing	0.93 (0.33, 2.59)	0.96 (0.34, 2.67)	1.00	0.37 (0.07, 1.92)	0.38 (0.07, 1.95)	1.00	1.00	1.00	1.00
Neighborhood									
Racial									
Quartile 1 (lowest)									
Quartile 2									
Quartile 3									
Quartile 4 (highest)									
Composition									
(Percent Black)									

^aModel 1 is adjusted for age.

^bModel 2 includes age and three individual measures of SEP: income (<\$15,000, \$15,000-\$29,999, \$30,000-\$49,999, \$50,000 or more); education (less than high school, completed high school, more than high school); occupation (combined spouse pair score, adapted from the Duncan Socioeconomic Index (Duncan 1961, Stevens 1981) categorized as quartiles plus a missing data category that included non-respondents as well as women who reported no occupation for either themselves or a partner.

^cModel 3 includes the variables in Model 2 plus adjustment for the percentage of Blacks in census tracts.

^dOdds ratios (OR) and 95% confidence intervals (CI).

^eHigher category signifies greater disadvantage. Categories mirror individual income distribution. African-American SEP categories: SEP Category 1, 16% living in least disadvantaged, corresponding to the distribution of individuals in the highest individual income category. Likewise, Category 2 represents the next 15%, Category 3 represents the next 21%; and Category 4 represents the 46% living in the most disadvantaged neighborhoods. Respective White SEP categories: Category 1 comprised of 59% (least disadvantaged); Category 2 represents the next 21%; Category 3 represents the next 11%; and Category 4 represents the 9% living in the most disadvantaged neighborhoods.

Category 1]). While individual-level education was independently associated with perceived racial discrimination in the fully adjusted model (OR 0.57, 95% CI: 0.33, 0.98 (12 years vs. more than 12 years); OR 0.51, 95% CI: 0.26, 0.99 (less than 12 years vs. more than 12 years)), individual-level income and occupational ranking were not associated with perceived racial discrimination. For White women, neither neighborhood-level nor individual-level SEP were significantly associated with perceived racial discrimination. In models adjusted for both neighborhood and individual SEP, neighborhood racial composition was not associated with perceived discrimination for either African-American or White women.

Discussion

In order to gain a better understanding of how racial discrimination influences health it is important to understand how discrimination is related to other well-known social determinants of health such as SEP. Our investigation into the associations between perceived racial discrimination and individual- and neighborhood-level SEP has revealed complex relationships between these factors. In race-specific unadjusted analyses, both individual-level and neighborhood-level SEP were significantly associated with perceived racial discrimination for African-American women (women in higher levels of disadvantage were less likely to report discrimination). One explanation for these findings may be underreporting by persons of low SEP, as also reported by others (Ruggiero and Taylor 1995, Krieger 2000). While it is not entirely clear why persons of low SEP are less likely to report experiences of racial discrimination, Krieger has suggested that persons of lower social position, especially those subject to multiple forms of subordination or deprivation, may internalize oppression, resulting in underreporting of perceived racial discrimination by individuals of lower SEP (Krieger and Sidney 1996, Krieger 2000). Underlying explanations include: denial (Crosby 1984), keeping quiet about unfair treatment (Krieger 1990), or the endorsement of racial ideology (the acceptance of beliefs about race and racial inequality), low levels of racial identification, or the internalization of racial prejudice (expression of negative feelings toward members of your racial group) (Brown *et al.* 2000, Jackson *et al.* 2003, Sellers and Shelton 2003). The sensitive nature of the topic, social desirability, or feeling uncomfortable reporting discrimination to a person of a different racial background may also contribute to underreporting (Barnes *et al.* 2008, Moorman *et al.* 1999). Although we were unable to race match our interviewers to study participants, our interviews were conducted by telephone, possibly ameliorating some of these barriers.

There are additional possible explanations for the observed inverse relationship between perceived racial discrimination and neighborhood disadvantage for African-American women, beyond adjustment for individual-level SEP. Because this association was in part explained by adjusting for racial composition of the neighborhood, it may be that African-American women living in more disadvantaged neighborhoods (as well as more racially segregated neighborhoods) do not experience as much interpersonal racial discrimination because of less interaction with persons of different races. Members of minority groups living in a majority community may be made more aware of belonging to a low status minority group

(Pickett and Wilkinson 2008). Other explanations for this finding may include potential buffering effects due to social cohesion and social support in more homogenous communities, or that racial discrimination is such a common and shared experience that it is not perceived of as extraordinary, and thus not reported. If reports of discrimination differ systematically by SEP, for reasons other than genuine differences in exposure, then how studies of discrimination and health are conceptualized, undertaken, and interpreted may need to be reconsidered.

It is clear that SEP had a significant effect on whether African-American women reported racial discrimination, whereas for White women, we did not observe SEP effects at the individual or neighborhood level. This was apparent both in our initial total population models in which we observed a significant interaction between race and the neighborhood SEP Index (data not shown) and in the race-specific models. For African-American women, once we controlled for racial composition of the neighborhood, the effect of neighborhood SEP was further attenuated. Thus, racial/ethnic composition may play an important role in the experience of discrimination for members of minority groups and should be appropriately accounted for in disparities research. Further research is needed to better understand how racial composition is related to neighborhood social cohesion (and whether it is particularly salient for disadvantaged populations), or if reporting less discrimination among African-American women in disadvantaged neighborhoods is simply due to less interaction with Whites. These racial/ethnic differences in results also underscore the underlying concept that perceived discrimination likely has very different context and meaning for individuals of minority races/ethnicities than individuals of majority races/ethnicities.

A strength of this study, in addition to the collection of detailed multilevel SEP information, is the multi-dimensionality of the perceived discrimination measure, by which we measured experiences that occurred in seven possible situations over the lifetime. While we were unable to separately examine each situation in which discrimination was experienced in multivariable models, the multi-dimensionality of the measure has been shown to be important in validity and reliability compared to other measures that use single-item responses (Krieger *et al.* 2005). Notwithstanding the many advantages of the measure of discrimination used here, other relevant measures of discrimination that assess additional dimensions, minor 'everyday' discrimination versus major events, acute versus chronic exposures, and frequency of exposure, may also be important in evaluating the relationships between neighborhood characteristics and perceived discrimination. Kressin *et al.* (2008) recently reviewed the discrimination literature and concluded that additional measures are needed to adequately assess perceived discrimination in the health care setting. Some studies have shown that chronic exposure to discrimination is a stronger predictor of health outcomes than acute or recent exposures (Williams *et al.* 1997, Bird and Bogart 2001, Lewis *et al.* 2006). Thus, examining how other measures of discrimination are related to neighborhood characteristics and subsequent health outcomes is an area for future research.

A limitation that many multilevel studies share is the use of administrative census data as a proxy for neighborhood. It is unlikely that census boundaries directly coincide with a meaningful definition of 'neighborhood' as defined by residents. However, there are several advantages to using census data, such as the systematic collection of data for the entire population and its accessibility. While 1990 census

information was chosen for reasons of temporal sequencing, we cannot rule out changes in neighborhood characteristics between the 1990 census and the timing of individual interviews. However, as neighborhoods generally do not change significantly over short time periods (Geronimus and Bound 1998), this is unlikely to have had a significant impact on reported findings.

Since these analyses involve cross-sectional associations, there is a potential concern about causality. However, if the individuals who perceived racial discrimination self-selected into predominantly same-race neighborhoods, one might observe a spurious association between perceived racial discrimination and neighborhood-level SEP. Because of the high correlation between neighborhood racial composition and neighborhood-level SEP (high percentage non-White and low SEP), in this scenario, perceived racial discrimination would appear to be associated with low neighborhood-level SEP in African-Americans, whereas it would be associated with higher neighborhood-level SEP in White women. Given the opposite direction of our findings, as well as the adjustment for racial composition of the neighborhoods, we can safely rule out this potential bias.

While these data were collected for the purpose of examining race differences in the screening mammography process, the sampling strategies were designed to reflect the general population of African-American and White women of screening age (i.e., healthy women, age 40–79). As the Connecticut African-American population is largely urban (US Census Bureau n.d. b), by identifying the major mammography facilities that serve this population (Jones *et al.* 2001) (but still serve predominantly White women), it is likely that this sample of African-American and White women is reasonably representative of the adult female population (in this age group) in the general Connecticut population. However, if women who were lost to follow-up or never presented for a mammogram (not assessed in this study) were more likely to have lived in even more disadvantaged neighborhoods than those represented in the study sample, it is possible that we underestimated the effect of neighborhood-level SEP on perceived racial discrimination. Connecticut, like many parts of the USA, can be characterized by significant socioeconomic gaps and residential racial segregation (University of Michigan Population Studies Center 2000), and while replication of these results in other populations is necessary, our findings may have broad implications for understanding the interplay between neighborhood disadvantage, residential segregation, and how racial discrimination is perceived and reported in African-Americans and Whites in the USA.

Conclusions

Individual- and neighborhood-level SEP may play a role in understanding how racial discrimination is perceived, measured, and processed. In order to understand how racism influences health, it is necessary to understand why perceptions of discrimination vary by social strata. If current measurement techniques are not adequate and lead to systematic differences in reports of racial discrimination by SEP, inclusion of additional dimensions of racial discrimination and race-related stressors in future studies may be necessary to fully capture the role of racism in health outcomes.

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