Epidemiologic Evaluation of Black:White Breast Cancer Disparities by Age in Kentucky

Delana N. Gilkey, B.A.[1], Richard N. Baumgartner, PhD[2], Kathy B. Baumgartner, PhD[2], Stephanie D. Boone, PhD, MPH[2]

R25 Program[1]; Department of Epidemiology & Population Health, School of Public Health & Information Sciences, James Graham Brown Cancer Center[2]

Introduction

About 1 in 8 women in the U.S. will develop breast cancer during their lifetime, making breast cancer the most commonly diagnosed cancer among women in the U.S. and the second leading cause of cancer death among women after lung cancer. Although incidence and mortality rates have been declining since the year 2000, breast cancer outcomes disproportionately affect women by age and racial/ethnic groups [1, 2]. Epidemiologic studies have reported that while breast cancer incidence is lower among women under 40y, it is associated with poorer prognosis and higher mortality than in older women [3]. Furthermore, Non-Hispanic Black (NHB) women are more likely to be diagnosed with breast cancer before 40y compared to Non-Hispanic White (NHW) women, before the recommended age (45-54y) to begin annual mammograms. Some studies report that NHB women <40y are more likely to be diagnosed at more advanced stages with a higher grade, larger tumor size, greater nodal involvement, and hormone-receptor-negative tumors than NHW women [4]. Additionally, data suggests that the NHB: NHW breast cancer mortality disparity is larger than for other cancer sites, and that this difference has persisted for nearly 30 years [2]. A recent analysis of Surveillance Epidemiology End Results (SEER) cancer registry data reported that the racial mortality gap was widest in women <40y; however the magnitude differed by geographic location and only selected states and cities were included that represented a high proportion of NHB women [5]. As a result, the extent to which this disparity is generalizable to other populations is unknown.

According to data from the Kentucky Cancer Registry, a SEER site, while NHB women only account for 4.4% of the total population, breast cancer incidence rates were higher than NHW between 2001 and 2015 [6], revealing a backwards disparity in comparison to National rates [7]. Similarly, KY-specific mortality rates were higher from 2011-2015 compared to NHW women of all ages (mortality rate ratio=1.33) [2]. It is unclear whether these disparities follow a similar pattern to previous work when stratified by age group.

Methods

Breast Cancer Disparities in Kentucky

Study Objective

The primary objective of this study was to analyze the Kentucky Cancer Registry's (KCR) SEER data from 2001-2015 to explore the epidemiology of NHB: NHW breast cancer disparities by age of diagnosis and clinical characteristics.

Study Population

Study Population-SEER-KCR

NHB and NHW women (all ages) residing in Kentucky diagnosed with an incident first primary breast cancer between 1/1/2001 and 12/31/2015 (n=42,598).

Study Population-KY, U.S. Census Bureau

NHW and NHB women residing in KY: Annual Estimates of the Resident Population by Age, Sex, Race, & Hispanic origin (7/1/2001-7/1/2016).

Statistical Analysis

- Rates, per 100,000
  - Crude Breast Cancer Incidence Rate (IR): # cases/population at risk) by 5-year period, race & 5-year age groups
  - Crude Breast Cancer Mortality Rate (MR): #deaths/population at risk) by 5-year period, race & 5-year age groups
  - Age-adjusted IR/MR (Age-specific Crude IR/MR*Proportion of 2000 U.S Standard Million Population for age groups)
  - Standardized Rate Ratios ($IR_{age\text{-}adj}$ NHB/ $IR_{age\text{-}adj}$ NHW) and ($MR_{age\text{-}adj}$ NHB/ $MR_{age\text{-}adj}$ NHW)
- Logistic regression models estimated odds of developing late stage invasive breast cancer, tumor subtypes (Luminal A, Luminal B, HER2+-enriched, and Triple Negative), and metastasis for NHB vs. NHW by age, reporting Odds Ratios (OR) and 95% Confidence Intervals (CI)
- Cox Proportional Hazards Regression estimated risk of breast cancer-specific mortality for NHB vs. NHW by age and stage reporting Hazard Ratios (HR) and 95% CI
- Kaplan Meier method used to construct survival curve reporting log-rank p-value, and to calculate short- and long-term survival rates by age groups
- All analyses conducted with SAS version 9.4.M5

Results

Figure 1. Age-adjusted Incidence Rates & Rate Ratios by Time Period

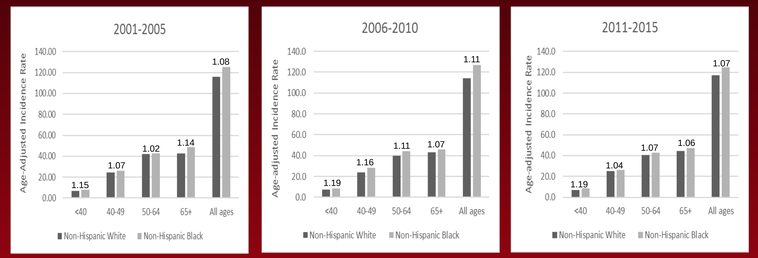

Figure 2. Age-adjusted Mortality Rates & Rate Ratios by Time Period

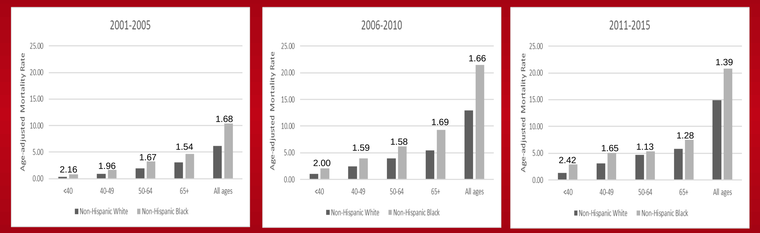

Figure 3. Invasive Breast Cancer Survival by Race

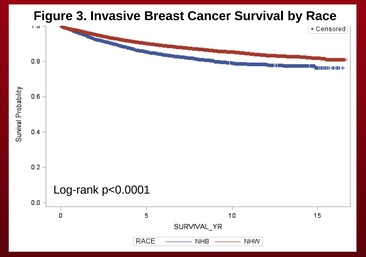

Table 3. Invasive Breast Cancer Survival Rates by Race and Age at Diagnosis

	<40y		40-49		50-64y		65+y	
Race	**5-yr**	**10-yr**	**5-yr**	**10-yr**	**5-yr**	**10-yr**	**5-yr**	**10-yr**
NHW	88%	78%	92%	89%	91%	84%	87%	62%
NHB	72%	68%	83%	78%	87%	74%	83%	82%
p-value	***0.0010***		***0.0002***		***0.0935***		***0.0986***	

Table 1. Associations between Race and Clinical Characteristics at Diagnosis

	Odds Ratios (95% CI)			
	<40y	**40-49y**	**50-64y**	**65+y**
Stage				
Late stage invasive	**1.94 (0.91-4.17)**	**1.71 (0.95-3.05)**	**1.36 (0.97-1.93)**	**1.38 (0.91-2.09)**
Molecular Subtype				
Luminal A (HR+/HER2-)	0.71 (0.44-1.13)	0.47 (0.35-0.62)	0.61 (0.51-0.74)	0.77 (0.60-0.99)
Luminal B (HR+/HER2+)	0.73 (0.38-1.38)	1.28 (0.86-1.91)	1.01 (0.76-1.34)	0.90 (0.59-1.37)
HER 2-enriched (HR-/HER2+)	1.29 (0.59-2.83)	1.82 (1.08-3.06)	1.24 (0.86-1.78)	1.05 (0.59-1.85)
Triple Negative (HR-/HER2-)	**1.80 (1.08-3.01)**	**2.03 (1.47-2.80)**	**1.96 (1.57-2.43)**	**1.64 (1.20-2.24)**
Metastasis				
Brain	--	1.47 (0.18-12.0)	0.71 (0.09-5.32)	0.82 (0.11-6.13)
Lung	11.4 (2.99-43.7)	1.08 (0.25-4.69)	2.10 (1.10-4.00)	1.41 (0.68-2.93)
Liver	3.75 (1.28-11.0)	1.98 (0.67-5.84)	1.15 (0.50-2.67)	1.14 (0.35-3.68)
Bone	2.44 (1.02-5.87)	1.13 (0.48-2.65)	1.40 (0.89-2.20)	1.50 (0.88-2.58)

Table 2. Associations between Race and Breast Cancer-Specific Mortality by Age and Stage

	Hazard Ratios (95% CI)			
	<40y	**40-49y**	**50-64y**	**65+y**
Race				
Non-Hispanic White	1.00	1.00	1.00	1.00
Non-Hispanic Black	2.27 (1.68-3.07)	1.55 (1.24-1.93)	1.44 (1.22-1.71)	1.49 (1.27-1.75)
Localized Stage (I)				
Non-Hispanic White	1.00	1.00	1.00	1.00
Non-Hispanic Black	2.48 (1.26-4.88)	1.40 (0.87-2.25)	1.47 (1.02-2.12)	1.52 (1.10-2.10)
Regional Stage (II-III)				
Non-Hispanic White	1.00	1.00	1.00	1.00
Non-Hispanic Black	1.63 (1.08-2.46)	1.58 (1.18-2.12)	1.22 (0.95-1.57)	1.39 (1.07-1.80)
Distant Stage (IV)				
Non-Hispanic White	1.00	1.00	1.00	1.00
Non-Hispanic Black	2.88 (1.52-5.45)	0.92 (0.56-1.51)	1.31 (0.98-1.74)	1.32 (1.00-1.74)

Take Home Message

Taken together, these findings indicate that NHB women are an at-risk population in KY with BOTH higher incident breast cancer rates and breast cancer mortality rates compared to NHW women, and there are variations by age, which compounds the interpretation. Understanding contributing factors for the observed racial disparities may lead to age-specific prevention guidelines, screening recommendations, treatment protocols, and tailored survivorship programs.

Conclusions

Incidence and Clinical Characteristics at Diagnosis

- Data from KCR-SEER indicates NHB women have a higher incidence rate than NHW women that has persisted for the latest data spanning 15-years, backwards from National rates
- The NHB:NHW white incidence disparity was inversely related to age, the widest disparity was observed in women diagnosed <40y and decreased as the age increased ('06-10, '11-15)
- Compared to NHW
  - NHB women had a higher odds of presenting at diagnosis with late stage invasive disease; although not statistically significant, these findings are suggestive of a higher odds across all age groups, with a nearly 2-fold increased odds in women <40y.
  - Similar across all ages, NHB women had a higher odds of being diagnosed with TNT molecular subtype
  - NHB women <40y were at higher odds of metastasis to the lung, liver and bone

Mortality and Survival

- NHB of all ages experienced a higher mortality rate compared to NHW women (RR=1.39-1.68)
- The disparity was much wider than that of incidence, with a ≥2-fold increased rate in women <40y across three time periods. Although still higher, the rate gap decreases as age increases
- Compared to NHW, breast cancer-specific mortality was significantly increased among:
  - NHB women <40y diagnosed with localized stage (HR=2.48).
  - NHB women <40y diagnosed with regional stage (HR=1.63).
  - NHB women <40y diagnosed with distant stage (HR=2.88).
- Survival rates were poorer among NHB across all age groups
- Future directions include evaluation of secular trends and cohort effects, and stability of rates; all could bias results

References

1.Deshpande, Anjali D., et al. (2009) "Racial Disparities in Breast Cancer Survival: An Analysis by Age and Stage." Journal of Surgical Research, vol. 153, no. 1, pp. 105–113.
2.Desantis, Carol E., et al. (2017) "Breast Cancer Statistics, Racial Disparity in Mortality by State." CA: A Cancer Journal for Clinicians, vol. 67, no. 6, pp. 439–448.
3.Sutton, Thomas, et al. (2018) "Breast Cancer in Women under 50: Most Are Not High Risk." The American Journal of Surgery, vol. 215, no. 5, pp. 848–851.
4.Mccarthy, Anne Marie, et al. (2015) "Increasing Disparities in Breast Cancer Mortality From 1979 to 2010 for US Black Women Aged 20 to 49 Years." American Journal of Public Health, 105:S3
5.Sighoko, Dominique, et al. (2018) "Disparity in Breast Cancer Mortality by Age and Geography in 10 Racially Diverse US Cities." Cancer Epidemiology, vol. 53,, pp. 178–183.
6. Age-Adjusted Cancer Incidence Rates by County in Kentucky, 2001 - 2015. Based on data released Nov 2017. Kentucky Cancer Registry. Cancer-Rates.info. Retrieved Jul 31, 2018, from http://cancer-rates.info/ky/
7. Noone AM, Howlader N, Krapcho M, Miller D, Brest A, Yu M, Ruhl J, Tatalovich Z, Mariotto A, Lewis DR, Chen HS, Feuer EJ, Cronin KA (eds). SEER Cancer Statistics Review, 1975-2015, National Cancer Institute. Bethesda, MD, https://seer.cancer.gov/csr/1975_2015/, based on November 2017 SEER data submission, posted to the SEER web site, April 2018.

Acknowledgements

Research support:
NCI R25-CA134283;
James Graham Brown Cancer Center