Exploratory Analysis of Rurality, Income, and Breast Cancer Outcomes in the SEER Database from 2000-2020

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Introduction

- Disparate breast cancer outcomes have been reported in urban versus rural settings and for low-income patients.

- A meta-analysis of 18 cohort studies found women with a higher education level had a significantly increased risk of developing breast cancer [1].

- Rural residence associated with more advanced stage or distant disease at time of breast cancer diagnosis [2].

- Urban residence has been associated with increased time to surgery in breast cancer patients [3].

- For all racial and ethnic groups, there have been improvements in 5-year disease free survival from 1975-2011 for urban and rural women [4].

- Lower socioeconomic status patients have been found to have significantly lower breast cancer-specific survival [5].
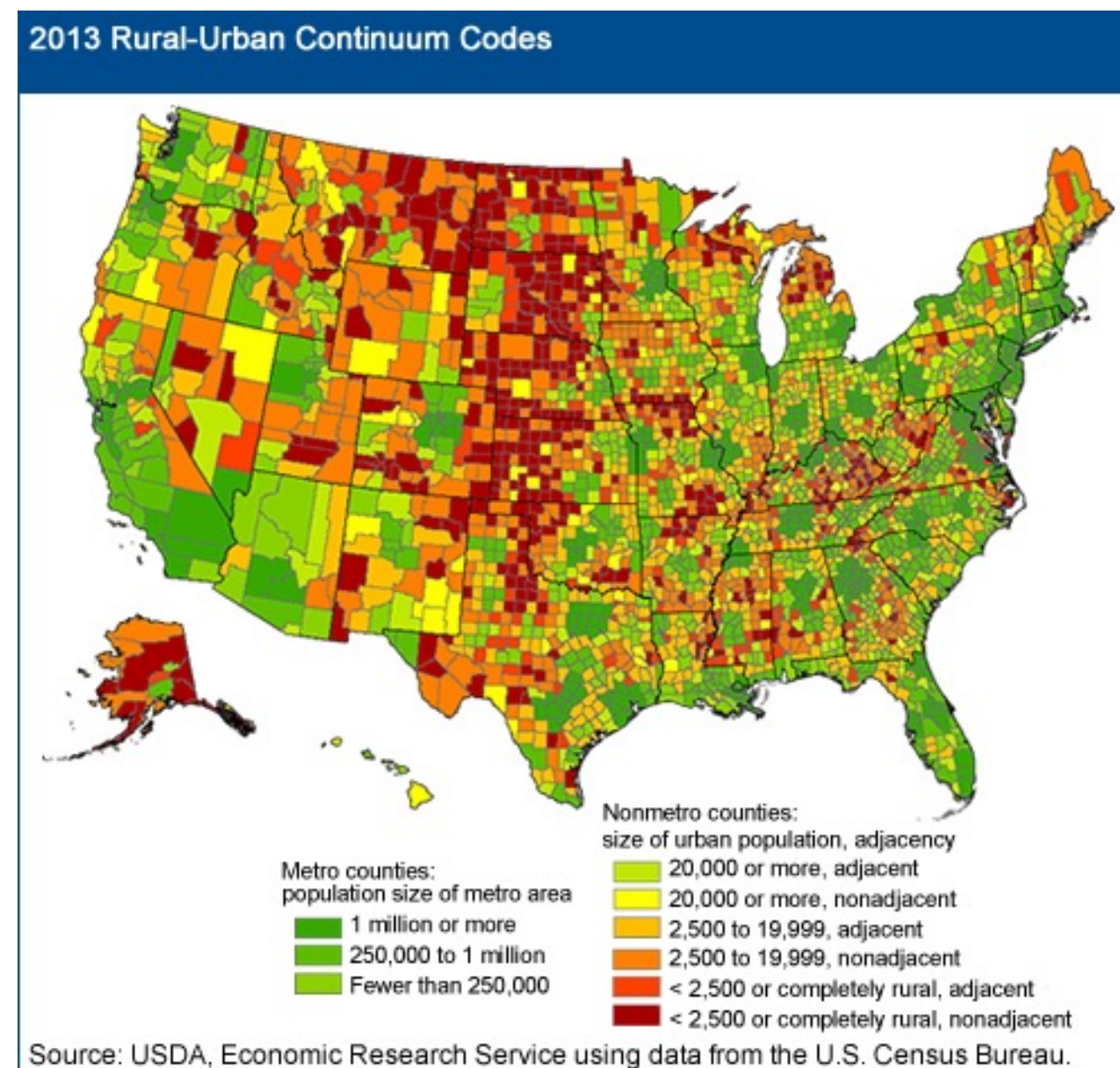
Aim

- To our knowledge, the interaction between rurality and income in breast cancer outcomes has not yet been explored.

- The most recently updated SEER database includes statistics from 2020 that encompass the first year of the COVID pandemic, which NCI acknowledges caused reduced incidence of breast cancer due to delays in diagnosis.

- Inclusion of this new data makes this analysis a timely addition to the body of research on breast cancer statistics from the SEER database.

Methods

- The National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) 17 Registry was queried for new breast cancer diagnoses from 2000-2020.

- Statistical analysis was performed with SEER*Stat version 8.4.1. Analysis stratified by rurality and income level.

- Location was defined according to SEER's Rural-Urban Continuum Code (RUCC), with urban=0-3 and rural=4-9.

- Annual income was defined as <$35K, $35-50K, $50-75K, and >$75K.

- Continuous variables analyzed via chi-square

- Survival analysis conducted via log rank testing and Ederer II actuarial methods.

2013 Rural-Urban Continuum Codes

Metro counties: population size of metro area
- 1 million or more
- 250,000 to 1 million
- Fewer than 250,000

Nonmetro counties: size of urban population, adjacency
- 20,000 or more, adjacent
- 20,000 or more, nonadjacent
- 2,500 to 19,999, adjacent
- 2,500 to 19,999, nonadjacent
- < 2,500 or completely rural, adjacent
- < 2,500 or completely rural, nonadjacent

Source: USDA, Economic Research Service using data from the U.S. Census Bureau.

2013 Rural-Urban Continuum Codes

Code	Description
	Metro counties:
1	Counties in metro areas of 1 million population or more
2	Counties in metro areas of 250,000 to 1 million population
3	Counties in metro areas of fewer than 250,000 population
	Nonmetro counties:
4	Urban population of 20,000 or more, adjacent to a metro area
5	Urban population of 20,000 or more, not adjacent to a metro area
6	Urban population of 2,500 to 19,999, adjacent to a metro area
7	Urban population of 2,500 to 19,999, not adjacent to a metro area
8	Completely rural or less than 2,500 urban population, adjacent to a metro area
9	Completely rural or less than 2,500 urban population, not adjacent to a metro area

Results

- 936,629 breast cancer cases were identified, of which 836,708 (89.3%) were urban and 99,921 (10.7%) were rural.

- In urban settings, significantly more white and Asian patients made >$75K, black patients made <$35K, and Hispanic patients made $50-75K (P<0.01).

- In rural settings, black and Hispanic patients were more likely to make <$50K compared to white and Asian patients (P<0.01).

- Across all incomes in both settings, the majority of patients were diagnosed <60 years.

- In urban settings, the proportion diagnosed age <60 increased significantly with income (36.1% vs 45.4%, P<0.01).

- No significant differences in rates of male breast cancer in urban or rural settings across incomes (<1%, P=0.07 and P=0.21).

- Majority of diagnoses were localized breast cancer (59.6-68.6%).

- Rates of regional and distant disease were significantly higher in incomes <$35K in urban (31.3% regional, 7.2% distant, P<0.01) and rural settings (32.9% regional, 7.5% distant, P<0.01).

- The majority of cases were HR+/Her2- (47%).

- Compared to >$75K, significantly more patients with income <$35K had TNBC in urban (10.8% vs 6.1%, P<0.01) and rural (9.5% vs 5.6%, P<0.01) settings.

- Significantly higher rates of TPBC was seen in incomes <$50K in urban (8.1% vs 6.7%, P<0.01) and rural settings (7.0% vs 5.9%, P<0.01).

- Significantly more <$35K patients were treated at 0 months in urban (40.9%, P<0.01) and rural settings (40.2%, P<0.01) compared to higher income patients.

- The majority of patients were treated within 3 months of diagnosis (97% urban, 98.5% rural).

Results

- 5-year overall survival, relative survival, and disease-specific survival were significantly lower in<$35K vs >$75K in both urban (74.4% vs 85.5%; 88.4% vs 92.1%; 83.4% vs 90.8%, P<0.05) and rural settings (75.6% vs 84.9%; 84.6% vs 91.3%; 84.0% vs 90.5%, P<0.05).

Conclusions

- Racial disparities in income levels are present among breast cancer patients in urban and rural settings.

- Lower-income patients in both settings were less likely to be diagnosed<60 years, more likely to have regional or distant disease, an aggressive subtype, and be treated at<1mo.

- Overall, relative, and disease-specific survival were significantly lower in<$35K incomes in both settings.

- The complex interaction between rurality and income in terms of breast cancer outcomes still needs to be elucidated, but disparities exist at the population level.

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