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Comparison of Mortality Data from Nebraska's Rural & Metropolitan Health Districts

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Abstract

As there has been minimal research done on the correlation between communities identified as rural or metropolitan and their mortality rates, this research aims to provide baseline evidence that mortality rates associated with non-infectious and infectious diseases are connected to an area's rural or metropolitan classification. This study analyzed public data from the Nebraska Department of Health and Human Services and the Center for Disease Control to compare mortality rates related to the top two causes of death in both rural and metropolitan health districts of the state of Nebraska, United States. This data was then compared to mortality rates from the current SARS-CoV-2 (COVID-19) pandemic as of January 13, 2021. Within this paper, metropolitan was be defined as any area containing at least one urbanized area/city of 50,000 residents or more, including the adjacent areas with high social and economic integration; rural will be defined as anything not metropolitan (U.S. Health Resources & Services Administration, 2021). Although underlying factors such as access to health care or quality of care may be relevant, they go beyond the scope of this study. Further research is needed to determine if the variations in mortality rates between Nebraska's rural and metropolitan health districts are statistically significant.

Keywords: SARS-CoV-2, cancer, heart disease, rural, metropolitan, mortality rate

Contents

Introduction

Metropolitan areas, defined as any area containing at least one urbanized area/city of 50,000 residents or more which includes the adjacent areas with high social and economic integration, are better equipped with access to quality healthcare when compared to rural communities, defined in this paper as anything not metropolitan (U.S. Health Resources & Services Administration, 2021). Rural communities are visibly lacking in reliable healthcare infrastructures, which in turn decreases quality of life and increases mortality rates within these populations (Inungu et al., 2020). Although these issues faced by rural populations in regard to health care are not new, rates of improvement are extremely slow (James, 2014). In consequence, mortality rates continue to increase in rural areas of the United States and so do the interconnected health disparities (Cossman, James, & Wolf, 2017). As it stands now, the rural health infrastructure can be considered one of the most fragile systems in America as a whole because of their shortage of health care professionals, the financial stress on rural hospitals, and unreasonable transport times to other medical facilities (Ricketts, 2000).

The reduction in quality of care and increase in mortality rates within rural populations is concerning when discussing the top two (2) causes of death, cancer and heart disease. Perhaps more concerning is the impact of this difference within the context of an infectious disease outbreak (Nebraska Vital Statistics, 2016). In the face of the current SARS-CoV-2 pandemic, rural communities, as well as metropolitan areas, have implemented guidelines on social distancing and mass gatherings to mitigate the transmission of the disease and therefore decrease hospitalizations and deaths; however, there is limited research available on how these public health responses can be scaled to better suit rural communities (Inungu et al., 2020).

Although the literature includes articles from authors such as Inungu and Ricketts that detail how all rural health care systems and populations in the United States are below average and in need of critical support, not one specifically targets Nebraska, or any singular state, and how their rural community mortality rates differ from those of the metropolitan rates; this study will bridge that gap by looking at this issue. Through comparison of the differences in mortality caused by non-infectious diseases to current mortality caused by the SARS-CoV-2 pandemic, the goal of this study is to identify the variances of mortality rates between rural and metropolitan health districts in Nebraska. This study should also provide confirmation that future research is needed on what underlying factors may be contributing to rising mortality rates and how our rural communities can receive the needed support for their healthcare system.

Materials & Methods

Data Collection

A list of the 93 counties in Nebraska was retrieved from the Nebraska Legislature Maps Clearinghouse website (Nebraska Counties - Maps Clearinghouse). The county designations of rural or metropolitan, determined through the use of the definitions mentioned earlier, were then taken from the Federal Office of Rural Health Policy's "Non-metro Counties (Micropolitan and non-core based counties)" file (Federal Office of Rural Health Policy (FORHP) Data Files, 2021). Once designated as rural or metropolitan, and color-coded in an excel sheet to reflect classification, the counties were sorted into their respective health districts. The 19 health districts, and the counties included within each, were retrieved from the Nebraska Association of Local Health Directors (Nebraska Local Health Departments). Health districts were also then designated as rural or metropolitan based upon the designation of their respective counties. The

populations of each health district were found by retrieving estimated population numbers of each county in Nebraska for years 2012-2016 from the United States Census Bureau's FactFinder service (Annual Estimates of the Resident Population, etc.). The 2021 population of each county, and health district, as of July 1, 2019 and was retrieved from the United States Census Bureau's QuickFacts of Nebraska (United States Census Bureau).

The number of deaths by cancer and heart disease within each health district for years 2012, 2013, 2014, and 2016, were retrieved from the Nebraska Vital Statistics Report – Table 44-50a: Deaths by Cause (Top Seven) by Place of Residence and transferred into a Microsoft Excel file for organization and future data analysis. For the year 2015, the Nebraska Vital Statistics Report – Table 44: Heart Disease Deaths by County of Residence, 2015 and 2011-2015; and Table 45: Cancer Deaths by County of Residence, 2015 and 2011-2015 were used to retrieve number of deaths for cancer and heart disease. These numbers were recorded into a Microsoft Excel file by county. The counties were then sorted into their respective health districts and the sum of the number of deaths was recorded for each cause of death. The number of deaths caused by SARS-CoV-2 as of January 13, 2021, within each Nebraska county was retrieved from the Global Epidemics website (Brown School of Public Health, 2021). The sum of number of deaths per each health district were found by sorting the number of deaths per county into their respective health district and adding them together.

Calculation of Mortality Rates

Once all health district populations, number of deaths by cancer, number of deaths by heart disease, and number of deaths by SARS-CoV-2 were collected, compiled, and sorted by year in a Microsoft Excel file, mortality rates were calculated. Mortality rates of cancer and heart

disease (per 1,000 persons in the population) for each of the 19 health districts in years 2012, 2013, 2014, 2015, 2016, and SARS-CoV-2 for 2021 were calculated using the following formula: $Mortality\ Rate = \frac{Total\ Deaths\ to\ Disease}{Total\ Population\ of\ Health\ District} * 1{,}000$. The average mortality rates of cancer and heart disease were calculated for each health district by adding all mortality rates for years 2012-2016, respective to each district, and divided by 5.

Data Analysis

The 93 counties in Nebraska were designated as rural or metropolitan prior to being sorted into their respective health districts (Figure 1). The health districts were also labeled as rural or metropolitan depending on the counties of which they were composed (Figure 2). All 19 health districts were composed of either completely metropolitan counties or completely rural counties except for the Central District which has mixed composition of two (2) rural counties and one (1) metropolitan county.

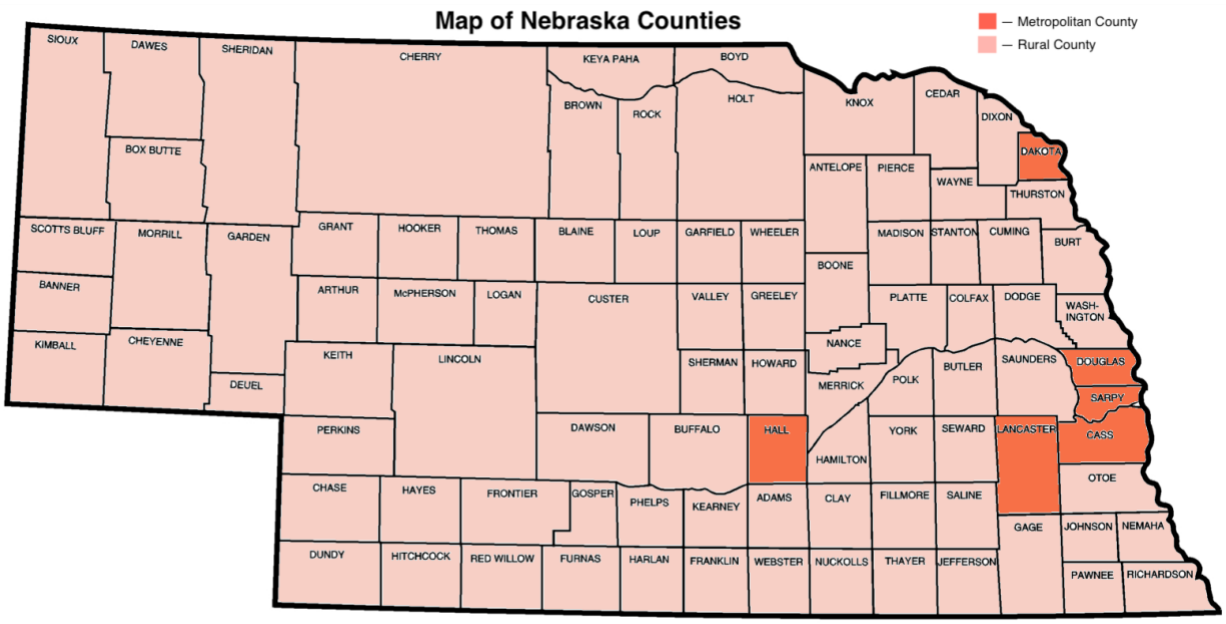


Figure 1. Map of Nebraska Counties. *Color-coded map of rural and metropolitan counties in the state of Nebraska. Counties were designated as rural or metropolitan based on definition and identification provided by HRSA (Federal Office of Rural Health Policy Data Files).*

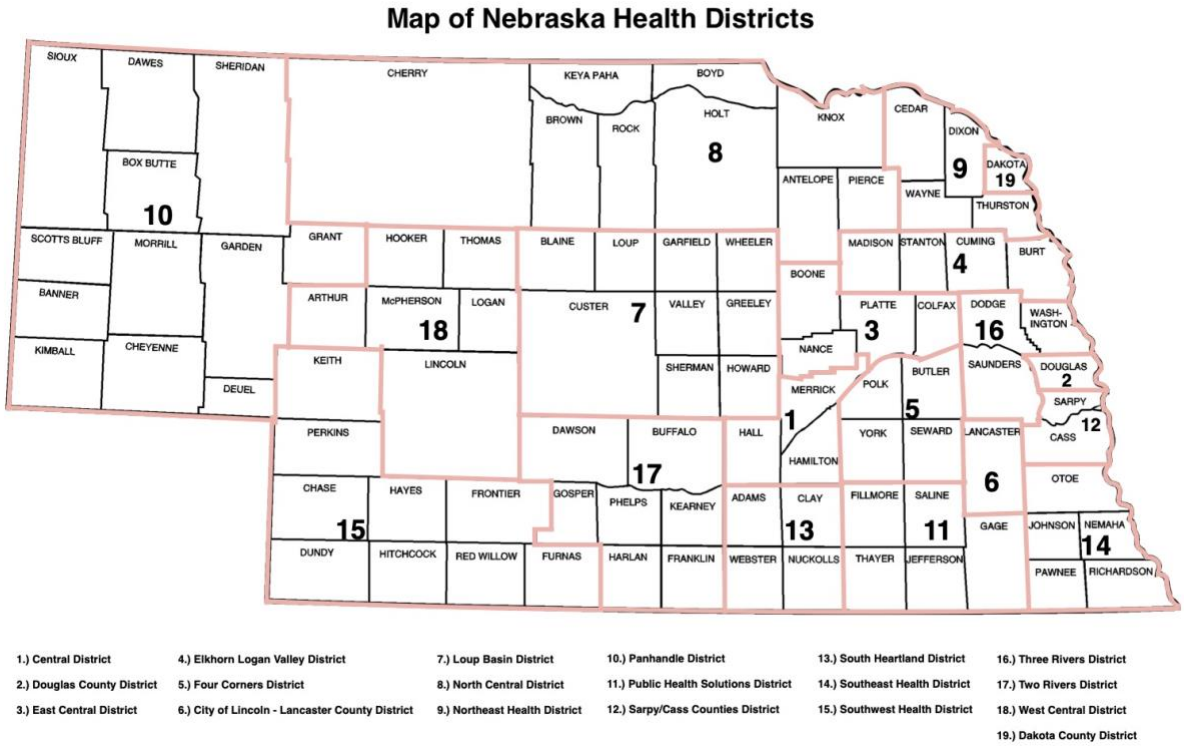


Figure 2. Map of Nebraska Health Districts. *Health districts are delineated and numbered. Health districts 2, 12, and 19 are the only health districts composed of solely metropolitan counties. Health district 1 is composed of one metropolitan county and two rural counties and should be acknowledged when comparing mortality rates. All other health districts are composed of only rural counties.*

Average mortality rates per 1,000 persons in the population were calculated for each health district and sorted into a table specific by cause of death (cancer, heart disease, and SARS-CoV-2) and year (Table 1). Health districts were also tagged if they were considered rural or non-metropolitan based on the designations of the composing counties. For a better glimpse into the possible differences between rural and metropolitan health districts, the mortality rates of cancer, heart disease, and SARS-CoV-2 for the two most populous and the two least populous health districts were compared (Graph 1.)

MORTALITY RATES BY HEALTH DISTRICT - CANCER, HEART DISEASE, SARS-CoV-2.

*mortality rate per 1,000 persons

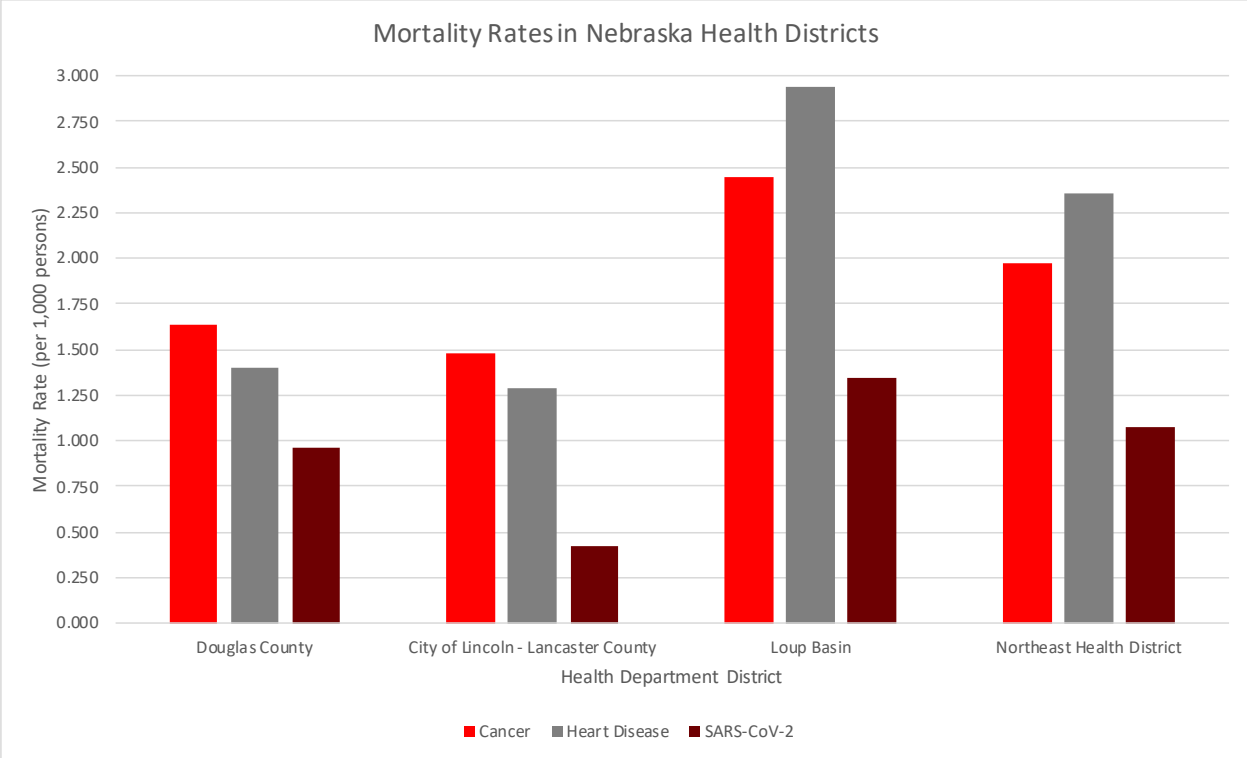
**SARS-CoV-2 mortality rates calculated w/ population estimates as of July 1, 2019

	Average mortality rate, 2012-2016		Mortality rate as of January 13, 2021
Health District	CANCER	HEART DISEASE	SARS-CoV-2
††Central District	1.899	1.712	1.645
Douglas County	1.638	1.396	0.959
†East Central District	2.024	1.954	1.437
†Elkhorn Logan Valley	2.014	2.831	1.190
†Four Corners	2.266	2.523	1.199
City of Lincoln - Lancaster County	1.479	1.293	0.423
†Loup Basin	2.447	2.934	1.339
†North Central District	2.567	3.250	1.324
†Northeast Health District	1.970	2.352	1.077
†Panhandle	2.069	2.528	1.759
†Public Health Solutions	2.720	2.876	0.507
Sarpy/Cass Counties	1.481	1.172	0.431
†South Heartland District	2.228	3.039	1.150
†Southeast Health District	2.676	2.610	0.882
†Southwest Health District	2.522	2.813	0.837
†Three Rivers District	2.437	2.027	0.964
†Two Rivers District	1.805	1.890	0.999
†West Central District	2.216	2.092	1.105
Dakota County	1.759	1.305	2.796

† Rural/non-metropolitan health district

†† The Central District is composed of two rural/non-metropolitan counties and one metropolitan county, which may cause inconsistencies in overall health district mortality rates.

Table 1. Average Mortality Rates for Cancer (2012-2016), Heart Disease (2012-2016), and SARS-CoV-2 (2021). Mortality rates of cancer and heart disease for the years 2012-2016 were calculated independently prior to being averaged. SARS-CoV-2 mortality rates were calculated using the number of deaths as of January 13, 2021, at the beginning of this study.



Graph 1. Mortality Rates in Nebraska Health Districts. *Average mortality rates of cancer (bright red) and heart disease (gray) for the two most populous health districts (Douglas County District & City of Lincoln – Lancaster County District) and the two least populous health districts (Loup Basin & Northeast Health District). SARS-CoV-2 mortality rates (dark red) for the same identified health districts were calculated using the number of deaths as of January 13, 2021, and estimated populations as of July 1, 2019.*

Discussion

The calculation and review of mortality rates provided a glimpse into the differences in mortality rates between Nebraska's rural and metropolitan health districts. As seen in Table 1, and more clearly in Graph 1, mortality rates in Nebraska's rural health districts are higher than those in the metropolitan health districts across all diseases looked at. An infectious disease such as SARS-CoV-2 would be thought to spread and cause death at much higher rates in metropolitan areas because of the population density; however, it is interesting to see that mortality rates due to SARS-CoV-2 are greater in rural areas of Nebraska. This leads to the question of what could possibly be affecting rural communities more than metropolitan communities that could be attributing to the increased mortality rates. Although identifying one

underlying factor may be the goal, it is more than likely that there are several elements which interact to complicate the matter of determining why mortality rates of Nebraska's rural health districts are greater than those in metropolitan health districts.

Conclusion

Collection of mortality data for cancer, heart disease, and SARS-CoV-2 within Nebraska allowed for the comparison of mortality rates between rural and metropolitan health districts for both non-infectious and infectious disease causes of death. The data shows that our rural health districts have mortality rates that are close to double that of our metropolitan districts for all three diseases examined in this study. However, further research is needed to determine if these differences are statistically significant. Future studies on possible factors contributing to higher mortality rates such as quality of medical care or access to care would also be beneficial to understanding the gap in mortality rates as well as helping us to prepare and predict the impact of the next infectious disease outbreak.

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