Breast cancer mortality in Nevada assessed for rural disparities using population informatics

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Authors declare no conflict of interest. Dr. Thaker is in private practice in Las Vegas, NV, and a clinical researcher with Carolina Blood and Cancer Care Associates, where Dr Gor is oncologist and researcher, Rock Hill, SC. No external funding, nor human or animal testing utilized in this research.

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Objectives: By the end of the session or abstract review, participant will be able to:

- Describe population informatics methods to analyze breast cancer mortality based on locality.
- Compare breast cancer mortality rates in urban versus rural counties in Nevada.
- Evaluate the utility of county classification models in explaining rural mortality variation.

Key words: breast cancer, rural health disparity, age-adjusted mortality rate (AAMR), binary divisions, CDC-NCHS county classification

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We study county statistics regarding cancer mortality to assess local resources and the need for healthcare infrastructure:

- National and state wide cancer incidence and mortality trends often utilize county-level epidemiological and informatics data.

- Various government and research entities propose county classification models. These have variable utility in elucidating health disparities and in explaining any mortality variation.

- Rural health disparities exist in most regions of the U.S. due to limited healthcare access and infrastructure, financial and educational barriers, demographic, geographic and other factors.

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Abstract

While breast cancer mortality has declined in the U.S., disparities persist due to demographic, socioeconomic, and systemic factors. Population and cancer informatics methods often examine county population, density, or urban/rural classification to explain mortality trends [1-2]. Nevada, with its extreme geographic variation, represents a test case to examine if standard health informatics methods elucidate breast cancer mortality patterns.

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Methods

We analyzed 2018–2022 age-adjusted breast cancer mortality rates (per 100,000) across all 17 Nevada counties. We assessed relationships with:

-- Population and population density as continuous variables, Pearson correlation and linear regression;

-- All 16 possible binary divisions of counties ranked by population, and 16 by density, Welch’s t-test;

-- 2023 CDC-NCHS urban–rural county classification scheme, two-way ANOVA.

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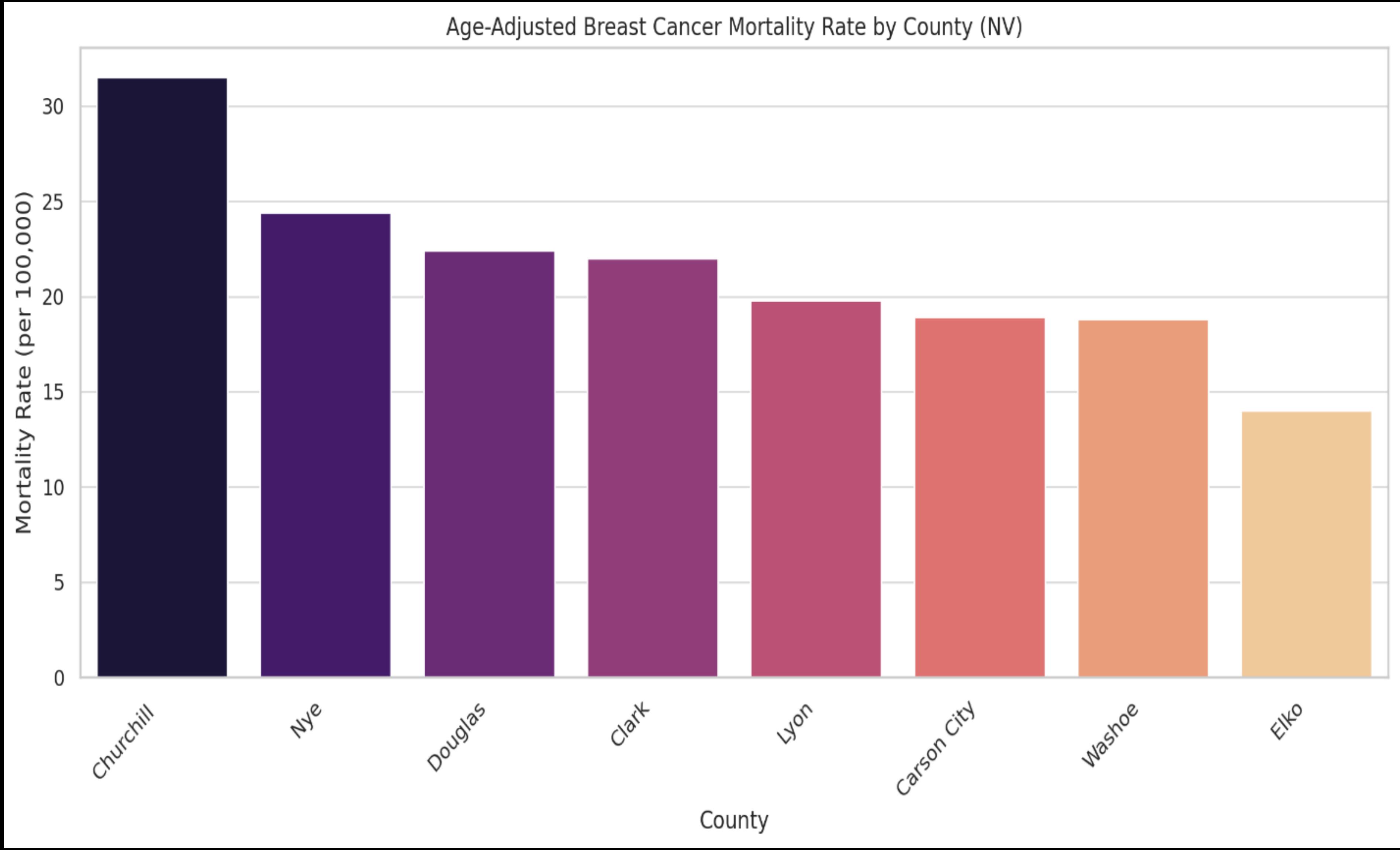

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Results

County population ($r = 0.042$, $R^2 = 0.0018$, $p = 0.92$) and density ($r = -0.19$, $R^2 = 0.0341$, $p = 0.62$) showed no meaningful association with breast cancer mortality. Nor did ANOVA across NCHS classifications ($F = 0.23$, $p = 0.87$).

Our ad hoc binary divisions to compare mortality between counties grouped by population or density were not significant. However, 9 smaller counties lacked necessary mortality data.

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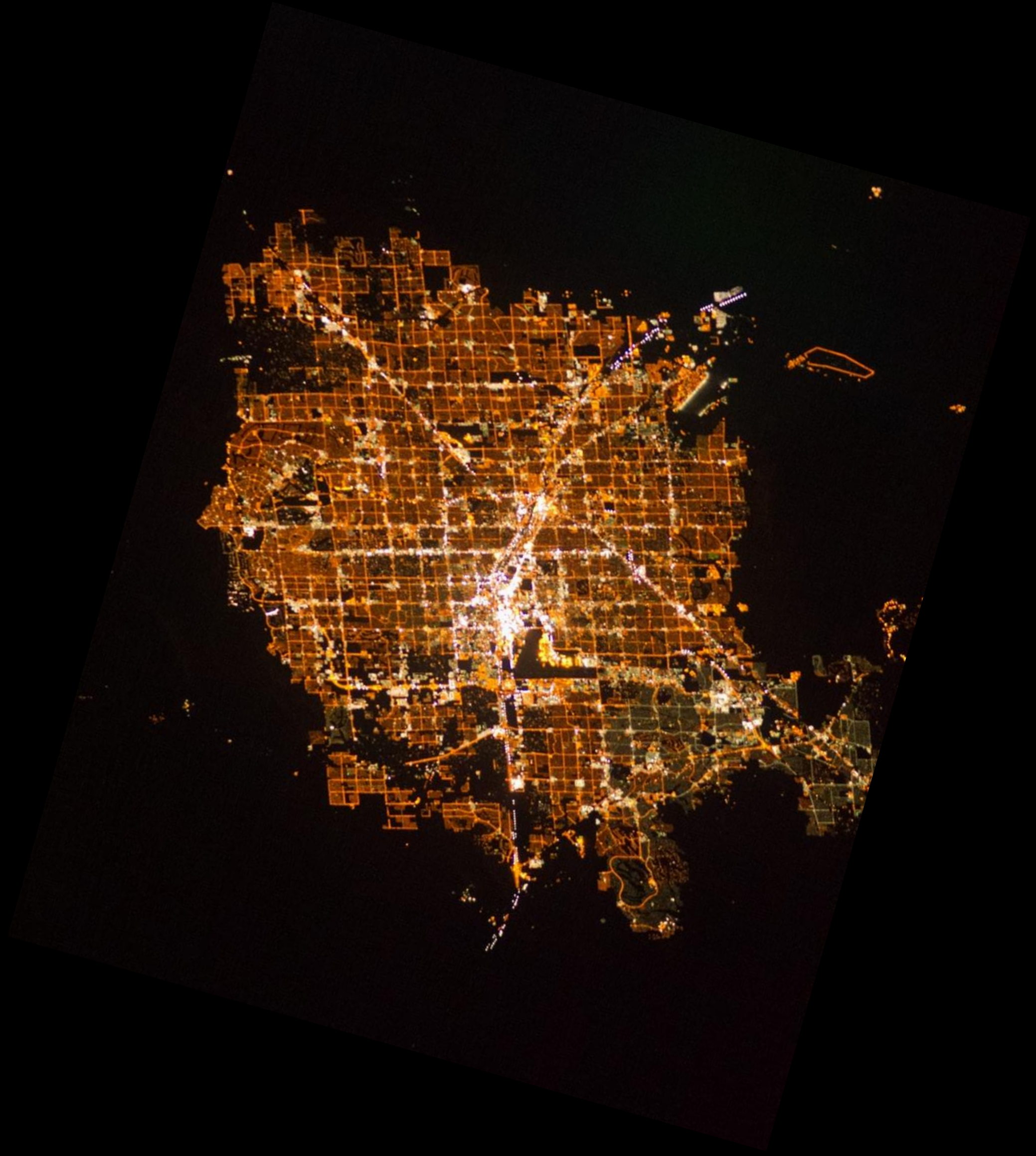
Results

- **Pearson (Population):** r = 0.042, p = 0.92
- **Pearson (Density):** r = -0.19, p = 0.62
- **Regression (Population):** R^2 = 0.0018, p = 0.92
- **Regression (Density):** R^2 = 0.0341, p = 0.62
- **ANOVA (NCHS Classes):** F = 0.23, p = 0.87
- **Best Welch t-test:** t = -2.42 (Top 5 most populous counties vs 2 others with data), p = 0.096



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Discussion

In Nevada, breast cancer mortality is not explained by typical geographic or demographic variables in our study. Unlike national patterns influenced by rurality or density, NV outcomes appear shaped by broader systemic issues [3-5]. NV ranks among the lowest in access to care and health system performance nationally, suggesting that beyond county classifications, or rural vs urban comparisons, statewide healthcare deficiencies may better explain mortality trends [6-8].

The U.S. breast cancer age-adjusted mortality rate is 19.2 per 100,000 (CDC, 2024). NV's rate is higher at 21.5. The 9 smallest counties lacked usable mortality data, and capturing this information could increase NV's mortality rate further.

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Discussion

Cancer prevention relies on patient compliance with screenings and behavioral changes. Treatment imposes technological, psychological and economic barriers, which may be exacerbated in rural communities. Improved integration of EHR and other data sources to state and national databases, may enhance data accuracy and inform interventions [9]. Expanding telehealth, specialist outreach, and online education may reduce cancer mortality in rural areas as well as statewide [3-4].

Our study suggests systemic factors in Nevada affecting the entire state may override geographic cancer mortality trends typically observed at the national level. Further development of healthcare infrastructure in Nevada is necessary, not only to adequately assess breast cancer mortality state wide, but to ensure screening, diagnosis and treatment measures.

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Lung cancer mortality in Nevada as elucidated through cancer informatics

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Lung cancer mortality in Nevada as elucidated through cancer informatics

Objectives: By the end of the session or abstract review, participant will be able to:

-describe current informatics methods to analyze lung cancer mortality based on location

-discuss lung cancer mortality rates of rural versus urban counties in NV and possible cancer health disparities;

-describe lung cancer mortality trends in the United States and in NV.

Key words: lung cancer, age-adjusted mortality rate, rural health disparity, cancer informatics, NCHS county classification

Lung cancer mortality in Nevada as elucidated through cancer informatics

Abstract

U.S. lung cancer mortality is declining, particularly in the western states, but is still affected by health disparities(1-2). Nevada ranks worst in the U.S. for lung cancer treatment rates(3). Rural/urban, large/small county binary studies often elucidate rural health disparities or other factors(4). Complex interplay of access to care, socioeconomic and other factors, affects lung cancer age-adjusted mortality rates (AAMR)(4-5). We examine whether lung cancer mortality rates are associated with county population size, population density, various binary classification of the 17 NV counties based on either measurement, and rural/urban CDC-National Center for Health Statistics (NCHS) county classification(1,6).

Lung cancer mortality in Nevada as elucidated through cancer informatics

Methods

For NV's 17 counties, we assessed 2018-2022 lung cancer AAMR (per 100,000) versus:

--total population or density, as continuous variables (pearson correlation, linear regression),

-all 16 theoretical binary divisions of 'large vs small' or 'urban vs rural' counties by population and by density (Welch's t-test of cancer mortality means),

--the 2023 CDC-NCHS six county rural/urban classification system (ANOVA).

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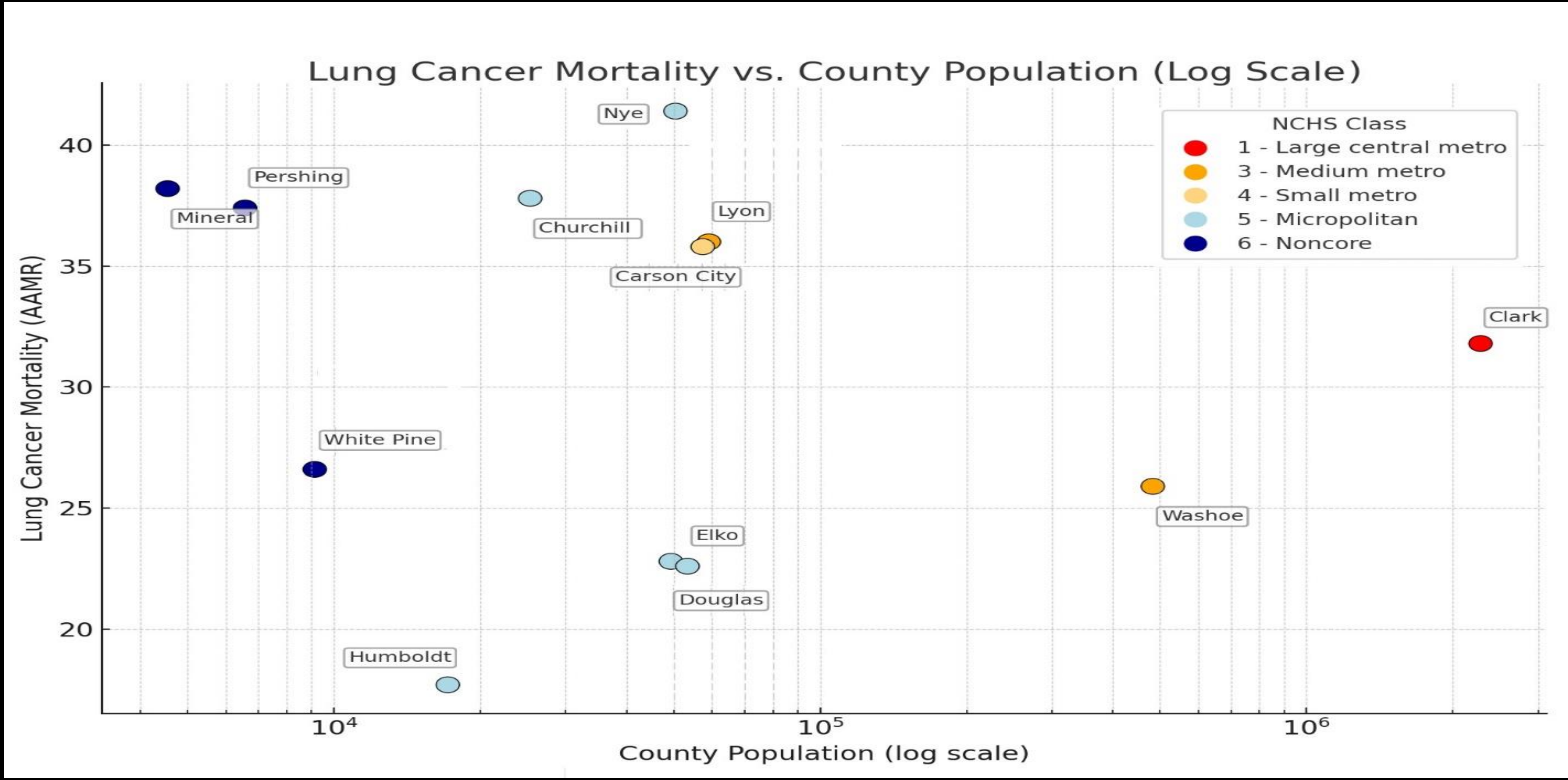
FIGURE 1: log scale showing lung cancer AAMR vs county population and NCHS class



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Results

No tested variable—population size (pearson r= -0.017, R^2= -2.01 p=0.958), density (pearson r=0.101, R^2=0.007 p=0.754), nor NCHS urban/rural classification (ANOVA F=0.257, p=0.90) —correlated with cancer mortality, **FIGURES 1 AND 2.**

We thus assessed all possible 'division points' between counties by density and population, to determine any mortality disparities between the resulting two groups of counties. No ad hoc density-based or population-based groups of counties revealed AAMR differences (welch's t test, all p>0.05). We note 5 of the smaller and least dense counties lacked lung cancer AAMR data. This resulted in 11 possible binary divisions based on density and population each.

Lung cancer mortality in Nevada as elucidated through cancer informatics

FIGURE 2: NCHS classes are descriptive but lack statistical significance for NV lung cancer.

CDC/NCHS 2023 CLASS	NEVADA COUNTY	Pop. Density (p/mi2)	avg pop (2018-2022)	Age-adjusted lung cancer mortality rate/100,000
1 - Large central metro	Clark (contains Las Vegas)	277	2,279,553	31.8
3 - Medium metro	3 counties washoe(88%)	39 (15.7-71.2)	182,106 (4128-483,134)	30.95
4 - Small metro	Carson City	348	57,358	35.8
5 - Micropolitan	6 counties	14 (0.5-67.6)	32,929 (1944-53,375)	28.46
6 - Noncore	6 counties	0.82 (0.2-1.2)	5871 (4554-9139)	34.07

Lung cancer mortality in Nevada as elucidated through cancer informatics

Discussion

In Nevada, typical measurements of health disparities may not elucidate cancer mortality(7-8). NV is large, with extreme geographic and demographic variations. As continuous variables, population nor density correlated with lung cancer mortality. Traditional rural-urban metrics may not fully capture disparities in structurally underperforming states like NV. Our ad hoc binary classifications by density or population, and the CDC/NCHS scheme, all failed to yield statistical differences in AAMR.

Lung cancer mortality in the U.S. has declined significantly over the past two decades, due to reduced smoking rates, advances in screening, and improved treatment. Between 1999 and 2020, AAMR for lung cancer dropped by ~42%. Despite this progress, lung cancer remains the leading cause of cancer death in the U.S.(1-2). In contrast, NV has significant healthcare challenges that affect lung cancer, ranking 50th for lung cancer treatment rates, 50th for healthcare access, 50th for primary care physicians, 41st for health systems performance(3, 9-11).

Lung cancer mortality in Nevada
as elucidated through cancer informatics

Discussion

Our study suggests broad and severe systemic factors influence lung cancer mortality in NV, and across typical divisions that consider county size, density, rurality, and national classification schemes. Also, other data sources may be needed to capture rural cancer burden, such as ‘big data’ from electronic medical records, or personal health data, to elucidate rural health disparities. Last, both systemic factors in NV and any rural health disparities highlight an urgent need for improved screening, access to care, and treatment delivery state wide.

Lung cancer mortality in Nevada as elucidated through cancer informatics

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