Race, Socioeconomic Status, and Breast Cancer Treatment and Survival

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Background: Previous studies have found that African-American women are more likely than white women to have late-stage breast cancer at diagnosis and shortened survival. However, there is considerable controversy as to whether these differences in diagnosis and survival are attributable to race or socioeconomic status. Our goal was to disentangle the influence of race and socioeconomic status on breast cancer stage, treatment, and survival.

Methods: We linked data from the Metropolitan Detroit Surveillance, Epidemiology, and End Results (SEER) registry to Michigan Medicaid enrollment files and identified 5719 women diagnosed with breast cancer, of whom 593 were insured by Medicaid. We first calculated the unadjusted odds ratios (ORs) associated with race, Medicaid insurance, and poverty for breast cancer stage at diagnosis, breast cancer treatment, and death. We then estimated the ORs of having late-stage breast cancer at diagnosis, breast-conserving surgery, no surgery, and death using logistic regression after controlling for clinical and nonclinical factors. All statistical tests were two-sided.

Results: Before controlling for Medicaid enrollment and poverty, African-American women had a higher likelihood than white women of each unfavorable breast cancer outcome. However, after controlling for covariates, African-American women were not statistically significantly different from white women on most outcomes except for surgical choice. African-American women were more likely than white women to have no surgery (adjusted OR = 1.62; 95% confidence interval [CI] = 1.11 to 2.37). Among women who had surgery, African-American women were more likely to have breast-conserving surgery than were white women (adjusted OR = 1.63; 95% CI = 1.33 to 1.98).

Conclusions: The linkage of Medicaid and SEER data provides more in-depth information on low-income women than has been available in past studies. In our Metropolitan Detroit study population, race was not statistically significantly associated with unfavorable breast cancer outcomes. However, low socioeconomic status was associated with late-stage breast cancer at diagnosis, type of treatment received, and death. [J Natl Cancer Inst 2002;94:490–6]
that African-American women are less likely to undergo breast-conserving surgery than are white women (6–9). However, other studies have shown that the racial differences in treatment choice disappear when factors such as socioeconomic status (15), hospital size (17), urban residence (16), and health insurance (14) are considered. Whereas some studies have found no differences in surgical choice among African-American and white women (18–20), others found that African-American women were more likely to undergo breast-conserving surgery compared with white women (21,22).

The data used for most of these studies come from either a single medical center or managed care organization that represents a distinct population (6,19), or they stem from the population-based Surveillance, Epidemiology, and End Results (SEER) registry linked with Medicare claim files (15). Data from each of these sources have their own limitations. For example, data from a single medical center may not be generalizable to patients in other medical centers, whereas data from linked Medicare–SEER records apply almost exclusively to women older than 65 years and rely on ecologic variables for income information. These data adequately measure some patient characteristics (e.g., age and race) but poorly measure socioeconomic variables (e.g., income or insurance status) and thus lead to the overall confusion about the effects of race, health insurance, and socioeconomic status on breast cancer diagnosis, treatment, and survival that is reflected in the literature.

The purpose of our study was to disentangle the influence of race and socioeconomic status on breast cancer stage at diagnosis, treatment, and survival. Toward that goal, we asked the following questions: 1) What clinical, demographic, and socioeconomic factors are associated with the stage of cancer at diagnosis and with the surgical choices of breast-conserving surgery, mastectomy, or no surgery? 2) If a woman chooses to have breast-conserving surgery, do clinical, demographic, and socioeconomic characteristics affect whether she is treated with radiation? 3) After controlling for stage of disease at diagnosis and the type of surgery performed, are there differences in survival between socioeconomic groups and/or between African-American and white women?

**METHODS**

**Data**

We used the Metropolitan Detroit Cancer Surveillance System (MDCSS), a participant in the SEER program, to identify 5957 women who were diagnosed in 1996 and 1997 with either *in situ* or invasive cancers of the breast. The MDCSS covers a population of more than 4 million residents in the Metropolitan Detroit tri-county (Wayne, Macomb, and Oakland counties) area.

Several previous studies have used SEER data linked to Medicare claim files to study cancer treatment and outcomes for persons older than 65 years (23–25). In this study, we used a similar approach to link Medicaid files with a SEER registry. The Michigan Department of Community Health matched women from the Detroit SEER cancer registry to the 1996 and 1997 Medicaid enrollment files by the patient’s Social Security number, name (first and last), month, day, and year of birth, sex, and address. Subjects who matched on all variables, matched on all variables except address, or matched on name (first and last), date of birth, sex, and either the first five digits or the last four digits of their Social Security numbers were considered valid matches. Using this procedure, we identified 615 women who were insured by Medicaid from the total study population of 5957. The Michigan Department of Community Health then searched for death certificates issued from 1996 through 1998 for all of the women in the data set. The resulting file, which contained cancer registry, death certificate, and Medicaid enrollment information, was provided to us after being stripped of data (such as names, addresses, Social Security numbers, or Medicaid recipient identification numbers) that could be linked to individuals. In addition, the 1990 U.S. Census data were used to determine the percentage of poverty in the specific census tract in which a subject resided. Institutional Review Board approvals (Michigan State University IRB# 99318) were obtained for the use of records from human subjects in this study.

**Variables**

The outcomes of interest were late-stage breast cancer at diagnosis, breast cancer treatment, and death within the 2-year study period. Breast cancer stage at diagnosis was defined by the following categories: *in situ*, localized, regional, distant, or invasive/unknown. Tumors that were unstaged but known to be invasive were categorized as invasive/unknown. We defined late-stage breast cancers as those that were regional, distant, or invasive/unknown. We defined treatment as the type of surgery performed (mastectomy, breast-conserving surgery, or no surgery). If breast-conserving surgery was performed, we also examined whether radiation was either delivered or planned. We compared the type of surgery received (either breast-conserving surgery or mastectomy) for women who had surgery, and then we analyzed surgery (breast-conserving surgery and mastectomies combined) versus no surgery separately. SEER defines breast-conserving surgery as either segmental mastectomy, lumpectomy, quadrantectomy, tylectomy, wedge resection, excisional biopsy, or partial mastectomy and categorizes radiation as none, beam radiation, radium implant, beam and implant or isotope, radiation not otherwise specified, refused, planned, and unknown. Among the women who had breast-conserving surgery, we recoded radiation into two categories: no radiation and any type of radiation received or planned. Subjects who refused radiation treatment or whose radiation treatment status was unknown (n = 8) were not included in the analysis. We did not consider whether study subjects received chemotherapy because this information was not consistently reported in the MDCSS and Medicaid claim files.

Our database contained many of the demographic variables known to be associated with cancer treatment and outcomes, including age at diagnosis (21,26–28), race (2–5), marital status (15), Medicaid insurance status (1,14), and poverty level in the subject’s census tract (15). Age at diagnosis was entered into the equations as a continuous variable and as a dichotomous variable for those women who were 65 years old or older to capture the effects that older age and enrollment in Medicare may have on care. Race/ethnicity was grossly defined as white (n = 4609), African-American (n = 1110), Asian (n = 54), and other/unknown (n = 184). We excluded subjects classified as Asian because there were too few of them for statistical analysis. We also excluded subjects classified as other/unknown because the racial and ethnic groups (e.g., Hispanics, Native Americans) in this category varied widely in their cancer outcomes, and we were concerned that combining such disparate groups together.
or with whites or African-Americans would lead to biased results. When these two groups of subjects (n = 238) were excluded, the sample size was 5719. Marital status was defined as married or unmarried (includes never married, separated, divorced, and widowed). We also distinguished between subjects who were enrolled in a Medicaid fee-for-service plan, which tends to care for an older, more disabled population, and subjects who were enrolled in a Medicaid managed care plan, which tends to care for a younger and healthier population.

We defined poverty by the percentage of residents living below the federal poverty line within a census tract (29). We categorized subjects into three groups: those who lived in a census tract with less than 5% poverty (n = 2520), those who lived in a census tract with 5%–12% poverty (n = 1718), and those who lived in a census tract with 13% or higher poverty (n = 1481). The latter category represents the subjects in the upper quartile of the distribution of residents below the poverty line, whereas the 5%–12% poverty category represents the subjects in the fiftieth to seventy-fifth percentile of the distribution of residents below the poverty line, and the less-than-5% poverty category represents subjects at or below the fiftieth percentile of the distribution of residents below the poverty line. We used percent poverty in a census tract, albeit an imperfect measure (30), to capture the effects of living in a low-income area that might otherwise be missed or absorbed by variables for enrollment in Medicaid. However, because Medicaid is an individually determined, means-tested program, we are confident that the women in our study who were insured by Medicaid had incomes below the federal poverty line.

**Statistical Analysis**

Unadjusted odds ratios (ORs) were calculated as a measure of association between particular variables of interest (i.e., race, Medicaid status, poverty) and late-stage breast cancer at diagnosis, treatment with breast-conserving surgery with and without radiation, no surgery, and death. We then used logistic regression analysis, controlling for clinical and nonclinical factors, to estimate the odds of having late-stage breast cancer at diagnosis, having breast-conserving surgery if surgery was performed, or having no surgery, and to estimate the odds of death. All analyses were conducted using Stata version 6.0 (Stata Corp., College Station, TX). All statistical tests were two-sided.

**RESULTS**

**Descriptive Statistics**

Table 1 presents the descriptive characteristics of the breast cancer subjects. The women had a mean age of 61.1 years, and 43% of the study population was older than 65 years. The majority (81%) of the breast cancer subjects were identified as white, and 19% were African-American. Slightly more than half (54%) of the women in our study were unmarried, had never been married, or were separated, divorced, or widowed. Eleven percent of the women were insured by Medicaid, with a near even split between those who had managed care and those who had fee-for-service coverage.

Among the women in our study, 69% had been diagnosed with early-stage breast cancer and 10% died from breast cancer during the 2-year study period. Consistent with the large number of early-stage cancers in the study sample, more than half (52%) of the women received breast-conserving surgery. The remaining women had a mastectomy (40%) or received no surgery of any sort (7%). Of those who received breast-conserving surgery, only 61% received, or planned to receive, radiation.

Table 2 shows the unadjusted ORs for late-stage cancers, breast-conserving surgery, breast-conserving surgery and radiation, no surgery, and death. For many of the outcomes of interest, African-American women had greater odds of having unfavorable outcomes than did white women. For example, African-American women were more likely to be diagnosed with a later-stage disease (OR = 1.53; 95% CI = 1.33 to 1.75), were less likely to receive radiation if they had breast-conserving surgery (OR = 0.74; 95% CI = 0.61 to 0.88), were more likely to receive no surgery (OR = 2.07; 95% CI = 1.68 to 2.58), and were more likely to have died from cancer within the 2-year study period (OR = 1.39; 95% CI = 1.14 to 1.70). However, African-American women were not statistically significantly different from white women in their likelihood of having received breast-conserving surgery.

In general, women insured by Medicaid, through either managed-care or fee-for-service systems, were more likely to have unfavorable outcomes than were women not insured by Medicaid. For example, Medicaid-insured women were more likely to be diagnosed with later-stage disease (OR = 1.85; 95% CI = 1.67 to 2.33 for those receiving Medicaid managed care and OR = 2.36; 95% CI = 1.85 to 3.01 for those receiving Medicaid fee-for-service), less likely to receive breast-conserving surgery (OR = 0.62; 95% CI = 0.47 to 0.82 for those receiving Med-

### Table 1. Descriptive characteristics of breast cancer subjects identified through the Detroit Metropolitan SEER Registry, 1996–1997*

<table>
<thead>
<tr>
<th>Patient characteristics</th>
<th>No. of subjects (SD or %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>61.1 (±14.1)</td>
</tr>
<tr>
<td>Older than 65</td>
<td>2472 (43%)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>4609 (81%)</td>
</tr>
<tr>
<td>African-American</td>
<td>1110 (19%)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>2617 (46%)</td>
</tr>
<tr>
<td>Not married</td>
<td>3102 (54%)</td>
</tr>
<tr>
<td>Medicaid status</td>
<td></td>
</tr>
<tr>
<td>Not eligible for Medicaid</td>
<td>5126 (89%)</td>
</tr>
<tr>
<td>Medicaid HMO</td>
<td>317 (6%)</td>
</tr>
<tr>
<td>Medicaid fee-for-service</td>
<td>276 (5%)</td>
</tr>
<tr>
<td>Poverty in census tract of residence</td>
<td></td>
</tr>
<tr>
<td>&lt;5%</td>
<td>2520 (44%)</td>
</tr>
<tr>
<td>5%–12%</td>
<td>1718 (30%)</td>
</tr>
<tr>
<td>≥13%</td>
<td>1481 (26%)</td>
</tr>
<tr>
<td>Clinical</td>
<td></td>
</tr>
<tr>
<td>Cancer stage at diagnosis?</td>
<td></td>
</tr>
<tr>
<td>In situ/local</td>
<td>3967 (69%)</td>
</tr>
<tr>
<td>Regional</td>
<td>1333 (23%)</td>
</tr>
<tr>
<td>Distant/invasive</td>
<td>419 (7%)</td>
</tr>
<tr>
<td>Deaths during study period</td>
<td>585 (10%)</td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
</tr>
<tr>
<td>No surgery</td>
<td>426 (7%)</td>
</tr>
<tr>
<td>Breast-conserving surgery only</td>
<td>1170 (21%)</td>
</tr>
<tr>
<td>Breast-conserving surgery followed by radiation</td>
<td>1822 (32%)</td>
</tr>
<tr>
<td>Mastectomy</td>
<td>2301 (40%)</td>
</tr>
</tbody>
</table>

*SEER = Surveillance, Epidemiology, and End Results Program; SD = standard deviation; y = years; HMO = health maintenance organization.
†Do not add up to 100% due to rounding.
Table 2. Unadjusted odds ratios (ORs) (95% confidence intervals [CIs]) for breast cancer stage at diagnosis, treatment, and death*  

<table>
<thead>
<tr>
<th>Variable</th>
<th>Late-stage cancer at diagnosis (N = 5719) OR (95% CI)</th>
<th>P†</th>
<th>Breast-conserving surgery (N = 5293) OR (95% CI)</th>
<th>P†</th>
<th>Breast-conserving surgery with radiation (N = 2992) OR (95% CI)</th>
<th>P†</th>
<th>No surgery (N = 5719) OR (95% CI)</th>
<th>P†</th>
<th>Death (N = 5719) OR (95% CI)</th>
<th>P†</th>
</tr>
</thead>
<tbody>
<tr>
<td>African-American§</td>
<td>1.53 (1.33 to 1.75)</td>
<td>&lt;.001</td>
<td>1.12 (0.97 to 1.29)</td>
<td>.125</td>
<td>0.74 (0.61 to 0.88)</td>
<td>.001</td>
<td>2.07 (1.68 to 2.58)</td>
<td>&lt;.001</td>
<td>1.39 (1.14 to 1.70)</td>
<td>.001</td>
</tr>
<tr>
<td>Medicaid HMO</td>
<td></td>
<td>1.85 (1.67 to 2.33)</td>
<td>&lt;.001</td>
<td>0.82 (0.65 to 1.05)</td>
<td>.115</td>
<td>0.49 (0.35 to 0.69)</td>
<td>&lt;.001</td>
<td>1.79 (1.24 to 2.58)</td>
<td>.002</td>
<td>1.41 (0.99 to 2.01)</td>
</tr>
<tr>
<td>Medicaid FFS</td>
<td></td>
<td>2.36 (1.85 to 3.01)</td>
<td>&lt;.001</td>
<td>0.62 (0.47 to 0.82)</td>
<td>&lt;.001</td>
<td>0.31 (0.20 to 0.48)</td>
<td>&lt;.001</td>
<td>3.83 (2.81 to 5.22)</td>
<td>&lt;.001</td>
<td>5.53 (4.24 to 7.21)</td>
</tr>
<tr>
<td>5%–12% Poverty in census tract¶</td>
<td>1.11 (0.97 to 1.27)</td>
<td>.131</td>
<td>0.88 (0.77 to 1.00)</td>
<td>.044</td>
<td>0.96 (0.80 to 1.14)</td>
<td>.631</td>
<td>1.56 (1.21 to 2.00)</td>
<td>.001</td>
<td>1.63 (1.32 to 2.01)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>≥13% Poverty in census tract¶</td>
<td>1.56 (1.36 to 1.79)</td>
<td>&lt;.001</td>
<td>0.81 (0.71 to 0.93)</td>
<td>.002</td>
<td>0.67 (0.56 to 0.80)</td>
<td>&lt;.001</td>
<td>2.46 (1.94 to 3.13)</td>
<td>&lt;.001</td>
<td>2.05 (1.66 to 2.53)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

*HMO = health maintenance organization; FFS = fee-for-service.
†Statistical significance is determined by dividing the maximum likelihood coefficient by its standard error (Z) with two-tailed, statistical significance level set at P≥0.05.
§Reference group: white women.
¶Reference group: women not insured by Medicaid.
†Reference group: women residing in census tracts with less than 5% poverty.

African-American women were less likely to receive breast-conserving surgery, more likely to receive no surgery (OR = 1.10; 95% CI = 1.10 to 1.81), and more likely to die during the 2-year study period than were women who were not Medicaid insured; and Medicaid insurance status, and race on cancer outcomes. When the independent effects of each of these variables are better understood, interventions can be targeted more effectively.

Table 3 presents the adjusted ORs for breast cancer stage at diagnosis, treatment, and death, controlling for all covariates. When we controlled for age, race, marital status, cancer stage, Medicaid status, and census tract poverty level, we found that African-American women did not have statistically significantly higher odds of having late-stage disease at diagnosis or of dying during the study period than did white women. In addition, African-American women who had breast-conserving surgery were statistically just as likely to receive radiation therapy as were white women who had breast-conserving surgery, and Medicaid-insured women were no longer less likely to receive breast-conserving surgery with radiation therapy following breast-conserving surgery (OR = 1.63; 95% CI = 1.33 to 1.98) than were white women. For those subjects who received surgery, African-American women and white women differed in the type of surgery they received for breast cancer; African-American women were consistently more likely to receive breast-conserving surgery than were white women (OR = 1.63; 95% CI = 1.33 to 1.98).

As shown in Table 3, Medicaid status in the adjusted analysis tended to predict the outcomes of interest, just as it did in the unadjusted analysis. Women insured by Medicaid were more likely to be diagnosed with late-stage disease (OR = 1.41; 95% CI = 1.10 to 1.81) than those receiving Medicaid managed care and OR = 1.93; 95% CI = 1.50 to 2.49) for those receiving Medicaid fee-for-service and were less likely to receive radiation therapy following breast-conserving surgery (OR = 0.56; 95% CI = 0.39 to 0.81) for those receiving Medicaid managed care and OR = 0.37; 95% CI = 0.24 to 0.57 for those receiving Medicaid fee-for-service) than were women who were not insured by Medicaid. Women enrolled in the Medicaid fee-for-service system were more than three times more likely to die during the 2-year study period than were those who were not insured by Medicaid (OR = 3.11; 95% CI = 2.19 to 4.42). One deviation from the results shown in Table 2 was the observation that Medicaid-insured women were no longer less likely to receive breast-conserving surgery than were those who were not Medicaid insured;
Table 3. Adjusted odds ratios (ORs) (95% confidence intervals [CIs]) for breast cancer stage at diagnosis, treatment, and death*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Late-stage cancer at diagnosis (N = 5719)</th>
<th>Breast-conserving surgery with radiation (N = 2992)</th>
<th>Breast-conserving surgery (N = 5293)</th>
<th>No surgery (N = 5719)</th>
<th>Death (N = 5719)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td>Age at diagnosis</td>
<td>1.00 (0.99 to 1.01)</td>
<td>.616</td>
<td>.539</td>
<td>0.99 (0.98 to 1.00)</td>
<td>.016</td>
</tr>
<tr>
<td>Older than 65¶</td>
<td>.87 (0.71 to 1.08)</td>
<td>.201</td>
<td>.079</td>
<td>1.27 (0.96 to 1.68)</td>
<td>.095</td>
</tr>
<tr>
<td>African-American¶</td>
<td>1.78 (0.98 to 1.81)</td>
<td>.089</td>
<td>1.63 (1.33 to 1.98)</td>
<td>&lt;.001</td>
<td>1.67 (1.62 to 2.37)</td>
</tr>
<tr>
<td>Married¶</td>
<td>1.07 (1.05 to 1.09)</td>
<td>.035</td>
<td>1.22 (1.04 to 1.44)</td>
<td>.083</td>
<td>.93 (0.70 to 1.23)</td>
</tr>
<tr>
<td>Medicaid HMO**</td>
<td>1.41 (1.10 to 1.81)</td>
<td>.007</td>
<td>0.93 (0.71 to 1.22)</td>
<td>.616</td>
<td>0.56 (0.39 to 0.81)</td>
</tr>
<tr>
<td>Medicaid FFS**</td>
<td>1.93 (1.50 to 2.49)</td>
<td>&lt;.001</td>
<td>0.76 (0.57 to 1.02)</td>
<td>.065</td>
<td>0.37 (0.24 to 0.57)</td>
</tr>
<tr>
<td>5%–12% Poverty in census tract††</td>
<td>1.03 (0.90 to 1.17)</td>
<td>.633</td>
<td>0.87 (0.76 to 1.00)</td>
<td>&lt;.001</td>
<td>0.97 (0.81 to 1.16)</td>
</tr>
<tr>
<td>&gt;13% Poverty in census tract††</td>
<td>1.16 (0.97 to 1.40)</td>
<td>.111</td>
<td>0.68 (0.56 to 0.82)</td>
<td>&lt;.001</td>
<td>0.78 (0.60 to 1.00)</td>
</tr>
<tr>
<td>Breast-conserving surgery</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Mastectomy</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

* N/A = Not applicable; HMO = health maintenance organization; FFS = fee-for-service.
† Statistical significance is determined by dividing the maximum likelihood coefficient by its standard error (Z) with two-tailed statistical significance set at P > |Z|.
‡ Reference group: women who had any surgery.
¶ Reference group: women younger than 65.
§ Reference group: unmarried women.
‖ Reference group: white women.
¶¶ Reference group: women residing in census tracts with less than 5% poverty.
†† Reference group: women residing in census tracts with 5%–12% poverty.
‡‡ Reference group: those not Medicaid-insured.
††† Reference group: women residing in census tracts with >13% poverty.

thus, the disparity in surgical delivery is not apparent for these low-income women, when other characteristics (e.g., cancer stage) are held constant.

When we controlled for all covariates, higher poverty levels within the census tract where a woman resided also continued to be associated with lower odds of having breast-conserving surgery and greater odds of death, although the latter was not statistically significant. Women who resided in census tracts with poverty levels of 13% or greater were less likely to receive breast-conserving surgery (OR = 0.68; 95% CI = 0.56 to 0.82) and subsequent radiation (OR = 0.76; 95% CI = 0.60 to 1.00) than were women residing in census tracts with less than 5% poverty. However, we found that women residing in census tracts with more than 5% poverty no longer had a statistically significantly greater likelihood of receiving no surgical treatment or of dying than were women residing in census tracts with less than 5% poverty.

These findings, taken at face value, suggest that low socioeconomic status, as defined by receiving Medicaid insurance, is a risk factor for having a late-stage breast cancer diagnosis, for receiving inadequate treatment, and for poor survival. However, low socioeconomic status is a somewhat unsatisfactory explanation for late-stage cancer diagnosis and poor treatment and survival because there are still many questions regarding the underlying disparities in cancer stage at diagnosis and survival. To shed light on some of these questions, we re-analyzed the total study population and the Medicaid-insured sample separately. Our finding, that African-American women who had had surgery were more likely to receive breast-conserving surgery, was robust regardless of their Medicaid status. However, other relationships were not as consistent. For example, after controlling for age and cancer stage at diagnosis within the group of women who were not insured by Medicaid, we found that African-American women were less likely to receive surgery than were white women. Moreover, African-American women who were not insured by Medicaid and were perhaps either uninsured or underinsured were more likely to receive no surgical intervention for breast cancer than were white women. Therefore, coverage by Medicaid insurance did, to some extent, decrease racial disparities in cancer care in our study sample.

To better understand why low-income women were more likely to have late-stage cancer at diagnosis, less likely to receive radiation, and more likely to die within the study period, we reviewed the Medicaid claims files for 257 (93%) of the 276 women identified through the MDCSS registry as being insured under a fee-for-service system. Data recovered from those files suggested that comorbid conditions might have played a role in preventing these women from receiving what is considered standard care for breast cancer screening and treatment.
ample, we found that the mean age of these women was 68.1 ± 15.8 years; as indicated in the literature, older women who are diagnosed with breast cancer are less likely to receive aggressive care compared with younger women who are diagnosed with breast cancer (25). Other characteristics of the women who received Medicaid fee-for-service insurance are summarized in Table 4. Fifty-six women lived in long-term care facilities and 68 women lived in nursing homes. Slightly higher percentages of the women who lived in such facilities were diagnosed with late-stage disease and died during the study period compared with women who did not live in such facilities. It is likely that women residing in long-term care facilities suffer from other chronic conditions, such as dementia, that could limit their access to breast cancer screening and follow-up care. Therefore, the low-income women in our study who were insured by Medicaid may have had a number of extenuating circumstances that predisposed them to having adverse outcomes.

**DISCUSSION**

On most outcomes examined (i.e., breast cancer stage at diagnosis, treatment, and survival), we found that African-American women were not statistically significantly different from white women when other covariates, such as age, socioeconomic status, and insurance coverage were controlled in the analysis. Two exceptions to this finding were regarding surgical delivery: in both the unadjusted and adjusted models, African-American women were less likely to receive surgery than were white women, but those who did receive surgery were more likely to have breast-conserving surgery than were white women.

Low socioeconomic status is a risk factor for unfavorable breast cancer outcomes, regardless of race. Public health programs that alleviate environmental conditions that may make low-income women more susceptible to cancer may help to reduce socioeconomic disparities in cancer outcomes. Likewise, public health programs aimed at increasing preventive behaviors among low-income persons may also lessen the gap in cancer outcomes.

Extending health care coverage to uninsured individuals is also likely to improve health outcomes. In our analysis, we found that within the Medicaid-insured group there were no racial differences in cancer stage at diagnosis or survival. However, health insurance is clearly not a panacea for all poverty-related disparities. As our findings show, women insured by Medicaid—both fee-for-service and managed care systems of health care delivery—have a higher likelihood of late-stage disease at diagnosis and a lower likelihood of receiving radiation therapy than do women not insured by Medicaid. Perhaps these disparities are due to circumstances beyond the control of Medicaid. For example, patients insured by Medicaid may have comorbid conditions that interfere with cancer screening and treatment. In addition, physicians may be reluctant to recommend routine screening or cancer treatment for low-income women, even those who are insured (31). Furthermore, a breast cancer diagnosis may be the condition that qualifies otherwise ineligible women for Medicaid coverage. These women may already have late-stage cancers that prevent such coverage from having a positive impact on survival. Hopefully, programs such as the National Breast and Cervical Cancer Control Program can provide low-income women with screening services that can identify their cancers at earlier stages. Only then can programs that extend health insurance coverage to women breast cancer, such as Medicaid, be more effective than they currently are.

Our study has four limitations. The first limitation concerns the possible underreporting of the number of women that received radiation therapy after breast-conserving surgery. Du et al. (23) have shown that the rate of underreporting of radiation therapy can be as high as 26.8% for women older than 65 years who have undergone breast-conserving surgery. The effect such potentially missing data would have on the results of our analysis of radiation receipt after breast-conserving surgery is unknown. Second, because our study sample comprised women who resided in a single urban geographic area, our results may not be generalizable to women who live in other areas. Third, because we relied, in part, on ecologic data for poverty measures and thus lacked specific economic information for the uninsured women in our study, we could use only the ecologic variables for poverty within a census tract to identify other medically vulnerable women in our sample (32). Fourth, cancer stage at diagnosis for older and lower income women may have been misclassified because these women were less likely to have undergone an axillary node dissection, which would have allowed a definitive classification of their cancer stages (33,34). Because cancer stage was such an important variable in our analysis, we used two broad categories for cancer stage—early, which included in situ and local cancers, and late, which included regional, distant, and invasive cancers—and we entered stage into our equations as a dichotomous variable. This gross classification of cancer stage was less likely to be subject to error than designating each stage separately.

In spite of these limitations, our results lend insight into the source of disparities in breast cancer treatment and survival. By linking Medicaid files and a SEER registry, we obtained more in-depth information on a group of low-income women than has been available in past studies. Our results are consistent with previous findings: race is not statistically significantly associated with breast cancer stage at diagnosis or survival when other covariates are controlled in the analysis. Poverty, as measured by Medicaid status and census data, continues to be a risk factor for unfavorable breast cancer diagnosis, treatment, and death, even when covariates are controlled in the analysis. However, the fact remains that African-American women are more likely to have lower incomes than white women. In our sample, 13% of the white women lived in census tracts with a 13% or higher poverty level, whereas 84% of the African-American women lived in census tracts with a 13% or higher poverty level.

In an editorial, Brawley and Freeman (35) considered the results obtained by Dignam et al. (8), who found that equal colon cancer treatment led to equal outcomes among African-American and white patients and stated that “this finding raises deep ethical and moral questions concerning how the research

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**Table 4. Characteristics of Michigan fee-for-service Medicaid breast cancer patients, SEER Registry, 1996 and 1997, N = 257**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N (%)</th>
<th>Died N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community residents</td>
<td>133</td>
<td>60 (45)</td>
</tr>
<tr>
<td>Resident of a long-term care facility</td>
<td>56</td>
<td>30 (54)</td>
</tr>
<tr>
<td>Resident of a nursing home</td>
<td>68</td>
<td>37 (54)</td>
</tr>
</tbody>
</table>

*SEER = Surveillance, Epidemiology, and End Results Program.*
community, the American health care system, and society as a whole will move toward providing remedies for this unacceptable reality.” Brawley and Freeman hypothesized that treatment was not equally disseminated in practice. Likewise, in our study, having Medicaid insurance reduced disparities in cancer treatment but did not improve survival. Poor persons, regardless of their race, are likely to have undesirable cancer outcomes. This finding should challenge the research and policy communities to provide remedies for reducing these disparities.

REFERENCES

(34) Lash TL, Stillman RA. A sensitivity analysis to separate bias due to confounding from bias due to predicting misclassification by a variable that does both. Epidemiology 2000;11:544–9.

Notes

1 Editor’s note: SEER is a set of geographically defined, population-based central cancer registries in the United States, operated by local nonprofit organizations under contract to the National Cancer Institute (NCI). Registry data are submitted electronically without personal identifiers to the NCI on a biennial basis, and the NCI makes the data available to the public for scientific research.

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