Area Deprivation, Rurality, and Sepsis Mortality: What's the Relationship?

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Abstract

External factors that put individuals at risk for contracting sepsis have only recently become a topic of study and further research on this topic is vital in the prevention of sepsis mortality. In this paper I analyze the relationships between area deprivation and sepsis mortality, rurality and sepsis mortality, and the relationship between area deprivation, rurality, and sepsis mortality with rurality as the moderating variable. I used data from the CDC Compressed Mortality File, 2013 Area Deprivation Index, and the 2013 Rural Urban Continuum Codes to perform simple and multiple linear regression analyses of the topic. High levels of area deprivation are a statistically significant predictor for high levels of sepsis mortality in Louisiana's parishes. Though rurality did not ultimately show a significant impact on sepsis mortality rates, certain disadvantages faced by those in rural areas should be considered in future sepsis research.

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Introduction

Septicemia (sepsis) is the "syndrome of body-wide systemic inflammation triggered by severe microbial infection"[1]. According to the CDC sepsis occurs when an infection that exists elsewhere in one's body, for example the skin, lungs, urinary tract, etc., triggers a chain reaction that spreads throughout the body[2]. Sepsis is considered a public health crisis as each year 1.7 million Americans develop sepsis and each year close to 270,000 Americans die as a result of sepsis[3]. Once identified, sepsis is treated rapidly with the administration of antibiotics, maintaining of blood flow to organs, and treatment of the source of infection[4]. In recent years researchers have begun to study the external factors that may put individuals at risk for contracting sepsis. Leading researchers in the field have identified a grouping of states in the southeastern United States as the "Sepsis Belt" , as well as county clusters in these states with disproportionately high sepsis mortality rates[5]. Researchers point to community characteristics, socioeconomic status, and diet as factors in these areas that may increase one's risk of contracting sepsis. In this paper I analyze the level of rurality in in counties within the "Sepsis Belt" as another potential factor in the contraction of sepsis. This focus on rurality is based on previous research identifying health disparities among rural populations. This research analyzes

[1] Gutierrez, et al, "Diet Patterns and Risk of Sepsis in Community Dwelling Adults: A Cohort Study", *BMC Infectious Diseases* 15, no. 231 (June 2015):Web.
[2] "What is Sepsis?" Sepsis, Centers for Disease Control and Prevention, Last modified July 20, 2018, https://www.cdc.gov/sepsis/what-is-sepsis.html
[3] "Data and Reports", Sepsis, Centers for Disease Control and Prevention, Last modified September 19, 2018, https://www.cdc.gov/sepsis/datareports/index.html
[4] "How is Sepsis Diagnosed and Treated?", Sepsis,Centers for Disease Control and Prevention, last modified August 28, 2018, https://www.cdc.gov/sepsis/diagnosis/index.html
[5] Moore et al. "Defining Sepsis Mortality Clusters in the United States", *Critical Care Medicine* 44, no.7 (July 2016): 1380-1387.

the relationship between area deprivation, rurality, and sepsis mortality in Louisiana, one of the states in the sepsis belt identified by Moore et. al[6].

Review of existing literature

Sepsis and SES

Research on the environmental factors of sepsis mortality is fairly new. Until a few years ago, physicians treated septicemia as an acute onset infection in hospital emergency rooms and not a condition that could be influenced by environmental factors[7]. Though the research is new, there have been many informative studies on the subject conducted in recent years. Malika et. al note the significant relationship between higher levels of neighborhood poverty and higher incidence of blood infections[8]. Another study pointed out that the communities with higher sepsis rates tend to have lower median household income, lower value of housing units, and lower proportion of population that had completed college[9]. These findings point to a relationship between socioeconomic status and contraction of septicemia.

In the process of identifying these social causes, researchers have identified regions in the southern United States where age-adjusted sepsis mortality rates are significantly higher than other regions in the U.S. These are known as the "sepsis belt", comprised of Alabama, Arkansas, Georgia, Louisiana, North Carolina, Mississippi, South Carolina, and Tennessee and "sepsis

[6] Moore et al. "Defining Sepsis Mortality Clusters in the United States", *Critical Care Medicine* 44, no.7 (July 2016): 1380-1387.

[7] Dr. Henry Wang, Phone Interview, October 2, 2018.

[8] Malika et al. "Relationship Between Neighborhood Poverty Rate and Bloodstream Infections in the Critically Ill", *Critical Care Medicine* 40, no. 5 (May 2012): 1427-1436.

[9] Moore et al., "Community Characteristics and Regional Variations in Sepsis", *International Journal of Epidemiology* 46, no. 5 (October 2017): 1607-1617.

county clusters" located in the Mississippi Valley, Middle Georgia, Central Appalachia[10]. Researchers have examined a variety of potential causes for this geographic disparity. Gutierrez et al found that a dietary pattern of eating most common in the south (and therefore deemed a "southern diet") contributed to higher incidence of sepsis even when controlling for other known risk factors[11]. And as previously mentioned, multiple researchers have explored the impacts of low socioeconomic status, neighborhood poverty, and community characteristics on sepsis mortality rates. I argue that the rurality of these areas should be considered as a potential cause for increased sepsis mortality rates in the areas.

Sepsis and Rural Health

Public health initiatives were developed to deal with issues of urban public health in the 1700's and it was not until the mid-1900's that there were initiatives to promote public health among rural populations[12]. Health initiatives over the past two decades have been concerned with how living in rural areas influences health outcomes. A study published in the *American Journal of Public Health* found that although health outcomes in very urban and very rural areas were worse than health outcomes in suburban areas, very rural areas often fared worse than both urban and suburban areas in a variety of categories[13]. Eberhardt and Pamuk attribute this to SES characteristics, health risk factors, and health care access in rural areas[14]. Another study published in the Journal of Rural Health concluded that rural residents must travel farther

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[10] Moore et al. "Defining Sepsis Mortality Clusters in the United States", *Critical Care Medicine* 44, no.7 (July 2016): 1380-1387.
[11] Gutierrez, et al, "Diet Patterns and Risk of Sepsis in Community Dwelling Adults: A Cohort Study", *BMC Infectious Diseases* 15, no. 231 (June 2015):Web.
[12] Meit, Michael and Alana Knudson, "Why is Rural Public Health Important? A Look to the Future", *Journal of Public Health Management and Practice* 15, no. 3 (May-June 2009):185-190.
[13] Eberhardt, Mark and Elsie Pamuk, "The Importance of Place of Residence: Examining Health in Rural and Non-Rural Areas", American Journal of Public Health 94, no. 10 (October 2004): 1682-6.
[14] Eberhardt, Mark and Elsie Pamuk, "The Importance of Place of Residence: Examining Health in Rural and Non-Rural Areas", *American Journal of Public Health* 94, no. 10 (October 2004): 1682-6.

distances and for longer times to receive health care compared to their urban counterparts[15]. Rural residents have "fewer overall visits" to healthcare professionals and when they do go are more likely to see general practitioners than specialists[16]. Extended travel time and fewer overall visits may matter a great deal in sepsis cases as sepsis often results from conditions and infections in other parts of the body[17]; even urinary tract infections and influenza can result in sepsis if they go untreated[18].

Researchers have observed that there is a relationship between community characteristics and sepsis mortality but have not explored how this relationship interacts with the rurality of a region. The sepsis belt and cluster areas are considered to be majority "rural" areas. I believe that the rurality of these regions as a significant factor in their high sepsis mortality rates should be examined. Additionally, the updated Area Deprivation Index, which incorporates a wider variety of community characteristics and socioeconomic factors has not been used in analysis concerning sepsis mortality rates in the sepsis belt.

This research seeks to answer three questions. The first: How does level of rurality impact sepsis mortality rates? Secondly: How does the area deprivation level impact sepsis mortality rates? And third: How is the magnitude of the relationship between area deprivation and sepsis mortality at the county level moderated by rurality at the county level? Based on the previous research in areas pertaining to these subjects I propose two hypotheses:

H1: Areas with higher levels of rurality will have higher rates of sepsis mortality and areas with higher levels of area deprivation will have higher rates of sepsis mortality.

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[15] Chan, Leighton, Gary Hart, and David Goodman, "Geographic Access to Healthcare for Rural Medicare Beneficiaries", *The Journal of Rural Health* 22, no. 2 (Spring 2006): 140-146.
[16] Chan, Leighton, Gary Hart, and David Goodman, "Geographic Access to Healthcare for Rural Medicare Beneficiaries", *The Journal of Rural Health* 22, no. 2 (Spring 2006): 140-146.
[17] "Sepsis And…", Sepsis Alliance, accessed November 19, 2018, https://www.sepsis.org/sepsis-and/
[18] "Sepsis And Prevention", Sepsis Alliance, accessed November 19, 2018, https://www.sepsis.org/sepsis-and/prevention/

H2: Rurality of a region will have a moderating effect on the relationship between area deprivation and sepsis mortality that increases the magnitude of the relationship.

Data and Measurement

For this research I used data from the 2013 Area Deprivation Index, the U.S. Department of Agriculture's 2013 Rural Urban Continuum Codes, and the 1999-2016 CDC Compressed Mortality File using ICD-10 codes. These data sets included data on all 50 United States but for the purpose of this research I used data only from the state of Louisiana. Louisiana is one of the states identified as part of the "Sepsis Belt". As this research is focused on sepsis mortality and rurality, I wanted to find a state with balanced levels of rural and urban counties. According to the Federal Office of Rural Health policy, 29 of Louisiana's 64 parishes are considered non-metro/rural[19]. A near perfect split down the middle, Louisiana appeared to be representative of both rural and metropolitan populations.

Sepsis Mortality

I obtained the CDC Compressed Mortality data from the CDC Wonder database. For this research I used only deaths that were attributed directly to septicemia from 1999 to 2016. These fall under A-40 and A-41 of the ICD-10 codes. The mortality rates were categorized by parishes (how counties are referred to in LA), resulting in 64 county level mortality rates. Only data from Cameron County, LA was considered unreliable, leaving 63 mortality rates in total. The rates were age adjusted to be generalizable to the population. In SPSS I coded the age adjusted mortality rate as "rate_adj".

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[19] "List of Rural Counties And Designated Eligible Census Tracts in Metropolitan Counties", Health Resources and Service Administration, last modified December 31, 2016, https://www.hrsa.gov/sites/default/files/ruralhealth/resources/forhpeligibleareas.pdf

Area Deprivation Index

The Area Deprivation Index has been recently updated by researchers and includes more variables than simply community characteristics or poverty[20]. According to the HIP Change website, it measures levels of incomes, type of employment, unemployment, percentage of people living below the poverty line, values of homes and properties, and homes lacking basic necessities[21]. Dr. Amy Kind and her team of researchers at the University of Wisconsin designed the most recent ADI from 2013 to measure down to the census block level. Though information at the census block level is extremely beneficial in targeting disparities among groups in specific areas of interest, for the purpose of this research and because of the structure of my other datasets, I had to adjust the ADI to be measured only at the county level. The ADI contains both national and state level rankings of area deprivation. For this research I used the state level rankings, as the sepsis mortality rates and rurality index were also at the state level. Each piece of census tract data contained a code that indicated what parish that census tract belonged to. The census tract data was separated by parish and the ADIs for each census tract in that parish were combined to create a mean ADI for each parish. These values were coded as "adicountymean".

Rurality

To measure the rurality of a region I used the Rural-Urban Continuum codes available from the U.S. Department of Agriculture's website. Counties are rated on rurality on a scale from 1-9. The level of rurality is based on population of the county, degree of urbanization, and adjacency to an urban area. Numbers 1-3 are considered to be metro areas. 4-9 are "non-metro" areas, becoming increasingly rural as the number increases. The Rural Urban Continuum codes

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[20]"About the 2013 Area Deprivation Index", Department of Medicine, University of Wisconsin, accessed October 30, 2018, levelshttps://www.neighborhoodatlas.medicine.wisc.edu/

[21] "Area Deprivation Index Datasets", Health Innovation Program, accessed October 30, 2018, https://www.hipxchange.org/ADI

were coded as “rucc”. I treated rurality of a region as the moderating variable between area deprivation and sepsis mortality rates.

Measurement

I used the program IBM SPSS to run frequencies and regression analyses on the variables. I ran frequencies for all three variables (adicountymean, rate_adj, and rucc). Next I ran a regression analysis with “rucc” as the x-value and “rate_adj” as the y-value to determine the relationship between rurality and sepsis mortality. After that I ran a regression analysis with “adicountymean” as the x-value and “rate_adj” as the y-value to determine the relationship between area deprivation and sepsis mortality. To test rurality as a moderating variable for area deprivation and sepsis mortality, I ran a regression analysis that included both “adicountymean” and “rucc” as x-value variables and “rate_adj” as the y-value.

Results

Table 1. Linear Regression Results for Predictors of Sepsis Mortality Rates

	Model 1	p-value	Model 2	p-value	Model 3	p-value
Independent Variables						
Rurality	1.98	0.006			0.357	0.741
Area Deprivation			4.081	0.001	3.608	0.055
Constant	0		0.997		0.859	
R-squared	0.115		0.167		0.168	
N=63						

Source: CDC Compressed Mortality File, 2013 Rural Urban Continuum Codes, 2013 Area Deprivation Index

Table 1 shows the results from the linear regression analysis of Model 1, Model 2, and Model 3. Model 1 is the linear regression showing rurality's relationship with sepsis mortality rates where rurality is x and sepsis mortality is y. Model 2 is the linear regression for the relationship between area deprivation and sepsis mortality where area deprivation is x and sepsis mortality is y. Model 3 includes both rurality and area deprivation in a multiple linear regression analysis of their relationship with sepsis mortality. In Model 3, rurality and area deprivation are both x variables and sepsis mortality is the y variable.

Model 1 has a coefficient of 1.98; for every one unit a county moved up on the Rural Urban Continuum Codes, sepsis mortality per 100,000 increased by 1.98. The r-squared value for Model 1 is 11.5%, meaning that in Model 1 rurality explains 11.5% of the variability of sepsis mortality around the mean. The p-value of 0.006 indicates that the results for Model 1 are significant at the $p<0.01$ level.

Model 2 has a coefficient of 4.081 which signifies that for every one unit that a county moved up on the Area Deprivation Index, sepsis mortality per 100,00 increased by 4.081. The r-squared value for Model 2 is 16.7% meaning that in Model 2 area deprivation accounts for 16.7% of the variability of sepsis mortality around the mean. The p-value is 0.001, indicating that the results for Model 2 are significant at the $p<0.01$ level.

In Model 3, when rurality is added to the relationship between area deprivation and sepsis mortality, rurality has a coefficient of only 0.357. This means that for every one unit a county moved up on the Rural Urban Continuum Codes, sepsis mortality per 100,000 increased by only 0.357. The p-value for rurality in Model 3 is $p=0.74$, signifying that the relationship between rurality and sepsis mortality is no longer significant. The coefficient for area deprivation is 3.608; for every one unit increase in the Area Deprivation Index, sepsis mortality per 100,000 increased by 3.608. The p-value for the relationship between area deprivation and sepsis mortality remains just barely significant at p=0.055.

The results of the regression analyses for the relationship between rurality, area deprivation, and sepsis mortality largely do not support my hypotheses. The results from Model 1 and Model 2 are statistically significant and support my first hypothesis. However, Model 3 shows that area deprivation explains away any influence that rurality appeared to have on sepsis mortality in Model 1. In Model 1, rurality accounted for 11.5% of the variability of sepsis mortality around the mean and was significant at the p<0.01 level, but in Model 3 rurality loses all significance. In Model 2, area deprivation accounts for 16.7% of the variability of sepsis mortality around the mean with a significant p-value of p<0.01. In Model 3, area deprivation just barely maintains its significance with a p-value of p=0.055. Therefore, I have enough evidence to accept the hypothesis that parishes in Louisiana with higher levels of area deprivation have higher levels of sepsis mortality. I do not have enough statistically significant evidence to accept the hypothesis that parishes with higher levels of rurality have higher levels of sepsis mortality. I also do not have enough statistically significant evidence to accept the hypothesis that rurality has a moderating effect on the relationship between area deprivation and sepsis mortality.

Discussion

Though the results from this study are not statistically significant, sepsis continues to be a major public health crisis that is disproportionately impacting citizens in the states of Alabama, Arkansas, Georgia, Louisiana, North Carolina, Mississippi, South Carolina, and Tennessee. Previous researchers have established a significant connection between aspects of lower socioeconomic status and elevated risk for sepsis mortality. Rural health also continues to be a major issue in the United States as doctors, especially those who are highly specialized, are less likely to settle in rural areas than urban or suburban areas[22]. In this research I attempted to measure rurality and area deprivation as two different variables contributing to sepsis mortality rates but I believe there was an overlap in the concepts of rurality and area deprivation. The 2013 Area Deprivation Index measures incomes, employment, unemployment, percentage of people living below the poverty line, values of homes and properties, and homes lacking basic necessities. The factors measured by the ADI are likely to be the very factors that are contributing to worsened health outcomes for those residing in rural areas. For example, some major aspects of rurality that contribute to poor health outcomes are: fewer health resources, lower levels of education, and barriers to transportation[23]. These are directly related to what is measured by the Area Deprivation Index. This being said, there is likely a relationship between rurality and sepsis mortality but it is best explained by the lack of material, economic, social, and health related resources available to those in rural areas.

Based on previous research about socioeconomic status and sepsis mortality as well as research on determinants of health in rural communities; more research should be done to determine the specific barriers to care in rural communities that lead to infections and complications that involve the contraction of sepsis.

Limitations of research

As a single student researching this topic, there were multiple limitations to my research. Time and resources were limited and I was not able to examine the statistics for all of the states in the Sepsis Belt. Because of this, I chose only one state. I was only able to use data from 63 of

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[22] Rosenblatt, Roger and Gary Hart, "Physicians and Rural America", *Western Journal of Medicine* 173, no. 5 (November 2000): 348-351

[23] "Social Determinants of Health for Rural People", Rural Health Information, last reviewed September 1, 2017, https://www.ruralhealthinfo.org/topics/social-determinants-of-health#rural-difference

Louisiana's 64 parishes. 63 is a small sample size and it is possible that with data from more states in the Sepsis Belt a significant relationship between rural counties and higher sepsis mortality rates would begin to appear. In future research it would be beneficial to collect and analyze data from all of the states in the sepsis belt. I used only two predictor variables in my research, which ultimately overlapped in their measure of concepts. In future research, a variety of measurements for both rurality and socioeconomic status should be used to gain a more complex understanding between the two and their relationship with sepsis mortality.

A Note on Qualitative Research

Pope and Mays[24] assert that in areas of health research that have previously received little attention, qualitative research serves as a prerequisite to good quantitative research. Researchers have primarily used quantitative data to find statistically significant values for predictor variables in sepsis mortality. Because sepsis can develop from a variety of infections and can be acquired inside or outside of the hospital, I believe that a qualitative research approach to sepsis would be beneficial in studying the nuances in sepsis contraction in different geographical locations and among different groups. Though it has been established that socioeconomic status and diet play a role in risk for sepsis mortality, there are factors such as health care seeking behavior, quality of services offered by closest medical center, personal differences in lifestyle, commuting time to

[24] Pope, Catherine and Nick Mays, "Qualitative Research: Reaching the parts other methods cannot reach: an introduction to qualitative methods in health and health services research", *The British Journal of Medicine* 311, no.42: Web.

nearest hospital, etc. that may contribute to the contraction or development of sepsis in individuals. There very well may be different causes for high sepsis mortality rates in different geographic locations. Taking all of this into consideration, I believe that qualitative research is necessary in finding the different causes and creating preventative tactics for increased sepsis mortality rates in the Sepsis Belt.

Appendices

Frequencies

mean ADI score for the county--IV

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3.06	1	1.6	1.6	1.6
	3.29	1	1.6	1.6	3.2
	3.92	1	1.6	1.6	4.8
	3.95	1	1.6	1.6	6.3
	3.97	1	1.6	1.6	7.9
	4.11	1	1.6	1.6	9.5
	4.29	1	1.6	1.6	11.1
	4.32	1	1.6	1.6	12.7
	4.81	1	1.6	1.6	14.3
	4.85	1	1.6	1.6	15.9

4.92	1	1.6	1.6	17.5
4.97	1	1.6	1.6	19.0
5.03	1	1.6	1.6	20.6
5.25	1	1.6	1.6	22.2
5.28	1	1.6	1.6	23.8
5.30	1	1.6	1.6	25.4
5.38	1	1.6	1.6	27.0
5.42	1	1.6	1.6	28.6
5.52	1	1.6	1.6	30.2
5.64	1	1.6	1.6	31.7
5.66	1	1.6	1.6	33.3
5.83	1	1.6	1.6	34.9
5.94	1	1.6	1.6	36.5
5.96	1	1.6	1.6	38.1
6.03	1	1.6	1.6	39.7
6.09	1	1.6	1.6	41.3
6.21	1	1.6	1.6	42.9
6.25	1	1.6	1.6	44.4
6.30	1	1.6	1.6	46.0
6.35	1	1.6	1.6	47.6
6.45	1	1.6	1.6	49.2
6.46	1	1.6	1.6	50.8
6.58	1	1.6	1.6	52.4
6.83	1	1.6	1.6	54.0
6.87	1	1.6	1.6	55.6
6.91	1	1.6	1.6	57.1
6.92	1	1.6	1.6	58.7
6.98	1	1.6	1.6	60.3
7.00	1	1.6	1.6	61.9
7.05	1	1.6	1.6	63.5
7.07	1	1.6	1.6	65.1
7.09	1	1.6	1.6	66.7
7.14	1	1.6	1.6	68.3
7.25	1	1.6	1.6	69.8
7.26	1	1.6	1.6	71.4
7.33	2	3.2	3.2	74.6
7.38	1	1.6	1.6	76.2
7.38	1	1.6	1.6	77.8

	7.50	1	1.6	1.6	79.4
	7.56	1	1.6	1.6	81.0
	7.61	1	1.6	1.6	82.5
	7.67	1	1.6	1.6	84.1
	7.80	1	1.6	1.6	85.7
	7.81	1	1.6	1.6	87.3
	7.82	1	1.6	1.6	88.9
	7.82	1	1.6	1.6	90.5
	8.31	2	3.2	3.2	93.7
	8.38	1	1.6	1.6	95.2
	8.60	1	1.6	1.6	96.8
	8.67	1	1.6	1.6	98.4
	8.88	1	1.6	1.6	100.0
	Total	63	100.0	100.0	

age adjusted mortality rate--DV

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	12.7	1	1.6	1.6	1.6
	13.1	2	3.2	3.2	4.8
	13.7	1	1.6	1.6	6.3
	13.8	1	1.6	1.6	7.9
	14.2	1	1.6	1.6	9.5
	14.4	1	1.6	1.6	11.1
	14.8	1	1.6	1.6	12.7
	14.9	1	1.6	1.6	14.3
	15.1	1	1.6	1.6	15.9
	15.6	1	1.6	1.6	17.5
	15.9	1	1.6	1.6	19.0
	16	2	3.2	3.2	22.2
	16.1	2	3.2	3.2	25.4
	16.2	1	1.6	1.6	27.0
	16.8	1	1.6	1.6	28.6

	17	1	1.6	1.6	30.2
	17.5	1	1.6	1.6	31.7
	18.1	1	1.6	1.6	33.3
	18.3	1	1.6	1.6	34.9
	18.6	1	1.6	1.6	36.5
	18.7	1	1.6	1.6	38.1
	19.1	1	1.6	1.6	39.7
	19.2	1	1.6	1.6	41.3
	19.5	3	4.8	4.8	46.0
	19.7	1	1.6	1.6	47.6
	19.9	1	1.6	1.6	49.2
	20.1	1	1.6	1.6	50.8
	20.3	1	1.6	1.6	52.4
	20.4	1	1.6	1.6	54.0
	20.9	2	3.2	3.2	57.1
	21	1	1.6	1.6	58.7
	21.1	1	1.6	1.6	60.3
	21.2	1	1.6	1.6	61.9
	21.4	3	4.8	4.8	66.7
	21.5	4	6.3	6.3	73.0
	21.8	1	1.6	1.6	74.6
	23.2	1	1.6	1.6	76.2
	23.3	2	3.2	3.2	79.4
	23.5	1	1.6	1.6	81.0
	24	1	1.6	1.6	82.5
	24.7	1	1.6	1.6	84.1
	24.8	1	1.6	1.6	85.7
	26	2	3.2	3.2	88.9
	26.4	1	1.6	1.6	90.5
	27.8	1	1.6	1.6	92.1
	29.5	1	1.6	1.6	93.7
	30	1	1.6	1.6	95.2
	32.3	1	1.6	1.6	96.8
	33.4	1	1.6	1.6	98.4
	33.8	1	1.6	1.6	100.0
	Total	63	100.0	100.0	

rural-urban continuum code of 2013--CV

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	8	12.7	12.7	12.7
	2	18	28.6	28.6	41.3
	3	8	12.7	12.7	54.0
	4	3	4.8	4.8	58.7
	5	1	1.6	1.6	60.3
	6	16	25.4	25.4	85.7
	7	4	6.3	6.3	92.1
	8	2	3.2	3.2	95.2
	9	3	4.8	4.8	100.0
	Total	63	100.0	100.0	

Regression Analysis

Model 1

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	rural-urban continuum code of 2013--CV[b]	.	Enter

a. Dependent Variable: age adjusted mortality rate--DV

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.340[a]	.115	.101	13.297

a. Predictors: (Constant), rural-urban continuum code of 2013--CV

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1408.178	1	1408.178	7.964	.006[b]
	Residual	10785.568	61	176.813		
	Total	12193.746	62			

a. Dependent Variable: age adjusted mortality rate--DV

b. Predictors: (Constant), rural-urban continuum code of 2013--CV

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	18.025	3.266		5.520	.000
	rural-urban continuum code of 2013--CV	1.978	.701	.340	2.822	.006

a. Dependent Variable: age adjusted mortality rate--DV

Model 2

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	mean ADI score for the county--IV[b]	.	Enter

a. Dependent Variable: age adjusted mortality rate--DV

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.408[a]	.167	.153	12.905

a. Predictors: (Constant), mean ADI score for the county--IV

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2034.192	1	2034.192	12.214	.001[b]
	Residual	10159.554	61	166.550		
	Total	12193.746	62			

a. Dependent Variable: age adjusted mortality rate--DV

b. Predictors: (Constant), mean ADI score for the county--IV

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.032	7.589		.004	.997
	mean ADI score for the county--IV	4.081	1.168	.408	3.495	.001

a. Dependent Variable: age adjusted mortality rate--DV

Model 3

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	rural-urban continuum code of 2013--CV, mean ADI score for the county--IV[b]	.	Enter

a. Dependent Variable: age adjusted mortality rate--DV

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.410[a]	.168	.141	13.001

a. Predictors: (Constant), rural-urban continuum code of 2013--CV, mean ADI score for the county--IV

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2052.825	2	1026.412	6.073	.004[b]
	Residual	10140.921	60	169.015		
	Total	12193.746	62			

a. Dependent Variable: age adjusted mortality rate--DV

b. Predictors: (Constant), rural-urban continuum code of 2013--CV, mean ADI score for the county--IV

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.605	8.994		.178	.859
	mean ADI score for the county--IV	3.608	1.847	.361	1.953	.055
	rural-urban continuum code of 2013--CV	.357	1.076	.061	.332	.741

a. Dependent Variable: age adjusted mortality rate--DV