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DESCRIBING THE RELATIONSHIP BETWEEN COUNTY-LEVEL
RATES OF NURSING PERSONNEL AND RATE OF
INPATIENT DAYS IN DIFFERENT
COMMUNITY CONTEXTS

by

LYDIA SEAGRAVES

Presented to the Faculty of the Honors College of
The University of Texas at Arlington in Partial Fulfillment
of the Requirements
for the Degree of

HONORS BACHELOR OF SCIENCE IN NURSING

THE UNIVERSITY OF TEXAS AT ARLINGTON

May 2021

ACKNOWLEDGMENTS

This research project would not have been made possible without the exceptional support and mentorship of Dr. Jessica Smith. I would also like to thank Dean Elizabeth Merwin and peers Linda Nguyen and Allison Bui for their feedback as I wrote the proposal. I would also like to recognize Dr. Maxine Adebola for continue support throughout the process of the project.

I would like to thank the professors I worked with on Honors projects in previous semesters that led me up to my final project: Dr. Mark Cichock, Dr. Timothy Henry, Professor Phyllis Pastwa, Dr. Sergio Espinosa, Professor Laura Hixon, Dr. Maxine Adebola, Dr. Mary Beth Reid, and Dr. Debra Hurd.

April 21, 2021

ABSTRACT

DESCRIBING THE RELATIONSHIP BETWEEN COUNTY-LEVEL RATES OF NURSING PERSONNEL AND RATE OF INPATIENT DAYS IN DIFFERENT COMMUNITY CONTEXTS

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The University of Texas at Arlington, 2021

Faculty Mentor: Jessica Smith

Rural communities are challenged due to fewer healthcare resources compared to urban communities. There are limited studies addressing how the availability of nurses may influence inpatient days depending on the community context. The purpose of this study was to determine the relationship of county-level nursing personnel and inpatient days in rural and urban counties. This was a cross-sectional study using secondary data about 45 Texas counties from the Area Health Resources File. In rural and urban counties there was a strong positive correlation between inpatient days and Registered Nurses. In urban counties there was a strong positive correlation between Advanced Practice Nurses and inpatient days but not in rural counties. This suggests that having an adequate number of Registered Nurses is an important factor in being able to provide inpatient care. More

information on Texas counties would be helpful to understand the acute healthcare needs of residents across Texas.

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CHAPTER 1

INTRODUCTION

1.1 Statement of Problem and Research Question

Rural communities face multiple health challenges, including decreased acute healthcare access, poorer socioeconomic status, fewer healthcare professionals, and fewer health resources compared to urban areas (*Health Disparities Affect Millions in Rural U.S. Communities*, 2017). Community availability of hospital and advanced practice nurses may influence the use of inpatient days in the hospital in relation to the population. It is important that communities, regardless of rural or urban classification, have enough nurses to provide acute care in the hospital setting for the number of residents in those communities to ensure equitable acute care access. The community context may influence the relationship between the rate of hospital personnel and advanced practice nurses and the rate of inpatient days, an indicator of hospital utilization, and therefore, acute care needs of patients in a geographic area. Therefore, the research question was: Is there a relationship between county-level rates of nursing personnel and rate of inpatient days, and how do rural-urban community contexts affect the relationship?

1.1.1 Significance of Research

Over 3 million people live in a rural Texas county while 25 million Texas residents live in urban areas (Rural Health Information Hub, n.d.). Researchers at Texas A&M found that at least 83% of Texas' land is rural, including ranch, farm, and forest land (Vanetta & Satija, 2014). Because rural areas make up a large part of Texas, it is important to recognize

accessibility barriers, such as transportation or fewer healthcare personnel, for rural populations. About 347,000 Texans live at least 30 minutes away from a hospital (Koeze et al., 2020). The distance and lack of transportation for rural residents to urban healthcare facilities impacts their ability for best health outcomes, especially in time-sensitive emergencies like strokes or heart attacks. Therefore, it is important for rural hospitals to remain utilized and open to care for residents, even if the population in a rural community is smaller than in an urban community. Although healthcare mortality rates have decreased in both urban and rural areas in the United States, the mortality rate of rural areas are consistently greater than urban areas (Hoffman & Holmes, 2017).

Due to a lack of healthcare professionals in rural communities, fewer nurses are available and may not be able to meet healthcare demands. When hospitals cannot open enough beds to care for patients, this could lead to a decrease in healthcare utilization, which leads to fewer job opportunities and healthcare access for communities. The number of acute nurse hospital staff and advanced practice nurses available for a community is important for assuring care access for residents of all communities, including rural communities. There have been 26 hospital closures since 2010, which is a threat to keeping nurses working in rural Texas communities (*Rural Hospital Closures*| TORCH, n.d.) If there are no positions for acute care nurses in rural communities, nurses will move or retire as retraining at their career stage may not be desirable to the nurse that loses their job in a mass layoff at a rural hospital. It is unclear if there is an adequate number of nurses to care for rural populations. In this study, the rate of nurses was scaled to the population rate which could provide evidence of acute care needs in relation to the population.

Having an adequate ratio of nurses to residents, a modifiable community health resource that could be bolstered by keeping hospitals open in small rural communities with no other acute care access, may serve a role in decreasing rural-urban acute healthcare access disparities. By comparing the rate of inpatient days in rural and urban Texas counties, the differences in community contexts can be compared to show ways of offering better care to patients in both urban and rural settings.

CHAPTER 2

LITERATURE REVIEW

2.1 Summary of Relevant Peer-Reviewed Scholarship

The need for adequate access to health services is mentioned in Healthy People 2030 as a social determinant of health (United States Department of Health and Human Services, Office of Disease Prevention and Health Promotion, n.d.). The National Academies of Sciences, Engineering, and Medicine defined access to healthcare as, “timely use of personal health services to achieve the best possible health outcomes.” (Millman, 1993, p. 4).

Lack of access to healthcare in rural settings in the United States (U.S.) has been a longstanding problem. Bolin et al. (2015) noted that rural acute healthcare access remains a top rural health priority, which is unchanged since the last decade. Lacking timely acute care for rural residents could result in poor outcomes, including death. Rural hospitals can deliver acute care or stabilize and transfer residents to more advanced care. However, rural hospital closures are on the rise (Kaufman, 2016).

In Texas, 26 rural hospitals have closed, either temporarily or permanently, since 2010 (Texas Organization of Rural & Community Hospitals [TORCH], 2019; TORCH, n.d.). Since 2010, rural hospital closures have occurred in 20 unique rural Texas counties, including Bastrop, Cass, Colorado, Franklin, Frio, Hardeman, Hill, Houston, Hunt, Jones, Kaufman, Milam, Montague, Red River, Shelby, Trinity, Upshur, Van Zandt, Wharton, and Wise (TORCH, 2019; TORCH, n.d.). Three of the 26 hospital closures across Texas

occurred in 2019 (TORCH, 2019). Rural hospital closures are a problem, because rural communities have populations with an older average age than urban communities, with rural residents having acute healthcare needs that may go unaddressed without close access to rural acute care.

Hospital closures can also lead nurses working in those hospitals to move to work elsewhere or retire, leaving residents in those communities without adequate resources for acute healthcare. There has been little research about the rate of nursing personnel in rural counties in relation to the population according to the census in rural counties in Texas following the closure of rural hospitals in the past decade. There has also been little rural-urban comparative research about how the rate of nurses may be associated with inpatient days, a measure of hospital utilization. Therefore, the purpose was to determine the relationship of county-level nursing personnel and inpatient days depending on rural or urban county classification using data from 2019 and 2018 to describe the current state of rural population acute care and nursing personnel, and their relationship in different community contexts.

Because urban counties have a greater population to serve, there are more specialized doctors, nurses, and other healthcare team members that work together and help take care of patients. Nurses in rural counties are likely to take on responsibilities that nurses working in urban counties could rely on other healthcare workers in the hospital to manage because fewer nurses are prepared at the advanced level. Fewer nurses can impact the quality of care the patient receives and potentially increase their length of stay. Longer patient stays in the hospital increase the risk of hospital acquired infections (HAIs) such as pneumonia, *Clostridium difficile*, urinary tract infections, or sepsis. These HAIs can be

deadly and could contribute to the greater mortality rate in rural areas compared to urban. HAIs also cost the hospital money because insurance will not cover a preventable infection. HAIs contribute to the rural hospital closures when hospitals cannot afford preventable expenses (Jia et al., 2019).

Nurse staffing is an important factor for healthcare access as well as quality of care. Previous studies focus on associations between nurse staffing and patient mortality, or nurse staffing and inpatient complications. Researchers found that risks of death were increased (Griffiths et al., 2020; Kosar et al., 2020) and rates of inpatient complications were increased (He et al., 2016; Schreuders et al., 2015) when staffing levels were low. Some studies suggest that there needs to be a balance in nursing skill mix to improve mortality rates and inpatient complications (Griffiths et al., 2020; Staggs, 2015). There are limited studies that examine the relationship between the rate of nursing personnel and inpatient days and how the rural-urban community context may affect this relationship.

One study focused on the nursing skill mix in California, Nevada, and Maryland and compared it to inpatient days and adverse events. The study showed a decrease in number of inpatient days and a decrease in number of adverse events with more Registered Nurses. The study concluded that hiring more Registered Nurses than unlicensed personnel proved better patient outcomes without raising the cost of care (Martsolf et al., 2014).

The focus of previous studies concludes that budget cuts should not be made to nursing staff as hospitals will have to pay more for longer stays, readmissions, or adverse events. A study suggests that the role of nurses on healthcare teams is likely misunderstood by management and non-nursing professionals. Therefore, unlicensed personnel, like

certified nursing assistants, are substituted to take on management's understanding of what a nurse does (Needleman, 2017).

Healthcare access and utilization is a focus for improving outcomes for rural residents of Texas. However, once healthcare access is established in rural communities, the focus should be on the quality of care.

CHAPTER 3

METHODOLOGY

3.1 Conceptual Framework

The Donabedian model was used to describe possible relationships between variables in this study. The Donabedian model proposes relationships between structures, processes, and outcomes, and is used to help target causes of healthcare disparities (Donabedian, 1966). Structures included professional nursing personnel and hospital resources, which are further described in the variables section. Outcomes included inpatient days. Processes, although influential to outcomes along with structures, were not part of this study.

3.2 Design and Population

The design was retrospective, cross-sectional, comparative, correlational, and used secondary data. The target population of this study included Texas counties. The unit of analysis was the county. County level information was used to represent the community. The number of nursing personnel included Nurse Assistive Personnel (NAP), Licensed Vocational Nurses (LVNs), Registered Nurses (RNs), and Advanced Practice Registered Nurses (APRNs) and were used to describe Texas counties.

3.2.1 Data and Human Subjects Protection

Secondary, county-level data were used from the Area Health Resource File (AHRF). The AHRF is published by the United States Health Resources and Services Administration (HRSA). The AHRF is updated annually and was last updated in July 2019.

In this study, data from 2018 and 2019 were used to describe the relationship between the rate of inpatient days and the rate of nursing personnel. The HRSA publishes data to improve health resources and outcomes for vulnerable communities and people. The AHRF has data from the American Hospital Association, the American Medical Association, the US Census Bureau, the Centers for Medicare & Medicaid Services, Bureau of Labor Statistics, InterStudy, and the Veteran's Administration. The data set includes over 6,000 variables that are related to healthcare at county levels (*Area Health Resource File | Healthy People 2020*, n.d.). The AHRF is a county-level data set. Therefore, there was no individual information included because data were aggregated at the county level.

3.2.2 Variables

Table 1 displays how study concepts were operationalized as variables from the AHRF for analysis. Hospital resources such as hospital beds, preventable hospital stays rate, number of hospitals with social work services, total hospital personnel, and number of hospitals with respiratory services were used to describe people, technology, and services available for use by healthcare professionals to improve patient outcomes. Median household incomes, unemployment and employment rates, persons with insurance, and levels of education were also used to describe Texas counties.

Table 3.1: Major Concepts, Study Concepts, and Variables

Outcome Variable	Study Concept	Variables
Inpatient Days	Utilization of inpatient care	Number of Inpatient days in ST Non Gen Hospital in county/10,000 census
Structural Variables	Study Concept	Variables
Professional Nursing Personnel	Level of nursing licensure and advanced practice registered nurses	Registered Nurses-FT, Licensed Vocational Nurses-FT, Nursing Assistive Personnel-FT, Advanced Practice Registered Nurses (APRN), Nurse Practitioners, Clinical Nurse Specialists, Certified Registered Nurse Anesthetist, Advance Practice Nurse Midwives, Certified Nurse Midwives
Population	Describing Texas counties	Rural-Urban Continuum Code, population total Female, population total Male

3.2.3 Inclusion and Exclusion Criteria

Inclusion criteria were 45 counties in Texas with data available for comparison. The greatest number of counties possible were included for state representation and for the findings to be more generalizable. Exclusion criteria were 209 counties in Texas that did not have data available from the Area Health Resource File above zero.

3.2.4 Data Analysis

3.2.4.1 Variable Construction

County-level rates for full-time nursing personnel, including Registered Nurses (RNs), Licensed Vocational Nurses (LVNs), nursing assistive personnel (NAPs), and Advanced Practice Registered Nurses (APRNs), were calculated by dividing the number of each nursing personnel category over the population estimate from 2019 for each county.

The number of inpatient days (continuous outcome variable) for each county was used to calculate the rate of inpatient days for Texas counties.

The Rural-Urban Continuum Code (a categorical variable) was used to describe rural-urban community status for each county using 9 levels (3 of which are metropolitan and 6 of which are non-metropolitan). A “rural” dichotomous variable was generated where 1= rural and 0 = non rural for use in linear regression.

3.2.4.2 Data Management and Analysis

Data was imported into SAS software and examined for errors or missingness (for variables in this study). I learned to use SAS, a statistical analysis software, for data analysis with the help of my mentor. Key variables were generated in SAS and summarized. For each continuous variable, measures of central tendency (means) and rates were summarized and evaluated. Frequencies were generated for categorical variables. Graphical analysis was used with the descriptive data.

County-level rates of RNs, LVNs, NAPs, APRNs, and inpatient days were tabulated with the Rural-Urban Continuum Code categorical variable to describe variations across the rural-urban continuum.

Spearman’s correlation test was used to describe the relationship between the number of nursing personnel and the number of inpatient days in Texas counties. Spearman’s test was used to measure the association between the rates of nursing personnel and the rate of inpatient days in rural compared to urban counties. Due to non-normal distribution of dependent variables and the low number of counties included with non-zero values, it was determined that linear regression would not be the best method to determine associations between resources and inpatient days. Therefore, Spearman’s correlation was used to test for associations.

CHAPTER 4

RESULTS

There were no missing values for the key variables in our initial dataset of 254 Texas counties, however, there was a large percentage of zeroes for our key variables to be used in the final models. For example, there were 209 counties (82%) in the sample with a value of zero for inpatient days. To account for this and to perform meaningful analyses, we excluded counties with a value of zero for the following key variables: inpatient days, Registered Nurses (RNs), Licensed Vocational Nurses (LVNs), and Nursing Assistive Personnel (NAP). We did not account for Advanced Practice Registered Nurses (APRNs) in this exclusion because they do not work exclusively in the hospital and may not therefore be impactful in predicting inpatient days. After excluding these counties, there were 44 urban counties and 165 rural counties that fell out of the dataset. There were zeroes for all counties in the three most rural non-metropolitan categories (88 counties), leaving counties in three rural and three urban categories. The final analytic sample included 38 urban counties and seven rural counties.

Table 4.1 describes characteristics of Texas rural and urban counties. After excluding counties with zero for inpatient days, seven non-metropolitan counties and 38 metropolitan counties were included in the sample. About 84% of counties included in the sample are metropolitan and about 15% of counties are non-metropolitan. The table shows the total population number for males and females in three urban and three rural classifications. There are fewer people the more rural an area becomes. However, there

are more people in areas adjacent to a metropolitan area compared to other rural classifications.

Table 4.1: Characteristics of Rural and Urban Texas Counties

Rural-Urban Classification	Number (%) of Counties	Sum of males	Sum of females
Metropolitan counties			
Counties in metro areas of 1 million population or more	18 (40)	8,882,363	9,707,919
Counties in metro areas of 250,000 – 1,000,000 population	9 (20)	1,880,307	2,319,265
Counties in metro areas of fewer than 250,000 population	11 (24)	807,795	911,152
Non-metropolitan			
Urban population of 20,000 or more, adjacent to a metro area	3 (7)	330,561	320,296
Urban population of 20,000 or more, not adjacent to a metro area	2 (4)	171,035	177,113
Urban population of 2,500-19,999, adjacent to a metro area	2 (4)	683,498	652,051

Note. County-level Rural-Urban Continuum Code data in the Area Health Resources File were from the Department of Agriculture, Bureau of Health Professions. (2001) National Center for Health Workforce Information Analysis.

Table 4.2 describes hospital characteristics of rural and urban counties. The number of beds, the number of respiratory therapists, and the number of hospitals with social work services steadily decreases the more rural an area becomes. However, non-metropolitan communities of 2,500-19,999, adjacent to a metropolitan area have more hospital resources compared to other non-metropolitan categories. Counties with 1,000,000 population or more have the lowest mean rate of preventable hospital stays. The mean number of preventable hospital stays remains consistent from metropolitan to non-metropolitan areas.

Table 4.2: County-Level Rural and Urban Hospital Characteristics

Rural-Urban Classification	Number of Beds	Number of Respiratory Therapists	Number of Hospitals with Social Work Services	Mean Number of Preventable Hospital Stays
Metropolitan counties				
Counties in metro areas of 1 million population or more	49,090	3,625	115	4898.69
Counties in metro areas of 250,000 – 1,000,000 population	14,150	1,151	32	5134.80
Counties in metro areas of fewer than 250,000 population	7,350	469	25	5273.45
Non-metropolitan				
Urban population of 20,000 or more, adjacent to a metro area	1,875	148	11	5622.15
Urban population of 20,000 or more, not adjacent to a metro area	1,130	97	8	5159.83
Urban population of 2,500-19,999, adjacent to a metro area	2,730	179	46	5624.78

Note. County-level Rural-Urban Continuum Code data in the Area Health Resources File were from the Department of Agriculture, Bureau of Health Professions. (2001) National Center for Health Workforce Information Analysis.

Table 4.3 describes economic characteristics of rural and urban counties. The mean unemployment rate for metropolitan counties is 3% and the mean unemployment rate for non-metropolitan counties is 4.1%. Median household income in metropolitan counties is highest in counties with 1,000,000 population or more. The most people were insured in counties with 1,000,000 population or more. This includes people less than 65 years old and does not include Medicare.

Table 4.3: County-Level Rural and Urban Economic Characteristics

Rural-Urban Classification	Mean of Median Household Income	Mean Unemployment Rate	Mean of Persons with Insurance
Metropolitan counties			
Counties in metro areas of 1 million population or more	70,108	3.3	388,787
Counties in metro areas of 250,000 – 1,000,000 population	49,462	4.0	118,472
Counties in metro areas of fewer than 250,000 population	53,383	3.2	55,315
Non-metropolitan			
Urban population of 20,000 or more, adjacent to a metro area	45,330	4.3	30,406
Urban population of 20,000 or more, not adjacent to a metro area	44,124	4.3	36,548
Urban population of 2,500-19,999, adjacent to a metro area	47,556	3.7	12,427

Note. County-level Rural-Urban Continuum Code data in the Area Health Resources File were from the Department of Agriculture, Bureau of Health Professions. (2001) National Center for Health Workforce Information Analysis.

Table 4.4 describes county-level inpatient days. The sum of inpatient days steadily decreases from metropolitan to non-metropolitan counties. Non-metropolitan communities of 2,500-19,999 adjacent to a metropolitan area have a higher sum of inpatient days compared to other non-metropolitan categories. The mean of inpatient days is higher in metropolitan areas compared to non-metropolitan areas.

Table 4.4: Description of County-Level Inpatient Days (Outcome Variable)

Rural-Urban Classification	Sum of Inpatient days	Mean of Inpatient Days
Metropolitan counties		
Counties in metro areas of 1 million population or more	3,197,199	91,348.5
Counties in metro areas of 250,000 – 1,000,000 population	455,008	182,200.3
Counties in metro areas of fewer than 250,000 population	485,337	22,060.8
Non-metropolitan		
Urban population of 20,000 or more, adjacent to a metro area	138,915	10,685.8
Urban population of 20,000 or more, not adjacent to a metro area	14,658	2,443.0
Urban population of 2,500-19,999, adjacent to a metro area	263,842	4,059.1

Note. County-level Rural-Urban Continuum Code data in the Area Health Resources File were from the Department of Agriculture, Bureau of Health Professions. (2001) National Center for Health Workforce Information Analysis. “Inpatient days” refers to the number of inpatient days in short term non general hospitals in counties.

Table 4.5 displays a detailed description of the resource variables in urban counties. Table 4.6 displays a description of the same resources in rural counties. The mean rate of RNs, LVNs, and NAP were higher in the urban population of 2,500-19,999, adjacent to a metro area compared to counties in metro areas of 1 million population or more. After running a sensitivity test and looking at another variable for the total population, there was not a difference in the mean rate of nursing personnel. The range for the mean rate of RNs in urban areas was from 5.1 to 6.2 per 10,000 population. In comparison, the mean rate of RNs in non-metropolitan area per 10,000 population ranged from 2.2 to 67.6. The range for the mean rate of APRNs in urban areas ranged from 7 to 11.5 per 10,000 population, while the mean rate of APRNs in non-metropolitan areas per 10,000 population ranged from 7.75 to 10.4. For all other hospital personnel and Advanced Practice roles, see Table 4.5 and Table 4.6.

Table 4.5: Metropolitan County-Level Rate of Nurses (Predictor Variable)

Rural-Urban Classification	Variable	N	Mean	SD	Min	Max
Metropolitan counties						
1	RN Rate	18	5.1	4.5	0.4	17.1
	LVN Rate	18	0.8	0.97	0	3.9
	NAP Rate	18	3.3	5.2	0.4	23.4
	CNS Rate	18	0.2	0.23	0	1.2
	CRNA Rate	18	0.9	0.9	0.1	3.1
	AP Nurse Midwife Rate	18	0.3	0.21	0	0.8
	CN Midwife Rate	18	0.4	0.25	0	1.1
	APRN Rate	18	7	2.7	3.5	13.2
	2	RN Rate	9	6.2	6.3	0.6
LVN Rate		9	0.9	0.67	0.2	1.8
NAP Rate		9	2.1	0.98	.3	3.4
CNS Rate		9	0.2	0.27	0.1	0.9
CRNA Rate		9	2	1.26	0.5	4.4
AP Nurse Midwife Rate		9	0.3	0.21	0	0.8
CN Midwife Rate		9	0.3	0.3	0	0.9
3	APRN Rate	9	11.2	5.5	5.2	21.9
	RN Rate	11	6.2	4.63	0.6	16.1
	LVN Rate	11	1.3	0.98	0.1	3.3
	NAP Rate	11	6.1	8.05	0.3	29.5
	CNS Rate	11	0.4	0.53	0	1.9
	CRNA Rate	11	2.3	1.26	0.8	4.3.
	AP Nurse Midwife Rate	11	0.3	0.26	0	0.7
	CN Midwife Rate	11	0.3	0.3	0	0.9
	APRN Rate	11	11.5	4.06	6.3	18.3

Note. County-level Rural-Urban Continuum Code data in the Area Health Resources File were from the Department of Agriculture, Bureau of Health Professions. (2001) National Center for Health Workforce Information Analysis. Descriptive statistics for Nurse Practitioners, Clinical Nurse Specialists, Certified Registered Nurse Anesthetist, Advance Practice Nurse Midwives, Certified Nurse Midwives are presented in text.

- 1= Counties in metro areas of 1 million population or more
- 2= Counties in metro areas of 250,000-1,000,000 population
- 3= Counties in metro areas of fewer than 250,000 population
- 4= Urban population of 20,000 or more, adjacent to a metro area
- 5= Urban population of 20,000 or more, not adjacent to a metro area
- 6= Urban population of 2,500-19,999, adjacent to a metro area

Table 4.6: Non-Metropolitan County-Level Rate of Nurses

Rural-Urban Classification	Variable	N	Mean	SD	Min	Max
Non-Metropolitan counties						
4	RN Rate	3	8.8	7.23	1.2	15.6
	LVN Rate	3	5.8	4.04	0.2	8.8
	NAP Rate	3	30.5	23.61	4.7	51
	CNS Rate	3	0.3	0.46	0	0.8
	CRNA Rate	3	2.3	1.26	0.8	1
	AP Nurse Midwife Rate	3	0.8	0.2	0.6	1
	CN Midwife Rate	3	0.4	0.64	0	1.1
	APRN Rate	3	8.2	3.36	4.7	11.4
	5	RN Rate	2	2.2	0.57	1.8
LVN Rate		2	0.7	0.42	0.4	1
NAP Rate		2	1.9	1.23	1	2.8
CNS Rate		2	0.35	0.07	0.3	0.4
CRNA Rate		2	2.2	0.28	2	2.4
AP Nurse Midwife Rate		2	0	0	0	0
CN Midwife Rate		2	0	0	0	0
APRN Rate		2	10.4	1.56	9.3	11.5
6	RN Rate	2	67.6	74.32	15	120.1
	LVN Rate	2	56.1	66.4	9.1	103
	NAP Rate	2	343.2	387.21	69.4	617
	CNS Rate	2	0.5	0.42	0.2	0.8
	CRNA Rate	2	0.3	0.42	0	0.6
	AP Nurse Midwife Rate	2	0	0	0	0
	CN Midwife Rate	2	0	0	0	0
	APRN Rate	2	7.75	2.33	6.1	9.4

Table 4.7 uses Spearman’s correlation to describe the relationship between the rate of inpatient days and types of nursing positions and advanced practice registered nurses. In rural counties, the rate of RNs, LVNs, and NAP and the rate of inpatient days has a high positive correlation and is statistically significant. The rate of APRNs and the rate of inpatient days is weakly correlated and not statistically significant in rural counties. In urban counties, there is a medium correlation between RNs, LVNs, and NAP with inpatient days. There is a higher correlation between the rate of APRNs and the rate of inpatient

days. All nursing positions were positively correlated with each other. All nursing positions except for APRN rate, LVN rate and NAP rate were statistically significant and positively correlated.

Table 4.7: Correlations Between Key Variables

Rural-Urban Classification	RN Rate	LVN Rate	NAP Rate	APRN RATE	Inpt Days Rate
Rural					
RN Rate	1	0.86	0.86	0.07	0.96*
LVN Rate	0.86	1	1	-0.29	0.79*
NAP Rate	0.86	1	1	-0.29	0.79*
APRN Rate	0.07	-0.29	-0.29	1	0.21
Inpt Days Rate	0.96	0.79	0.79	0.21	1
Urban					
RN	1	0.57*	0.74*	0.58*	0.61*
LVN	0.57*	1	0.67*	0.34*	0.57*
NAP	0.74*	0.67*	1	0.5*	0.62*
APRN Rate	0.58*	0.34*	0.5*	1	0.82*
Inpt Days Rate	0.61*	0.57*	0.62*	0.82*	1

Note: A “rural” variable was created by collapsing categories 1-3 of the Rural-Urban Continuum Code. An “urban” variable was created by collapsing categories 4-9 of the Rural-Urban Continuum Code.

*If *P* is less than 0.05, then it is statistically significant.

Figure 4.1 shows the bi-variate relationships between the variables in the rural counties. Figure 4.2 shows the bi-variate relationships between the variables in the urban counties.

Figure 4.1: Rural Scatter Plot Correlations Between Key Variables

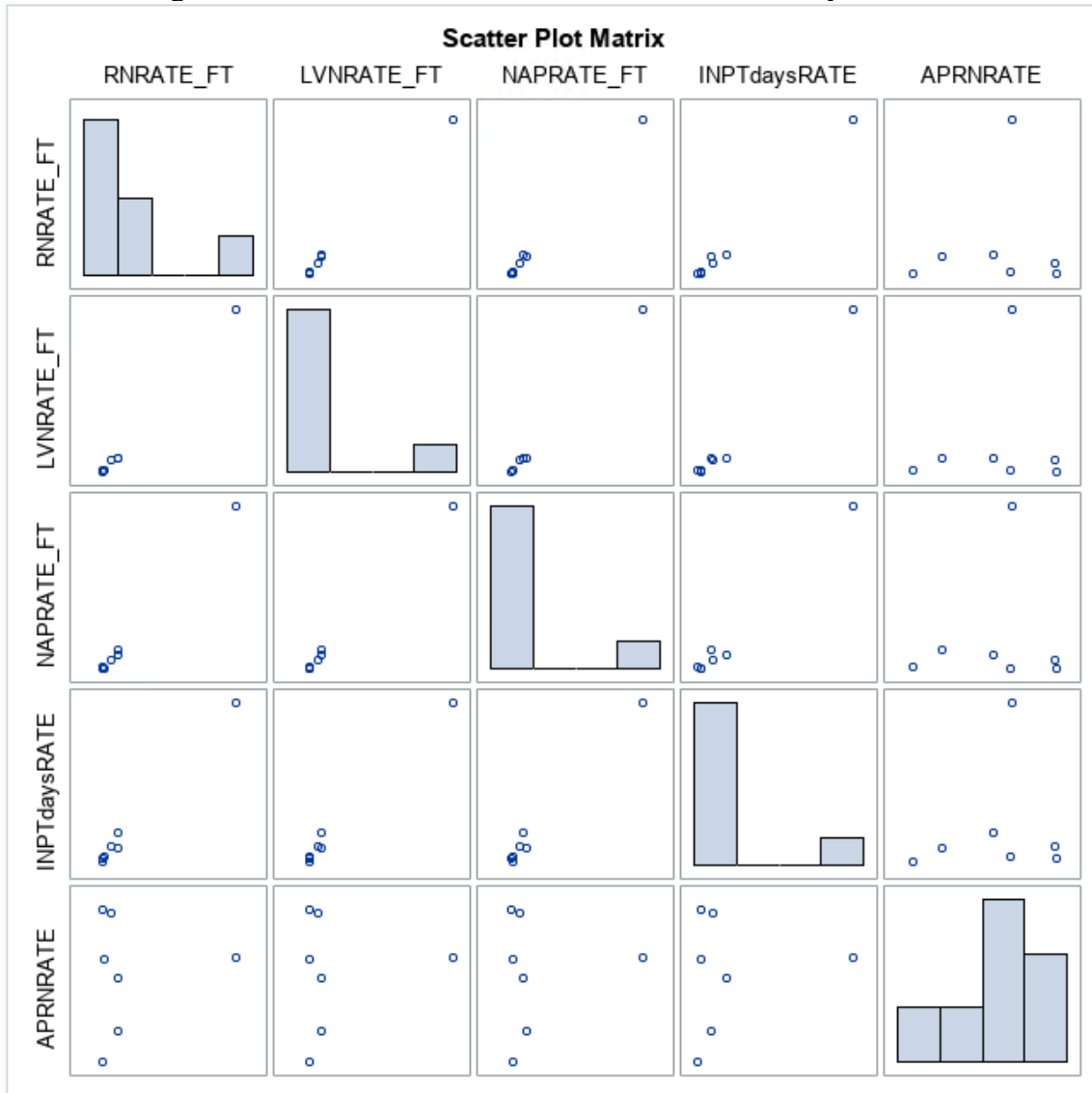
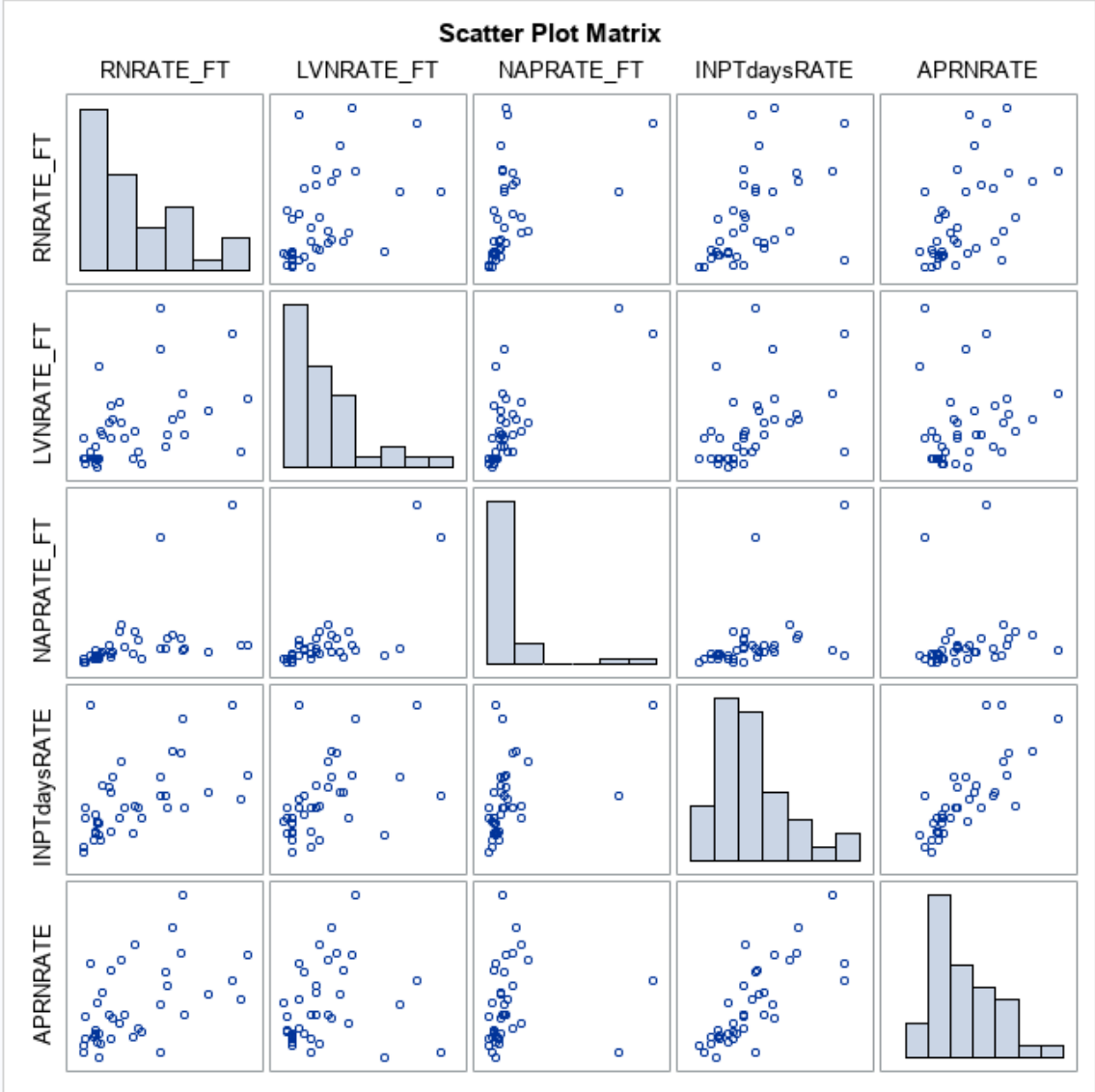


Figure 4.2: Urban Scatter Plot Correlations Between Key Variables



CHAPTER 5

DISCUSSION

The purpose of the study was to look at the relationship between types of nurses and inpatient days in different community contexts. In both rural and urban areas there was a strong positive correlation between the rate of Registered Nurses (RNs), Licensed Vocational Nurses (LVNs), and Nursing Assistive Personnel (NAP) and the rate of inpatient days. Staff nurses working in acute care settings are essential to delivering inpatient care regardless of their classification within a rural or urban county. In contrast, the rate of Advanced Practice Registered Nurses (APRNs) in rural counties was weakly and not significantly correlated with inpatient days while there was a strong positive significant correlation for APRN rate and inpatient days rate for urban counties. This could suggest that APRNs in rural areas are not associated with inpatient days.

There were a limited number of counties included in urban population of 2,500-19,999 adjacent to a metropolitan area. Rates for RNs, LVNs, and NAP were highly increased in comparison to the other community contexts. One explanation could be lack of job diversity, another explanation could be inaccuracies in American Hospital Association data within the Area Health Resource File. The range of APRNs for rural and urban counties is similar compared to the range of hospital nursing staff from AHA data. Job availability could impact where APRNs practice.

Non-metropolitan areas not adjacent to a metropolitan area have the least sum of inpatient days because they may not be close to a healthcare facility or there is no

healthcare facility in their county. Seventy-five of 254 Texas counties do not have a healthcare facility (TORCH, 2019).

The community context differed for economic indicators in rural and urban counties. Higher paying jobs in urban areas may offer more benefits such as insurance compared to lower paying jobs in rural areas. The median household income and the mean of persons with insurance are from 2018. However, the mean unemployment rate is from 2019. The year difference between the variables may influence the median household income.

Nurses are attracted to working in an urban facility with magnet status which provides more benefits to nurses and has better patient outcomes. Magnet status helps recruit and retain skilled and highly educated nurses. To achieve magnet status, hospitals hire people with higher levels of education and nurses are encouraged to earn their bachelor's degree. To apply for magnet status, it takes a significant amount of preparation and resources. Rural hospitals may not have the funding or the percentage of RNs with a BSN that magnet hospitals are expected to have (*Magnet Recognition Program® | ANCC, n.d.*)

Moreover, rural hospitals are not located near big universities that would attract more RNs with a BSN to work. RNs with a bachelor's degree are important for high quality patient care (Martsolf et al., 2014). One study found that hospitals who had more Registered Nurses with a BSN had fewer incidences of adverse events such as preventable hospital infections or avoidable deaths (Martsolf et al., 2014).

One limitation to this study was the type of statistical analysis used to describe the relationship between the rate of nursing personnel and the rate of inpatient days between

rural and urban counties. Spearman's correlation is not a directional measure. Also, the data is cross-sectional, therefore casual inference cannot be determined. Another limitation to the study was missing data from the more rural counties in Texas. Results do not reflect all rural counties and residents of Texas.

Social determinants of health, such as access to health services, have an influence on people's health and quality of life. Healthcare access remains a primary healthcare concern for rural residents across Texas. Inpatient days are a measure used to describe healthcare utilization across different Texas counties. More inpatient days means more care is provided to their population. Having enough nurses is essential to the provision of hospital care and allows the hospital to provide appropriate levels of care and remain open.

CHAPTER 6

CONCLUSION

There was a strong relationship between nurse personnel and inpatient days. One reason could be that more patients can be taken care of in the inpatient setting when there is adequate nursing personnel. In rural counties, there was a stronger relationship between inpatient hospital staff and rate of inpatient days. Future studies should compare rural-urban differences about health complications related to length of stay, such as pneumonia, urinary tract infections, sepsis, or pressure ulcers, and if the relationships could be associated with differences in nursing personnel. Future studies should look at the relationship between education level and outcomes of Registered Nurses, especially in rural settings. Future studies should incorporate different data sources and include information on more Texas counties for greater representation of the rural residents of Texas. Future research should focus on establishing both access and quality of healthcare in rural communities in the interest of improving patient outcomes and the overall health of the community.

REFERENCES

- Area Health Resource File | Healthy People 2020*. (n.d.). Retrieved July 18, 2020, from <https://www.healthypeople.gov/2020/data-source/area-health-resource-file>
- Bolin, J. N., Bellamy, G. R., Ferdinand, A. O., Vuong, A. M., Kash, B. A., Schulze, A., & Helduser, J. W. (2015). Rural healthy people 2020: New decade, same challenges. *The Journal of Rural Health, 31*(3), 326-333. <https://doi.org/10.1111/jrh.12116>
- Donabedian, A. (1966). Evaluating the quality of medical care. *The Milbank Memorial Fund Quarterly, 44*(3), 166-206. <https://doi.org/10.2307/3348969>
- Griffiths, P., Maruotti, A., Recio Saucedo, A., Redfern, O. C., Ball, J. E., Briggs, J., Dall’Ora, C., Schmidt, P. E., & Smith, G. B. (2019). Nurse staffing, nursing assistants and hospital mortality: Retrospective longitudinal cohort study. *BMJ Quality & Safety, 28*(8), 609–617. <https://doi.org/10.1136/bmjqs-2018-008043>
- Health Disparities Affect Millions in Rural U.S. Communities*. (2017). AAMC. Retrieved July 21, 2020, from <https://www.aamc.org/news-insights/health-disparities-affect-millions-rural-us-communities>
- He, J., Staggs, V. S., Bergquist-Beringer, S., & Dunton, N. (2016). Nurse staffing and patient outcomes: A longitudinal study on trend and seasonality. *BMC Nursing, 15*(1), 60. <https://doi.org/10.1186/s12912-016-0181-3>

- Hoffman, A., & Holmes, M. (2017). Regional differences in rural and urban mortality trends. *North Carolina Rural Health Research Program*.
https://www.shepscenter.unc.edu/wp-content/uploads/dlm_uploads/2017/08/Regional-Differences-in-Urban-and-Rural-Mortality-Trends.pdf
- Jia, H., Li, L., Li, W., Hou, T., Ma, H., Yang, Y., Wu, A., Liu, Y., Wen, J., Yang, H., Luo, X., Xing, Y., Zhang, W., Wu, Y., Ding, L., Liu, W., Lin, L., Li, Y., & Chen, M. (2019). Impact of Healthcare-Associated Infections on Length of Stay: A Study in 68 Hospitals in China. *BioMed Research International*, 2019.
<https://doi.org/10.1155/2019/2590563>
- Kaufman, B. G., Thomas, S. R., Randolph, R. K., Perry, J. R., Thompson, K. W., Holmes, G. M., & Pink, G. H. (2016). The rising rate of rural hospital closures. *The Journal of Rural Health*, 32(1), 35-43. <https://doi.org/10.1111/jrh.12128>
- Koeze, E., Patel, J. K., & Singhvi, A. (2020, April 26). Where Americans live far from the emergency room. *The New York Times*.
<https://www.nytimes.com/interactive/2020/04/26/us/us-hospital-access-coronavirus.html>
- Kosar, C., Loomer, L., B. Ferdows, N., Trivedi, A., Panagiotou, O., & Rahman, M. (2020). Assessment of rural-urban differences in postacute care utilization and outcomes among older US adults. *JAMA Network Open*, 3, e1918738.
<https://doi.org/10.1001/jamanetworkopen.2019.18738>
- Magnet Recognition Program*® | ANCC. (n.d.). ANA. Retrieved April 8, 2021, from <https://www.nursingworld.org/organizational-programs/magnet/>

- Martsof, G. R., Auerbach, D., Benevent, R., Stocks, C., Jiang, H. J., Pearson, M. L., Ehrlich, E. D., & Gibson, T. B. (2014). Examining the value of inpatient nurse staffing: An assessment of quality and patient care costs. *Medical Care*, 52(11), 982–988. <https://doi.org/10.1097/MLR.0000000000000248>
- Millman, M. (Ed.). (1993). Access to health care in America. *The National Academies of Sciences, Engineering, and Medicine*. <http://www.nap.edu>.
- Needleman, J. (2017). Nursing skill mix and patient outcomes. *BMJ Quality & Safety*, 26(7), 525–528. <https://doi.org/10.1136/bmjqs-2016-006197>
- Rural Health Information Hub. (n.d.). *Rural health for Texas Introduction*. Retrieved July 18, 2020, from <https://www.ruralhealthinfo.org/states/texas#:~:text=More%20on%20Texas,Texas,central%20region%20of%20the%20state>
- Schreuders, L. W., Bremner, A. P., Geelhoed, E., & Finn, J. (2015). The relationship between nurse staffing and inpatient complications. *Journal of Advanced Nursing*, 71(4), 800–812. <https://doi.org/10.1111/jan.12572>
- Staggs, V. S. (2015). Correlates of licensed and unlicensed nurse staffing levels on inpatient psychiatric units. *Journal of Nursing Care Quality*, 30(4), 359–365. <https://doi.org/10.1097/NCQ.0000000000000120>
- Texas Organization of Rural & Community Hospitals. (2019). *Texas rural acute care hospital closures*. Retrieved from <https://files.constantcontact.com/1355b334201/834b0d45-a8e0-419f-a0fc-3b219ee7e918.pdf>

Texas Organization of Rural & Community Hospitals. (n.d.). *Rural hospital closures*.

Retrieved from <https://www.torchnet.org/advocacy--rural-hospital-closure.html>

Vanetta, M., & Satija, N. (2014). Texas sees significant decline in rural land. *The Texas*

Tribune. Retrieved July 23, 2020, from

<https://www.texastribune.org/2014/10/14/open-space-texas/>

BIOGRAPHICAL INFORMATION

Lydia Seagraves is a nursing student graduating in May 2021 with an Honors Bachelor of Science in Nursing. She began studying at the University of Texas at Arlington in 2017. While at UTA, Lydia was a part of the symphonic and concert band, piano studio, Arlington Nursing Student Association, intramural soccer, and Honors College. During school, Lydia worked as a Resident Assistant for 2.5 years at Arbor Oaks west campus apartments. She also was a Research Assistant for Dr. Jessica Smith's research study on rural hospital closures in Texas. Lydia worked as a Patient Care Technician in Fort Worth during her final semester. Upon graduation, Lydia plans to continue to be a leader and scholar while stepping into her new role in servicing the community as a nurse.