Racial and Economic Disparities in Breast Cancer Incidence and Mortality in Pennsylvania

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ABSTRACT

Introduction. Many studies have demonstrated disparities in breast cancer (BC) mortality among Black women and have shown an association with differences in tumor and socioeconomic factors. We hypothesized that in Pennsylvania (PA), a large economically diverse state, BC mortality would be similar among races when stratified by a municipality's median income.

Methods. We collected the frequencies of female BC diagnoses and mortalities for years 2011-2016 in each PA municipality from the Pennsylvania Cancer Registry. We also collected demographics (population by age, gender, and race, and median income) for each municipality from the 2010 U.S. Census. We analyzed BC diagnoses and mortalities when municipalities were stratified by median income (as a proxy of neighborhood socioeconomic status) and race using chi square and Cochran-Mantel-Haenszel tests.

Results. In this cohort of 5,398,893 women there were 54,111 BC diagnoses (1.0% incidence) and 9,837 BC mortalities (18.2% mortality rate). BC incidence was highest among White women ($p<0.001$), whose odds for developing breast cancer were 1.69x higher than non-White women when controlling for income ($p>0.001$). BC incidence increased with median income ($p<0.001$) in all races except for Black women whose incidence was highest and equivalent for the top and bottom income groups. BC mortality was highest in Black women ($p<0.001$) and varied significantly across income groups for all races (all $p=0.008$). Black women had the highest rate of mortality across income groups except in the lowest income where women of other races had the highest mortality. When controlling for income, odds of BC mortality in non-White women 1.29x higher than for White women ($p<0.001$).

Discussion. We found that in PA, a municipality's median income is associated with the rate at which women are diagnosed with and die from BC regardless of race. This likely represents differences in exposure to risk factors, the rates of BC screening and differential access to care. The fact that BC mortality for poor non-White women is disproportionately higher highlights that, in addition to presenting with different tumor characteristics, income and race remain important factors related to BC survival.

INTRODUCTION

Breast cancer outcomes are linked to socioeconomic and demographic variables

- Non-white women are more likely to present with more advanced disease
- Despite breast cancer being more common in White women, rates of mortality are higher in Black women
- Cancer disparities are also seen when socioeconomic and geographic variables are analyzed
- The interaction of biologic, socioeconomic and demographic variables is difficult to measure, especially in large, population-based data sets

Hypothesis: In Pennsylvania (PA), a large socioeconomically diverse state, breast cancer mortality is similar among races when stratified by a municipality's median income.

METHODS

PA Cancer Registry* -- 2011-2016

2574 municipalities, 67 counties

Frequency of breast cancer diagnosis and mortality

2010 Census demographics for each municipality:

- age
- race
- gender
- median income

*These data were provided by the Division of Health Informatics, Pennsylvania Department of Health. The Department specifically disclaims responsibility for any analyses, interpretations, or conclusions.

RESULTS

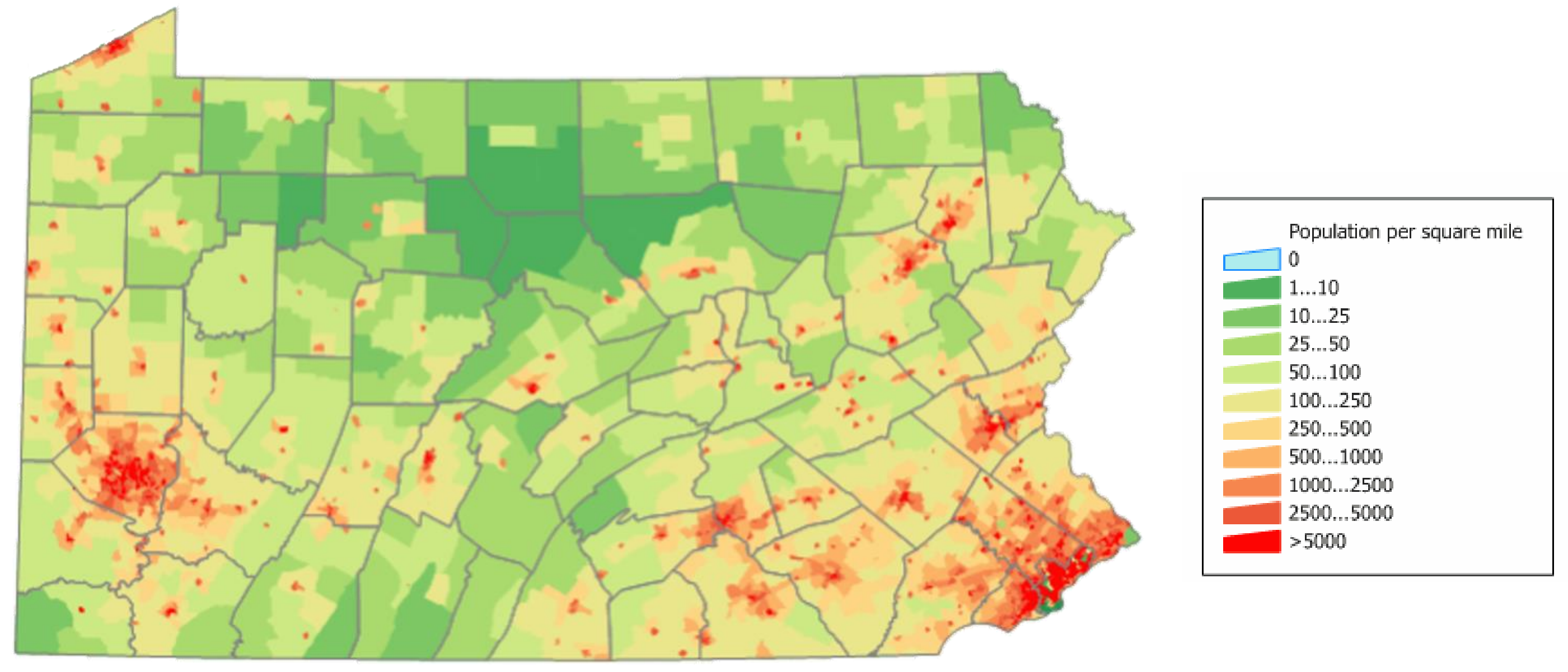

FIGURE 1 – Population density in Pennsylvania from the 2010 U.S. Census.

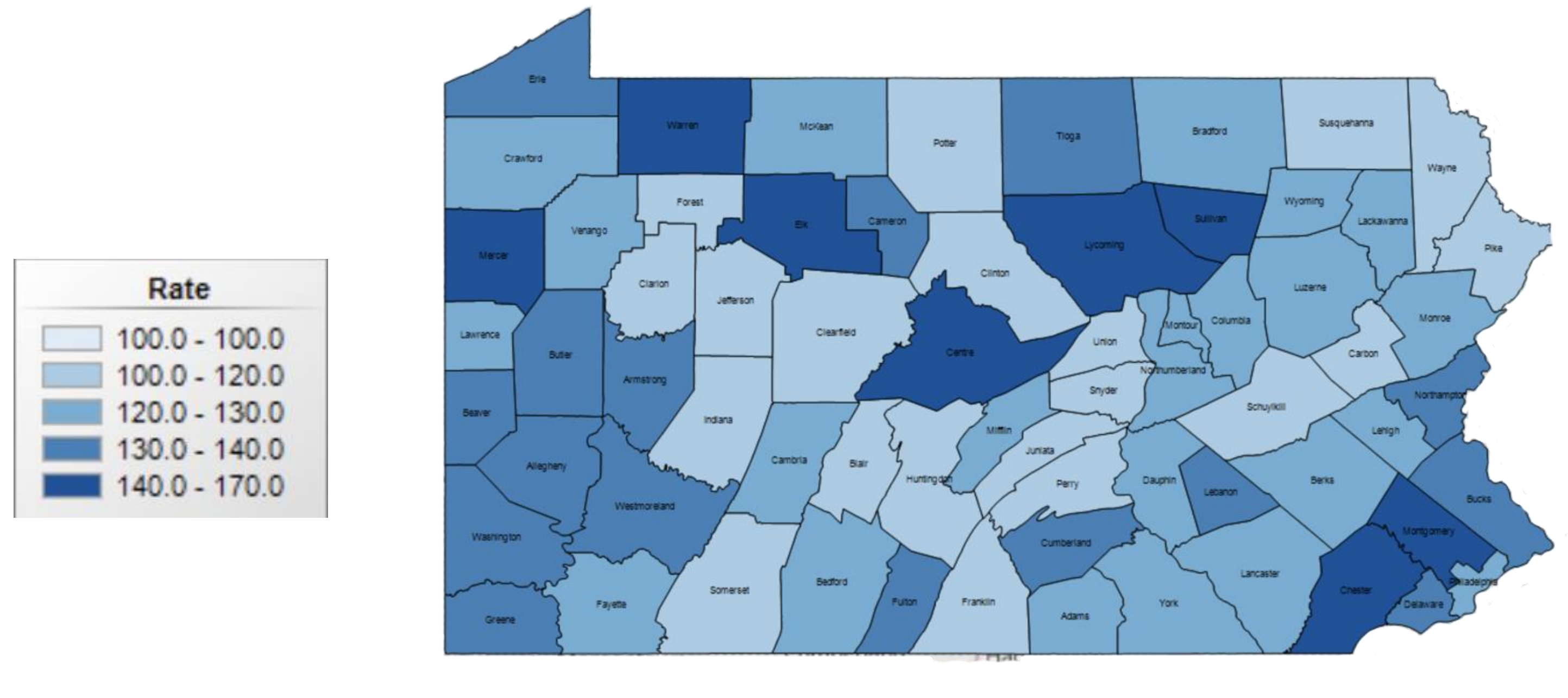

FIGURE 2 – Female breast cancer incidence per 100,000 in years 2011-2015 by county.

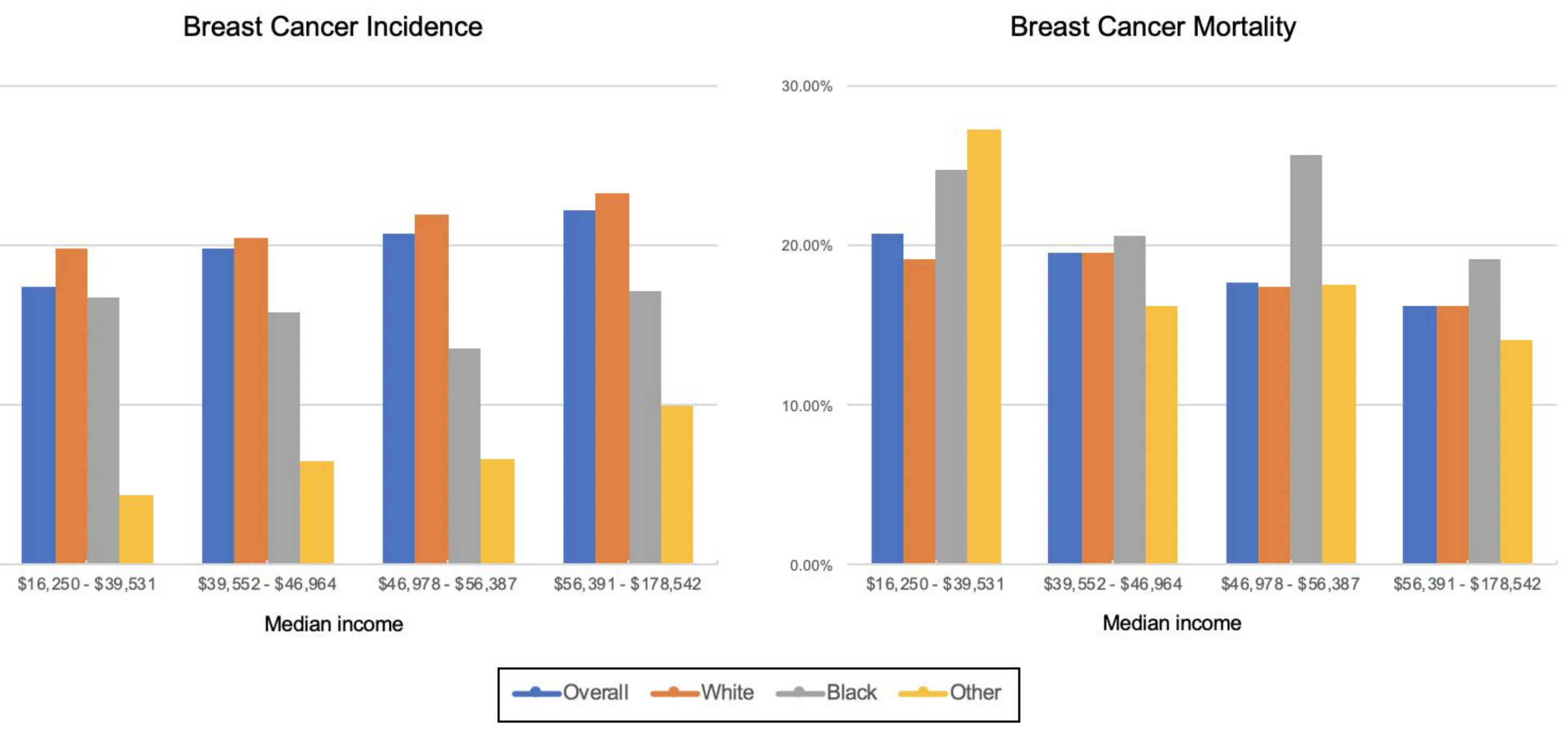

FIGURE 3 – Breast cancer incidence and mortality stratified by race and income.

RESULTS

	Breast Cancer Diagnosis			Breast Cancer Mortality		
	OR	95% CI	p-value	OR	LCL	p-value
Income						
$16,250-$39,531 (reference)						
$39,552 - $46,964	1.14	1.10 - 1.17	<0.001	0.93	0.86 - 1.00	0.04
$46,978 - $56,387	1.20	1.17 - 1.23	<0.001	0.82	0.77 - 0.87	<0.001
$56,391 - $178,542	1.28	1.26 - 1.31	<0.001	0.74	0.71 - 0.78	<0.001
Population Size						
4 - 227 (reference)						
228 - 462	0.86	0.78 - 0.94	0.001	0.72	0.58 - 0.91	0.005
463 - 783	0.84	0.77 - 0.92	<0.001	0.81	0.66 - 1.00	0.05
784 - 1353	0.90	0.82 - 0.97	0.010	0.70	0.57 - 0.85	<0.001
1356 - 2776	0.89	0.82 - 0.97	0.005	0.70	0.57 - 0.84	<0.001
2778 - 667345	0.87	0.80 - 0.94	<0.001	0.73	0.61 - 0.88	0.001
Race						
White (reference)						
Black	0.76	0.74 - 0.78	<0.001	1.46	1.36 - 1.56	<0.001
Other	0.29	0.28 - 0.31	<0.001	1.11	0.96 - 1.28	0.16
Income Within Race						
White						
$16,250-$39,531 (reference)						
$39,552 - $46,964	1.04	1.00 - 1.07	0.02	1.02	0.94 - 1.10	0.64
$46,978 - $56,387	1.11	1.08 - 1.14	<0.001	0.88	0.82 - 0.95	0.001
$56,391 - $178,542	1.17	1.15 - 1.20	<0.001	0.82	0.77 - 0.87	<0.001
Black						
$16,250-$39,531 (reference)						
$39,552 - $46,964	0.95	0.84 - 1.07	0.37	0.79	0.59 - 1.05	0.11
$46,978 - $56,387	0.81	0.71 - 0.91	0.001	1.06	0.80 - 1.40	0.71
$56,391 - $178,542	1.02	0.94 - 1.11	0.58	0.72	0.59 - 0.89	0.002
Other						
$16,250-$39,531 (reference)						
$39,552 - $46,964	1.50	1.19 - 1.89	0.001	0.52	0.28 - 0.96	0.04
$46,978 - $56,387	1.52	1.25 - 1.84	<0.001	0.57	0.35 - 0.92	0.02
$56,391 - $178,542	2.30	2.03 - 2.60	<0.001	0.44	0.32 - 0.60	<0.001
Population Size Within Race						
White						
4 - 227 (reference)						
228 - 462	0.87	0.79 - 0.96	0.004	0.71	0.57 - 0.90	0.004
463 - 783	0.85	0.78 - 0.93	<0.001	0.80	0.65 - 0.99	0.04
784 - 1353	0.91	0.84 - 0.99	0.04	0.70	0.57 - 0.85	<0.001
1356 - 2776	0.92	0.85 - 0.99	0.04	0.68	0.56 - 0.83	<0.001
2778 - 667345	0.96	0.88 - 1.04	0.27	0.68	0.57 - 0.82	<0.001
Black						
4 - 227 (reference)						
228 - 462	0.27	0.07 - 1.08	0.06	3.00	0.15 - 59.89	0.47
463 - 783	0.64	0.22 - 1.84	0.40	0.95	0.08 - 10.89	0.97
784 - 1353	0.67	0.24 - 1.83	0.43	0.50	0.05 - 5.25	0.56
1356 - 2776	0.64	0.24 - 1.73	0.38	0.94	0.10 - 9.26	0.96
2778 - 667345	0.84	0.31 - 2.25	0.73	0.94	0.10 - 9.05	0.96
Other						
4 - 227 (reference)						
228 - 462	0.34	0.10 - 1.10	0.07	---	---	---
463 - 783	0.62	0.23 - 1.67	0.35	---	---	---
784 - 1353	0.60	0.24 - 1.52	0.28	---	---	---
1356 - 2776	0.71	0.29 - 1.75	0.46	---	---	---
2778 - 667345	0.53	0.22 - 1.28	0.16	---	---	---
Race within Income [(White vs. Black/Other (ref)]						
$16,250-$39,531	1.55	1.50 - 1.61	<0.001	0.71	0.66 - 0.78	<0.001
$39,552 - $46,964	1.70	1.54 - 1.89	<0.001	0.99	0.77 - 1.28	0.94
$46,978 - $56,387	2.20	2.00 - 2.43	<0.001	0.70	0.56 - 0.89	0.003
$56,391 - $178,542	1.83	1.73 - 1.94	<0.001	0.96	0.83 - 1.12	0.63

TABLE 1 – Regression models of breast cancer incidence and mortality for race, income and community size.

DISCUSSION

Foci of high breast cancer incidence statewide in areas of both high and low population density

Disparities exist in both incidence and mortality for:

Income

- Higher income =
  - ⬆ incidence
  - ⬇ mortality

Community size

- Variable effect, though smallest population has highest incidence and mortality

Race

- Black race =
  - ⬇ incidence
  - ⬆ mortality

These factors interact with one another such that:

- Higher income decreases odds of mortality for all races, but is most pronounced in non-White patients
- Community size decreases odds of mortality only for White patients underscoring other socioeconomic differences in urban patients

QUESTIONS & FUTURE WORK

- Are there differences in the rates of screening mammography among these demographic and socioeconomic groups?
- Are there differences in the rates and type of insurance between these groups?
- How do biologic factors such as stage at diagnosis and breast cancer subtype interact with socioeconomic and demographic variables?
- What is the mean distance to a healthcare facility for each community type and does this impact rate of diagnosis and mortality?
- Are these groups equivalent in the types of treatment modalities used such and chemotherapy and radiation regimens?

- Perform more comprehensive data gathering and analysis from the PA Cancer Registry to allow more granular view of these questions and associations.

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