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Disparities in death rates between rural and urban areas due to acute myocardial infarction: Evidence from Nebraska

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Abstract

Objectives: Acute myocardial infarction (AMI) continues to be a leading cause of mortality and disability globally, including in the US. There is a lack of ongoing monitoring of AMI incidence and mortality, as well as information about survival outcomes beyond 30 days of AMI hospitalization and risk factors, particularly in rural regions, which is a shame since surveillance and secondary prevention are crucial. The present research looks at the disparities between rural and urban areas in terms of AMI patients' in-hospital and out-of-hospital survival rates. Methods: We conducted a retrospective study using death certificate information from Nebraska up to October 2011 and hospital discharge data from January 2005 to December 2009. To evaluate the rural-urban difference in 30-day mortality, multivariate logistic regression was used. The overall survival rate and out-of-hospital survival rate were predicted using a Cox proportional hazard model.

Patients residing in urban regions had a lower risk of dying compared to those residing in rural areas in the 30-day mortality model, even after accounting for factors such as age, comorbidities, and rehabilitation (odds ratio: 0.709, 95% confidence interval: 0.626e0.802). Patients residing in urban regions were shown to have a decreased risk of AMI mortality in the overall survival model compared to those residing in rural areas (hazard ratio: 0.86, 95% confidence interval: 0.806e0.931). Overall survival was poorer in patients with chronic renal disease, atrial fibrillation, or a history of heart failure, and the risk of 30-day death was significantly greater in those with this history. Patients who participated in cardiac rehabilitation for at least one session showed a significant improvement in

Death rates within 30 days and overall ($p < 0.0001$).

The results of this study corroborate those of earlier research on the rural-urban mortality gap in the 30 days after an acute myocardial infarction (AMI) hospitalization, and they add to the existing body of knowledge about this topic. Unprecedented at the population level, the research also discovered a correlation between cardiac rehabilitation and decreased mortality. More work is required to establish protocols in remote areas and hospitals to guarantee that individuals with AMI get the treatment they need.

INTRODUCTION

One of the leading killers in the US is heart attacks, also known as acute myocardial infarction (AMI). Roughly 7.6 million individuals had at least one episode of AMI in 2013, according to the American Heart Association. Additionally, it is projected that 280,000 Americans will have recurrent AMI and 635,000 will have a first-time AMI in 2013.1

In 2008, AMI was responsible for the deaths of almost 134,000 Americans.2 The severity of acute myocardial infarction (AMI) and the frequency of readmission to the hospital are indicators of the quality of treatment that patients get while they are in the hospital.3e5 In an effort to enhance the treatment process for patients with acute myocardial infarction, the American College of Cardiology, the Centers for Medicare and Medicaid Services, and the American Heart Association have developed quality

improvement standards.The gap between ideal and actual treatment for AMI patients in the US is really large, 6e8, notwithstanding these efforts.9, 10 The result is that there are regional and demographic differences in health outcomes.eleven, twelve Here, we take a look at how AMI patients in Nebraska fare in comparison to their metropolitan counterparts.

It is a major public health issue since there is a significant gap between rural and urban areas in the treatment and results of cardiovascular illnesses, such as AMI.13 Process metrics for acute myocardial infarction (AMI) care varied significantly across rural and urban hospitals, according to prior research conducted both before and after the quality improvement standards were implemented.14e16 Inpatient treatment for patients with acute myocardial infarction was found to be of worse quality in rural hospitals compared to metropolitan hospitals, according to data from the mid-1990s. By analyzing data from 1994 to 1995, Sheikh and Bullock discovered that patients who were hospitalized to

Patients at remote hospitals were less likely to get aspirin, beta-blockers, and thrombolytic therapy—treatments that may save lives.15 Disparities in the delivery of recommended therapy continue to exist, even while there has been an overall improvement in patients following treatment recommendations for AMI and the treatment quality gap between big rural and urban hospitals has been closed.18, 14, 16 e When comparing 30-day mortality rates, rural hospitals also do worse than their metropolitan counterparts. those admitted to rural hospitals had a greater 30-day risk-adjusted death rate than those admitted to urban hospitals, according to two prior studies that used Medicare inpatient data.9,19 One Iowa research, however, indicated that hospitals in metropolitan areas had a lower AMI in-hospital mortality rate than hospitals in rural areas.20 Although the majority of the studies mentioned before reported death within 30 days or while hospitalized, this research goes above and beyond by reporting mortality across all time points.
Rural Nebraskans have a number of disadvantages compared to their urban counterparts, including a greater prevalence of chronic illnesses, lower socioeconomic level, and less access to preventative health care services like cholesterol screening and cardiac rehabilitation. Additionally, they tend to be older.21e24 In 2005, non-metropolitan and frontier counties (with a population density of less than 6 per square mile) were home to about 45% of Nebraska's total population. Over half of the inhabitants lived in one of the three metropolitan counties: Douglas, Sarpy, or Lancaster.25 Between 2005 and 2009, there was a significant difference in the prevalence of obesity (28.12% vs. 25.12%), chewing tobacco use (10.34% vs. 4.77%), perception of health status as fair or poor (13.1%), and lack of exercise outside of work (25.03% vs. 20.66%) between rural and urban residents aged 19 and above. Furthermore, compared to urbanites, ruralites were less likely to have had a regular medical exam in the previous year (35.86%) and to have had their cholesterol examined in the last five years (25.27% vs. 32.64%).26
There are a lot of obstacles that make it hard for people living in rural areas to get the best treatment possible after an AMI.27, 28 To start, Lincoln and Omaha are home to the vast bulk of Nebraska's cardiology services and facilities. There were 130 cardiologists in the state in 2012, with 102 of them having their main practice sites in Omaha, Lincoln, Douglas, or Lancaster county, according to the Health Professions Tracking Service at the University of Nebraska Medical Center.29 Secondly, it is crucial to provide treatment to rural residents suffering an AMI within the first 30 to 40 minutes. Unfortunately, not all patients have the time to go to an urban hospital. Also, out of the ninety rural counties in Nebraska, only seven have a primary care cardiologist on staff. Consequently, some patients in rural areas may see a family doctor instead of a cardiologist. Thirdly, a patient with a rural AMI may end up at an urban hospital, but

the time it takes for EMS to get there and the care they get while they're there may not be ideal.18 There is a lack of research on rural-urban inequalities or risk factors for AMI mortality beyond the first 30 days after hospitalization, even though much of the prior research has concentrated on these disparities in the first 30 days. Mortality from AMI is rarely consistently observed, particularly in rural regions, despite the need of monitoring and secondary prevention.30 Mortality outcomes might vary due to differences in medical care, availability of health resources, and kinds of comorbidities. Consequently, in order to assess rural-urban disparities in AMI survival outcomes, this research used a linked dataset including hospital and community data from Nebraska. Using in-hospital mortality and survival result after discharge, we examined mortality outcomes across rural and urban hospitals for patients treated with AMI.

For five years (2005–2009), we used two data sources to do a county-based population analysis of AMI mortality. To begin, we contacted the Nebraska Hospital Association to get data on patients who were released from hospitals due to acute myocardial infarction (AMI) between 2005 and 2009. All Nebraska hospitals contribute to a database that includes patient demographics, diagnostic codes, procedure codes, and details on inpatient and outpatient visits, as well as information about visits to the emergency room and rehabilitation centers. The second source for the Nebraska death records was the Office of Vital Records inside the Nebraska Department of Health and Human Services. From January 2005 through October 2011, the Nebraska Hospital Association connected hospitalization records with Nebraska death records using a probabilistic linking method. Name, DOB, sex, and home ZIP code were the variables used for the association. Subsequently, the data was stripped of all identifying information, including patients' names and addresses. We used the first hospitalization for AMI if the data related to a single patient contained information about several hospitalizations and readmissions. That being said, the data analysis is not focused on AMI events but on persons. In order to identify cases of AMI diagnosis and deaths, the International Classification of Diseases, Ninth Revision, codes were used. The US Department of Agriculture's Business and Industry Loan Program defines Douglas, Lancaster, and Sarpy counties as urban, so these three counties were classified as ruraleurban. Lastly, the prevalence of AMI by age group and gender was determined by comparing rural and urban locations using population data from the US Census Bureau.25 The research used the Nebraska Hospital Discharge data from 2005 to 2009 as its cross-sectional observational dataset. Data linking allowed for a passive longitudinal follow-up to determine mortality status. University of Nebraska Medical Center's Institutional Review Board gave their stamp of approval to the study's protocol. People from Nebraska who were admitted to a hospital in Nebraska are part of the research. This study did not include Nebraska residents who sought treatment in another state, nor did it include out-of-state patients hospitalized to a Nebraska hospital between 2005 and 2009. We used 12,783 distinct patient records Patients' ages, sexes, and comorbidities served as control variables. Several significant comorbidity problems, including diabetes mellitus, anemia, atrial fibrillation, chronic renal disease, and a history of heart failure, were included as controls because, according to previous research, the presence of these disorders may influence the efficacy of a treatment. We scored a diagnosis as 1 if it includes any of these health issues and 0 otherwise. Studies have shown that individuals with coronary heart disease, including AMI, benefit from cardiac rehabilitation, which is sometimes called secondary prevention of heart disease. This kind of treatment increases survival rates and decreases disability.31 But there is a dearth of research on how certain patient populations, such as those living in remote regions, might get access to cardiac rehabilitation programs. Important indicators of engaging in cardiac rehabilitation include long travel distances and shame about ignoring family obligations.31,32 years The use of outpatient rehabilitation was also included. 2.5. Analyzing statistical data

Survival after leaving the hospital was the main measure of success. Nevertheless, we added 30-day mortality as a benchmark since it is often reported in other research. All of the variables in the descriptive statistics are proportional, and the differences between rural and urban areas are analyzed using Pearson chi-squared tests. The AMI mortality rates were compared by age, comorbidities, rural status, and unadjusted descriptive analysis. By controlling for factors such as age, comorbidity status, and sex, the adjusted analysis (multivariate regression) shed light on the patterns of AMI mortality and survival in rural and urban populations. The Cox proportional hazard model was used to forecast survival rates, whereas logistic regression was employed to forecast 30-day mortality. To determine the mortality and survival rates of AMI, hazard ratios (HR) and odds ratios (OR) were computed, with 95% confidence intervals (CIs) for each. Version 9.3 of SAS software (SAS Institute Inc., Cary, NC) was used for all statistical analysis. Every piece of data was analyzed using a p-value less than 0.05.

Nebraska had 12,764 individuals hospitalized with AMI between 2005 and 2009, with males making up 60.8% (7773) and females 39.2% (4991) of the total. This information is shown in Table 1. Patients from rural regions made up over half of the total (58.5%). Patients in rural regions were more likely to be 60 or older (74.2%) than those in urban areas (66.0%). Using the US Census Bureau's 2010 data on 10-year age groups ranging from 15 to 85 years old, we were able to determine both the crude and age-standardized AMI incidence rates, which are based on age-sex specific incidence by rural and urban regions. Males in rural counties had a crude incidence rate of 135.1 per 10,000 people, while females in urban counties had a rate of 67.1 per 10,000 people. After correcting for age using the standard population of 2000, the rates for rural counties were 114.6 and 100.5, and for urban counties they were 114.6, and for female counties they were 55.6. The same holds true for men: After normalization, the rural-urban rates for females were similar, however the rates for AMI incidents were higher in rural regions.
When comparing rural and urban locations, it was found that fewer people in the former had anemia, diabetes mellitus, and chronic kidney disease, with the exception of atrial fibrillation. There was no statistically significant difference between rural and urban individuals with a history of heart failure. Patients in rural areas were far more likely to have participated in cardiac rehabilitation (30.8% vs. 16.3%) than those in urban areas. There was a statistically significant difference between rural and urban patients in terms of death rates within 30 days of hospitalization (11.5% vs. 9.3%, $p < 0.001$).

The results of logistic regression models that examined variables linked to 30-day mortality for AMI are shown in Table 2. The odds ratio (OR) clearly increased with age (range from 1.368 to 8.994), with the exception of the 40–59 year age group, suggesting that age was a major determinant of death and that older patients had a much higher mortality rate than younger patients. Regarding comorbidity, 30-day AMI mortality was inversely linked with anemia and diabetes mellitus, and the probability of death within 30 days was almost doubled for those with a history of heart failure. When patients participated in cardiac rehabilitation at least once, the risk of death within 30 days was significantly lower (OR: 0.010; 95% CI: 0.003e0.032). Survival rates at 30 days were significantly lower for city dwellers compared to those in rural areas (OR: 0.709; 95% CI: 0.626e0.802). Furthermore, our data did not show a significant association between patient sex and AMI mortality.
Models for both in-hospital and overall survival were run using the same set of variables as in Table 2 to evaluate survival result. There was no difference between the two models' findings when looking at age, sex, and rehabilitation (Table 3). There was no correlation between sex and death rates. Similar to the

logistic regression, the age effect was gradient-based, with older patients showing a higher HR. For instance, the HR for patients 91 and above was 21.413, in comparison to out-of-hospital patients 39 and under. Overall survival was 0.554 (95% CI: 0.516e0.595), and out-of-hospital survival was 0.748 (95% CI: 0.700e0.801), both of which indicate that rehabilitation significantly reduced the risk of AMI death. Heart failure had the highest HR (out-of-hospital survival 2.190; overall survival 2.002), whereas atrial fibrillation and chronic renal disease also raised the risk of AMI death. Only in the out-of-hospital survival model were anemia and diabetes mellitus positively related with death. Following adjustments for age, sex, co-morbidities, and Our research discovered rural-urban inequalities in AMI mortality in Nebraska between 2005 and 2009 by merging hospital discharge data with community-based vital statistics information. Our findings are in line with the existing literature showing that the risk of 30-day in-hospital mortality is lower for patients residing in urban regions compared to rural ones. In general, patients in urban settings have a higher likelihood of survival compared to those in rural areas.
One possible explanation for the higher 30-day in-hospital death rate for rural AMI patients might be the disparity in healthcare quality between rural and urban hospitals. Another possible explanation could be the underlying systemic discrepancies between rural and urban areas. It is probable that variations in the quality of AMI patient treatment contribute, given that the majority of rural AMI patients are treated in rural hospitals and the majority of urban AMI patients are treated in urban hospitals. To start, people living in remote regions may visit more generalist doctors for acute myocardial infarction (AMI) due to a shortage of cardiologists and emergency services. When comparing the prescription habits of general practitioners with those of cardiologists, two studies indicated that the latter were more likely to suggest medicine for acute myocardial infarction (AMI) than the former.33,34 This scarcity is expected to worsen as long as the demand for cardiologists in the US continues to outstrip the supply.30 Second, when it comes to AMI therapy, medical judgments are influenced by characteristics that are individual to the patient and the place. When it comes to treating patients with AMI, cardiologists at rural hospitals have limited choices due to a lack of resources. Without access to specialists in a timely manner,

They may see a family doctor or other general practitioner, who may not send them to a cardiologist or order the testing they need.31 Last but not least, pre-hospital treatment in rural locations may not be up to par. This is because the majority of rural ambulance systems and many long-distance EMS transports are run by volunteers, many of whom lack the necessary training to provide advanced cardiac life support techniques.18
Disparities in out-of-hospital and overall rural-urban survival were also evaluated. Because secondary preventive interventions, such public health services, may have an impact on long-term survival patterns that vary from short-term survival predictions, it is vital to have a look at these patterns. Overall survival was better for urban patients compared to rural ones, even after adjusting for age and comorbidities. Following an AMI, the risk of complications is significantly reduced when patients engage in behavioral therapies such as adopting a balanced diet, increasing physical exercise, and quitting smoking. cardiovascular events that occur repeatedly.35 Compared to their urban counterparts, rural Nebraskans are less likely to engage in regular physical activity, are overweight, and smoke more cigarettes.The rural-urban heart disease discrepancy may be influenced by people's perceptions of hazards. Some people living in rural areas have the mistaken belief that they are not vulnerable to cardiovascular disease and stroke, and this belief influences their actions. In remote locations, screening services are less readily available, which contributes to a reduced perceived risk.37; 38 Reducing mortality is another benefit of cardiac rehabilitation, which has not been previously shown at the community level. When compared to other

states in the US, Nebraska's cardiac rehabilitation rate is among the highest.39 Patients with acute myocardial infarction (AMI) who participated in cardiac rehabilitation sessions had a substantially lower risk of death compared to those who did not. It is worth noting that our data indicates that a higher percentage of AMI patients in rural areas compared to metropolitan areas underwent cardiac Furthermore, 30-day mortality was higher in patients with an older age and a history of heart failure; total survival was primarily decreased in patients with a history of heart failure and other comorbidities, including atrial fibrillations, diabetes mellitus, and chronic kidney disease. Although anemia does not directly increase the chance of death within 30 days, it does reduce the long-term survival result for patients with acute myocardial infarction (AMI), which is in line with earlier research.40 Patients with AMI who also had diabetes mellitus had a lower risk of dying within 30 days, according to some earlier research.41,42 Diabetes mellitus was associated with a lower risk of death from AMI within 30 days, which is an interesting finding. However, the long-term survival prognosis was significantly reduced in patients Our research has a number of limitations. Firstly, due to a lack of information in hospital discharge records, we did not account for differences in case severity or treatment between patients in urban and rural areas. Secondly, we lacked data on key risk variables, including smoking status, level of physical activity, and body mass index, for the individuals we examined. Thirdly, information about the frequency of cardiac rehabilitation was not available to us. As a fourth point, a linking issue can cause certain entries to be missing. Lastly, transfers were not included in our investigation, which might explain why rural hospitals Potential biases No author has anything to disclose. Notes of Thanks The data on practicing cardiologists in Nebraska was provided by Marlene Deras of the Health Professions Tracking Service at the University of Nebraska Medical Center. Sue Nardie edited the manuscript, and the authors are grateful to both of them.

Referance :

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