Disparity in breast cancer mortality by age and geography in 10 racially diverse US cities

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ABSTRACT

Objectives: Assess geographic variation in breast cancer racial mortality disparity by age cohorts in US and ten cities with large African American populations.

Methods: Non-Hispanic Black (NHB) and Non-Hispanic White (NHW) female breast cancer mortality rates and NHB:NHW rate ratio (RR) (disparity) were calculated by four age group categories: < 40, 40–49, 50–64 and 65 + with time period 1999–2013.

Results: In all 10 cities and the US, the most pronounced breast cancer disparities, measured by RR, were seen among younger women. In age group < 40, the RR ranges from 1.71 in Houston to 5.37 in Washington, DC. For age group 50–64, the disparity was less pronounced, ranging from 1.24 in New York to 1.72 in Chicago. For 65 + age group, there was wide city to city variation in breast cancer mortality disparity. Three cities had higher mortality for NHW compared to NHB; Baltimore 0.78, Washington DC 0.94 and New York 0.98. One city had no statistically significant racial variation in breast cancer mortality in this age group and six cities had increased NHB: NHW mortality disparities.

Conclusions: While the mortality rate for breast cancer is lower among younger women, the NHB:NHW disparities, as measured by rate ratios, are most pronounced in these age groups. Given the absence of available data regarding incidence, stage and subtypes, further research is necessary and such research is important, given the possible policy implications of these results with respect to screening guidelines and coverage for mammography and breast cancer treatment in particular for younger NHB women.

1. Introduction

With an estimated 40,160 deaths to occur in 2017, breast cancer is the second leading cause of cancer death among women in the US with Non-Hispanic Black (NHB) women experiencing the highest mortality rate compared to other race/ethnic groups [1,2]. Breast cancer mortality among younger NHB women, (< 50) in particular, is higher compared to that of younger Non-Hispanic White (NHW) women [3,4]. The latest data also suggest that, among women 20–49 years of age, the Black:White disparity in breast cancer mortality is the largest disparity among cancer-specific diseases and has widened over the past 30 years [5].

Recent analyses have documented significant variation in NHB and NHW breast cancer mortality and disparity across the US and its largest cities [6,7]. This is the first study to address age specific racial breast cancer mortality disparity at the city level. Analyses at the city level are necessary as certain public health systems, interventions and policies are organized at a city level. Also, as access to care in cities can vary from neighborhood to neighborhood, because of historical patterns of segregation and structural racism in America's largest cities, we hypothesized that these conditions could result in variation in age specific racial breast cancer disparity rates.

The current study explores breast cancer mortality disparities by age group (< 40, 40–49, 50–64, and 65 +) and geographic location building upon prior work [7] that looked at city-level geographic variation overall without breaking out age cohorts. These city-specific data

can help inform local health officials and contribute to more tailored public health interventions and policies.

2. Methods

2.1. Population

In addition to the US, 10 cities were included in this analysis based on the following criteria: 1) total population of at least 500,000 and 2) the largest number of African Americans (the US Census 2010 "The Black Population" Table 6). Cities that met these criteria were: Baltimore, MD; Chicago, IL; Dallas, TX; Detroit, MI; Houston, TX; Los Angeles, CA; Memphis, TN; New York City, NY; Philadelphia, PA; and Washington, District of Columbia (DC). Deaths where the cause was malignant neoplasm of the breast (ICD-10 C50.0-C50.9) were extracted from the mortality data files maintained by the National Center for Health Statistics for the period 1999–2013. The extracted death cases were restricted to Non-Hispanic White (NHW) and Non-Hispanic Black (NHB) women. The Person-years (P-years) were obtained from the US Census Bureau. Population by 5-year age groups for the individual 15 years of our study was available for Baltimore, New York City, Philadelphia, Washington, DC, and the US. For Chicago, Dallas, Detroit, Houston, Los Angeles, and Memphis, the P-years were estimated using linear extrapolation and interpolation of the 2000 and 2010 population data from the US Census Bureau by 5-year age group.

2.2. Statistical analysis

The data were stratified by four age groups: < 40, 40–49, 50–64 and 65+. For these categories, truncated age standardization was used to obtain the mortality rates. Using the NHB:NHW rate ratio (RR) with 95% confidence intervals (CI), the disparity was assessed by age group for the US and the 10 cities over the 15-year study period. A 15-year period was chosen to increase the stability of the city-level data, especially in younger age groups, but the overall trend in the disparity by age group for each individual year was calculated for the US and is displayed in Fig. 1a. A RR of 1.00 indicates no disparity between NHB and NHW mortality rates and it represents the target to reach. A RR greater than 1 indicates higher mortality rates among NHB compared to NHW, and a RR less than 1 indicates that the mortality rates is lower among NHB compared to NHW.

Another measure of disparity, the mortality risk differences (RD) with 95% confidence interval, were calculated across the different age groups. Excess deaths among NHB stemming from the NHB:NHW disparity were obtained by applying the age-specific NHW breast cancer mortality rate per 100,000 to the age-specific NHB population for the entire 15 years of the study. These were then totaled and subtracted from the NHB observed number of deaths and the difference represents the excess breast cancer mortality deaths due to the disparity [7]. The excess deaths were only calculated for age group and cities where statistically significant disparities were observed. The analyses were not stratified or controlled by breast cancer incidence, subtypes or stage as the mortality data files do not include any of these variables and they are not available elsewhere at the city level. All statistical analyses were conducted with STATA.14 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP.)

3. Results

Table 1 presents the 15-year NHB and NHW breast cancer mortality rates and rate ratios by age group for the US and the 10 study cities. In the US, the disparity is statistically significantly different between each age cohort and largest among women < 40 (RR of 2.17, 95% CI [2.10–2.25], second largest for the 40–49 age cohort RR 1.90, CI [1.86–1.93], with the 50–64 showing a lower RR 1.55, CI[1.53–1.57] and the lowest RR 1.18, CI[1.17–1.19] for the 65+ age cohort.

The pattern of larger disparities among younger age groups (< 40 and 40–49) is observed across all 10 study cities. For example, in Chicago, the disparity is largest among women younger than 40 years old (RR 2.57, 95% CI [1.87; 3.52]) and among women 40–49 (RR 1.93, 95% CI [1.62; 2.31]). It is then followed by women 50–64 (RR 1.72, 95% CI [1.54; 1.91]) and 65+ (RR 1.19, 95% CI [1.11; 1.28]). Across the 10 study cities, the largest disparities in NHB:NHW breast cancer mortality rates were observed in the < 40 age group in Washington, DC (RR 5.37, 95% CI [2.28; 12.67]) and the 40–49 age group in Memphis (RR 3.10, 95% CI [2.07; 4.65]).

In all cities, the lowest disparities in NHB:NHW breast cancer were found for the age group 65+. However, for this age cohort, there was considerable variation between cities regarding the level and direction of this disparity. In Baltimore, NHB women aged 65+ had a statistically significantly lower breast cancer mortality rate as compared to NHW (Table 1). In several other cities (New York, Detroit, Philadelphia, and Washington DC), there was an absence of mortality disparity as measured by Rate Ratios for this 65+ age group. In contrast, Memphis, Dallas and Los Angeles retained significantly higher disparities at this 65+ age stage (Memphis RR 1.60, 95% CI [1.40–1.84], Dallas RR 1.45 95% CI [1.28–1.65], Los Angeles RR 1.35, 95% CI [1.24–1.47] compared to New York, Philadelphia, Washington DC and Baltimore.

These data are illustrated in Fig. 1a and b, which show mortality rates and disparity trends over the 15 years of the study in the US as a whole. While the lowest mortality rates occur among women < 40 and 40–49, these are the age groups for which the largest disparity in mortality outcomes is observed. Conversely, the highest mortality rates are observed among women 65+ and this is the age group for which the smallest disparity in mortality rates is observed. Similar results were found with different age group cut-offs (< 50, 50–69 and 70+) (Supplemental Fig. 1)

Table 2 contains the mortality rate difference and the number of excess NHB deaths by age group for the period 1999–2013. In the US, the number of excess NHB deaths among women < 40 was 2832, followed by 6479 excess death in the age group 40–49. Among age groups 50–64 and 65+, there were 10,775 and 5583 excess NHB deaths, respectively. In Chicago, 93 excess NHB deaths were seen among women < 40, 197 among women 40–49. In the 50–65 age group, 418 excess NHB deaths were observed, and in the 65+ age group, 234 excess NHB deaths were calculated. As expected in Baltimore, NHW women in the age group 65+ had a higher number of excess deaths compared to NHB. Similar results were found with different age group cut-offs (< 50, 50–69 and 70+) (Supplemental Table 2).

4. Discussion

The findings of this study supplements prior city level analysis of racial disparity on breast cancer mortality [7], adding comparison of mortality disparities by age cohorts between the 10 cities with the largest African American populations and the US. There is a statistically significant gradient in the NHB:NHW breast cancer mortality disparity across age groups with the largest disparities observed among women less than 40 years old and aged 40–49 and the smallest among women aged 50–64 and those 65+. All 10 cities demonstrated the same trend. However, the direction and magnitude of disparities varied not only by age group, but by geographic location. Some cities have less racial breast cancer mortality disparity than other cities across age groups. For example, US Eastern cities such as New York, Philadelphia, Washington and Baltimore exhibited no or lower breast cancer mortality disparities among women 65+ compared to the US or other cities. Lastly, almost two-thirds of excess deaths were observed among women in < 50.

These results were not controlled for incidence, stage, and subtype due to the lack of such data. NHB women in their forties are known to have a higher incidence of breast cancer compared to NHW. Also, there is a higher proportion of estrogen negative breast cancer among NHB