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Analyzing the Impact of Incentive Programs on Retention of Family Practice Providers
in Rural Nebraska

By
Andrew J. Pedley

A PROFESSIONAL PROJECT

Presented to the Faculty of
The Graduate College of the University of Nebraska
In Partial Fulfillment of Requirements
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Under the Supervision of Professor
Yunwoo Nam

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Analyzing the Impact of Incentive Programs on Retention of Family Practice Providers
in Rural Nebraska

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Abstract

Rural populations in Nebraska are generally older, less affluent and suffer from more chronic diseases than their urban counterparts. To address these disparities, the Nebraska Department of Health and Human Services Office of Rural Health oversees incentive programs that compensate providers for costs associated with education in exchange for time worked in shortage areas. This report examines the impact that these incentive programs have on the retention of family medicine providers in Nebraska using survival analysis methodologies. The findings of this report indicate a positive correlation between participation in incentive programs and workforce retention of family medicine providers.

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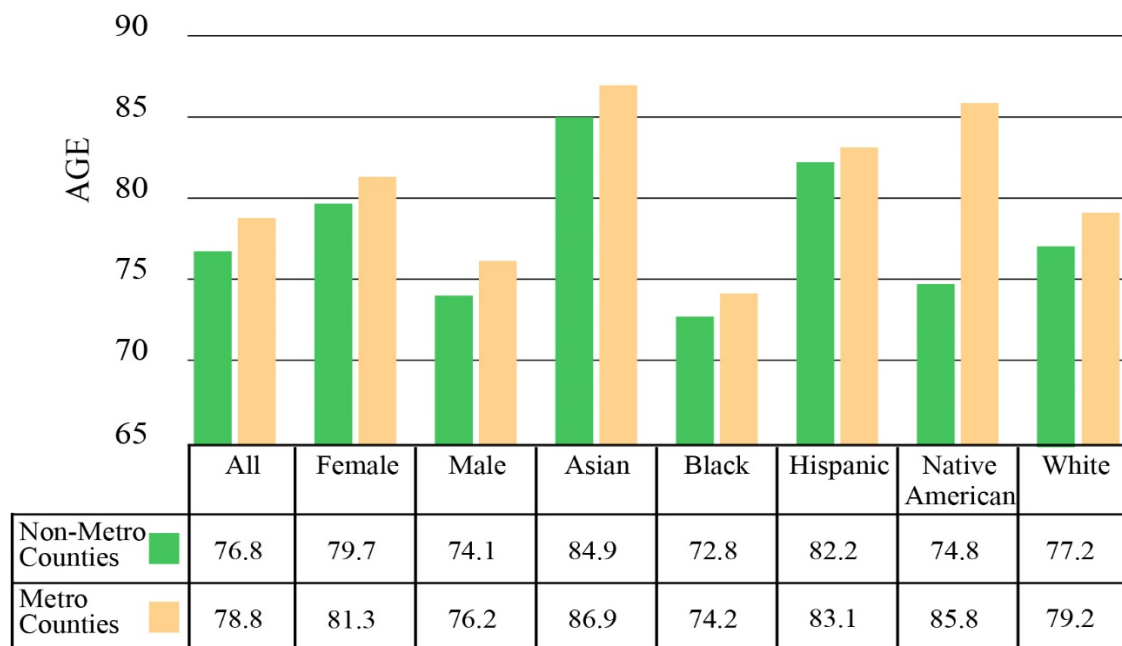
Table of Abbreviations and Acronyms

APRN	Advanced Practice Registered Nurse
CPH	Cox Proportional Hazards
DHHS	Department of Health and Human Services
GIS	Geographic Information Systems
HPSA	Health Professional Shortage Area
HPTS	Health Professions Tracking Service
HRSA	Health Resources Services Administration
MD	Medical Doctor
NHSC	National Health Service Corps
NHSC SLRP	National Health Service Corps Student Loan Repayment
OMB	Office of Management and Budget
PA	Physician Assistant
POC	Primary Care Office
RUCA	Rural Urban Commuting Area
UA	Urban Area
UC	Urban Cluster
UNMC	University of Nebraska Medical Center

Chapter 1 Introduction

Individuals living in rural areas experience significant disparities in health outcomes compared to urban dwellers. Rural populations are generally older, poorer, and have lower life expectancies than urban populations (Singh, 2014). They also have higher incidents of death from chronic disease like cancer, heart disease, and Chronic Obstructive Pulmonary Disease (COPD), and they experience more workplace injuries, accidental death, and traffic deaths than their urban counterparts (Moy, et al., 2017) (Meit, et al., 2014). Figure 1.1 shows the disparities between life expectancy for metropolitan and non-metropolitan residents in the United States. For the population as a whole and for most demographic groups, the life expectancy for metropolitan residents is around 2 years longer than for non-metropolitan residents. The demographic group that shows the largest disparity between metropolitan and non-metropolitan residents is Native Americans with metropolitan residents expected to live 11 years longer than their non-metropolitan counterparts.

Table 1.1 shows additional evidence of disparities between metropolitan and non-metropolitan residents. In each of the causes of death listed in table 1.1, non-metropolitan residents experience mortality at higher rates than metropolitan residents. The causes of these disparities are extremely complex, often nuanced, and are influenced by a combination of factors which include demographics, geography, social and cultural norms, and economic conditions. These factors work in concert to effect both the supply of healthcare providers in rural areas and the level of access that rural residents have to healthcare services.

Figure 1.1 United States non-metropolitan vs. metropolitan life expectancy.

Source: Singh, 2014

Table 1.1 United States metropolitan and non-metropolitan mortality rates per 100,000 population per year

	<u>Non-metropolitan Counties</u>		<u>Metropolitan Counties</u>		
	<u>With a city ≥ 10,000 Population</u>	<u>Without a city ≥ 10,000 population</u>	<u>Large central</u>	<u>Large fringe</u>	<u>Small</u>
Infant mortality	6.8	7	6.8	5.7	6.7
COPD	79.9	81.9	56.2	60.6	70.9
Ischemic heart disease	197.2	206.5	192.9	174.9	173.8
Unintentional injuries	58.9	52.7	32.1	33.1	40.8
Motor vehicle traffic-related injuries	23.3	19.5	7.9	9.3	12.1
Suicide	18.2	20	12.8	13.7	16.1

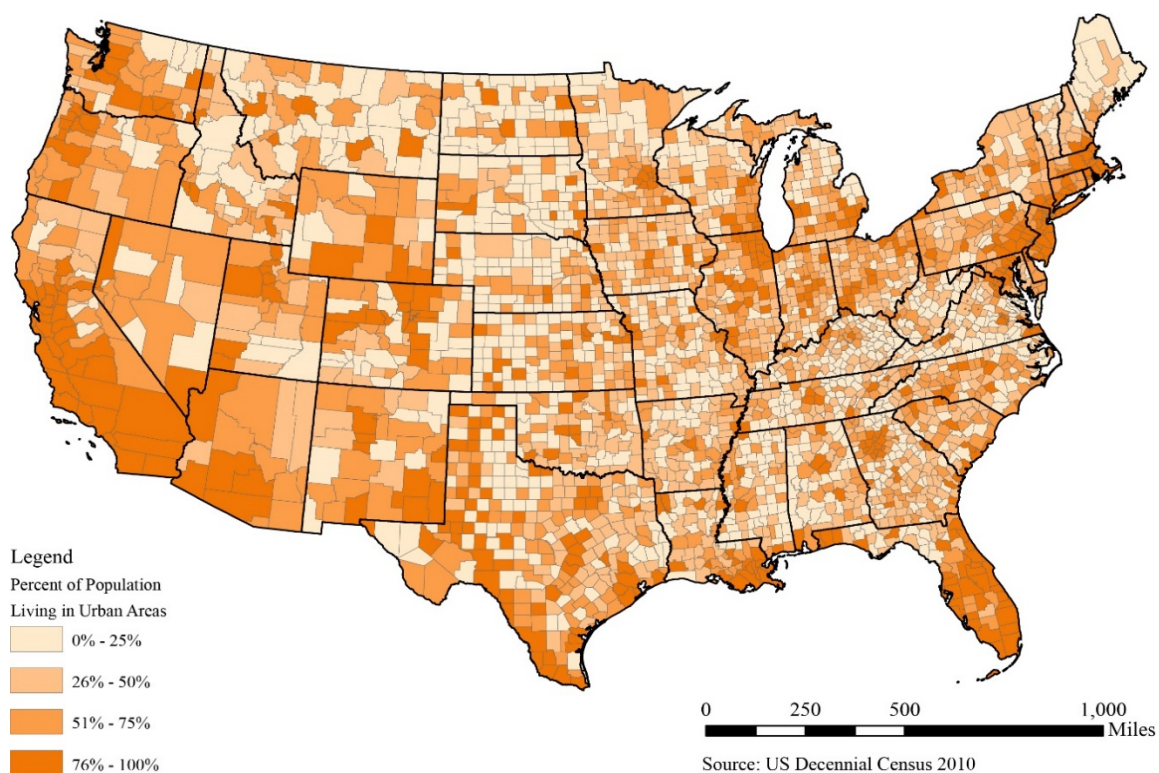
Source: Meit, et al., 2014

According to the 2010 United States Census, the estimated number of individuals living in rural areas within the continental US was 59,140,989 which makes up 19.3% of the total United States population. Counties within the continental United States that have fewer than 50% of their residents living in urban areas, make up a total land area of 1,640,080 square miles which amounts to 53.9% of land area in the lower 48 states (U.S. Census Bureau, 2010). Figure 1.2 shows a map of US counties based on the percentage of population living in urban areas. It is important to note that while rural counties make up over 50% of US land area, less than 20% of the US population lives in these counties resulting in an extremely low population density as compared to more urban counties.

This low population density makes it difficult for rural healthcare facilities to be sustainable due to low patient volumes. In addition, the relative isolation of rural areas poses additional challenges in recruiting healthcare providers, as it is often difficult for providers to develop social networks, rural areas generally have fewer amenities, and there are fewer employment opportunities for spouses.

In order to address these disparities, public health officials as well as state and federal governments, have developed programs and policies intended to recruit healthcare providers to work in rural areas. In Nebraska, there are state and federal student loan, loan repayment, and scholarship programs intended to create incentives for healthcare providers to work in healthcare shortage areas. In addition, several academic institutions within the state actively recruit rural high school students through training track programs under the assumption that providers who grow up in rural areas are well suited to work in rural areas after they have completed training.

Figure 1.2 United States counties by percent of population living in urban areas in 2010.



One important piece of the rural healthcare puzzle is the retention of healthcare providers once they decide to work in a rural area. While some workforce turnover is necessary and allows for new ideas and innovation, the retention of a well-trained workforce is essential to the provision of quality healthcare services (Meier & Hicklin, 2008).

This report has been created for the Nebraska Department of Health and Human Services (DHHS), Office of Rural Health to address the retention of family medicine providers in Nebraska from January 1, 1998 to January 1, 2018. The purpose of this project is to determine if participation in incentive programs effects the retention of

family medicine providers in Nebraska. The analysis in this report compares length of retention for all family medicine providers in that practiced in the state from 1998 to 2018, based on their participation in incentive programs. This comparison is made for five unique groups depending on level of rurality with a primary focus on providers that have worked in small town and rural areas.

By analyzing the length of time and locations worked by these healthcare providers, insight is gained regarding the effectiveness of the state and federal incentive programs not only on recruitment of providers but also on their retention. This research provides significant additions to the existing body of workforce retention research specifically for rural medical providers, as there appear to be no published studies that focus on the impact of incentive programs on retention.

Retention of rural healthcare providers is important not only from a healthcare delivery perspective, but also from an economic standpoint. The National Center for Rural Health Works published a report in 2016 that used Impact Analysis for Planning (IMPLAN) to estimate the total economic impact of primary care physicians in rural areas (Eilrich, Doeksen, & St. Clair, 2016). This study found that, on average, a rural primary care physician creates 26.3 local jobs and nearly \$1.4 million annually in income. The report finds that in many rural areas, between 10 and 15 percent of all jobs are in the healthcare industry, second only to local school systems. It is because of this significant impact on communities that it is important to study the retention of healthcare providers in these areas. The results from data analysis used in this project can help rural health policy makers and healthcare administrators make more informed decisions that

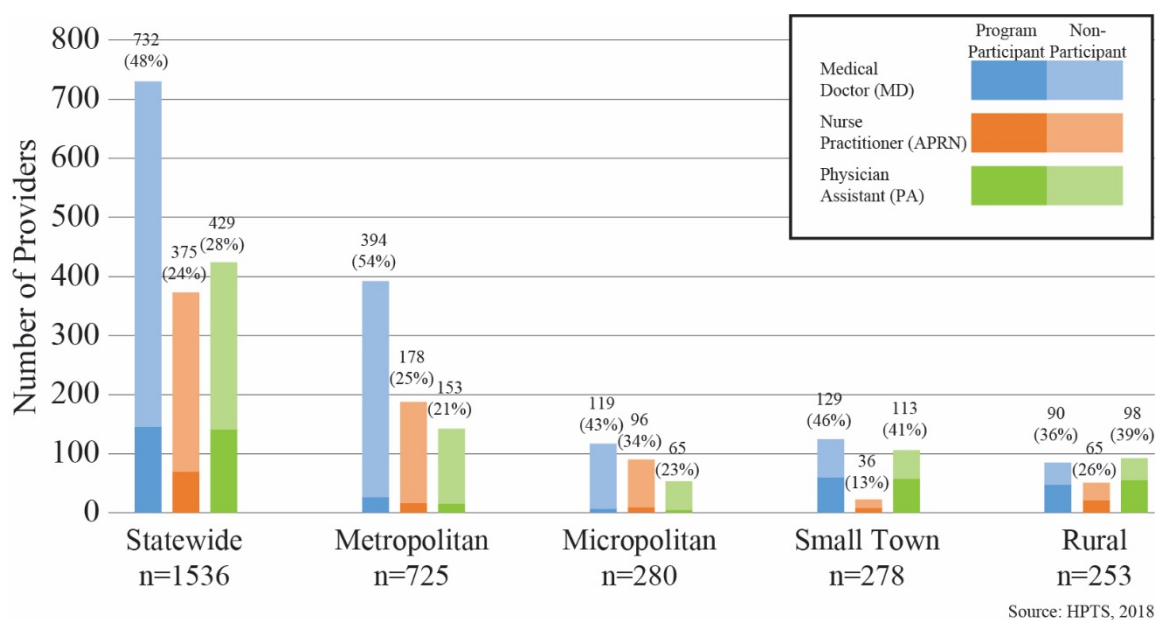
can lead to greater provider retention and therefore improved healthcare access and economic vitality.

1.1 Primary Care in Nebraska

The majority of the local healthcare services in rural areas are provided by primary care specialists. This category of providers includes medical doctors (MDs), doctors of osteopathy (DOs), physician assistants (PAs), and nurse practitioners (APRNs) that specialize family medicine, internal medicine, pediatrics, obstetrics, gynecology, or geriatrics. The most prevalent off these specialties is family medicine. According to a 2017 internal report from the University of Nebraska Medical Center's (UNMC) Health Professions Tracking Service (HPTS), 51.1% of all full time equivalent (FTE) hours worked by primary care physicians practicing in state designated shortage areas, can be attributed to family medicine providers. For this reason and to insure a manageable sized dataset, this project has focused only on family practice providers in the state of Nebraska. Figure 1.3 shows the distribution all family medicine providers actively practicing as of January 1, 2018 based on profession, rurality, and participation in incentive program. MDs made up 48% of all active family medicine providers statewide, APRNs made up 24% and PAs made up 28%. Using rural-urban commuting area (RUCA) codes to define levels of rurality, it was found that the majority of providers (725) worked in metropolitan areas while micropolitan, small town and rural areas each had between 250 and 280 providers. In small town and rural areas, a larger proportion of providers participated in incentive programs than in metropolitan and micropolitan areas.

This is due in large part to the availability of qualifying practice locations at the rural and small town level.

Figure 1.3 Family medicine providers actively practicing in Nebraska as of January 1, 2018, as described by profession and program participation.



1.2 What Is Rural?

Due to the disparities in health outcomes between urban and rural residents, this report has placed specific emphasis on family medicine providers practicing in rural and small town areas. The term rural is inexact and has differing definitions depending on spatial scale, intensity of development, and population density of an area. However, rural generally refers to areas with populations living outside of high density metropolitan

regions. Three common definitions of rural that are used by government agencies include the US Census Bureau classification, the Federal Office of Management and Budget (OMB) classification, and the Rural-Urban Commuting Area (RUCA) classification. Other variations of these definitions are used from time to time depending on the type of analysis being presented.

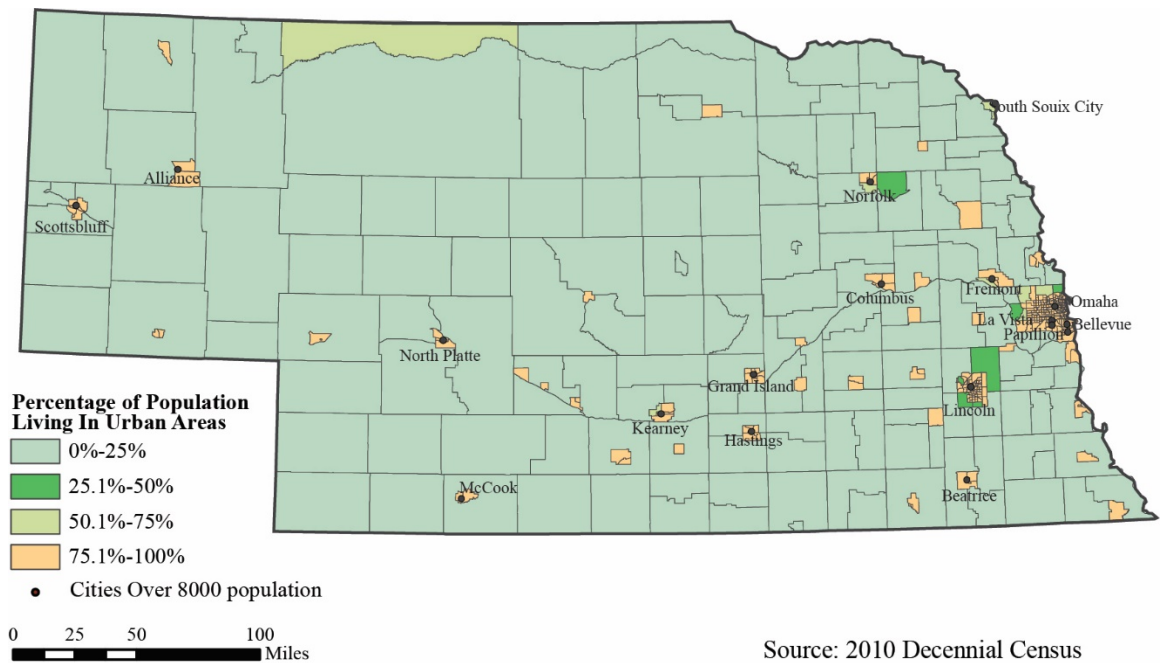
Each of these classifications represent similar populations but are presented at different spatial scales. Therefore, it is important to understand that population, land area and other one-to-one comparisons between rural and urban populations should be done using a consistent definition of rurality. For example, if comparing the population of a rural area from one year to another, it would be important to use the same definition of rural for both years. However, generally speaking, health outcome, healthcare access, demographic and socio-economic trends remain relatively consistent across all rural definitions. Therefore, the rural-urban health outcome disparities discussed in this report tend to hold true regardless of how rurality is defined. This section explains how levels of rurality are determined using three common classification schemes.

1.2.1 United States Census Bureau

The U.S. Census Bureau defines rural as all areas not considered an Urbanized Area (UA) or Urban Cluster (UC). Urban Areas are groups of census blocks with 50,000 or more people. A UA must also contain a core of contiguous blocks that have a population density greater than 1,000 persons per square mile. UCs have lower density and are made up of groups of census blocks with total populations between 2,500 and

50,000 people. These classifications are based on block level geographies and are available from the US Census Bureau as a statewide dataset presented by census tract (Ratcliffe, Burd, Holder, & Fields, 2016). Figure 1.4 shows the proportion of the population in each Nebraska census tract that is identified by the 2010 US Census as living in an urban census block. It can be seen in figure 1.4 that the vast majority of census tracts in Nebraska and be considered rural, meaning that they have between 0% and 25% of their populations living urban areas.

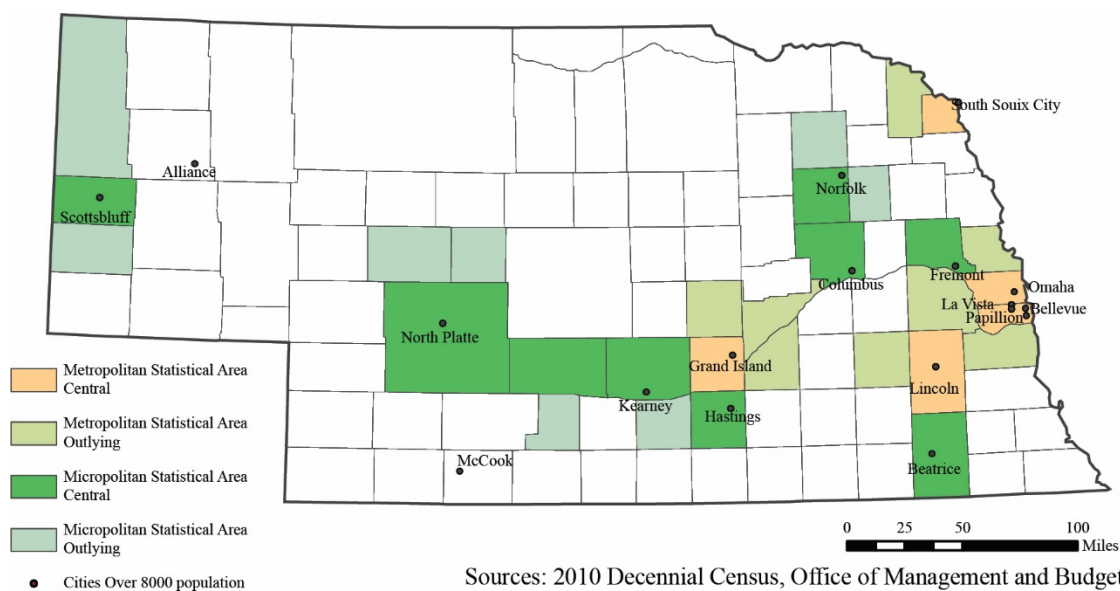
Figure 1.4 Nebraska census tracts based on percentage of persons living in urban areas



1.2.2 Office of Management and Budget (OMB)

The federal Office of Management and Budget (OMB) classifies counties as metropolitan or micropolitan. While OMB classifications are based on U.S. Census urban and rural designations, OMB and US Census Bureau designations are not interchangeable because they represent different spatial areas. For OMB classifications, counties containing one or more UAs, as well as outlying counties economically tied to the central or core counties, are classified as metropolitan. Micropolitan counties are non-metro counties with an urban cluster of at least 10,000 persons or more. As with metropolitan counties, connected counties that are economically tied are also classified as micropolitan. Economically connected counties are those counties close to a central county that either contribute 25% or more of their commuters to the central county or 25% or more of their employment is generated in the central county (Office of Management and Budget, 2010). Figure 1.5 shows Nebraska counties based on their OMB metropolitan classification. With the exception of Alliance and McCook, all of the cities in Nebraska with a population over 8,000 are in either metropolitan or micropolitan areas.

Figure 1.5 OMB definition of metropolitan and micropolitan counties in Nebraska



1.2.3 Rural-Urban Commuting Area (RUCA)

RUCA classifications are used to delineate sub-county components of rural and urban areas at a zip-code or census tract level.. Current RUCA classifications for census tracts are based on 2010 Census data, as well as daily commuting patterns collected from the 2006-2010 American Community Survey. The classification scheme contains 10 primary and 21 secondary codes that can be further subdivided into smaller classifications.

This project uses a four-level classification system that separates Nebraska census tracts into metropolitan, micropolitan, small town, and rural classifications. Metropolitan areas represent “Urban Area” (UA) census tracts and the tracts supporting them. Micropolitan areas consist of large “Urban Clusters” (UCs) and census tracts that are

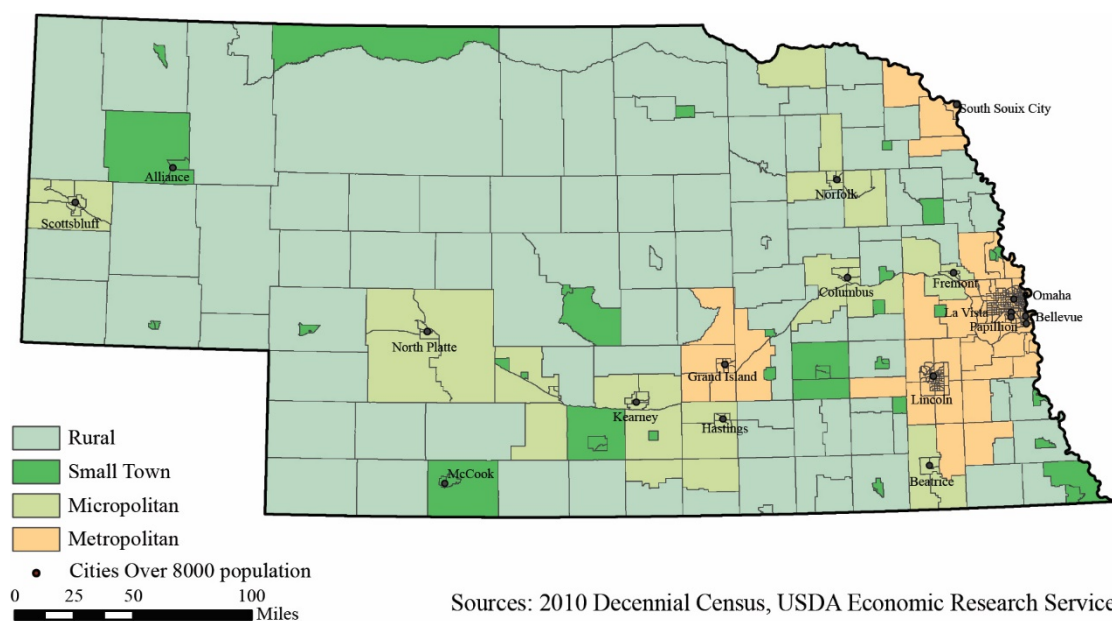
economically tied to UAs. Small town areas are associated with small UCs. These areas can also consist of census tracts that support UAs; however, small town census tracts are less closely associated with UAs than micropolitan tracts. Rural areas are those that have the least association with UAs and UCs. Table 1.2 lists the characteristics of each rurality classification used for this study.

Figure 1.6 depicts Nebraska census tracts classified using RUCA criteria. The RUCA classification scheme was developed in part by the United States Department of Agriculture (USDA) and the WWAMI Regional Medical Education Program, a medical partnership with between Washington, Wyoming, Alaska, Montana, and Idaho. The WWAMI Medical Education Program focus heavily on rural healthcare, education, and delivery. Because the RUCA classification scheme provides an intuitive, and evenly distributed way to classify rurality in Nebraska, census tract RUCA designations were used to determine rurality for this project (WWAMI Rural Health Research Center, 2017) (USDA Economic Research Service, 2018). As with the OMB classification scheme, all of the Nebraska cities with population over 8,000 with the exception of Alliance and McCook (small town), are either in metropolitan or micropolitan levels of rurality.

Table 1.2 RUCA code classification scheme, the population, and the land area for each level of rurality in Nebraska, 2010.

	Code	Classification description	Number of Census Tracts	Pop.	Total Land Area (sq. MI)
Metropolitan		1: Metropolitan area core: primary flow within an urbanized area (UA)	312 (58.6%)	1,114,990 (61.1%)	5,890.6 (7.7%)
	1.1	Secondary flow 30% to 50% to a larger UA			
		2: Metropolitan area high commuting: primary flow 30% or more to a UA			
	2.1	Secondary flow 30% to 50% to a larger UA			
		3: Metropolitan area low commuting: primary flow 10% to 30% to a UA			
Micropolitan		4: Micropolitan area core: primary flow within an urban cluster of 10,000 to 49,999 (large UC)	81 (15.2%)	301,323 (16.5%)	9,591.3 (12.5%)
	4.1	Secondary flow 30% to 50% to a UA			
		5: Micropolitan high commuting: primary flow 30% or more to a large UC			
	5.1	Secondary flow 30% to 50% to a UA			
		6: Micropolitan low commuting: primary flow 10% to 30% to a large UC			
Small Town		7: Small town core: primary flow within an urban cluster of 2,500 to 9,999 (small UC)	44 (8.3%)	166,039 (9.1%)	5,398.0 (7.0%)
	7.1	Secondary flow 30% to 50% to a UA			
	7.2	Secondary flow 30% to 50% to a large UC			
		8: Small town high commuting: primary flow 30% or more to a small UC			
	8.1	Secondary flow 30% to 50% to a UA			
	8.2	Secondary flow 30% to 50% to a large UC			
		9: Small town low commuting: primary flow 10% to 30% to a small UC			
Rural		10: Rural areas: primary flow to a tract outside a UA or UC	95 (17.9%)	243,989 (13.4%)	55,944.3 (72.8%)
	10.1	Secondary flow 30% to 50% to a UA			
	10.2	Secondary flow 30% to 50% to a large UC			
	10.3	Secondary flow 30% to 50% to a small UC			
Sources: USDA Economic Research Service, US 2010 Decennial Census			532	1,826,341	76,824.20

Figure 1.6 RUCA classifications of 2010 census tracts in Nebraska



1.3 Healthcare Delivery in Rural Nebraska

The Nebraska DHHS Office of Rural Health is concerned with addressing the rural-urban healthcare disparities that exist within the State of Nebraska. As a whole, Nebraskans are in better health than most people nationally, but disparities between urban and rural residents do still exist. Between 2010 and 2014, the largest rural-urban disparity in Nebraska was seen in unintentional injury deaths, which had a rate 53% higher in rural areas than urban areas. A large component of unintentional injury death was attributed to motor vehicle crashes, in which rural residents experience death rates 2.7 times higher than urban residents. This can be attributed to longer commute distances, higher speed limits on rural roads and highways than on urban streets, and the tendency for rural residents to forgo seatbelt use. Similar to national trends, heart disease deaths rates were

8% higher for rural residents than for urban residents. Cancer mortality rates, however, were higher for urban residents than for those living in rural areas, with urban residents experiencing an 8% higher death rate from all cancers and a 20% higher rate of lung cancer (Nebraska Department of Health and Human Services, Office of Community Health and Performance Management, 2016).

Another important disparity between urban and rural residents is the lack of preventative care in rural areas. The 2016 Nebraska Statewide Health Needs Assessment found that rural Nebraskans are 11% less likely to have regular colon cancer screening; they are 8% less likely to undergo regular breast cancer screening; and they are 5% less likely to have regular cervical cancer screening. This could be due to a variety of reasons, including geographic isolation, accessibility challenges or cultural norms (Nebraska Department of Health and Human Services, Office of Community Health and Performance Management, 2016).

1.4 Incentive Programs

The Nebraska Department of Health and Human Services, Office of Rural Health oversees five incentive programs designed to increase the number of healthcare providers in areas of need. Two of these programs, the Nebraska Student Loan, and Nebraska Loan Repayment programs are administered by the state. The National Health Service Corps (NHSC) Loan Repayment and NHSC Scholarship are federally administered, and a fifth program, the NHSC Student Loan Repayment Program (NHSC SLRP), is funded through federal grants but is administered at the state level. All of the incentive programs require

participants to work in a predetermined shortage area for a designated period of time.

Failure to complete this obligation results in significant default penalties.

Between January 1, 1998 and January 1, 2018, the NE Loan Repayment program made up 54.0% of all incentive program contracts awarded to family practice providers in the state, followed by NHSC Loan Repayment (23.5%), NE Student Loan (15.3%), NHSC Scholarship (4.2%) and NHSC SLRP (3.0%) as seen in Table 1.3. Table 1.3 also shows the distribution of incentive program participants in each level of rurality.

Table 1.3 Nebraska family medicine incentive program contracts issued from 1998 to 2018 by RUCA rurality classification

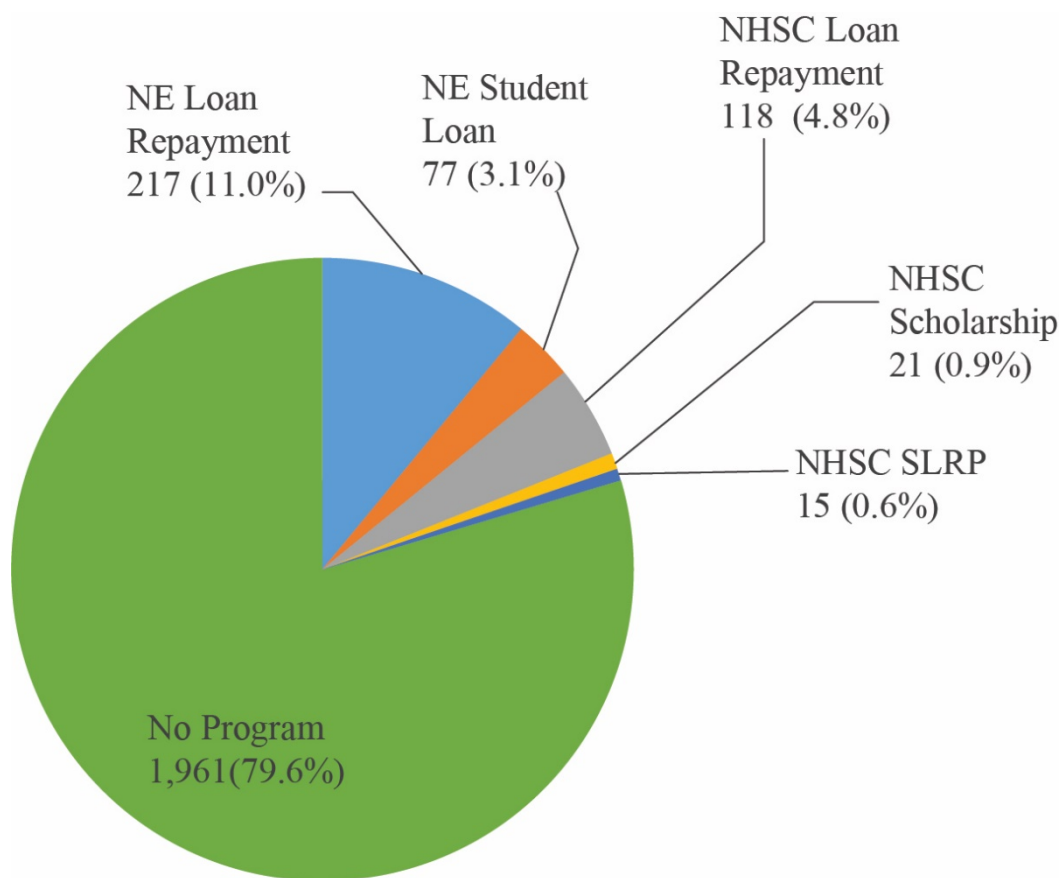
	Statewide	Metropolitan	Micropolitan	Small Town	Rural
n= total number of family medicine providers	n=2431	n=1430	n=563	n=523	n=543
NE Loan Repayment (% of total)	271 (54.0%)	66 (41.8%)	56 (55.3%)	144 (65.2%)	141 (57.3%)
NE Student Loan (% of total)	77 (15.3%)	20 (12.7%)	14 (13.9%)	38 (17.2%)	40 (16.3%)
NHSC Loan Repayment (% of total)	118 (23.5%)	62 (39.2%)	23 (22.8%)	30 (13.6%)	48 (19.5%)
NHSC Scholarship (% of total)	21 (4.2%)	10 (6.3%)	5 (5.0%)	2 (0.9%)	8 (3.3%)
NHSC SLRP (% of total)	15 (3.0%)	0 (0.0%)	3 (3.0%)	7 (3.2%)	9 (3.7%)
Total Program Providers Only	502 (100.0%)	158 (100.0%)	101 (100.0%)	221 (100.0%)	246 (100.0%)

Source: HPTS, 2018

Statewide, the vast majority of family providers have not participated in any of the incentive programs. Figure 1.7 shows the proportional distribution of incentive

program participants statewide. Of the 2,431 providers studied in this report, 1,961 (79.6%) did not participate in a program. NE Loan Repayment providers made up 11.0% of all providers statewide followed by NHSC Loan Repayment (4.8%), NE Student Loan (3.1%), NHSC Scholarship (0.9%) and NHSC SLRP (0.6%).

Figure 1.7 Relative distribution of incentive program providers and non-program providers statewide in Nebraska, 1998-2018.



Source: HPTS, 2018

Table 1.4 Comparison of incentive programs available in Nebraska.

Program	State / Federal	Eligible Providers	Eligible Facilities	Payout	Obligation	Penalty for Default
NE Student Loan	State	MD, PA, DDS, Masters Level Mental Health	State Designated Shortage Areas	\$15,000-\$30,000 /year up to 4 years	1 year for each year of loans	150% repayment plus 8% interest
NE Loan Repayment	State	MD, APRN,PA, DDS, Licensed Mental Health, Pharmacists, OT, PT	State Designated Shortage Areas	\$15,000-\$30,000 / year up to 3 years. Plus community match.	3 years	150% repayment plus 8% interest
NHSC Loan Repayment	Federal	MD, APRN, PA, DDS, Masters Level Mental Health, Dental Hygienist, Certified Nurse Midwives	Federal HPSAs	Up to \$50,000 depending upon HPSA score	2 years	\$7,500 for each obligated month not served
NHSC Scholarship	Federal	MD, DDS, APRN, PA, Nurse-midwife, Masters Level Mental Health	Federal HPSAs	Dependent upon tuition and fees	2 years for each year of scholarship	Scholarship repayment with interest
NHSC SLRP	Federal /State	MD, APRN, PA, DDS, Masters Level Mental Health, RN, Pharmacist	Federal HPSAs	\$25,000-\$50,000	2 years for each year of loan repayment	Repayment plus interest

1.4.1 Nebraska Student Loan

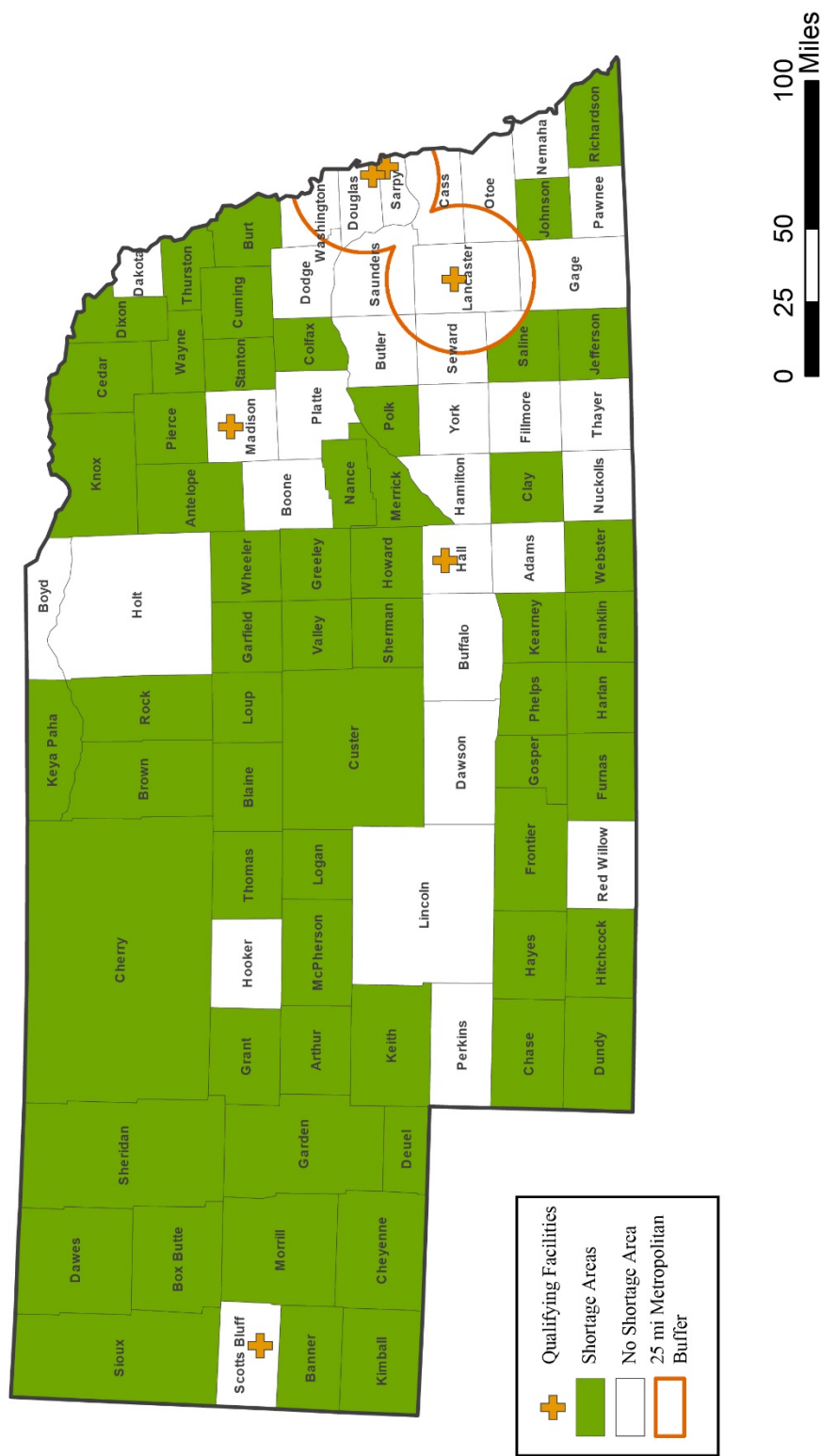
The Nebraska Student Loan Program (for Medical, Dental, Physician Assistant, and Graduate-Level Mental Health Students) originated in 1979 when the State of Nebraska began awarding low-interest loans to medical students who committed to practice in State designated shortage areas. The program was redefined with the passing of the Rural Health Systems and Professional Incentive Act in 1991. Currently, the

program awards forgivable, tax-free student loans to medical, dental, physician assistant, and graduate-level mental health students who agree to practice in a state designated shortage area (Figure 1.8).

The NE Student Loan Program awards a maximum of \$30,000 per year for up to four years to medical, dental and psychologist students and a maximum \$15,000 per year for up to two years to PA and master's level mental health students. The award amount and number of student loans available is determined annually based on availability of state funding.

Only specific specialties within each discipline are eligible for the program. Medical and PA students must specialize in family practice, general surgery, general internal medicine, general pediatrics, obstetrics/gynecology, or psychiatry. Dental students must agree to specialize in general practice, pediatric dentistry, or oral surgery. Mental health students must pursue licensure through the Department of Health and Human Services for "Licensed Mental Health Practitioner" or "Licensed Psychologist." Participating students must agree to practice full-time (40 hours/week) in a state designated shortage area for each year they are awarded a loan through the program once they are fully trained and licensed. Additionally, providers must also accept Medicaid patients. If a student does not fulfill their commitment to pursue an approved specialty and practice in a shortage area, there is a substantial default penalty imposed. Recipients that default must repay 150% of the principal plus 8% simple interest from the date of default (Table 1.4).

Figure 1.8 Nebraska State designated family practice shortage areas 2018.



Source: Nebraska Department of Health and Human Services:
Office of Rural Health

1.4.2 Nebraska Loan Repayment

The Nebraska Loan Repayment Program for Rural Health Professionals was authorized by the Rural Systems and Professional Incentive Act in 1991. It is a local-state matching fund program to help local communities in shortage areas recruit healthcare providers.

The Nebraska Loan Repayment Program is available to licensed physicians, nurse practitioners, physician assistants, dentists, clinical psychologists, mental health practitioners, pharmacists, occupational therapists and physical therapists. Like the Student Loan Program, physicians, nurse practitioners and physician assistants must specialize in family medicine, general internal medicine, general pediatrics, obstetrics/gynecology, general surgery, or psychiatry. Dentists participating in the program must specialize in general dentistry, pediatric dentistry or oral surgery. Because the Nebraska Loan Repayment program is available to a wider range of disciplines, it is the largest of the state administered incentive programs.

The Nebraska Loan Repayment program requires local entities to match funding up to \$30,000 per year for three years for physicians, dentists and clinical psychologists, and up to \$15,000 per year for three years for nurse practitioners, physician assistants, master's level mental health professionals, pharmacists, occupational therapists, and physical therapists. Because state funding matches local contributions, providers are eligible to receive a maximum of \$60,000 or \$30,000 tax free, per year for up to three years depending on the individual provider's student loan burden, their profession and the local entity's matching funding and the availability of state funds.

In exchange for loan repayment, participating providers agree to serve a three-year full- or part-time practice obligation in a state designated shortage area (Figure 1.8), and accept Medicaid patients. Full-time practice consists of at least 40 hours per week in a state shortage area and part-time requires a minimum of 20 hours per week with part-time providers receive reduced benefits. If a provider leaves the shortage area before their three year obligation is complete, they are charged a default penalty of 150% of the funds received through the program at 8% interest from the date of default (Table 1.4).

1.4.3 National Health Service Corps (NHSC) Loan Repayment

The NHSC Loan Repayment program offers tax-free loan repayment for healthcare providers working in federally designated shortage areas called Health Professional Shortage Areas (HPSAs). NHSC Loan Repayment is available to primary care physicians, nurse practitioners, certified nurse midwives, physician assistants, dentists, dental hygienists, and master's level mental health providers.

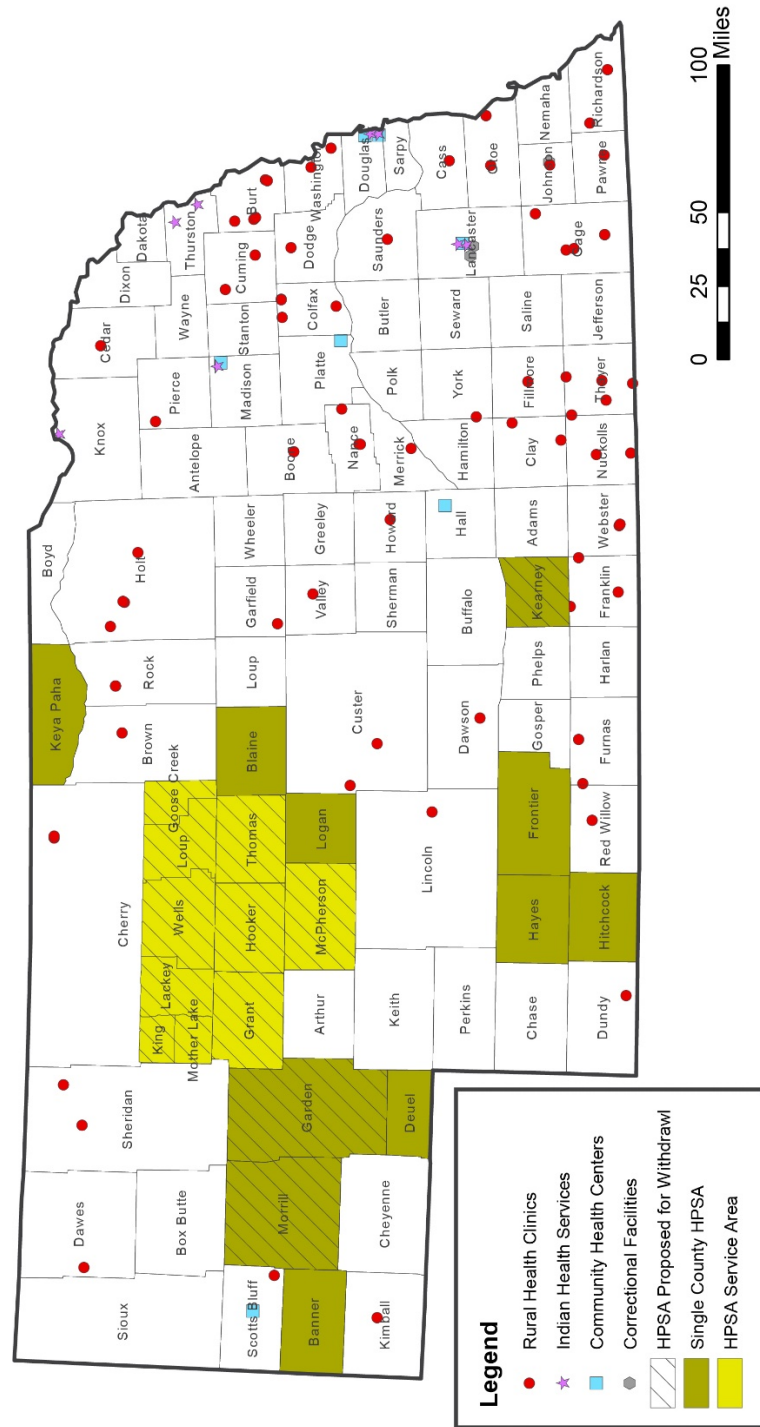
The program offers up to \$50,000 in exchange for a full-time clinical practice obligation of 2 years. It is available to qualified healthcare providers working in a NHSC-approved site. A site's HPSA score is used to determine eligibility and amount of funding provided to a site with a HPSA designation. In order to receive maximum funding, a site must have a HPSA score of 14 or have an auto-HPSA designation. If a provider's site has a HPSA score of 13 or lower, they may still be eligible to receive up to \$30,000 for a two year service commitment. NHSC Loan Repayment offers providers working half-time in National Health Service Corps approved sites the opportunity to receive up to \$25,000 if

in a HPSA with a score of 14 or higher or \$15,000 for HPSAs with scores of 13 or lower (Figure 1.9).

The program is administered federally by the NHSC regional office in Kansas City with direct cooperation from the Nebraska Department of Health and Human Services Primary Care Office (PCO). The state's PCO director is responsible for working with communities to establish NHSC approved site status, HPSA scores and to recruit eligible providers. The NHSC is responsible for reviewing applications, assigning HPSAs and awarding loan repayment.

As with other incentive programs, the penalty for a provider defaulting on their program obligation is significant. If a participant breaches their obligation contract, they are liable to pay back any student loan repayments paid to them representing the period of obligated service not completed. Defaulting providers are also required to pay a penalty of \$7,500 (\$3,750 for half-time participants) multiplied by the number of obligated months not served (Table 1.4).

Figure 1.9 Federal primary care Health Professions Shortage Areas (HPSAs) in Nebraska, 2018



1.4.4 National Health Service Corps (NHSC) Scholarship Program

The NHSC Scholarship program is one of the least utilized incentive programs in this study, with only 21 providers having participated in the program. It is a competitive federal program that offers to pay tuition and eligible fees to primary care health professionals while in training. In exchange, the healthcare provider must commit to work in a federally designated HPSA (Figure 1.9). The scholarship program is available to students pursuing careers in primary care medicine or dentistry, as well as master's level mental health providers, nurse-midwives, nurse practitioners, and physician assistants.

The time participating providers are obligated to serve is dependent on the number of years the student is awarded a scholarship. Participating students are required to practice in a qualifying HPSA for one year for every year they are awarded the scholarship if they are full-time workers or two years for every year they receive scholarship funding if they are working half-time. Additionally, all participants must agree to a minimum of two years of service.

Default penalties for the NHSC Scholarship are dependent upon the amount of education received by the participant. If a participant fails to complete academic training, they must repay all NHSC Scholarship funds that they have received, interest free, within three years of the default date. If this debt is not paid within three years, the defaulting student is assessed interest. However, if a scholar fails to meet the program terms after completing their education, they are required to pay penalties equal to three times the scholarship award plus interest (Table 1.4).

1.4.5 National Health Service Corps State Loan Repayment Program (NHSC SLRP)

The NHSC SLRP provides federal cost sharing grants to states to operate their own loan repayment programs. The program is funded through the Health Resources Services Administration (HRSA) but is administered at the state level through the Nebraska Office of Rural Health. The program is available to qualified primary care providers practicing in medicine, dental, and graduate level mental health as well as nurse practitioners, physician assistants, registered nurses and pharmacists practicing in an eligible federally designated HPSA (Figure 1.9).

Participating providers must agree to serve a minimum of 2 years in a qualifying HPSA in exchange for loan repayment assistance on qualified education debt in the amount of \$25,000-\$50,000 per year depending on discipline and specialty. This program can be extended, providing participants with an additional year of support for an additional year of service. Part-time service options are also available (Table 1.4).

1.5 Previous Retention Studies

The study of workforce attrition and retention is important to many industries because a stable workforce has many benefits, especially when dealing with public health. Therefore, there is an abundance of scholarly articles that examine one or more factors that influence workforce turnover and retention. Several of these articles use the Cox Proportional Hazard Right Censored Regression Model (CPH) and longitudinal employment data to analyze retention in a manner similar to the methodology used in this report.

The CPH model is a regression method used for survival or time-to-event analysis. This type of regression uses the amount of time until an event happens for two or more cohorts based on specific factors. The model provides a hazard ratio which is a calculation that compares the rate at which an event is expected to happen (hazard) for each of two or more cohorts over time (Cox, 1972). The CPH model is discussed in more detail later in this report.

In 1994, Pathman, Konrad, and Agnew published an article detailing best practices for studying retention in the field of healthcare and introduced the use of the survival analysis to quantitatively investigate retention. Prior to this article, most retention studies focused primarily on data obtained from workforce surveys. However, these studies were relatively weak from an empirical standpoint, and were often based on informal sources, anecdotal reports and indirect information. In the article, Pathman, Konrad and Agnew suggested ways that the methodology could be strengthened to more accurately answer causal questions about retention of healthcare providers. These methods focused primarily on maximizing internal and external validity (Pathman, Konrad, & Agnew, 1994).

A study is internally valid when the factors it finds are affecting the outcome do indeed affect the outcome in real world applications. Pathman, Konrad and Agnew suggest three ways to increase internal validity in a study. The first is to verify that chance alone is not likely to explain study findings. This is accomplished by having a large number of study subjects and by using quantitative studies with statistical tests. The second way to increase internal validity is to minimize bias. Two types of bias common

to retention studies are selection bias, where comparisons are made between groups that differ for reasons other than those under study, and measurement bias, where the actual measurement is different from the study measurement. The third way to increase internal validity is to control for confounding. Confounding occurs when unrecognized factors are associated with both the purported effect and cause under study and these unrecognized factors are largely responsible for the effect observed (Pathman, Konrad, & Agnew, 1994).

Currently, the use of survival analysis methodologies to study workforce retention is commonplace in academic literature. These studies span multiple employment sectors and work settings, and nearly all of them use the CPH model to compare factors that influence retention and attrition of workers. One such study by Vasterling, et al., in 2015 looked at military personnel and the predictors of retention for soldiers that were deployed in the Iraq war. This article used a combination of demographic data obtained from US Army service records and survey data generated from post deployment surveys, as well as interviews of soldiers three months after returning from Iraq. The study looked at a number of factors to determine if any were predictors of extended retention among soldiers. This included demographic factors like age, sex, race/ethnicity, and marital status; employment factors like duration of military service, occupational type, and rank; and psychological factors relating to deployment experience, post-traumatic stress, depression, traumatic brain injury and other issues effecting post-deployment military members. The results of the study found that the predictors of retention were duration of military service (soldiers with less than 6 years of service left the military at a rate 4 times higher than those who had over 6 years of service), marital status (unmarried

soldiers left military service at a rate twice that of married soldiers), and unit support (soldiers reporting high satisfaction with support from their unit were more likely to be retained than those reporting moderate or low unit support) (Vasterling, et al., 2015).

Another study conducted by Madden, Scannapieco, and Painter in 2014, examined retention and length of employment among public child welfare workers in Texas. This study looked at longitudinal demographic and survey data collected from all new public child welfare caseworkers hired between 2001 and 2010. Using a CHP model, the study looked at demographic factors like ethnicity, gender and level of education, as well as organizational factors like satisfaction with management, job desirability, and unit support. The study found that female child welfare caseworkers and those with higher levels of education left their positions at a rates slightly lower than their counterparts. It was also discovered that caseworkers that had participated in Title IV-E stipend programs stayed in their positions at rates nearly 30% higher than non-participants (Madden, Scannapieco, & Painter, 2014). This finding is of particular interest because the Title IV-E stipend program is a loan repayment program that is very similar to the incentive programs in Nebraska that are investigated in this report. These results support this report's hypothesis that incentive programs have a positive impact on retention.

A review of academic research on workforce retention shows that a large proportion of studies focus on healthcare providers. In a 2012 article, Daniels, et al., determined that turnover patterns among part-time and casual nurses in Canada were statistically different than turnover patterns of full- and part-time nurses using CHP methodology. They therefore concluded that future nursing workforce studies should

account for part-time nurses and casual nurses differently due in large part to differing levels of retention (Daniels, et al., 2012).

Another study used survival analysis to measure turnover of the medical education workforce in Ethiopia (Assefa, Mariam, Mekonnen, & Derbew, 2017). This article looked at medical educators in state operated medical schools to determine factors that could be used to predict retention. The study found that educating physicians who had higher academic rank (associate professors and above) and those born prior to 1975 were more likely to stay in their positions than younger physicians with lower academic rank. These results may be influenced by selection bias, as associate professors achieve their advanced rank over time, while lecturers and assistant professors simply haven't been in the workforce long enough to reach a higher academic rank. Similarly, physicians born prior to 1975 could have longer retention by the sheer fact that they have been alive and able to practice longer than those in younger age cohorts. The study also identified specific medical training hospitals that were statistically worse off than others with regard to physician retention. These findings could be used by public health officials and administrators to identify the need for site specific strategies to improve retention in struggling hospitals.

One retention study that focused specifically on rural physician retention was conducted by Pathman, et al., in 2004 to determine if average job retention duration was shorter for physicians in rural health professional shortage areas (HPSAs) than for physicians in rural non-HPSAs. The study initially identified primary care physicians in 1991 that had recently moved to rural HPSAs and rural non-HPSAs. Then in 1996 and

1997, they resurveyed those physicians to document any job changes. The study then compared the two cohorts using the CHP methodology and concluded that retention of primary care providers in rural HPSAs is identical to, or very slightly shorter than, retention for those working in rural non-HPSAs (Pahtman, Konrad, Dann, & Koch, 2004). These findings are important because they show that the causes of healthcare shortage in these areas is more due to lack of recruitment than poor retention.

A 2015 study by Pagaiya, Kongkam and Sriratan investigated retention of rural physicians in Thailand and compared physicians who had completed their training through normal channels and those who participated in a rural recruitment program. The study found that physicians participating in the rural recruitment program had retention rates 20% longer than those who did not participate (Pagaiya, Kongkam, & Sriratana, 2015).

Bailey, Wharton and Holman published a 2016 study that compared rural doctor retention over time in Western Australia. Being a large, mostly rural country, Australia has placed significant focus on improving healthcare delivery in rural areas over the last 20 years. The study compared doctors who first began working in Western Australia between 2004 and 2008 to those who began working in the same area between 2009 and 2014 with a goal of determining whether or not rural health policies were having a positive impact on retention of doctors. The study found that retention for the 2009-2014 cohort was longer than the 2004-2008 cohort, indicating that the implementation of rural health policy was indeed having a positive impact on the retention of doctors in Western Australia (Bailey, Wharton, & Holman, 2016).

These studies have contributed to the body of well-established research into workforce retention. This report aims to use the methodologies implemented by this established research to analyze retention in Nebraska. By using these methodologies, this study is able to identify not only if program participation has an impact on retention, but also the magnitude of that impact.

Chapter 2 Data

The primary dataset for this project was acquired from the Health Professions Tracking Service (HPTS) based out of the University of Nebraska Medical Center (UNMC) in Omaha, NE. The HPTS was developed in 1995 as a key repository for tracking essential information about healthcare providers in Nebraska and western Iowa. It also maintains information about the facilities where providers practice. The HPTS keeps track of a wide range of data including demographic, training, expertise, licensure, practice locations, and participation in incentive programs. The HPTS obtains data through semi-annual surveys sent to all licensed providers and to the administrators of the facilities where they work. Those surveys are then cross referenced with Nebraska state licensure data, resulting in an extremely robust and accurate dataset. The dataset for this project pertains to all family medicine providers (Physicians, Physician Assistants and Advanced Practice Registered Nurses) that have practiced or are practicing in Nebraska between January 1, 1998 and January 1, 2018.

The initial data download from the HPTS was organized by each unique tenure served by each practicing provider. A tenure is defined as the period of time a provider works at a unique location from the start of employment to the time they left that position. In some cases, the dataset included duplicate entries to account for providers with multiple licenses (APRN and PA) or providers that have participated in more than one incentive program. These duplicate entries were accounted for in the data cleanup portion of this study.

In addition to the HPTS dataset, RUCA census tract data were obtained from the United States Department of Agriculture Economic Research Service and population data were obtained from the US Census Bureau. This RUCA data was separated into four distinct levels of rurality which were used in the majority of the analysis in this report. All other geospatial data were obtained from the Nebraska DHHS, GIS server.

The Nebraska DHHS Office of Rural Health, partners with other states to collect qualitative survey information through organizations like the Rural Recruitment and Retention Network (3RNet). These data are useful understanding specific issues that could be influencing providers retention but they shouldn't be relied upon alone to understand retention. By using the longitudinal data provided from the HPTS, quantitative data analysis can provide a more precise assessment of the influence of the institutional and systemic factors that could impact retention.

Chapter 3 Methods

Data management and analysis for this project involved two steps. The first step was to clean and organize the dataset obtained from HPTS in order to prepare it for statistical analysis. This step allowed for the creation of descriptive statistical tables based on consistent rural classifications, length of time worked at each location, profession and program participation. This data management step also organized the dataset so that it enabled analysis using advanced statistical tools.

The second step was to employ survival analysis methodologies using SPSS statistical software. These analyses were based on general epidemiological methods designed to draw conclusions from time to event data. By using this methodology, it was possible to determine if there were statistically significant differences between retention of program participants and non-participants while also quantifying the magnitude of any differences.

3.1 Data Cleaning and Organization

In order to prepare the dataset for analysis, it first needed to be cleaned and organized to fit the parameters for statistical modeling. The primary goal of this process was to identify the populations to be investigated and to compile the information into a format that was conducive to analysis in SPSS. Appendix 1 shows a table of the data fields included in the original provider and facility datasets that were obtained from HPTS and how those data were used to create the final dataset used for analysis.

The first step in this process was to eliminate personal identifying data fields such as provider name, home address, phone number, email address and license number. In addition, unneeded and redundant data fields regarding facility contact information and provider sub-specialty fields were removed. In order to identify individual providers for statistical analysis, a Subject ID (SID) number, generated by HPTS, was retained.

In order to fit the statistical model used in this project, providers that were actively practicing on January 1, 2018, the end of the study period, were labeled as “currently practicing.” These currently practicing providers were then identified with either a “1” meaning they were practicing at a facility at the end of the study period or a “0” meaning that they had started and ended a tenure within the study period. This designation was used to determine right censoring which is discussed in more detail later in this chapter.

As mentioned in Chapter 2 of this report, the initial provider dataset obtained from HPTS contained multiple entries for each individual family medicine provider. In most cases, each entry represented the unique tenure at a location that a provider had worked or is currently working. However, a small percentage of providers had duplicate entries because they either held licenses as both a physician assistant and nurse practitioner, or they had participated in more than one incentive program. To account for this, providers with duplicate entries were identified and new data fields were created to designate those with dual licenses or those who participated in multiple programs. The duplicate entries were then removed from the dataset leaving, only entries representing each provider’s unique tenure at individual locations.

The next step in cleaning and organizing the data was to create a data field that calculated the number of months worked at each location by each provider. This was done using the DATEDIF function in Microsoft Excel to subtract the date listed in the “Location To” field from the date listed in the “Location From” field. These fields represent the data collected by HPTS from provider and facility surveys and cross referenced with Nebraska State Licensure information. As a result, the dates in these fields may not be exact but can be assumed to be accurate within 6 months. This is primarily due to the inherent lag in the HPTS data reporting system (Deras, 2017).

Information regarding participation in incentive programs was cleaned and organized in a similar way. First, fields were created to identify participation in each individual program. This was done using a binomial identifier with a “1” representing participation and a “0” indicating that the provider did not participate. In addition, the number of months worked as part of program obligation was calculated using the DATEDIF function to subtract the “program start” field from the “program end” field for each participating provider.

The next step was to geographically locate the facilities where each provider had worked. This was accomplished by entering each facility’s street address into ESRI’s ArcGIS Online geocoding system. The resulting geocoded data points were then imported into ArcMap where they were categorized by census tract using a spatial join. This data table was then exported to Microsoft Excel and the census tract information was added to the working dataset using the VLOOKUP function. The census tract for each facility was then cross-referenced to the 2010 RUCA codes dataset. These codes

were then classified by level of rurality (Metropolitan, Micropolitan, Small Town and Rural) based on a USDA classification scheme (USDA Economic Research Service, 2018).

The final pre-analysis data cleanup step was to calculate the number of months worked at each level of rurality for each provider. This was done to reduce bias in the statistical model, as most providers in the dataset had practiced in more than one location over the course of the study period, and many of those locations existed at various levels of rurality. The first step in this process was to create a new master data set where each unique provider was listed only once. This was done by removing duplicate subject identification numbers from a copy of the working dataset. Then, using the working dataset, an Excel pivot table was created that calculated the number of months worked at each level of rurality for each individual provider. The VLOOKUP function was then used to join the pivot table information to the master dataset to be used for statistical analysis. Appendix 1 shows the data fields present in the master dataset and summarizes their importance to the statistical model used for the project.

3.2 Data Analysis

The statistical process used to compare length of retention for this project falls into a category of statistical modeling called survival analysis. Survival analysis is commonly used in epidemiology and is designed to analyze time to event data such as time to death, hospitalization, or recurrence of a condition. In the case of this project, the “event” in question occurs at the end of a providers’ cumulative time worked in a

particular level of rurality and is therefore a powerful tool in making statistical comparisons about provider retention.

There are two components to take into account when analyzing time to event data. The first is a binary component called censoring where an observation is classified with a “0” indicating that it is censored or a “1” indicating that the stated event has happened within the time frame of the study. Because it is impossible to create a study period where the event happens for all subjects, instances where a subject does not experience the event during the study period are identified through a process called censoring. Censored observations are data points where the exact time to event is not known. In the case of this project, censored observations are those where a provider was actively working at a location at the end of the study period. This is known as right censoring and is the only type of censoring used in this project. Other forms of censoring do exist however. Left censoring is used for events known to have happen prior to the study period, and interval censoring is for events known to have happened within the study period.

The second part of time to event data is the time component. This is a calculation of the amount of time a subject is at risk of an event happening during the study period. In this project, the time component represents either the total months worked at a specific level of rurality or, in the case of a censored observation, the amount of time a provider worked from the start of employment at that level of rurality until the end of the study period.

The first step in data analysis was to plot a Kaplan-Meier curve for each level of rurality. The Kaplan-Meier curve plots turnover (survival) over time and compares the percentage of retained individuals at any given time over the course of the study period. This plot visually displays separate survival curves for providers who have participated in incentive programs and those who have not. It also provides an estimate of the mean and median length of retention (survival) for each curve after taking into account any censored data points (Kleinbaum & Klein, 2012).

As part of this analysis, a chi-squared test called a log-rank test is conducted to check the Kaplan-Meier assumption by testing the null hypothesis that there are no differences between the probabilities of an event (leaving a position) for either group over the course of the study. It also can help to identify if censoring influences either group more than the other or if the odds of an event occurring changes over time (Bland & Altman, 2004).

The final analysis method used for this project is the Cox Proportional Hazard (CPH) regression model. This model calculates a hazard ratio, which is a ratio of the rate of hazard for a variable compared to the rate of hazard for a baseline variable. In this case, the retention for participating providers was compared to the baseline group of non-participating providers. The resulting hazard ratio is interpreted by examining its relation to 1. A hazard ratio of 1 would indicate no difference between the two variables. A ratio less than 1 indicates that events in the exploratory variable occur at a rate lower than those in the baseline variable. Likewise, if the hazard ratio is greater than 1, it indicates that events in the exploratory variable occur at a higher rate than those in the baseline

group. The magnitude of the difference in rates is determined by the distance of the hazard ratio from 1. For example, a hazard ratio of .38 would indicate that events in the exploratory variable are expected to occur at a rate 62% lower than the same event in the baseline group. Conversely, a hazard ratio of 1.62 would indicate that events in the exploratory variable occurred at a rate 62% higher than baseline (Kleinbaum & Klein, 2012).

It is important to look at the statistical significance and goodness of fit for this type of model. As part of the CPH model results, a p-value is returned as well as a 95% confidence interval for the hazard ratio. If the p-value less than or equal to 0.05, the resulting hazard ratio is considered statistically significant, meaning that with 95% confidence, the difference in retention between the two groups is not due to chance alone.

The CPH model operates on the assumption that the risk of an event happening is constant across the entire study period. In order to test this assumption, and thus validate the results of a CPH model, a goodness of fit test must be conducted. Survival analysis texts recommend a graphical analysis by plotting a log-log graph from a standard survival curve and verifying that the resulting curves appear to be parallel. This method of testing goodness of fit has potential drawbacks due to subjectivity in determining if the curves are parallel. However, Kleinbaum and Klein suggest that the CPH assumption is generally accepted unless there is strong evidence of nonparallelism (Kleinbaum & Klein, 2012).

For this project, both a Kaplan-Meier survival curve and a Cox proportional hazard test were run on each of the five separate datasets representing the rurality of

providers. Because some providers have worked in multiple locations across varying levels of rurality, it was necessary to break the master dataset into these smaller groups. Therefore, separate analyses were conducted for providers at each level of rurality (rural, small town, micropolitan, metropolitan), as well the state as a whole.

Chapter 4 Results

Each rurality cohort studied in this project underwent three levels of analysis. First, Table 4.1 shows general descriptive statistics compare the basic demographic, profession and program participation counts at each level of rurality. Second, a Kaplan-Meier survival curve was generated to graphically compare retention of participating and non-participating providers. The Kaplan-Meier test also provided an estimate of mean and median length of retention. Lastly, a Cox Proportional Hazard model was fitted to retention data to compare participating and non-participating providers. For both, the Kaplan-Meier and CPH models, a test of fit was conducted to determine the viability of the results.

Table 4.1 Gender and incentive program participation of family medicine providers in Nebraska who started a position between January 1, 1998 and January 1, 2018

All Locations	n=2431		
	Total (% of total)	Participants (% of participant providers)	Non-participants (% of non-participant providers)
Gender			
F	1357 (55.8%)	270 (57.4%)	1087 (55.4%)
M	1074 (44.2%)	200 (42.6%)	874 (44.6%)
Total (% of total)	2431 (100%)	470 (100%)	1961 (100%)
Profession			
APRN	537 (22.1%)	88 (18.7%)	449 (22.9%)
MD	1230 (50.6%)	197 (41.9%)	1033 (52.7%)
PA	664 (27.3%)	185 (39.4%)	479 (24.4%)
Total (% of total)	2431 (100%)	470 (100%)	1961 (100%)

Table 4.1 Continued

Metropolitan n=1430 (58.8% of statewide providers)			
	Total (% of total)	Participants (% of participant providers)	Non-participants (% of non-participant providers)
Gender			
F	816 (57.1%)	82 (56.2%)	734 (57.2%)
M	614 (42.9%)	64 (43.8%)	550 (42.8%)
Total (% of total)	1430 (100%)	146 (100%)	1284 (100%)
Profession			
APRN	327 (22.9%)	31 (21.2%)	296 (23.1%)
MD	756 (52.9%)	62 (42.5%)	694 (54.0%)
PA	347 (24.3%)	53 (36.3%)	294 (22.9%)
Total (% of total)	1430 (100%)	146 (100%)	1284 (100%)
Micropolitan n= 563 (23.2% of statewide providers)			
Gender			
F	320 (56.8%)	50 (53.8%)	270 (57.4%)
M	243 (43.2%)	43 (46.2%)	200 (42.6%)
Total (% of total)	563 (100%)	93 (100%)	470 (100%)
Profession			
APRN	155 (27.5%)	24 (25.8%)	131 (27.9%)
MD	246 (43.7%)	33 (35.5%)	213 (45.3%)
PA	162 (28.8%)	36 (38.7%)	126 (26.8%)
Total (% of total)	563 (100%)	93 (100%)	470 (100%)
Small Town n=523 (21.5 % of statewide providers)			
Gender			
F	281 (53.7%)	120 (58.0%)	161 (50.9%)
M	242 (46.3%)	87 (42.0%)	155 (49.1%)
Total (% of total)	523 (100%)	207 (100%)	316 (100%)
Profession			
APRN	71 (31.6%)	25 (12.1%)	46 (14.6%)
MD	236 (45.1%)	89 (43.0%)	147 (46.5%)
PA	216 (41.3%)	93 (44.9%)	123 (38.9%)
Total (% of total)	523 (100%)	207 (100%)	316 (100%)
Rural n= 543 (22.3% of statewide providers)			
Gender			
F	314 (57.8%)	136 (59.4%)	178 (56.7%)
M	229 (42.2%)	93 (40.6%)	136 (43.3%)
Total (% of total)	543 (100%)	229 (100%)	314 (100%)
Profession			
APRN	125 (23.0%)	50 (21.8%)	75 (23.9%)
MD	220 (40.5%)	89 (38.9%)	131 (41.7%)
PA	198 (36.5%)	90 (39.3%)	108 (34.4%)
Total (% of total)	543 (100%)	229 (100%)	314 (100%)

Table 4.1 shows general descriptive statistics for all levels of rurality studied in this project. Over the 20-year study period, there were a total of 2431 family medicine providers who practiced in Nebraska. Of these providers, 1430 (58.8%) practiced in a metropolitan area, 563 (23.2%) practiced in a micropolitan area, 523 (21.5%) practiced in a small town and 543 (22.3%) practiced in rural areas. Many of these providers have worked at locations in more than one level of rurality over the course of the 20-year study period.

Out of the total of 2431 statewide providers during the 20-year period, 470 (19.3%) have participated in one or more incentive programs, and 1961 (80.7%) have not participated in any of the incentive programs. Of the 1430 providers who at some point during the study period practiced in a metropolitan area, 146 (10.2%) were program participants and 1284 (89.8%) were not. In micropolitan areas, program participants made up 93 (16.5%) of the 563 providers while non-participants accounted for 470 (83.5%) of the providers. The number of program participants in small town areas was 207 (39.6%) and the number of non-participants was 316 (60.4%). In rural areas, out of 543 providers, 229 (42.2%) participated in incentive programs and 314 (57.8%) did not (Table 4.1).

Of all providers studied, just over half (1230, 50.6%) were MDs, 664 (27.3%) were PAs, and 537 (22.1%) were ARPNs. Of the 470 program providers statewide, 197 (41.9%) were MDs, 185 (39.4%) were PAs, and 88 (18.7%) were ARPNs. Of the non-program providers, 1033 (52.7%) were MDs, 479 (24.4%) were PAs, and 449 (22.9%) were ARPNs (Table 4.1).

Table 4.2 shows the average amount of time served including all levels of rurality throughout Nebraska for each program. This calculation gives a general idea of how long providers in each program have worked; however, because these calculations include providers who were working at the end of the study period, they likely skew lower than the actual mean retention times. Also, NHSC SLRP is a relatively new program and, therefore, participating providers have simply not had the ability to generate retention times like participants in other programs.

Table 4.2 Mean retention times for all providers statewide, based on participation in incentive programs.

Program	Total	Total Months Worked (years)	Average Months Worked (Years)	Total months worked after obligation (Years)	Average months worked after obligation (Years)
NE Loan Repayment	271	30462 (2538.5)	112.4 (9.4)	21000 (1750.0)	77 (6.5)
NE Student Loan	77	10939 (911.6)	142.1 (11.8)	8038 (669.9)	104 (8.7)
NHSC Loan Repayment	118	14670 (1222.5)	124.3 (10.4)	11237 (936.4)	95 (7.9)
NHSC Scholarship	21	2631 (219.3)	125.3 (10.4)	2149 (179.1)	102 (8.5)
NHSC SLRP	15	931 (77.6)	62.1 (5.2)	486 (40.5)	32 (2.7)
No Program	1961	193304 (16108.7)	98.6 (8.2)	193304 (16108.7)	98.6 (8.2)
All Providers	2431	248287 (20690.6)	102.1 (8.5)	233064 (19422)	95.9 (8.0)

Statewide, the program with the longest average length of retention, was the NE Student Loan program (11.8 years). The NHSC Loan Repayment and NHSC Scholarship

programs both had an average retention of 10.4 years and the NE Loan Repayment program had an average retention of 9.4 years. As expected, the newer program, NHSC SLRP only had an average retention of 5.2 years. For all non-program providers, the average length of retention was 8.2 years.

Between 1998 and 2018 there were an average of 19.75 program awards issued yearly across the five incentive programs. Figure 4.1 shows the number of awards issued yearly by each program as well as the total number of annual awards. On average, there were 12.1 Nebraska Loan Repayment awards, 4.25 NHSC Loan Repayment awards, 2.25 Nebraska Student Loan awards, 0.4 NHSC Scholarships awarded to Nebraska family medicine providers between 1998 and 2018. Additionally, there were on average 3.75 NHSC SLRP awards granted to family medicine providers from the program's inception in 2014 to the end of the study period in 2018.

Figure 4.1 Program awards issued in Nebraska between 1998 and 2018 by program type

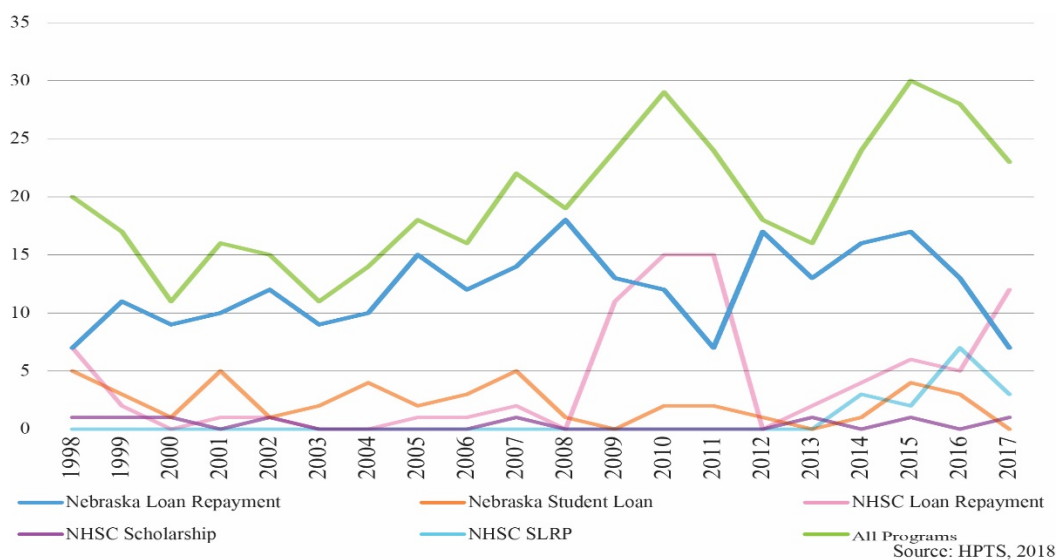
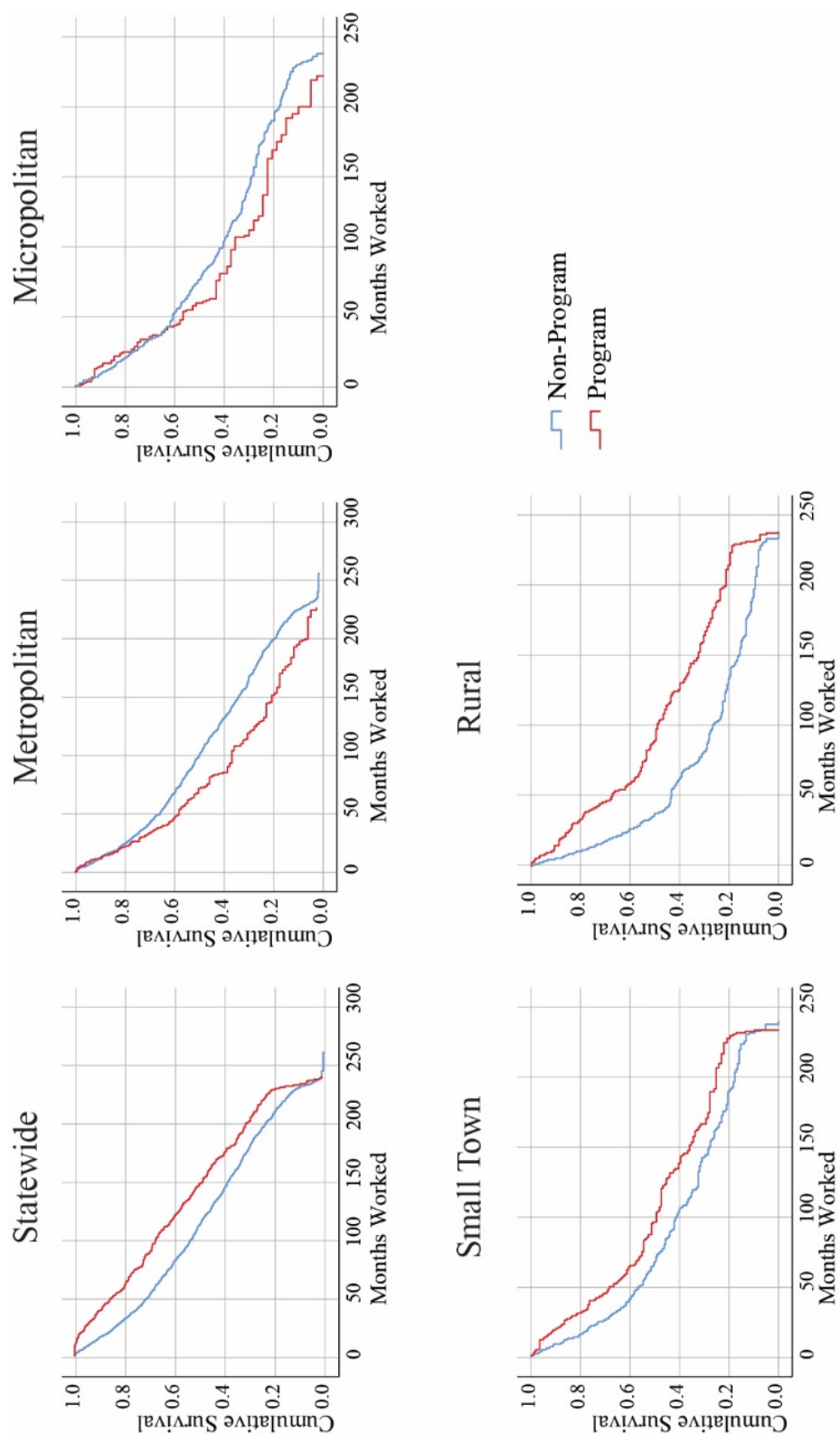


Figure 4.2 shows the results from Kaplan-Meier survival analysis that graphically compares the length of retention for family medicine providers. The Kaplan-Meier analysis not only plots a curve for the retention (survival) of cohorts, it also provides an estimate of the mean and median length of retention. This estimate takes into account those providers who are currently working and thus right-censored. Table 4.3 shows the resulting mean and median retention as well as the logrank test scores for each level of rurality. The logrank test is used to determine if there is in fact a difference between survival curves for program and non-program providers.

Table 4.3 Kaplan-Meier results for all levels of rurality.

	n=	Censored (% of cohort)	Median months worked	Mean months worked	Logrank test		
					Chi- square	df	P-value
Statewide	2431	550 (22.6%)	120	121.9	24.904	1	0.000
Non-program	1961	415 (21.2%)	112	117.0	-	-	-
Program	470	135 (28.7%)	147	141.9	-	-	-
Metropolitan	1430	297 (20.8%)	94	106.5	13.723	1	0.000
Non-program	1284	265 (20.6%)	99	108.8	-	-	-
Program	146	32 (21.9%)	69	84.7	-	-	-
Micropolitan	563	147 (26.1%)	74	96.0	2.852	1	0.091
Non-program	470	123 (26.2%)	77	98.1	-	-	-
Program	93	24 (25.8%)	60	84.2	-	-	-
Small Town	523	155 (29.6%)	77	102.7	6.48	1	0.011
Non-program	316	87 (27.5%)	68	94.2	-	-	-
Program	207	68 (32.9)	96	114.7	-	-	-
Rural	543	135 (24.9%)	58	87.7	31.181	1	0.000
Non-program	314	68 (21.7%)	38	69.6	-	-	-
Program	229	67 (29.3%)	90	111.6	-	-	-

Figure 4.2 Kaplan-Meier survival curves for all five levels of rurality studied.



Statewide, 550 (22.6%) of the 2431 providers were censored for survival analysis. Of the 470 program providers, 135 (28.7%) were censored, and of the 1961 non-program providers, 425 (21.2%) were censored. For the metropolitan group as a whole, 297 (20.8%) of the 1430 providers remained in their position at the end of the study period and were therefore censored. Out of the 146 incentive program participants, 32 (28.7%) were censored and of the 1284 providers who did not participate, 265 (20.6%) were censored. Out of the 563 micropolitan providers, 147 (26.1%) were censored. Of the 93 program providers in micropolitan areas, 24 (25.8%) were censored and of the 470 non-program providers in micropolitan areas, 123 (26.2%) were censored. In small town areas, 155 (29.6%) of the 523 providers were censored. Of the 207 program providers, 68 (32.9%) were censored. Out of the 316 non-program providers in small town areas, 87 (27.5%) were censored. Of the 543 providers who had worked in rural areas, 135 (24.9%) remained in their positions at the end of the study period and were therefore censored. For rural program providers, 67 (29.3%) out of 229 were censored. For non-program providers 68 (21.7%) out of 314 were censored.

During the study period, the median number of months worked for all family medicine providers statewide was estimated to be 120 (10 years). Statewide, the estimated median number of months worked for program providers was 141 (12.3 years) and for non-program providers it was 112 (9.3 years). In metropolitan areas as a whole the estimated median length of retention was 94 months (7.8 years). The estimated median number of months worked by metropolitan program providers was 69 (5.8 years) and the estimated median length of retention for metropolitan non-program providers was 99 months (8.3 years). In micropolitan areas, the estimated median length of retention for

all providers was 74 months (6.2 years). Micropolitan program providers had an estimated median length of retention of 60 months (5 years), and for non-program providers estimated median length of retention was 77 months (6.4 years). Estimated median length of retention for all providers in small town areas was 77 months (6.4 years). For small town program providers, median retention was 96 months (8 years) and for non-program providers it was 68 months (5.7 years). The estimated median length of retention for all rural providers was 58 months (4.8 years). Rural providers that participated in incentive programs had an estimated median length of retention of 90 months (7.5 years) and non-program providers had a median length of retention of 38 months (3.2 years). At a 95% confidence level, all of the Kaplan-Meier tests with the exception of the micropolitan cohort (p-value=0.091) returned statistically significant results.

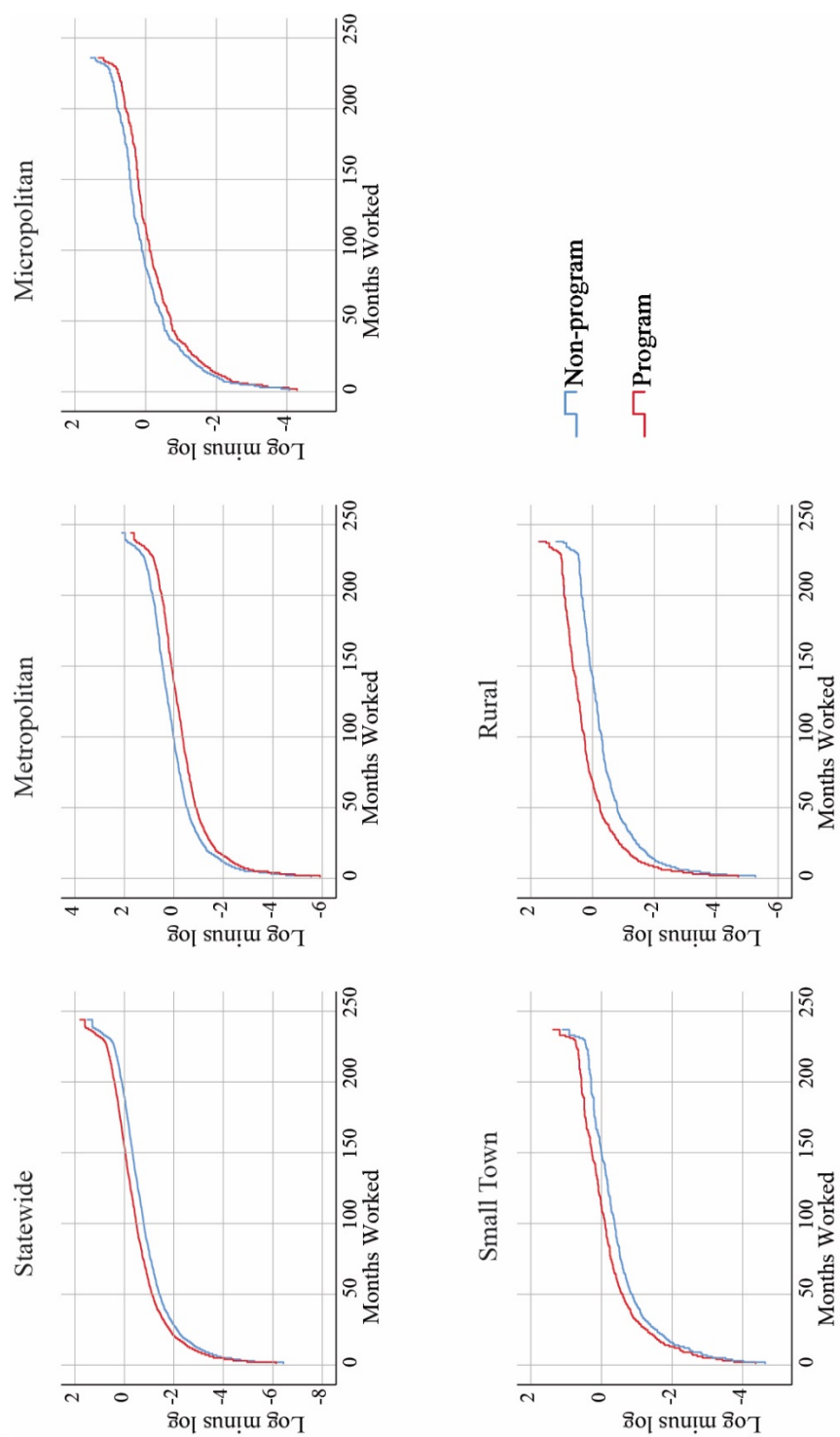
The CPH analysis provided a calculation of the magnitude of difference in retention between program providers and non-program providers in the form of a hazard ratio. Table 4.4 displays the results from CPH analysis for all levels of rurality. For each level of analysis, the group of non-program providers served as the baseline for comparison with program providers. At a statewide level, the hazard ratio was 0.743 (p-value = 0.000, 95% CI: 0.661-0.837). In metropolitan areas, the hazard ratio was 1.441 (p-value = 0.000, 95% CI: 1.185-1.751). For micropolitan areas, the hazard ratio was 1.25 (p-value = 0.094, 95% CI: 0.963-1.623). Small town areas had a hazard ratio of 0.763 (p-value = 0.012, 95% CI: 0.681-0.943). In rural areas, the hazard ratio was 0.571 (p-value = 0.000, 95% CI: 0.468-0.698). Of these tests, only micropolitan areas returned a p-value of

greater than 0.05 meaning that with the exception of the micropolitan cohort, all of the CPH results can be considered statistically significant.

Table 4.4 Cox proportional hazard analysis results

	B	SE	df	P-value	Hazard Ratio	HR 95% Confidence Interval Lower	HR 95% Confidence Interval Upper
Statewide							
Non-program	-	-	-	-	-	-	-
Program	-0.297	0.060	1	0.000	0.743	0.661	0.837
Metropolitan							
Non-program	-	-	-	-	-	-	-
Program	0.365	0.100	1	0.000	1.441	1.185	1.751
Micropolitan							
Non-program	-	-	-	-	-	-	-
Program	0.223	0.133	1	0.094	1.25	0.963	1.623
Small Town							
Non-program	-	-	-	-	-	-	-
Program	-0.271	0.108	1	0.012	0.763	0.618	0.942
Rural							
Non-program	-	-	-	-	-	-	-
Program	-0.560	0.102	1	0.000	0.571	0.468	0.698

In order to test the proportional hazard assumption that the risk of leaving a position is the same throughout the study period, and ensure goodness of fit for the CPH models used, a log minus log graph was plotted for each model. Figure 4.3 shows the five log minus log plots that accompany the CPH models. All five of the plots display parallelism between the provider and non-provider curves and therefore indicate that the proportional hazard assumption has been met.

Figure 4.3 Log minus log plots for each level of rurality.

Chapter 5 Discussion

In general, the results generated in this study can be compared in two categories based on rurality: (1) Rural and small town areas had a high proportion of providers who participated in incentive programs (around 40%); whereas, (2) metropolitan and micropolitan areas had fewer than 10% to 16% of providers participating in incentive programs. In addition, retention was longer for rural and small town program providers than for non-program providers. Conversely, in metropolitan and micropolitan areas, retention was longer for non-program providers than for program providers.

A closer look at the distribution of family medicine providers throughout the state shows some of the challenges that rural and small town residents face in accessing healthcare. In metropolitan areas, there are 1.28 providers per 1000 residents at a density of 243 providers per 1000 square miles. In micropolitan areas, there are 1.87 providers per 1000 residents at a density of 59 providers per 1000 square miles. In small towns there are 3.15 providers per 1000 residents at a density of 97 per 1000 square miles. In rural areas, there are 2.23 providers per 1000 residents at a density of 9.7 providers per 1000 square miles. Due to the large land area that makes up the rural portion of the state, the number of providers per 1000 square miles is considerably lower in rural areas than in small town, micropolitan and metropolitan areas. This low density of providers is a major cause of the access issues that contribute to the rural/urban health disparities in Nebraska.

The solution to this problem isn't as simple as adding more providers to the equation, however. With an average provider ratio of 2.23 per 1000 residents, rural residents have more available providers in relation to their population than both

metropolitan and micropolitan residents. If rural providers were spatially distributed in a manner similar to the other levels of rurality, there would simply be too many providers for rural communities to support. Therefore, it is important for public health officials to make sure that the distribution of providers in rural areas is such that the most people are helped without having too many providers in an area. The incentive programs help to facilitate this distribution, as qualifying facilities and shortage areas are regularly updated to reflect the most current state of the provider workforce.

Therefore, the overall goal of these incentive programs should be to continue to identify areas in Nebraska that are in need of healthcare providers and help to recruit providers to those areas. These shortage areas are ever-changing and therefore need to be constantly monitored. The Nebraska DHHS Office of Rural Health should continue working to provide an adequate level of healthcare services to these areas through incentive programs.

Not only do these programs play a role in improving the access to care in areas of need, they help to bolster the local economies of these areas. Eilrich, Doeksen, & St. Clair estimate that a rural physician has a \$1.4 million annual economic impact on a community and estimate that PAs and ARPNs contribute around \$700,000 yearly to the local economy (Eilrich, Doeksen, & St. Clair, 2016).

In 2016, there were a total of 23 Nebraska Loan Repayment awards issued of those, 13 (56.5%) were issued to family medicine providers all of whom worked in either small town or rural areas. According to the 2017 Rural Health Annual Report from the Nebraska DHHS, Office of Rural Health, nearly \$2.25 million was distributed to

Nebraska Loan Repayment recipients in 2016 (Jensen, 2017). Assuming that award amounts were evenly distributed among program providers, it can be estimated that between a combination of state funds and local matching funds, the estimated total investment in family medicine providers by the Nebraska Loan Repayment program was \$1.27 million.

Of the 13 Nebraska Loan Repayment Recipients in 2016, five were MDs and the remaining eight were either ARPNs or PAs. Using the estimated economic impact of rural healthcare providers outlined by Eilrich, Doeksen, & St. Clair, it can be estimated that in 2016, family medicine providers that participated in the Nebraska Loan Repayment program generated an economic impact of \$12.6 million. This is a nearly tenfold return of on investment. Budget and payment information was not readily available for this analysis. However, the other incentive programs would be expected to have similar returns on investment.

This information has enormous planning implications because it allows public health planners and administrators to demonstrate that there are quantifiable economic and public health benefits to these incentive programs. This information can therefore be included in grant applications to help secure continued and additional funding for the programs.

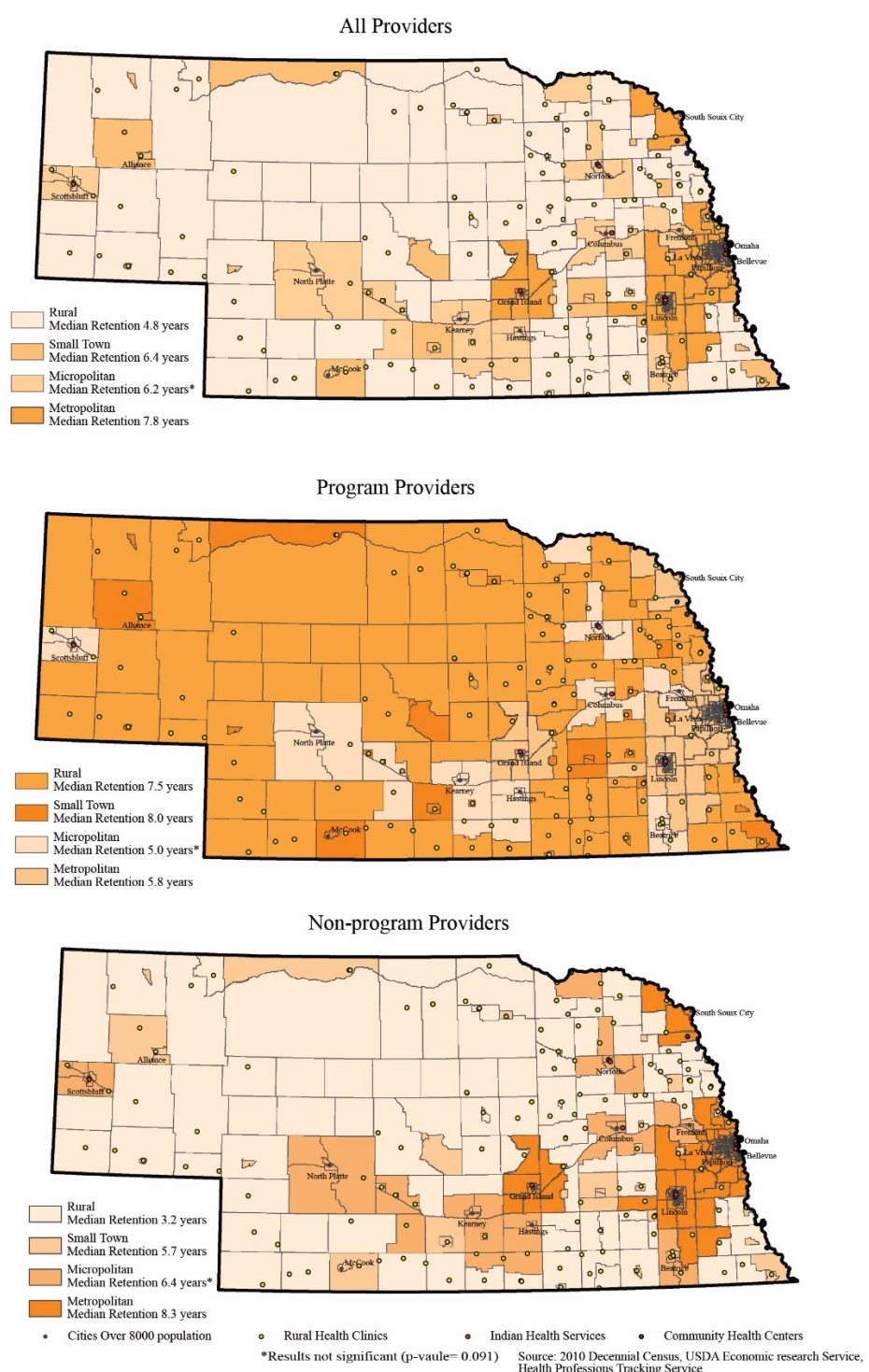
Analysis of the Kaplan-Meier test results show two important things. First, by analyzing the logrank test for each Kaplan-Meier curve, it can be confirmed that there is a statistically significant difference between the retention of program providers and non-program providers at all levels of rurality with the exception of micropolitan areas.

However, the results for micropolitan areas are close to significant with a p-value of 0.091 (>0.05).

The Kaplan-Meier curves also provide insight into the magnitude of the differences in years of retention of program and non-program providers in the four levels of rurality used in this study. For all family medicine providers statewide, the estimated median length of retention is 2.9 years longer for program providers than it is for non-program providers. This difference is even greater for rural areas where the estimated median length of retention is 4.3 years longer for program providers. In small town areas, the median length of retention for program 2.3 years longer than for non-program providers. In metropolitan environments however, the estimated median length of retention was 2.5 years longer for non-program providers than for program providers (Figure 5.1).

Figure 5.1 Estimated median length of retention for all family medicine providers in

Nebraska



The results for the CPH analysis provided more precise insight into the magnitude of difference between retention of program and non-program providers. Statewide, the hazard ratio for program providers compared to non-program providers was 0.743 (p-value=0.000, 95% CI: 0.661 – 0.837). This means that the risk of program providers leaving a position within the state is 25.7% lower than that of non-program providers. In rural areas, the hazard ratio for program providers was 0.571 (p-value= 0.000, 95% CI: 0.468 – 0.698), meaning that program providers had a risk of leaving a position in a rural area that was 41.9% lower than that of non-program providers. Similarly, program providers in small town areas had a hazard ratio of 0.763 (p-value= 0.012, 95% CI: 0.618 - 0.942), meaning that the risk of a program provider leaving a small town position was 23.7% lower than that of a non-program provider.

For providers in metropolitan and micropolitan areas, the trend was opposite that of small town and rural areas. In these areas, non-program providers left positions at rates lower than program providers. Metropolitan program providers had a hazard ratio of 1.441 (p-value= 0.000, 95% CI: 1.185 – 1.751), which means that program providers left positions in metropolitan areas at a rate 44.1% higher than their non-program counterparts.

In micropolitan areas, the findings were not statistically significant at a 95% confidence but they did return predictable results. Micropolitan program providers had a hazard ratio of 1.25 (p-value= 0.094, 95% CI: 0.618 – 0.942), meaning that program providers left micropolitan positions at a rate 25% higher than non-program providers.

From a planning and healthcare administration perspective, these comparisons provide an indication that specific factors may be present causing these disparities. By identifying these disparities, future investigation into the causes of these disparities can be carried out. For example, additional investigation using methods similar to those found in this report can identify other factors that could influence retention, such as provider's place birth, the type of facility where they practice, the specific program they have participated in, or level of community support. This report has laid the groundwork for using HPTS data to conduct survival analysis, thus opening up the potential for additional retention research.

The planning implications of the CPH portion of the study again center on the establishment of a method of analysis to compare retention using HPTS data. By using this type of survival analysis, planners and healthcare administrators can get a quantifiable assessment of how likely members of a specified cohort are to leave a position in a specific location type (i.e. metropolitan, micropolitan, small town or rural). These methods can be used to improve understanding of the factors that affect retention and help decision makers to implement policy designed to increase the length of time a provider works in a location.

Chapter 6 Conclusion

Disparities in health outcomes between urban and rural residents exist in Nebraska (Nebraska Department of Health and Human Services, Office of Community Health and Performance Management, 2016). The Nebraska State Office of Rural Health has put forth considerable effort to address these disparities. One of the primary strategies in combating this problem has been the implementation of state and federal incentive programs designed to recruit healthcare providers to areas of need. In many cases, these areas of need are rural in nature. Recruitment of providers is only one piece of the healthcare delivery puzzle however. The ability to retain providers in shortage areas is just as important to addressing rural-urban health disparities.

This study has examined the connection between participation in incentive programs and length of retention among family medicine providers at varying levels of rurality and has determined that there is in fact a positive correlation between participation in incentive programs and length of tenure by providers.

In conclusion, this report adds to the body of research regarding workforce retention of healthcare providers and establishes a methodology that can be used with existing HPTS data to further investigate workforce retention issues. Using the methodologies outlined in this report and data collected by HPTS, planners and healthcare administrators are able to take a close look at other factors that might impact retention of healthcare providers, such as the type of facility where they work, the type of environment where they grew up, or the location of their residency, among many more.

This report also provides compelling evidence that participation in incentive programs has a positive impact on the overall retention of healthcare providers in rural and small town areas. These findings can be used to support claims that incentive programs are important to the overall healthcare delivery system in the state of Nebraska which in turn can help to secure additional program funding in the future.

By using the methodologies found in this report, further investigation into provider retention could be conducted in the future. Potential future studies could look into the roles that facility type or specific program type play in length of retention. This analysis could be used to identify weak spots in the state's healthcare delivery system, especially pertaining to retention of providers in rural and small town areas.

In general, this type of retention study is important to the overall mission of the Nebraska Department of Health and Human Services Office of Rural Health because it is able to quantify the differences in length retention between program and non-program providers. By understanding these differences, the Office of Rural Health can more effectively administer these incentive programs and more effectively use them as a tool to improve rural healthcare and economic viability.

Appendix 1

Dataset Column Headers	Description	Application to Project	New Column(s) Created	New Column Application
SID	Unique identification number for each provider	Used to anonymously identify providers		
BIRTH_YEAR, AGE, AS_OF_DOWNGRADO_DATE, AGE_GROUP, GENDER, ETHNICITY, ETHNICITY2, HISPANIC, LANGUAGES, HS_CITY, HS_COUNTRY, HS_STATE, BIRTH_COUNTRY, BIRTH_STATE	Demographic information			
2 professions - rows not duplicated	Denotes providers with MD and PA licenses	Providers counted as MDs and not duplicated in the original dataset. Column deleted	APRN, MD, PA	Static data fields used to count providers by type
duplicate rows - two professions	Denotes providers with APRN and PA licenses	Providers counted as based on most recent license		
PROFESSION	Identifies provider profession (MD, PA, APRN)	Used to create new static data fields		
duplicate rows because of two loans types	Denotes providers who have participated in more than one incentive program	Used to identify providers who participated in two programs. This information was compiled and used to create new static data fields	NE_LR, NE_SL, NHSC_LR, NHSC_S, NHSC_SIRP, Program	Denotes participation in incentive programs
PROGRAM_TYPE	Type of program participated in	Used to identify and count participation in incentive programs		
PROFESSION_STATUS as of 02-21-2018, STATUS, PROFESSIONAL STATUS, Professional status unknown	Lists providers' employment status (full-time, part-time, etc.)	Used to verify currently working providers	Censor/Currently Working	Denotes providers currently working. Used to right censor dataset and for currently practicing counts.
FACILITY_CODE	Unique ID for each practice facility	Used to cross reference facility location data		
LOCATION_MAP_ADDRESS1, LOCATION_MAP_ADDRESS2, LOCATION_MAP_CITY, LOCATION_MAP_STATE, LOCATION_MAP_ZIP, COUNTY	Facility location information	Used to geocode facility locations	RUC_ACT Classification	Used to identify rurality of specific practice locations
LOCATION_FROM_DATE	Start of tenure date	Used to calculate total months worked per tenure		
LOCATION_TO_DATE	End of tenure date	Used to calculate total months worked per tenure		
LOCATION_NUMBER	Identifies facility as a provider's primary location	Used to calculate total months worked per tenure	TMW_METRO, TMW_MICRO, TMW_ST, TMW_RURAL	Total months worked for each provider at each level of rurality
CLINIC_TYPE	Identifies type of clinic (clinic, office, residency)	Only primary locations used		
BEGIN_DATE	Beginning of program obligation	Residency tenures removed		
END_DATE	End of program obligation	Used to calculate total months obligated as part of incentive program participation		
OUTCOME	Notes regarding program outcome	Used to calculate total months obligated as part of incentive program participation		
COUNTY1, COUNTY2, COMMUNITY1, COMMUNITY2	Community where program participants were obligated	Used to identify program default		
PREFIX, FIRST_NAME, MIDDLE_NAME, LAST_NAME, SUFFIX, LASTNAME_PREV1, LASTNAME_PREV2, LICENSE_INFO, LIC_MD, LIC_DO, LIC_UC, IEP, LIC_PA, LIC_NP, LIC_CNMI, LIC_CNS, Person_NPI, HOME_ADDRESS1, HOME_ADDRESS2, HOME_CITY, HOME_STATE, HOME_ZIP	Personally identifying data. Deleted to ensure anonymity of providers.	Not used		
OCRH_LOC_CONTACT, OCRH_PHONE, OCRH_LOC_EMAIL, OCRH_LOC_PHONE, LOCATION_PHONE, LOCATION_FAX	Facility contact information, deleted	Not used		
Primary Specialty	Identifies primary specialty of provider	Not used		
FACILITY_PRIMARY_NAME, BUSINESS_NAME	Facility name	Not used		
PRACTICE_SPECIALTY	Identifies any specialty at a facility	Not used		
ACADEMIC_ACTIVITY	Identification of providers participating in academia	Not used		
COMMENT	Comment field used by HPTS	Not used		
MD DO Residency Specialty 1, MD DO Residency Specialty 2, MD DO Residency Specialty 3	Residency specialty for MDs and DOs	Not used		
LOCATION_AVG_WKLY_HRS	Average number of hours worked at a facility	Not used		

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