Unemployment and the Likelihood of Detecting Early-Stage Breast Cancer

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ABSTRACT

Objectives. The objective of this study was to test the hypothesis that unexpectedly high unemployment in a community is associated with reduced odds that registered breast tumors are local.

Methods. The hypothesis was tested with data from San Francisco for the 132 months beginning with January 1983.

Results. Registered breast tumors were less likely to be local during periods of unexpectedly high unemployment (8% less likely among non-Hispanic White women and 24% less likely among African-American women).

Conclusions. Job loss may restrict access to health services. Fear of job loss may also distract women from breast self-examination and the identification of suspicious breast signs. (*Am J Public Health.* 1998;88:586–589)

Introduction

Breast cancer is the most common cancer in women, second only to lung cancer in the age-adjusted rate of cancer mortality.[1,2] The stage of disease at diagnosis is among the clearest prognostic indicators for breast cancer survival. The 5-year relative survival rates for women aged 50 years and older with local, regional, and remote breast cancer are 93%, 71%, and 18%, respectively.[2] Among survivors, moreover, women whose cancer was detected at a late stage are most likely to report difficulty with upper body limitations, after adjustment for the effects of comorbidity and type of treatment.[3] Given these facts, there is considerable interest in understanding why some women are diagnosed with localized disease while others are diagnosed with more advanced disease.

African-American women and women of lower social class are at elevated risk for being diagnosed with later stage disease.[4–9] Racial differences in breast cancer stage are due in part to differences in socioeconomic status, as measured by family income, educational level, and socioeconomic indicators of the census tract of residence.[4–9] In New York City, for example, older African-American lower-class women treated in public hospitals were almost 4 times as likely as younger White, high-social-class women treated in nonpublic hospitals to be diagnosed with late-stage breast cancer.[10] Social class was defined by the median income of the census tract of residence.

Data from California also suggest an association between neighborhood economic characteristics and stage of disease.[11] Income was based on median household income for census tract block group of residence (a smaller census unit). While income differences by census block were modest for White patients, they were more pronounced for African-American patients.[11]

Although census tract data are often used as proxy measures for the individual's socioeconomic status, other studies suggest that census data may capture more global, ecological effects on breast cancer stage. Haan and colleagues reported that residents of a federally designated poverty area experienced higher age-, race-, and sex-adjusted mortality rates than residents of nonpoverty areas over a 9-year follow-up period, independently of a variety of individual characteristics, including race, income, and employment status.[12] The authors concluded that properties of the sociophysical environment may contribute to the relationship between low socioeconomic status and excess mortality, independently of individual behaviors. These findings also suggest that other aggregate economic indicators should be examined in an effort to enhance our understanding of the association between race, social class, and breast cancer stage. Unemployment rates, for example, have been shown to be associated with different health outcomes, including symptoms of psychological distress and nonspecific physiological illness.[13,14]

Unemployment could affect breast cancer stage in several ways. Women who lose their jobs, or whose partners lose theirs, may not have employer-provided health insurance and may therefore be less likely to visit a physician than when they or

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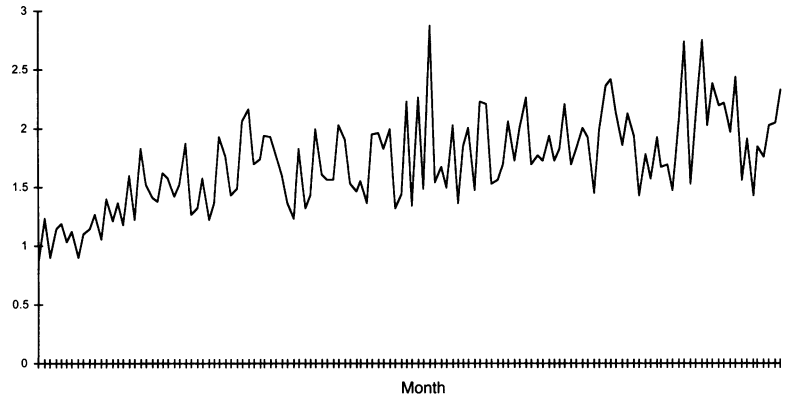

FIGURE 1—Monthly odds that a breast tumor discovered in non-Hispanic White women will be local (data for 132 months beginning with January 1983).

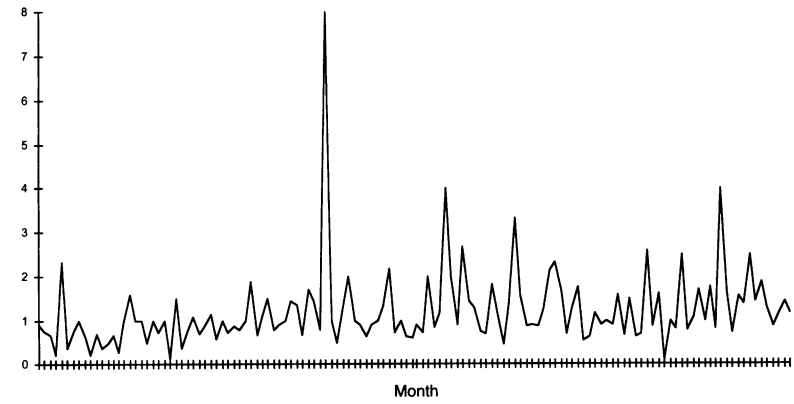

FIGURE 2—Monthly odds that a breast tumor discovered in African-American women will be local (data for 132 months beginning with January 1983).

their partners are employed. Uninsured women and women covered by Medicaid are less likely than other women to be screened regularly for breast cancer.[15] Results from a number of studies also indicate that African-American women and women of lower socioeconomic status are less likely than other women to be screened for breast cancer.[15,16] Job loss may present other barriers as well. For example, less money may be available for child care or transportation to obtain medical attention. Screening for local cancers may, therefore, be curtailed during periods of elevated unemployment.

Unemployment may distract women from their regular activities. Suspicious breast signs are more likely to be detected first by women themselves (during breast self-examination or accidental palpation) than by clinical breast examinations or mammography.[17] It may be, therefore, that coping with their own unemployment or that of their partner may distract women from subtle changes in their breasts. For example, women whose husbands are unemployed are at elevated risk of demoralization and depression.[18,19] Illness induced in partners by unemployment also may prove distracting. There is evidence, for example, that women who report illness in their spouses are more likely than others to be diagnosed with advanced breast cancer.[20]

Unemployment in the community may affect the likelihood of detecting early-stage tumors even though women or their partners have not lost their jobs. Unexpectedly high levels of unemployment are known to cause fear of job loss among employed persons and their families.[21] This fear, and the anxiety it engenders, may distract women from breast symptoms. This mechanism is potentially important because the number of people who fear job loss during periods of high unemployment is much greater than the number who actually lose jobs.[22]

The purpose of this paper is to estimate the association between unexpected changes in unemployment and breast cancer stage. This association is examined for African-American and non-Hispanic White women separately. We focus on the San Francisco Bay Area because it has a relatively high rate of incident breast cancer and because reliable data on breast cancer stage are available for this area.

Methods

Breast Cancer Data

Incident cases of invasive breast cancer by stage of disease were obtained from the Greater Bay Area Cancer Registry from January 1983 through December 31, 1993. The Registry, a participant in the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program, maintains data on all cancer cases diagnosed among residents of Alameda, Contra Costa, Marin, San Francisco, and San Mateo counties.

Stage of disease was defined according to criteria established by the SEER program and categorized as local (invasive tumor confined to the point of origin) or nonlocal (tumors metastasized to the regional lymph nodes or distant sites).[23] There is no consensus regarding the advisability of either including or excluding in situ cases in studies of social class and breast cancer stage. Following other research in this area,[24] we elected to restrict our analysis to invasive cases of breast cancer.

Time series of monthly incident cases of local and nonlocal tumors were created for non-Hispanic Whites and African Americans for the 132 months in the test period. These 2 groups accounted for 88% of all localized tumors during the period. The mean numbers of monthly local and nonlocal tumors were 99 (SD = 16, range 54–135) and 59 (SD = 9, range 34–88), respectively, for non-Hispanic Whites. The means for African Americans were 8 (SD = 3, range 1–17) and 9 (SD = 3, range 1–18). The odds of a discovered tumor's being local were computed for each month. The time series of these odds for non-Hispanic White and African-American women are plotted in Figures 1 and 2.

The dependent variable for each group was computed as $\text{Log}_e[L_t/(A_t - L_t)]$, where L_e is the natural logarithm, L_t is the number of local tumors discovered in month t for either non-Hispanic White or African-

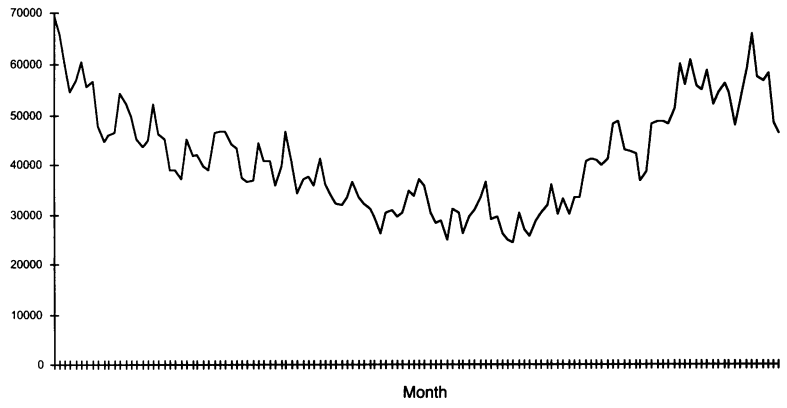

FIGURE 3—Number of unemployed persons in the San Francisco Bay Area for 132 months beginning with January 1983.

American women, and A_t is the total number of tumors discovered in month t for the same group. The transformation to natural logarithms allowed our models to fit the logistic curve implied by the possible ecological effect of unexpectedly high unemployment.

Unemployment Data

Monthly estimates of the number of unemployed persons in the 5 counties covered by the Greater Bay Area Cancer Registry were provided by the California Employment Development Department. The department computes these estimates from unemployment compensation data as well as from data from the Current Population Survey conducted by the US Bureau of the Census. To be considered unemployed, a person who is not working has to have been looking unsuccessfully for work in the past month. The monthly number of unemployed persons for the test period is plotted in Figure 3.

Data Analysis

The association between unexpected changes in unemployment and breast cancer stage was estimated in 4 steps. The first required identifying and modeling autocorrelation in the dependent variable. Phenomena measured over time may exhibit trends and cycles that can coincide and induce spurious correlation.[25] Autocorrelation in the dependent variable also may be carried over to the residuals of the test equation. Autocorrelation in residuals, in turn, will distort the estimates of confidence intervals of parameters. We used the approach devised by Ljung and Box to identify autocorrelation in the dependent variables.[26] Any discovered autocorrelation was modeled with the methods attributed to Box and Jenkins.[27]

The second step involved adjusting the unemployment data so that seasonal variation and other autocorrelations were removed, leaving a measure of the degree to which changes were unexpected. We used the methods alluded to above to seasonally adjust the unemployment data.[27]

The third step was to estimate the equation formed by adding the adjusted unemployment variable to the model developed in step 1 (i.e., the model of autocorrelation in the dependent variable). The effect of the unemployment variable was specified in the same month as the dependent variable as well as at lag 1 (i.e., the employment variable temporally preceding the dependent variable by 1 month). The lagged configuration was included to guard against the type II error that could result if more than 1 month were needed for the realization and fear of unemployment to propagate throughout the labor force. That fear, for example, may result in large part from media reports of unusual increases in unemployment. Such reports are based on seasonally adjusted data released a month after the data were collected.

The last step in the analysis was to inspect the residuals of the model to ensure that they were free of autocorrelation and were not related to the independent variable.

Results

The results suggest that the odds of breast cancers' being localized at diagnosis are lower when the number of unemployed persons increases unexpectedly. The effect was synchronous for Whites and lagged 1 month for African Americans. A detailed description of the results for each step in the analysis is available from the first author.

The strength of the associations can be most familiarly expressed as odds ratios. The antilogs of the coefficients for unemployment can be understood as odds ratios because the dependent variable is expressed as the natural logarithm of odds. Taking the antilogs of the coefficients for a continuous variable is not informative, however, because doing so returns the functional form to a sigmoid shape, meaning that the effect varies over the distribution of the independent variable. To avoid this problem, we dichotomized the adjusted employment variable at the median of its nonzero values (i.e., 4838 persons). We then scored values lower than the median to 0. Values higher than the median were scored to 1. Substituting this variable for the continuous unemployment variable allowed us to estimate the reduction in the odds that a detected tumor was local during the 33 months when seasonally adjusted increases in unemployment exceeded the median.

Best fitting models were identified separately for non-Hispanic White and African-American women. The coefficients for the economic variable were –0.0867 (SE = 0.0337) for non-Hispanic White and –0.2776 (SE = 0.1146) for Black women. These coefficients suggest that the likelihood of breast cancer's being diagnosed at a local stage among non-Hispanic White women was reduced by 8% in the months when seasonally adjusted increases in unemployment exceeded their median (i.e., $e^{-0.0867} = 0.92$). In contrast, the coefficient for African Americans suggests a 24% reduction in the likelihood that breast cancers would be diagnosed at the local stage (i.e., $e^{-0.2776} = 0.76$).

Discussion

Unexpected increases in monthly unemployment in the San Francisco Bay Area over an 11-year period were associated with decreased likelihood of diagnosing breast cancer at a local stage. This pattern was especially pronounced for African-American women, which may suggest greater vulnerability and sensitivity in the African-American population to the effects of unemployment. These findings provide additional evidence that race and socioeconomic factors are associated with the stage of breast cancer at diagnosis and consequently with the length and quality of life for women with the disease.[3–11] These find-

ings are also in keeping with research reporting associations between unemployment and other health outcomes.[14]

The relationship between unemployment and stage of breast cancer discovered in the San Francisco Bay Area may not generalize to other communities. It is necessary, therefore, to replicate the results elsewhere. This could be done for labor markets covered by population-based cancer registries.

More work needs to done to determine why the estimated effect was synchronous for Whites but lagged 1 month for African Americans. More generally, it will be necessary to determine the extent to which the results, if replicated, are due to the direct effects or the ecological effects of unemployment, or both. Such a determination should be coupled with a comparative examination of the individual, household, and community effects of unemployment and other economic factors in African-American and White populations.[28] In addition, it will be necessary to examine the mechanisms by which unemployment and other indicators of socioeconomic status affect the stage of breast cancer at diagnosis and to determine, in particular, the significance of community distractions for understanding the timing of breast cancer diagnosis.[29] The direct and ecological effects of unemployment on breast self-examination and access to screening and treatment should be given special attention.

Finally, there are implications for breast cancer control. If confirmed in other studies, these results may indicate that breast cancer control efforts should be intensified during periods of unexpectedly high unemployment. □

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