**Examining Geographic Disparities in Asthma Mortality Rates**

**Across Counties in California for All Age Group**

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**Background/literature review**

Asthma, characterized by chronic inflammation of the airways, is a widespread respiratory condition affecting millions worldwide (CDC, 2020). Its symptoms, ranging from mild wheezing to severe breathlessness, can significantly impair quality of life and productivity (Mims J. W., 2015). Despite advancements in medical science enabling effective management strategies, including bronchodilators and inhaled corticosteroids, asthma continues to pose substantial challenges, particularly in severe cases where hospitalization may become necessary (GINA, 2021).

In the context of California, asthma stands out as a significant public health concern (California Department of Public Health ,2019). With its diverse population and varied environmental factors, the state experiences a considerable burden of asthma-related morbidity and mortality (CDC, 2020). According to data from the California Department of Public Health (2019), asthma consistently ranks among the top causes of hospital visits, exerting a considerable strain on healthcare resources and infrastructure. Moreover, the economic impact of asthma cannot be overstated, with substantial healthcare costs and productivity losses attributed to the condition (California Department of Public Health ,2019).

The geographic distribution of asthma-related outcomes, including mortality rates, presents an intriguing area for investigation. Disparities in asthma prevalence, severity, and outcomes have been well-documented, often intersecting with social determinants of health such as socioeconomic status, access to healthcare, and environmental factors (American Lung Association, 2020). By examining disparities at the county level, this study aims to unravel the underlying factors contributing to differential asthma outcomes across California.

**Methods**

The dataset used for the study comprises counts and rates (per 1,000,000 residents) of asthma-related deaths among Californians statewide and by county. These data were stratified by age group (all ages, 0-17, 18+) and reported for 3-year periods. Sourced from the California Death Statistical Master Files, the dataset encompassed information gathered from death certificates, incorporating all deaths where asthma was coded as the underlying cause (ICD-10 CM J45 or J46) (California Department of Public Health, 2021).

For spatial data processing “County” was replaced by “ ” in shape file to add join “COUNTY” variable in original dataset. For the spatial analysis, Getis-Ord Gi statistic in ArcGIS software and Choropleth map was utilized.

Getis-Ord Gi statistics are a widely used method for identifying clusters of high or low values within the geographic area of interest, aiding in the detection of spatial autocorrelation and pinpointing hot spots or cold spots. This involved configuring parameters such as the input feature class (California counties shapefile) and the field containing Age-adjusted Mortality Rates, with the analysis generating z-scores and p-values for each county to identify hot spots or cold spots. For the Choropleth map of age-adjusted mortality rates, quantile method was utilized. This approach divides the data into equal intervals based on rank order, ensuring a balanced representation across the map, and providing a clear depiction of geographic disparities.

This methodological approach integrates comprehensive datasets and advanced spatial analysis techniques to identify geographic disparities in asthma-related mortality rates, guiding targeted interventions for improved healthcare outcomes in California.

**Results**

The analysis of age-adjusted mortality rates for all ages reveals noteworthy patterns in asthma-related fatalities across California counties. The distribution of these mortality rates exhibits a right-skewed trend, with a mean of 8.17 deaths per 1,000,000 residents and a standard deviation of 6.06. Similarly, the distribution of actual death counts also reflects a right-skewed distribution, with an average of 29 deaths per 1,000,000 residents, inclusive of outliers. These findings underscore the heterogeneity of asthma mortality rates within the state and lay the groundwork for further exploration into geographic disparities and their implications for public health intervention.

Overall, California's age-adjusted asthma mortality rate is 9.6 deaths per 1,000,000 residents. However, the result is insignificant with p>0.05. Among the counties studied, ten showed statistically significant variations (p < 0.05). Darker-colored counties on Map 2 indicate higher age-adjusted mortality rates, while lighter-colored counties represent lower rates. Among these, Santa Clara (11.1), Alameda (11.2), Mendocino (21.6), Monterey (14.2), and Stanislaus (13) had notably high rates, depicted as hot areas on Map 1 in red. Mendocino County recorded the highest mortality rate at 21.6 deaths per 1,000,000 residents. Certain counties reported zero mortality rates with p-values < 0.05, such as Alpine, Sierra, Lassen, Tehama, and Trinity, identified as cold areas on Map 1 in blue.

Identifying areas with the highest mortality rates, particularly Mendocino County, is imperative for targeting interventions effectively. By directing resources and interventions to high-risk regions, we can mitigate disparities in healthcare access and outcomes, ultimately enhancing asthma management and care statewide.

**Tables/Figures**

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Table 1: Summary statistics for significant age adjusted mortality rate by county and corresponding Gi Bin

Map 1: Hot and Cold maps fo Asthma Age-Adjusted death rates in California by County in 2021

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Map 2: Choropleth map for Age adjusted death rates in California by county, 2021.

**Discussion (1 pg)**

**Discussion**

The analysis of age-adjusted mortality rates across California counties reveals significant variability, with a mean of 8.17 age-adjusted deaths per 1,000,000 residents and an average of 29 deaths per 1,000,000 residents. Statistically significant variations in mortality rates highlight geographic disparities, notably in counties including Santa Clara, Alameda, Mendocino, Monterey, and Stanislaus. Mendocino County stands out with the highest mortality rate at 21.6 deaths per 1,000,000 residents. The presence of zero mortality rates in certain counties underscores the complex interplay of factors affecting asthma outcomes, including healthcare access and socioeconomic status.

This study offers a comprehensive analysis of asthma mortality rates in California, using data from the California Death Statistical Master Files. Incorporating age-adjusted mortality rates and spatial analysis techniques enhances our understanding of geographic asthma outcome disparities, aiding in the identification of high-risk areas for targeted interventions. However, limitations such as potential biases in death certificate data and the exclusive focus on mortality rates should be considered. Additionally, while spatial analysis provides valuable insights, it may not fully address socioeconomic and environmental factors influencing asthma outcomes.

In conclusion, this study highlights geographic disparities in asthma mortality rates across California, emphasizing the need for further research to understand underlying determinants. Considering community-specific challenges and implementing targeted interventions, policymakers and healthcare providers can reduce asthma-related morbidity and mortality, promoting equitable healthcare access and outcomes statewide.

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