Race and Differences in Breast Cancer Survival in a Managed Care Population

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Background: African-American women with breast cancer have poorer survival than European-American women. After adjustment for socioeconomic variables, survival differences diminish but do not disappear, possibly because of residual differences in health care access, biology, or behavior. This study compared breast cancer survival in African-American and European-American women with similar health care access.

Methods: We measured survival in women with breast cancer who are served by a large medical group and a metropolitan Detroit health maintenance organization where screening, diagnosis, treatment, and follow-up are based on standard practices and mammography is a covered benefit. We abstracted data on African-American and European-American women who had been diagnosed with breast cancer from January 1986 through April 1996 (n = 886) and followed these women for survival through April 1997 (137 deaths). Results: African-American women were diagnosed at a later stage than were European-American women. Median follow-up was 50 months. Five-year survival was 77% for African-American and 84% for European-American women. The crude hazard ratio for African-American women relative to European-American women was 1.6 (95% confidence interval [CI] = 1.1–2.2). Adjusting only for stage, the hazard ratio was 1.3 (95% CI = 0.9–1.9). Adjusting only for sociodemographic factors (age, marital status, and income), the hazard ratio was 1.2 (95% CI = 0.8–1.9). After adjusting for age, marital status, income, and stage, the hazard ratio was 1.0 (95% CI = 0.7–1.5). Conclusion: Among women with similar medical care access since before their diagnoses, we found ethnic differences in stage of breast cancer at diagnosis. Adjustment for this difference and for income, age, and marital status resulted in a negligible effect of race on survival.

Methods

Setting

The setting for this study was the Health Alliance Plan (HAP) HMO. HAP is located in southeastern Michigan and is the largest HMO in Michigan, with more than 450,000 members. Approximately 20% of these members are African-American, 53% are female, and 57% are cared for by physicians in the Henry Ford Medical Group (HFMG). Our study population was drawn from HAP members served by the HFMG. The HFMG is a large group practice that includes an urban medical center in Detroit with primary and specialty care clinics and 26 smaller clinics throughout urban and suburban southeastern Michigan.

The HFMG maintains a computerized tumor registry database accredited by the American College of Surgeons. Registry staff use a thorough case-finding system, including review of all pathology and cytology reports, as well as radiation and oncology consultations. The American Joint Commission on Cancer staging system (21)—called “TNM staging”—is used to determine the stage of disease by evaluating tumor size, extent of invasion, microscopic involvement of lymph nodes, and presence of metastases. HFMG registry staff link these data with Detroit Area Surveillance, Epidemiology, and End Results (SEER) Program records and conduct annual follow-up for vital status and recurrence. Follow-up information is complete for 94% of the women in the tumor registry.

Ascertainment of Case Patients

By use of the HFMG cancer registry, we identified all African-American and European-American women with incident breast cancer first diagnosed from January 1986 through April 1996. To minimize heterogeneity in clinical practice and access to care before diagnosis, we limited the study population to women continuously enrolled in HAP for at least 1 year before diagnosis and assigned to a primary care physician within the HFMG at the time of diagnosis. We defined continuous enrollment as no

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more than a 60-day gap in coverage according to membership files.

Outcome Data

We used several sources to identify follow-up data. First, we obtained vital status, date of death (if applicable), and date last known alive from the HFMG tumor registry. Next, for those women thought to be alive, we used HFMG administrative billing data to obtain information about hospitalizations and outpatient visits from January 1986 through April 1997. We used the billing data to update the tumor registry date where appropriate.

Identification of Related Variables

By use of the tumor registry, we obtained information on tumor characteristics, date of diagnosis, pathologic stage at diagnosis (including tumor size), and demographic factors (race, date of birth, and marital status). The demographic variables were primarily obtained from a self-administered questionnaire completed by new patients. We geocoded addresses from billing files into census block groups. We estimated household income for each woman by use of block group level median household income from the 1990 census data. Information about duration of HAP membership and mammography benefits was downloaded from the HMO membership files.

Statistical Methods

To evaluate the association between stage and race, we fit a multinomial logistic model in which we included pathologic stage (0, I, II, III, or IV) as the dependent variable and race (European-American or African-American) as the independent variable. We compared survival between African-American and European-American women by use of the hazard ratio and 95% confidence interval (CI) calculated from Cox proportional hazards models. In the model, we included marital status (unmarried or married), age at diagnosis (<55 years or ≥55 years [corresponding to the mean of this dataset]), estimated household income (<$35,000 or $35,000 or ≥$35,000 [likewise, the mean]), and pathologic stage (0, I, II, III, or IV) as indicator terms. Age of less than 55 years, married, income below $35,000, and stage II disease were the reference categories used in the adjusted model.

RESULTS

We identified 1321 African-American and European-American women members of HAP who were diagnosed with breast cancer from January 1986 through April 1996 and for whom mammography was a fully covered benefit. From this group, we excluded 161 women because they were not assigned to HFMG physicians at the time of diagnosis and an additional 274 women because they were not continuously enrolled in HAP for 1 year before diagnosis, for a final sample of 886 women. The proportion of African-Americans (30%) was the same among the women included and the study group.

The median follow-up time was 50 months overall and was similar for African-American (49 months) and European-American (50 months) women who were alive at the end of follow-up. A total of 137 deaths occurred during the study period. Table 1 shows the baseline demographic and tumor-specific characteristics of the study population. The multinomial logistic model indicated that European-American women were more likely to have earlier stage disease at diagnosis than were African-American women. When we examined this issue more closely, European-Americans were more likely than African-Americans to have disease of an earlier stage (0 or I), with an absolute difference of 11% (95% CI = 3%–18%). Among women diagnosed with stage II disease (which includes cancers with and without lymph node involvement), we found no material difference between African-American and European-American women in the proportions with positive lymph nodes (difference = 5%; 95% CI = −6% to 17%).

The 5-year survival was 77% for African-Americans and 84% for European-Americans. The crude estimates by race are shown in Fig. 1. African-American women had poorer survival compared with European-American women (hazard ratio = 1.6; 95% CI = 1.1–2.2). Table 2 presents the hazard ratios adjusted for pathologic stage and sociodemographic factors, separately and in combination. When stage was added to the model, the hazard ratio decreased to 1.3 (95% CI = 0.9–1.9). Adjusting only for sociodemographic factors, the hazard ratio was re-

Fig. 1. Crude Kaplan–Meier survival estimates, by race. For the 886 African-American and European-American women with breast cancer who were seen at the Health Alliance Plan—Henry Ford Medical Group from January 1986 through April 1996, the cumulative survival proportion at 36 months of follow-up was 0.85 (95% confidence interval [CI] = 0.80–0.89) and 0.92 (95% CI = 0.89–0.94) for European-Americans; at 72 months, the cumulative survival was 0.77 (95% CI = 0.70–0.82) for African-Americans and 0.84 (95% CI = 0.80–0.87) for European-Americans; at 108 months, the cumulative survival was 0.70 (95% CI = 0.61–0.77) for African-Americans and 0.76 (95% CI = 0.68–0.82) for European-Americans. The table below the x-axis shows the numbers of patients at risk at representative time points. Symbols used: ——— ——— ——— = European-American; ——— = African-American.
duced to 1.2 (95% CI = 0.8–1.9). When we controlled for both stage and sociodemographics, the hazard ratio was reduced to 1.0 (95% CI = 0.7–1.5). The survival curves by race, adjusted for sociodemographic characteristics and stage, are shown in Fig. 2 and reflect this equivalent survival pattern. There was no evidence of violation of the proportional hazards assumption in the adjusted model.

**DISCUSSION**

It is well-known that survival after breast cancer diagnosis is poorer for African-American women than for European-American women (1–3, 6, 13–15, 17, 19). It is difficult to summarize the pertinent literature because no two studies are precisely comparable, and many papers are quoted differently by the authors who cite them. Nevertheless, some valid generalizations are relevant here. As we found, the difference in distribution of stage at detection has a major influence on differential African-American/European-American survival but does not fully explain it (6, 10–15).

By studying only HAP–HFMG patients, we eliminated the issue of lack of insurance coverage for screening and diagnostic services, a factor associated with both later stage at diagnosis and lower SES (4, 6, 15, 23). Even within this equal-coverage population, with its relative homogeneity of health care access and delivery, a large discrepancy in stage remains between African-American and European-American women (Table 1). Our study was not designed to investigate reasons for differences in stage at detection such as mammography use. However, two existing studies, both conducted in HAP–HFMG populations during approximately the same time period as this study, shed some light on this question. These studies measured, respectively, the proportion of women more than 50 years old who received mammography according to guidelines (relatively, 5.6% fewer African-American than European-American women) (24) and the proportion of women more than 50 years old with normal screening mammograms who were screened again within 2 years (relatively, 7.2% fewer African-American than European-American women) (25). These small racial differences in mammography use among women in the same health care system as our sample have two implications: 1) The differences in mammography use are probably too small to explain the racial differences in stage at detection (relatively, 19% fewer African-American women with stage 0 or I disease; Tables 1 and 2) as implied above, uniform insurance coverage and clinical practices are not sufficient to equalize completely African-American and European-American women’s use of breast cancer screening services.

Use of health care influences stage at diagnosis and the effectiveness of treatment (4, 11, 23). The difficulty of obtaining data on populations with even approximate uniformity of care motivates our study. Its detailed results cannot be generalized to different populations or regions, but it constitutes an important addition to the body of work that greatly reduces the influence of race on survival by adjusting for stage and SES.

Wojcik et al. (26) eliminated the insurance factor by studying women cared for in the Department of Defense system, which also tries to provide equal access. The authors found that, among women with breast cancer, after adjustment for age and stage, European-American women had better survival than African-American women; however, Wojcik et al. did not control for income, a factor that varied by race in our sample of HMO members.

In our population, sociodemographic variables and stage, taken separately, had comparable confounding effects on the association between race and survival. As noted by Weiss et al. (27) and illustrated in the literature that we cite, SES is difficult to quantify and consists of a constellation of factors, although income plays a primary role. We know of one study besides our own that employs census data at the block group level (28) to improve the precision of SES estimates. Bassett and Krieger (16) do this by using six measures of SES other than income, and they adjust for age and stage. However, they did not study a sample with equivalent health care coverage. Both our study and that of Bassett and Krieger (16) come very close to eliminating race as an independent influence on survival.

The results of our study indicate that factors other than the ability to pay for services affect breast cancer survival. These factors may have some influence on stage at detection in particular. They include various beliefs about cancer risk and the usefulness of early detection, differences in the effects of various outreach and reminder strategies, differences in access mediated by transportation or the ability to get time off from work to keep appointments, obesity, comorbidities, and

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**Fig. 2.** Survival by race, adjusted for age, income, marital status, and stage. Adjusted Kaplan–Meier curves for 886 women with breast cancer seen at the Health Alliance Plan–Henry Ford Medical Group from January 1986 through April 1996. The table under the x-axis gives the numbers of patients at risk at representative time points. CI = confidence interval. Symbols used: --- = European-American; ----- = African-American.
differences in breast density that modify the effectiveness of mammograms (4,11,23,29–33).

A fundamental question for us, and for the related studies we cite, is whether African-American women have intrinsically more aggressive tumors than European-American women, thus affecting their survival either directly or by way of stage at detection because of more rapid progression. Our study did not incorporate estrogen receptor status or histologic tumor grade because they were often omitted from the HFMG tumor registry and, when available, had not been evaluated consistently.

The literature can be roughly divided into studies that find intrinsic differences in tumor aggressiveness (higher nuclear and histologic grade, S-phase fraction or mitotic index, and estrogen receptor negativity) to exercise a major influence on differential African-American/European-American survival (6,9,10), and the greater number that find no positive evidence for this effect because they attribute a very limited influence to race after adjustment for stage and SES (15–20). In a population with uniform health care coverage, we found that the residual influence of race after adjustment is negligible (hazard ratio = 1.0; 95% CI = 0.7–1.5). This result lends support to the view that the effect of an intrinsic difference in tumor biology (if any) must be small and exercised mainly through its influence on stage at diagnosis.

### Table 1. Baseline demographic and tumor characteristics*

<table>
<thead>
<tr>
<th>Sociodemographics†</th>
<th>Value (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>African-American (n = 273)</td>
</tr>
<tr>
<td>Married</td>
<td>54% (48%–60%)</td>
</tr>
<tr>
<td>Mean age in y at diagnosis</td>
<td>55 (54–57)</td>
</tr>
<tr>
<td>Median household income ($1000)</td>
<td>26 (24–27)</td>
</tr>
<tr>
<td>Mean HMO enrollment before diagnosis, y</td>
<td>6.9 (6.3–7.5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tumor characteristics</th>
<th>Race + stage*</th>
<th>Race + sociodemographic factors†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage‡</td>
<td>1.3</td>
<td>1.2</td>
</tr>
<tr>
<td>I</td>
<td>1.6</td>
<td>1.0</td>
</tr>
<tr>
<td>II</td>
<td>0.9–1.9</td>
<td>0.7–1.5</td>
</tr>
<tr>
<td>III</td>
<td>0.8–1.9</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>0.7–1.5</td>
<td></td>
</tr>
<tr>
<td>Mean tumor size, cm</td>
<td>2.1 (2.0–2.3)</td>
<td>2.4 (2.1–2.6)</td>
</tr>
</tbody>
</table>

*CI = confidence interval; HMO = health maintenance organization.
‡Stage according to the American Joint Commission on Cancer system (21).

### Table 2. Effect of demographic and tumor characteristics on survival estimates

<table>
<thead>
<tr>
<th>Variables in model</th>
<th>Hazard ratio, African-American versus European-American</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race only</td>
<td>1.6</td>
<td>1.1–2.2</td>
</tr>
<tr>
<td>Race + stage*</td>
<td>1.3</td>
<td>0.9–1.9</td>
</tr>
<tr>
<td>Race + sociodemographic factors†</td>
<td>1.2</td>
<td>0.8–1.9</td>
</tr>
<tr>
<td>Race + stage + sociodemographic factors†</td>
<td>1.0</td>
<td>0.7–1.5</td>
</tr>
</tbody>
</table>

*Stage according to the American Joint Commission on Cancer system (21).
†Age, marital status, and median household income.

### References

23. Lannin DR, Mathews HF, Mitchell J, Swanson MS, Swanson FH, Edwards MS. Influence of...


NOTES

1Editor’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 biannual basis and the NCI makes the data available to the public for scientific research.

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