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Disparities Among Minority Women With Breast Cancer Living in Impoverished Areas of California

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Background: *Interaction effects of poverty and health care insurance coverage on overall survival rates of breast cancer among women of color and non-Hispanic white women were explored.*
Methods: *We analyzed California registry data for 2,024 women of color (black, Hispanic, Asian, Pacific Islander, American Indian, or other ethnicity) and 4,276 non-Hispanic white women (Anglo-European ancestries and no Hispanic-Latin ethnic backgrounds) diagnosed with breast cancer between the years 1996 and 2000 who were then followed until 2011. The 2000 US census categorized rates of neighborhood poverty. Health care insurance coverage was either private, Medicare, Medicaid, or none. Cox regression was used to model rates of survival.*
Results: *A 3-way interaction between ethnicity, health care insurance coverage, and poverty was observed. Women of color inadequately insured and living in poor or near-poor neighborhoods in California were the most disadvantaged. Women of color adequately insured and who lived in such neighborhoods in California were also disadvantaged. The incomes of such women of color were typically lower than the incomes of non-Hispanic white women.*
Conclusions: *Women of color with or without insurance coverage are disadvantaged in poor and near-poor neighborhoods of California. Such women may be less able to bare the indirect, direct, or uncovered costs of health care for breast cancer treatment.*

Background

Prognoses are excellent among women with breast cancer diagnosed early and treated in a timely manner with evidence-based surgical and adjuvant care.[1] The vast majority of such women will survive for 5 to 10 years or more with a high quality of life, but racial and ethnic disparities persist.[1] Findings from systematic reviews have found consistent disadvantages in breast cancer screening, diagnosis, treatment, and survival rates in the United States among ethnic minority women of color compared with non-Hispanic white women.[2-13] Non-Hispanic white women have Anglo-European ancestries and no Hispanic-Latin ethnic backgrounds. Women of color represent a diverse population — defined as black, Hispanic, Asian, Pacific Islander, American Indian, or other minority ethnicity — and certain subpopulations of Asian and Hispanic American women even seem to be advantaged on access to breast cancer care and survival.[14,15] However, ethnic minority women of color who live in poverty or are inadequately insured tend to be more alike than higher income women of color and they also tend to be disadvantaged on cancer care compared with non-Hispanic white women.[14,15]

This field of research may also be limited by its focus on the main effects of ethnicity, rates of income, and health care insurance coverage. Access to cancer care as well as rates of survival may be affected by diverse sociodemographic and economic factors, possibly in complex ways.[16,17] For example, a 3-way interaction of ethnicity, health care insurance coverage, and poverty has been observed among patients with colon cancer, indicating that the multiplicative disadvantage of being inadequately insured and living in impoverished areas was worse for African Americans than for non-Hispanic

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white Americans.[16] Furthermore, such disadvantages may be greater for women than for men.[17-20]

Because select groups of African Americans and women who live in impoverished areas have fewer capital reserves than their non-Hispanic white American counterparts, researchers have suggested that these vulnerable groups may be less able to absorb the indirect, direct, or uncovered costs of cancer care.[21] This suggestion led us to hypothesize a 3-way interaction of ethnicity, health care insurance coverage, and poverty. Furthermore, we hypothesize that the interaction will operate such that the survival disadvantage of women of color with breast cancer compared with non-Hispanic white women with breast cancer will be greatest in places where the economic divide between them is greatest.

Methods

Women diagnosed with breast cancer between 1996 and 2000 were randomly selected from 3 socioeconomic strata of the California Cancer Registry and followed until 2011. Cancer data were joined via US census tracts to the 2000 US census with strata based on federal poverty criteria defined as extremely poor (≥ 30% households poor), poor (5%–29%), and near-poor neighborhoods (< 5% poor).[22-24] Based on previous analyses, primary health care insurance coverage was defined as adequate (private or Medicare) or inadequate (Medicaid or none).[15,16,18-20]

Oversampling of women living in poverty seemed to be associated with oversampling of women of color. Approximately one-third of this sample was women of color (n = 2,024), defined as being black, Hispanic, Asian, Pacific Islander, American Indian, or other ethnicity; the other two-thirds were non-Hispanic white women (n = 4,276). Within the study population, women of color were represented as black (28%), Hispanic (49%), Asian, Pacific Islander, American Indian (21%), or other minority ethnicity (2%). None of the ethnic minority subsamples significantly differed from each other with regard to rates of low income or inadequate health care insurance coverage.

We used an age- and tumor grade–adjusted Cox regression model to explore hypotheses about the interacting effects of ethnicity, health care insurance coverage, and level of poverty on the predictive outcomes of 7-year overall survival (OS) rates (SPSS Statistics for Windows, v22.0, IBM, Armonk, New York).[25] Hazard ratios (HRs) and 95% confidence intervals (CIs) were estimated. Prevalence estimates were used to describe our study population, and survival rates aided interpretation of the observed 3-way interaction. Prevalence estimates and rates per 100 participants were directly adjusted for age and grade using the study population as the standard population and reported as percentages. Standardized prevalence ratios, rate ratios, or rate differences were then used to assess the practical significance of discrete comparisons with chi-square test–based 95% CIs. The median test was used for continuous comparisons of skewed distributions.[26] Other details have been previously reported elsewhere.[27,28]

The study was reviewed and cleared by the University of Windsor research ethics board.

Results

Study Sample

Table 1 displays study sample descriptions. Women of color were significantly younger than the non-Hispanic white women. They were also more likely to have high-grade, poorly or undifferentiated tumors than non-Hispanic white women. Women of color (56%) were also more than twice as likely as non-Hispanic white women (22%) to live in poor neighborhoods (adjusted prevalence ratio = 2.63; 95% CI, 2.46–2.81), and they were nearly twice as likely to be inadequately in-

Table 1. — Sociodemographic and Clinical Characteristics of Women With Breast Cancer at Diagnosis: Unadjusted Percentage Distributions

Variable	Non-Hispanic White Women		Women of Color	
	n	%	n	%
Age,[a] y				
25–44	458	10.7	446	22.0
45–54	874	20.4	512	25.3
55–64	907	21.2	437	21.6
65–74	1,021	23.9	354	17.5
≥ 75	1,016	23.8	275	13.6
Neighborhood poverty, %				
< 5	1,763	41.2	337	16.6
5–29	1,552	36.3	548	27.1
≥ 30	961	22.5	1139	56.3
Primary health insurers				
Private	2,390	55.9	986	48.7
Medicare	1,298	30.4	476	23.5
Medicaid	167	3.9	298	14.7
Uninsured	421	9.8	264	13.0
Summary stage				
Node negative	2,942	68.8	1227	60.6
Node positive	1,334	31.2	797	39.4
Tumor grade				
Well differentiated	1,052	24.6	279	13.8
Moderately differentiated	1,843	43.1	753	37.2
Poorly or undifferentiated	1,381	32.3	992	49.0

All categorical ethnic group differences were statistically significant (chi-square test; $P < .001$).
[a]Non-Hispanic white women (M = 62.9; SD = 14.1) vs women of color (M = 56.9; SD = 14.3); 1-way analysis of variance = 246.01; $P < .001$.
M = mean, SD = standard deviation.

sured compared with non-Hispanic white women (ie, uninsured or Medicaid insured; 28% vs 14%; adjusted prevalence ratio = 1.84; 95% CI, 1.71–2.05). Therefore, further analyses were adjusted for age and grade while testing the effects of ethnicity, health care insurance coverage, and poverty.

Interaction of Ethnicity by Health Insurance Coverage and Poverty

Table 2 displays the survival analysis. Consistent with findings from previous research,[14-20] having adequate health care insurance coverage predicted rates of OS while living in poverty and being a woman of color predicted rates of mortality. The women of color in our study were twice as likely to die within 7 years of being diagnosed with breast cancer than were non-Hispanic white women (HR = 2.28). Significant 2-way interactions of ethnicity with adequate health care insurance coverage and poverty as well as a significant 3-way interaction were observed ($P = .047$).

The 3-way interaction of ethnicity, health care insurance coverage, and level of poverty is depicted in Table 3.

Table 3. — Description of 3-Way Interaction of Ethnicity, Health Insurance, and Poverty on 7-Year Survival Rates Among Women With Breast Cancer

Ethnic Group Living Within a Location	No. of Cases of Breast Cancer	Rate, %	Rate Ratio[a]	95% CI	Difference in Rate of Survival, %
Poor or near-poor neighborhood and adequately insured					
Non-Hispanic white women	2,922	76.7	1.00		
Women of color	714	72.3	0.94	0.90–0.99	4.4
Poor or near-poor neighborhood and inadequately insured					
Non-Hispanic white women	393	68.6	1.00		
Women of color	171	54.5	0.79	0.69–0.91	14.1
Extremely poor neighborhood					
Non-Hispanic white women	961	64.1	1.00		
Women of color	1,139	62.0	0.97	0.91–1.03	2.1

All rates were adjusted for age and tumor grade.
[a]A rate ratio of 1.00 was the baseline.
CI = confidence interval.

Table 2. — Cox Regression Effects of Ethnicity, Health Insurance, and Poverty on 7-Year Mortality Rates Among Women With Breast Cancer

Predictor Variable	HR	95% CI
Main Effect[a]		
Ethnicity (non-Hispanic white women)		
Women of color	2.28	1.43–3.63
Health insurer (uninsured or Medicaid)		
Medicare or private insurance	0.71	0.60–0.85
Neighborhood poverty (near poor)		
Poor	1.34	1.17–1.53
Extremely poor	1.90	1.63–2.23
Interaction Effect		
Ethnicity by health insurer	0.66	0.51–0.85
Ethnicity by poverty	0.58	0.35–0.96
Ethnicity by health insurer by poverty	1.33	1.00–1.75

All effects were adjusted for all other effects in the regression model as well as for age and tumor grade.
[a]Baseline.
CI = confidence interval, HR = hazard ratio.

Women of color and non-Hispanic white women living in extremely poor neighborhoods did not significantly differ on rates of OS, and the effect of health care insurance coverage did not differ by ethnicity. Typical or median annual household incomes of women of color ($24,050) and non-Hispanic white women ($25,150) were also similar among those living in high poverty places.

Among women living in lower poverty, poor, or near-poor neighborhoods, women of color with private or Medicare insurance coverage were modestly disadvantaged on rates of OS compared with their counterparts (4% rate difference to 6% rate ratio differential). Among these women, median incomes of women of color ($61,700) and non-Hispanic white women ($68,725) differed by more than $7,000 ($P < .05$). In the same poor or near-poor neighborhoods, women of color inadequately insured by Medicaid or those without health care insurance coverage had an OS disadvantage when compared with similar non-Hispanic white women (14% rate difference to 21% rate ratio differential). The incomes of these women of color ($46,425) were typically about $15,000 lower than those of non-Hispanic white women ($61,000; $P < .05$). The OS disadvantage among women of color was greatest among those living in places where the economic divide between women of color and non-Hispanic white women was greatest.

Adjunct Interpretive Findings

Women of color living in poor and near-poor neighborhoods were less likely to be diagnosed early with node-negative disease (rate ratio = 0.95; 95% CI, 0.90–1.00). When breast-conservation surgery was

the most indicated mode of therapy, women of color were less likely than their non-Hispanic white women counterparts to receive it (rate ratio = 0.94; 95% CI, 0.88–1.00) or breast reconstruction (rate ratio = 0.44; 95% CI, 0.32–0.60). Women of color were significantly less likely to receive all adjuvant therapies when they were the most indicated: radiotherapy (rate ratio = 0.91; 95% CI, 0.84–0.99), chemotherapy (rate ratio = 0.91; 95% CI, 0.83–0.99), or hormone therapy (rate ratio = 0.87; 95% CI, 0.78–0.97). Women of color were also more likely to experience long waits for initial surgery (≥ 90 days after diagnosis; rate ratio = 1.48; 95% CI, 1.15–1.91) and radiotherapy (≥ 120 postoperative days; rate ratio = 1.28; 95% CI, 1.03–1.59). When these factors were added to the HR model of OS, the interactions involving ethnicity as well as the main effect of ethnicity no longer entered the model.

Discussion

The results of this study suggest that an interaction exists between ethnicity, health care insurance coverage, and poverty on rates of OS among a cohort of women with breast cancer living in select areas of California. Our data were able to produce 3 central findings across these 3 socioeconomic strata.

Among women of color and non-Hispanic white women living in extremely poor neighborhoods — in areas where at least 30% of the households were poor — the rates of OS did not significantly vary, and this finding is similar to a previous report.[23] Regardless of ethnicity, women living in extremely poor neighborhoods appear to be have similar cancer care and OS disadvantages.[28] The largest rate of OS based on ethnicity was seen among those who were uninsured or Medicaid-insured and who also lived in neighborhoods where poverty was less prevalent. Women of color with breast cancer living in such poor or near-poor neighborhoods were 21% less likely to survive than their non-Hispanic white women counterparts.

Living in poor or near-poor neighborhoods proved to have the greatest effect on ethnicity and income. The difference among women of color and non-Hispanic white women in annual income was $14,575. Thus, it may be possible that uninsured women of color are less able to bare the uncovered costs of care due to a possible inability to cover out-of-pocket expenses; in addition, women of color covered by Medicaid were also at a disadvantage.[29] In the same lower-poverty neighborhoods, women of color with private health care insurance or those with Medicare were 6% less likely to survive than were similarly insured non-Hispanic white women. On average, income among these women of color was $7,025 less than that of non-Hispanic white women. Women of color with private health care insurance coverage may have been more likely to be covered by so-called "bronze plans" with high deductibles, whereas women of color with Medicare coverage may be less able to purchase necessary "Medigap" coverage.[30,31]

Disadvantages among women of color may also exist in relation to diagnostic and therapeutic care for breast cancer due to the possible inadequacy of their incomes and health care insurance coverage. That is to say that the effects we observed in this study may not be racial or ethnic effects per se; rather, they may be socioeconomic effects. This inference could be interpreted to mean that race or ethnicity does not matter in this instance. However, we think not for the following reasons. Our findings are similar to those of other studies, which may have observed only the tip of the proverbial socioeconomic iceberg — these disparities may be the result of structural inequalities not only in health care, but in education, employment, housing, and banking.[5-10,32-34] For example, compared with non-Hispanic white women, women of color are more likely to live in poverty, to live in *deeper* poverty, and be less wealthy.[21,35,36] Lacking capital reserves seems to further disadvantage women of color in many ways, including compounding their inability to purchase adequate health care insurance coverage for breast cancer care. Race/ethnicity still seems to matter very much in American health care.[37]

Limitations

We focused on OS rates rather than cancer-specific rates of survival. Although vital status and survival duration are accurate in cancer registries, the underlying cause of death probably is not.[38-40] In addition, the underlying cause of many deaths not coded as being a cancer-related death can be directly associated with lack of treatment or with treatment-related complications.[41] Therefore, we believe that OS has a higher rate of accuracy and is a better practical indicator of policy and of clinical significance.

Our findings could be confounded by comorbid differences between women of color and non-Hispanic white women. The California Cancer Registry did not code comorbidities known to be associated with socioeconomic factors and breast cancer survival.[42] However, women of color and non-Hispanic white women with similar tumors were compared through mathematical modeling, matching them to cancer virulence proxy, grade, and on 2 correlates of other chronic diseases (age, poverty). Therefore, the 2 groups are quite similar, making comorbid alternative explanations unlikely.

Our findings about women of color living in California may not be generalizable to all such women in the United States. Our sample of women of color was composed of even more diverse subsamples, some of which were quite small. The majority of the Hispanic participants were Mexican American (83%) and the remainder had diverse Central or South American or Ca-

ribbean heritages. Asian American participants were Filipino (31%), Chinese (20%), Japanese (15%), Korean (6%), Vietnamese (6%), East Indian or Pakistani American (5%), or of another Asian heritage. The consistency and significance, both statistical and practical, of our findings, along with our explanation of a coherent health care insurance theory, bode for convergence. That is, it seems likely that these findings apply to most women of color, particularly those with inadequate incomes and health care insurance coverage.

This study was exploratory. Its findings are best thought of as screened hypotheses. We recommend that investigators systematically replicate these analyses with much more powerful ethnic group subsamples. Narrative study of the experiences of each ethnic group would also substantially advance our practical knowledge.

Conclusions

Women of color living in poor and near-poor neighborhoods of California are disadvantaged in terms of breast cancer care. It is those neighborhoods where they may be less able than non-Hispanic white women to bare the indirect, direct, or uncovered costs of care. Intersecting structural barriers may exist between high-quality care for women of color, those who live in poverty, and those who are uninsured or underinsured. Thus, US policy makers ought to be cognizant of these factors as they consider future reforms of health care.

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