



ORIGINAL RESEARCH

Geographic disparities associated with travel to medical care and attendance in programs to prevent/manage chronic illness among middle-aged and older adults in Texas

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PUBLISHED

9 November 2019 Volume 19 Issue 4

HISTORY

RECEIVED: 22 October 2018

REVISED: 8 July 2019

CITATION

Smith ML, Towne Jr SD, Bergeron CD, Zhang D, McCord C, Mier N, Goltz HH. Geographic disparities associated with travel to medical care and attendance in programs to prevent/manage chronic illness among middle-aged and older adults in Texas. *Rural and Remote Health* 2019; 19: 5147. <https://doi.org/10.22605/RRH5147>

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ABSTRACT:

Introduction: Accessing care is challenging for adults with chronic conditions. The challenge may be intensified for individuals needing to travel long distances to receive medical care.

Transportation difficulties are associated with poor medication adherence and delayed or missed care. This study investigated the relationship between those traveling greater distances for medical care and their utilization of programs to prevent and/or manage their health problems. It was hypothesized that those traveling longer distances for medical care attended greater chronic disease management programs.

Methods: Thirty six thousand households in nine counties of central Texas received an invitation letter to participate in a mailed health assessment survey in English or Spanish. A total of 5230 participants agreed to participate and returned the fully completed survey. To investigate distance traveled for medical services and participation in a chronic disease management program, the analyses were limited to 2108 adults aged ≥ 51 years with one or more chronic conditions who visited a healthcare professional at least once in the previous year. Other variables of interest included residential rurality, health status, and personal characteristics. The data were first analyzed using descriptive and bivariate analyses. Then, an ordinal logistic regression model was

Keywords:

central Texas, chronic disease management, medical care, middle-aged and older populations, rural health, transportation, USA.

fitted to identify factors associated with longer distances traveled to medical services. Additionally, a binary logistic regression model was fitted to identify factors associated with attending a chronic disease self-management program.

Results: Among 2108 adults, rural participants ($p < 0.001$), those with more chronic conditions ($p < 0.001$), and those attending a chronic disease program ($p = 0.037$) reported traveling further distances to medical services. Participants with limited activity ($p < 0.001$), those from urban counties ($p = 0.017$), and those who traveled further ($p = 0.030$) were more likely to attend a chronic disease program.

Conclusion: While further distances to healthcare providers was found to be a protective factor based on the utilization of community-based resources, rural residents were less likely to attend a program to better manage their chronic conditions, potentially choosing to use long distance travel to address urgent medical needs rather than focusing on prevention and management of their conditions. Important policy and programmatic efforts are needed to increase reach of chronic disease self-management programs and other community services and resources in rural areas and to reduce rural inequities.

FULL ARTICLE:

Introduction

Identifying factors associated with access to medical care for particularly at-risk individuals is necessary to inform action by health policy makers and community stakeholders¹. This is increasingly critical as the number of middle-aged and older adults with chronic conditions is rising, due in part to the aging of the baby boomers² and advances in medical care³. In addition to the high prevalence of those with one chronic condition, multiple chronic conditions are becoming more common with nearly three-quarters of older adults having two or more chronic conditions⁴. Thereby self-management of these conditions, with a goal of avoiding preventable complications, is more challenging. Older adults may be a particularly at-risk group in clear need of access to medical care in order to successfully age in their homes in a community setting, also referred to as *successfully aging in place*⁵, as opposed to residing in institutionalized settings like nursing

homes.

With comorbid or concurrent chronic conditions comes increasing complexity (eg medication, potential for complications)⁶. This typically means that those with chronic conditions may need to visit healthcare providers to receive medical care more frequently, yet these same individuals may face barriers accessing care⁷. While this raises a set of issues related to keeping appointments and adhering to medical recommendations⁸, an initial barrier may be the amount of travel associated with getting adequate medical care. Transportation difficulties or long travel distance for medical care are associated with delayed care, poorer medication adherence, and foregone care^{9,10}. This is especially true in rural areas, where resources are scarcer and additional travel distances are required to reach healthcare providers¹⁰. Rural health disparities have persisted over time and more work is necessary to continue to monitor gaps and advise on possible solutions in the

realm of both policy and practice¹¹.

Although it has been documented that individuals in rural areas travel further distances to receive medical care, these studies often examine one-way or round-trip distance^{9,12} and do not consider the total distance driven to medical care in a 12-month period, which reflects a continuing burden of travel for care. Further, such studies examining healthcare access do not only focus on those with chronic conditions who may need frequent medical services¹³, or focus on those eligible for services offered through the aging services network who may receive community-based interventions¹⁴. To address these gaps, the primary purpose of this study was to identify factors associated with the travel distance to medical care providers among middle-aged and older adults with chronic health conditions. Secondly, this study aimed to assess utilization of community-based health programs as related to participants' residential rurality and distance traveled to medical care providers. Because long travel distances to medical care are believed to be an important barrier to healthcare access, it was hypothesized that longer travel distance to formal medical care providers would encourage attendance in community-based programs to prevent/manage chronic illness that are offered closer to home (eg hosted in senior centers, libraries, faith-based organizations)¹⁴.

Methods

Participants and procedures

Data gathered for the 2013 Regional Healthcare Partnership Community Health Needs Assessment of Region 17 were used for this study. Region 17 includes nine counties from central Texas: Brazos, Bursleson, Grimes, Leon, Madison, Montgomery, Robertson, Walker, and Washington. Thirty-six thousand households were invited to participate in the study via a mailed recruitment letter. A total of 24 768 households were reached in a follow-up call (68.8% contact rate), with 12 177 of those agreeing to complete the survey in either English or Spanish (33.8% agreement rate). Finally, 5320 of the 12 177 who agreed to participate returned surveys, for a return rate of 42.9% (ie 14.8% overall response rate).

Of the 5089 participants with complete data, the following cases were excluded as they did not meet the study's purposes: participants younger than 51 ($n=1201$), those without a chronic condition ($n=384$), those traveling to a doctor from a location other than their home ($n=337$), those with no routine doctor's visit in the past year ($n=500$), and those not reporting the exact number of doctor's visits in the previous 12 months ($n=307$). Of the remaining 2360 participants, the authors omitted those with missing data on the variables of interest, including education ($n=22$), marital status ($n=5$), number of people living in the household ($n=61$), healthcare access ($n=38$), days of poor physical/mental health ($n=93$), total distance traveled for medical services ($n=83$), and attending a program to prevent/manage chronic illness ($n=13$). Some cases had missing data for more than one of these variables. The final analytic sample was 2108 adults aged 51 years and older with one or more chronic conditions who visited a healthcare professional one or more times in the previous

year originating from home.

County-by-county comparisons were made between the study sample and the nine-county study region using US Census data. The proportion of study participants from each sample mirrored the county population size and county rurality. The study sample was comparable to the county characteristics in terms of education. Slight variations were noted, with the study sample having modestly smaller household sizes and greater proportions of females and white individuals. These subtle differences may be attributed to the study inclusion criteria.

Measures

Dependent variables: Two dependent variables were included in this study. The first dependent variable was the distance traveled for medical services in the previous 12 months. This variable was constructed from two separate questions. First, participants were asked, 'In the past 12 months, how many times did you use the following for your own healthcare? Doctor's office or clinic (all types of medical care).' This variable was open-ended, and participants could write in the number of visits they attended in the past year. Then, participants were asked, 'Thinking about where you go for medical care, please tell us how far you travel to get there.' This variable was open-ended, and participants could write in the distance they travel to get to their medical care (one-way). This value was multiplied by two to obtain the distance traveled to medical care (round-trip). Then, distance (round-trip) was multiplied by the number of doctor's office visits reported for the previous 12 months. This final value represented the total distance traveled to medical care in the previous year. This variable was trichotomized into statistical tertiles for analysis purposes. The second dependent variable was whether or not participants ever attended a program to help them prevent or manage a chronic illness. Response choices for this dependent variable were 'no' and 'yes'.

Residential rurality Participants' county of residence were coded based on Rural-Urban Continuum Codes (RUCCs). Each of the nine counties in this region were coded as urban or rural^{15,16}.

Health status Participants were also asked, 'Has a medical care provider (physician, nurse practitioner or physician assistant) ever told you that you had any of the following health problems?' Participants were asked to self-report their chronic conditions from a list of 16 health problems (scored 'no'/'yes'). Examples of health conditions included hypertension, congestive heart failure, diabetes, cancer, asthma, arthritis and depression. All items each participant endorsed were summed to create a continuous variable (range 1–11 conditions). Participants were also asked to complete two open-ended items from the Centers for Disease Control and Prevention Healthy Days Scale¹⁷. The first question was, 'Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?' Responses could range from 0 days to 30 days¹⁷. The second question was, 'Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was

your mental health not good?' Responses could also range from 0 days to 30 days. These items were summed and recoded to create a single variable ranging from 0 days to 30 days indicating the number of days the participant reported physical and/or mental health being not good. Participants were asked, 'Are you limited in any way in any activities because of any impairment or health problem?' Response choices were 'no' and 'yes'. Then, participants were asked to rate their perceptions about the following statement: 'Your access to healthcare whenever you need it.' Responses were scored using a six-point Likert-type scale ranging from 'very poor' (scored 1) to 'excellent' (scored 6). This variable was treated continuously in analyses.

Personal characteristics The following participant characteristics were examined: age (range 51–96 years), sex (male, female), race (white, non-white), education (high school or less, more than high school), and marital status (married, unmarried). Participants were also asked to report the number of people who reside with them in their household, including themselves (range 1–8 people).

Statistical analyses: The Statistical Package for the Social Sciences v24 was used to perform all analyses (IBM, <https://www.ibm.com/analytics/us/en/spss/spss-statistics-version/>). The authors first calculated frequencies and descriptive statistics for all variables of interest and then compared them across the two dependent variable categories. We used χ^2 tests to measure the differences in distribution for all categorical variables. Independent sample *t*-tests and one-way ANOVA were run to assess the differences in mean for continuous and count variables. An ordinal regression model was used to assess factors associated with traveling further distances (in miles) to medical services in the past 12 months (ie tertiles from shortest distance to longest distance). A binary logistic regression model was fitted to examine factors associated with attending a program to prevent/manage chronic illness. In this case, not attending a program to prevent/manage chronic illness served as the referent group. For all analyses, statistical analysis was determined at an alpha level of less than 0.05. Odds ratios (ORs) and 95% confidence intervals were also determined.

Ethics approval

The University of Georgia provided institutional review board approval for this secondary data analysis (#00004540).

Results

Table 1 presents sample characteristics by rurality. Overall, approximately 69% of participants resided in a rural county. On average, participants had 5.65 (standard deviation (SD): ± 6.86) doctor's office visits and traveled 346.32 (± 872.72) km (215.19 (± 542.28) mi) for medical care in the previous 12 months. The average age of participants was 64.90 (± 7.53) years, and the majority of participants were female (62.4%), white (92.9%), married (77.9%), and had more than a high school education (73.6%). On average, participants self-reported 3.53 (± 1.91) chronic conditions and 7.24 (± 10.57) days of poor physical/mental health. Approximately 43% of participants reported they experienced

limited activity due to their impairment or health problem, and 13.5% reported having attended a program to prevent or manage a chronic illness. When comparing participant characteristics by whether or not the participant resided in a rural county, a significantly larger proportion of participants with a high school education or less resided in a rural county. On average, participants residing in a rural county were younger, traveled further to medical services in the past year, had more days of poor physical/mental health, and lower ability to access health care when needed.

Table 2 presents sample characteristics by the two dependent variables. When comparing participant characteristics by total distance traveled for medical care in the previous 12 months (by tertile), significantly larger proportions of those in a rural county, females, those with a high school education or less, and those with limited activity traveled further for medical care. On average, participants with more chronic conditions, more days of poor physical/mental health, and less ability to access health care when needed traveled further for medical care. When comparing participant characteristics by whether or not the participant attended a program to prevent/manage a chronic illness, those who attended a program traveled significantly further in total to medical care in the previous 12 months. On average, those who attended a program reported more doctor's visits in the previous 12 months, more self-reported chronic conditions, and more days of poor physical/mental health.

Table 3 presents findings from an ordinal regression model examining factors associated with further travel to medical services in the previous 12 months. Across tertiles, participants residing in rural areas ($\beta=1.01, p<0.001$), females ($\beta=0.28, p=0.001$), and those who were married ($\beta=0.11, p=0.030$) reported traveling further distances to medical services in the previous 12 months. Participants with more self-reported chronic conditions ($\beta=0.13, p<0.001$) and those reporting more days of poor physical/mental health ($\beta=0.02, p<0.001$) reported traveling further distances to medical services in the previous 12 months. Across tertiles, participants with limited activity due to impairment or health problems ($\beta=0.28, p=0.004$) and those who attended a program to prevent/manage chronic illness ($\beta=0.03, p=0.037$) reported traveling further distances to medical services in the previous 12 months.

Table 4 presents findings from a logistic regression model examining factors associated with attending a program to prevent or manage chronic illness. Compared to those with a high school education or less, participants with more than a high school education were more likely to attend a program to prevent/manage chronic illness (OR=1.14, $p=0.006$). For each additional self-reported chronic disease diagnosis, the odds of attending a program to prevent/manage chronic illness significantly increased (OR=1.27, $p<0.001$). For each additional day of poor physical/mental health in the previous month, the odds of attending a program to prevent/manage chronic illness significantly increased (OR=1.01, $p=0.030$). Compared to those without limited activity due to impairment or health problems,

participants with limited activity were more likely to attend a program to prevent/manage chronic illness (OR=2.91, $p<0.001$). Compared to those residing in urban counties, participants residing in rural counties were less likely to attend a program to prevent/manage chronic illness (OR=0.70, $p=0.017$). For every

tertile increase in total distance traveled for medical care in the previous 12 months, the odds of attending a program to prevent/manage chronic illness significantly increased (OR=1.22, $p=0.030$).

Table 1: Sample characteristics by rurality

Characteristic	Total (%/mean±SD) [†] (n=2108)	Rurality		p-value
		Urban (%/mean±SD) [†] (n=656)	Rural (%/mean±SD) [†] (n=1452)	
Rurality				
Urban	31.1%	–	–	
Rural	68.9%	–	–	
Total distance traveled for medical care (past 12 months) (km)	346.32 (±872.72)	219.13 (±979.08)	403.77 (±814.02)	<0.001***
Total distance traveled for medical care (past 12 months) (miles)	215.19 (±542.28)	136.16 (±608.37)	250.89 (±505.81)	
Tertile 1	32.0%	47.1%	25.2%	<0.001***
Tertile 2	35.3%	35.8%	35.1%	
Tertile 3	32.7%	17.1%	39.7%	
Number of doctor's office visits (past 12 months)	5.65 (±6.86)	5.53 (±7.32)	5.70 (±6.65)	
Age (years)	64.90 (±7.53)	65.44 (±7.77)	64.65 (±7.41)	<0.05*
Sex				
Male	37.6%	39.3%	36.8%	
Female	62.4%	60.7%	63.2%	
Race				
White	92.9%	92.2%	93.2%	
Non-White	7.1%	7.8%	6.8%	
Education				<0.001***
High school or less	26.4%	17.2%	30.5%	
More than high school	73.6%	82.8%	69.5%	
Married				
No	22.1%	23.9%	21.2%	
Yes	77.9%	76.1%	78.8%	
Number of people living in household	2.16 (±0.90)	2.13 (±0.89)	2.17 (±0.90)	
Number of self-reported chronic conditions	3.53 (±1.91)	3.47 (±1.95)	3.57 (±1.89)	
Number of days poor physical and/or mental health (past 30 days)	7.24 (±10.57)	6.21 (±9.84)	7.70 (±10.85)	**
Limited activity due to impairment or health				
No	57.2%	59.6%	56.1%	
Yes	42.8%	40.4%	43.9%	
Ability to access health care whenever needed	5.20 (±0.96)	5.34 (±0.87)	5.14 (±0.99)	***
Attend program to prevent/manage chronic illness				
No	86.5%	84.5%	87.5%	
Yes	13.5%	15.5%	12.5%	

* $p<0.05$. ** $p<0.01$. *** $p<0.001$. Means and standard deviations reported for continuous variables. Mean differences compared using t-tests. Distribution differences for categorical variables compared using χ^2 tests. SD, standard deviation.

Table 2: Sample characteristics by dependent variables

Characteristic	Distance traveled for medical care				Attend program?		
	Tertile 1 (%/mean±SD) [†] (n=675)	Tertile 2 (%/mean±SD) [†] (n=744)	Tertile 3 (%/mean±SD) [†] (n=689)	p-value	No (%/mean±SD) [†] (n=1824)	Yes (%/mean±SD) [†] (n=284)	p-value
Rurality				***			
Urban	45.8%	31.6%	16.3%		30.4%	35.9%	
Rural	54.2%	68.4%	83.7%		69.6%	64.1%	
Total distance traveled for medical care (past 12 months) (km)	29.29 (±15.50)	118.06 (±41.84)	903.37 (±1365.53)	***	300.55 (±783.64)	640.26 (±1270)	***
Total distance traveled for medical care (past 12 months) (miles)	18.20 (±9.63)	73.36 (±26.00)	561.33 (±848.50)		186.75 (±486.93)	397.84 (±789.55)	
Tertile 1	–	–	–		33.4%	22.9%	***
Tertile 2	–	–	–		35.7%	32.4%	
Tertile 3	–	–	–		30.8%	44.7%	
Number of doctor's office visits (past 12 months)	2.76 (±1.76)	4.61 (±3.76)	9.58 (±10.05)	***	5.16 (±6.14)	8.75 (±9.84)	***
Age (years)	65.10 (±7.62)	64.80 (±7.43)	64.80 (±7.56)		64.78 (±7.53)	65.66 (±7.55)	
Sex				***			
Male	43.7%	35.5%	33.8%		37.7%	37.0%	
Female	56.3%	64.5%	66.2%		62.3%	63.0%	
Race							
White	92.9%	93.1%	92.6%		93.3%	90.1%	
Non-White	7.1%	6.9%	7.4%		6.7%	9.9%	
Education				***			
High school or less	22.4%	23.7%	33.2%		26.7%	24.3%	
More than high school	77.6%	76.3%	66.8%		73.3%	75.7%	
Married							***
No	21.3%	22.7%	22.1%		20.8%	30.3%	
Yes	78.7%	77.3%	77.9%		79.2%	69.7%	
Number of people living in household	2.17 (±0.90)	2.18 (±0.93)	2.14 (±0.85)		2.17 (±0.90)	2.13 (±0.87)	
Number of self-reported chronic conditions	3.01 (±1.71)	3.56 (±1.90)	4.02 (±1.97)	***	3.34 (±1.80)	4.78 (±2.09)	***
Number of days poor physical and/or mental health (past 30 days)	4.47 (±8.33)	7.01 (±10.35)	10.19 (±11.91)	***	6.42 (±10.02)	12.48 (±12.32)	***
Limited activity due to impairment or health				***			***
No	68.0%	58.5%	45.1%		62.1%	25.4%	
Yes	32.0%	41.5%	54.9%		37.9%	74.6%	
Ability to access health care whenever needed	5.29 (±0.90)	5.22 (±0.95)	5.11 (±1.01)	**	5.21 (±0.96)	5.16 (±0.95)	
Attend program to prevent/manage chronic illness				***			
No	90.4%	87.6%	81.6%		–	–	
Yes	9.6%	12.4%	18.4%		–	–	

* $p<0.05$. ** $p<0.01$. *** $p<0.001$. Means and standard deviations reported for continuous variables. Mean differences compared using t-tests and one-way ANOVA. Distribution differences for categorical variables compared using χ^2 tests. SD, standard deviation.

Table 3: Factors associated with further travel to medical services (previous 12 months)[†]

Characteristic	Estimate	Standard error	p-value	95% confidence interval	
				Lower	Upper
Rurality: urban	–	–	–	–	–
Rurality: rural	1.01	0.09	<0.001	0.83	1.19
Age	0.00	0.01	0.468	-0.02	0.01
Sex: male	–	–	–	–	–
Sex: female	0.28	0.09	0.001	0.11	0.45
Race: white	–	–	–	–	–
Race: non-white	-0.12	0.17	0.476	-0.44	0.21
Education: high school or less	–	–	–	–	–
Education: more than high school	-0.10	0.10	0.312	-0.29	0.09
Married: no	–	–	–	–	–
Married: yes	0.25	0.11	0.030	0.02	0.47
Number of people living in household	-0.10	0.05	0.059	-0.20	0.00
Number of self-reported chronic conditions	0.13	0.03	<0.001	0.08	0.18
Number of days poor physical and/or mental health (past 30 days)	0.02	0.00	<0.001	0.01	0.03
Limited activity due to impairment or health: no	–	–	–	–	–
Limited activity due to impairment or health: yes	0.28	0.10	0.004	0.09	0.47
Ability to access health care whenever needed	-0.03	0.05	0.505	-0.12	0.06
Attend program to prevent/manage chronic illness: no	–	–	–	–	–
Attend program to prevent/manage chronic illness: yes	0.03	0.01	0.037	0.00	0.05

[†] Nagelkerke R² = 0.155, Proportional odds assumption: -2 log likelihood = 4190.70, $\chi^2=14.52$, $p=0.269$

Table 4: Factors associated with attending a program to prevent or manage chronic illness[†]

Characteristic	Odds ratio	p-value	95% confidence interval	
			Lower	Upper
Age	1.00	0.770	0.98	1.02
Sex: male	1.00	–	–	–
Sex: female	0.96	0.796	0.72	1.28
Race: white	1.00	–	–	–
Race: non-white	1.25	0.364	0.77	2.01
Education: high school or less	1.00	–	–	–
Education: more than high school	1.58	0.006	1.14	2.20
Married: no	1.00	–	–	–
Married: yes	0.78	0.153	0.56	1.10
Number of people living in household	0.99	0.861	0.85	1.15
Number of self-reported chronic conditions	1.27	<0.001	1.18	1.37
Number of days poor physical and/or mental health (past 30 days)	1.01	0.030	1.00	1.03
Limited activity due to impairment or health: no	1.00	–	–	–
Limited activity due to impairment or health: yes	2.91	<0.001	2.11	4.01
Ability to access health care whenever needed	1.07	0.368	0.93	1.23
Rurality: urban	1.00	–	–	–
Rurality: rural	0.70	0.017	0.52	0.94
Tertile for total distance (miles) traveled for medical care (past 12 months)	1.22	0.030	1.02	1.47

[†] Nagelkerke R² = 0.182

Discussion

Findings confirm that rural disparities persist in this sample as related to education, healthcare access, and travel to medical care. This highlights the need to identify available services and resources in the community and link residents to them. If they are not present, they should be strategically introduced to ensure a shorter commute to reach them. An estimated 3.6 million Americans are unable to access necessary medical treatment due to lack of transportation¹⁸, and often those missed appointments can result in the use of more costly services down the road^{18,19}. Bolstering non-emergency medical transportation has proven to have significant potential for cost savings^{20,21}. Existing infrastructure (eg transportation services) should be capitalized upon^{22,23}. In addition, a focus on health-related services outside traditional medical care, such as evidence-based programs focused on chronic disease management and/or physical activity, may also hold promise for improving older adults' ability to successfully age in place, especially for older adults residing in rural areas^{22,24}. While it is intuitive that those traveling further distances for medical care each year reside in rural areas, this measure may also be indicative of those traveling more because of being in worse health. More specifically, those traveling greater distances had, on average, more doctor's appointments, had more self-reported chronic conditions, more days of poor physical/mental health, and more activity limitations. Part of this issue is that sicker people, who must travel further distances, are more prone to missed visits and health complications, highlighting the value of having

alternative services closer to home, including online services and technology^{25,26}. Those who had to travel further distances were more likely to attend programs that focus on education, prevention, and stress management to mitigate the impact of chronic health conditions. People attending programs were in worse health, thus indicating that they are serving those who need them; these sicker individuals travel more. The programs were reaching those in urban areas more than rural areas, which may indicate limited program availability in less population-dense areas (again supporting that the distance traveled is about illness, not just rurality).

Residents of rural areas traveled longer distances, had lower access to health care, were older, and had more days of poor physical/mental health. This can represent several layers of limited access to necessary care among potentially vulnerable individuals with poorer health. Rural areas typically have further distances to travel, yet in this case further distance to healthcare providers may have increased the utilization of other community-based resources. This is similar to past research highlighting further distances traveled for medical care by residents of rural areas²⁷. What did remain was that those in rural areas were less likely to attend a program that may help them better manage their chronic conditions. Potentially because the travel burden is so high in rural areas, individuals with the need to conserve resources may have difficulty reconciling the payoff between seeking medical services for immediate needs compared to the value of prevention, education, and management. Thus, rural health disparities in

access and utilization of healthcare services, namely attending a program to prevent or manage chronic illness, is a major issue²². Targeting rural areas with programs to prevent or manage chronic illness may help serve a critical function for at-risk individuals with chronic conditions. Previous research has documented the reach of chronic disease self-management programs to rural areas, and while these programs are reaching rural residents, much more in the way of widespread dissemination and implementation is needed^{22,28}. Policies that target funding for outreach to rural residents are needed to support the aging services sector to deliver programs to rural residents^{22,24}.

Using telehealth, including web-based applications and videoconference technology, is an important consideration for reaching rural areas and has demonstrated success in previous applications^{25,26}. Increased attention to improving connectivity infrastructure in the rural areas must happen simultaneously to the promotion of distance programs, to ensure maximum reach. Telehealth may also alleviate the burden for those in urban areas who have more health-related needs and travel more and longer distances to receive health care. At this time, the digital divide can make offering services to a mobile device or other in-home methods difficult in some rural areas due to slow or non-existent high speed internet connectivity^{29,30}. Less than half of rural residents have access to high-speed internet compared to 92% of urban residents³¹. Typically, the areas of greatest population density in a rural area are the first to be served with high-speed internet. Therefore, hub and spoke models of telehealth, where individuals can access services at a location closer to home, can improve access to care, reduce travel burden, and work within current limitations of slow connectivity are likely a good fit for evidence-based prevention programs³².

Limitations

This study was cross-sectional in nature and does not measure change over time. As such causality is not implied, but associations with the study outcomes and independent variables are suggested. Further, surveys rely on self-reported data and as such may be affected by recall bias and social desirability. Further, the generalizability of the findings may be limited given the scope of the study is restricted to a single nine-county Texas region, just a small portion of the 254 counties in Texas and an even smaller portion of the more than 3000 counties in the USA. As with much research, this study focused on key outcomes and as such that focus on variables of interest reduced the possible representativeness of the sample (omitting certain cases from analyses). While the county-specific county sub-groups mostly represented the county demographics, differences may have been attributed to the sample being purposively limited to individuals aged 51 years and older with one or more chronic conditions who visited a healthcare professional one or more times in the previous year, originating from home. Because county-specific estimates are not available with this level of specificity, the exact

representativeness of the sample to each county is unknown.

Information about the general medical visits and purposes for each visit was not available. Such information may shed further insight into reasons individuals are seeking care (eg treatment for preventable complications versus routine visits). In line with this, there is no information regarding other trips that were related to medical care including visits to the pharmacy to fill medications, going to the dentist, rehabilitation, or seeking care for vision-related medical services. Also, there was no information available about the use of in-home health services, such as rehabilitation or skilled nursing, which may reduce or increase travel distance to health care. When considering responses for attending a program to prevent or manage chronic illness, there was no information about what specific program they attended, how many times they came to the program, or any related outcomes. Thus, it is recommended that more research be conducted to further investigate what programs individuals are attending and what programs are reaching particularly at-risk individuals.

Additionally, in the current study, tertiles to describe distance traveled to health care were calculated for the entire study, then compared by rurality. To further understand the context of travel distance and rurality, future studies should examine factors associated with healthcare travel and program attendance after creating rurality-specific tertiles (separately for rural and urban).

Conclusion

This study highlights the complexity in access to medical care for middle-aged and older adults. The existing literature may underrepresent the true travel burden in rural and urban areas by neglecting to account for the number of round trips taken in a given period, especially for those with complex, comorbid health conditions. Several policy-relevant issues that can be targeted, including building and maintaining adequate healthcare infrastructure; building, expanding, and maintaining a non-emergency transportation infrastructure, especially in rural areas; encouraging collaborative efforts between urban health professionals and rural/regional providers; and ensuring adequate delivery of evidence-based programs (non-clinical in nature) to particularly at-risk individuals. Further research can provide insight into the success of these potential policy actions in ameliorating gaps in access to care for the millions of older adults throughout the USA.

Acknowledgements

This study was supported by the Center for Community Health Development under the Cooperative Agreement Number 1U48 DP001924 from the Centers for Disease Control and Prevention through the National Center for Chronic Disease Prevention and Health Promotion and the National Center for Injury Prevention and Control. The authors report no conflicts of interest.

REFERENCES:

- 1** Andersen RM, Davidson PL, Baumeister SE (Eds). *Changing the US health care system: key issues in health services policy and management*. San Francisco, CA: Jossey-Bass, 2007.
- 2** Ortman JM, Velkoff VA, Hogan H. *An aging nation: the older population in the United States*. Washington, DC: US Census Bureau, 2014.
- 3** Olshansky S, Goldman DP, Zheng Y, Rowe JW. Aging in America in the twenty-first century: demographic forecasts from the MacArthur Foundation Research Network on an aging society. *Milbank Quarterly* 2009; **87(4)**: 842-862. <https://doi.org/10.1111/j.1468-0009.2009.00581.x> PMID:20021588
- 4** Bauer UE, Briss PA, Goodman RA, Bowman BA. Prevention of chronic disease in the 21st century: elimination of the leading preventable causes of premature death and disability in the USA. *The Lancet* 2014; **384(9937)**: 45-52. [https://doi.org/10.1016/S0140-6736\(14\)60648-6](https://doi.org/10.1016/S0140-6736(14)60648-6)
- 5** Wiles JL, Leibing A, Guberman N, Reeve J, Allen RE. The meaning of 'aging in place' to older people. *The Gerontologist* 2012; **52(3)**: 357-366. <https://doi.org/10.1093/geront/gnr098> PMID:21983126
- 6** Lorig KR, Ritter P, Stewart AL, Sobel DS, Brown BW Jr, Bandura A, et al. Chronic disease self-management program: 2-year health status and health care utilization outcomes. *Medical Care* 2001; **39(11)**: 1217-1223. <https://doi.org/10.1097/00005650-200111000-00008> PMID:11606875
- 7** World Health Organization. *World Report on ageing and health*. 2015. Available: http://apps.who.int/iris/bitstream/10665/186463/1/9789240694811_eng.pdf?ua=1 (Accessed 25 February 2018).
- 8** Jerant AF, Von Friederichs-Fitzwater MM, Moore M. Patients' perceived barriers to active self-management of chronic conditions. *Patient Education and Counseling* 2005; **57(3)**. <https://doi.org/10.1016/j.pec.2004.08.004> PMID:15893212
- 9** Syed ST, Gerber BS, Sharp LK. Traveling towards disease: transportation barriers to health care access. *Journal of Community Health* 2013; **38(5)**: 976-993. <https://doi.org/10.1007/s10900-013-9681-1> PMID:23543372
- 10** Goins RT, Williams KA, Carter MW, Spencer SM, Solovieva T. Perceived barriers to health care access among rural older adults: a qualitative study. *Journal of Rural Health* 2005; **21(3)**: 206-213. <https://doi.org/10.1111/j.1748-0361.2005.tb00084.x> PMID:16092293
- 11** Bolin JN, Bellamy GR, Ferdinand AO, Vuong AM, Kash BA, Schulze A, et al. Rural healthy people 2020: new decade, same challenges. *Journal of Rural Health* 2015; **31(3)**: 326-333. <https://doi.org/10.1111/jrh.12116> PMID:25953431
- 12** Chan L, Hart LG, Goodman DC. Geographic access to health care for rural Medicare beneficiaries. *Journal of Rural Health* 2006; **22(2)**: 140-146. <https://doi.org/10.1111/j.1748-0361.2006.00022.x> PMID:16606425
- 13** Meden T, John-Larkin CS, Hermes D, Sommerschild S. Relationship between travel distance and utilization of breast cancer treatment in rural northern Michigan. *JAMA* 2002; **287(1)**: 111-111. <https://doi.org/10.1001/jama.287.1.111-JMS0102-5-1> PMID:11754721
- 14** Arcury TA, Gesler WM, Preisser JS, Sherman J, Spencer J, Perin J. The effects of geography and spatial behavior on health care utilization among the residents of a rural region. *Health Services Research* 2005; **40(1)**: 135-156. <https://doi.org/10.1111/j.1475-6773.2005.00346.x> PMID:15663706
- 15** Hall SA, Kaufman JS, Ricketts TC. Defining urban and rural areas in US epidemiologic studies. *Journal of Urban Health* 2006; **83(2)**: 162-175. <https://doi.org/10.1007/s11524-005-9016-3> PMID:16736366
- 16** Minore B, Hill ME, Pugliese I, Gauld T. *Rurality literature review*. 2008. Available: http://www.northwestlin.on.ca/~media/sites/nw/uploadedfiles/Home_Page/Integrated_Health_Service_Plan/CRaNHR_NWLHIN_Rurality_FINAL_Feb.01,2008.pdf (Accessed 25 February 2018).
- 17** Centers for Disease Control and Prevention. *Measuring healthy days: population assessment of health-related quality of life*. 2000. Available: <https://www.cdc.gov/hrqol/pdfs/mhd.pdf> (Accessed 25 February 2018).
- 18** Wallace R, Hughes-Cromwick P, Mull H, Khasnabis S. Access to health care and nonemergency medical transportation: two missing links. *Transportation Research Record* 2005; **1924**: 76-84. PMID:<https://doi.org/10.3141/1924-10>
- 19** Mattson J. *Transportation, distance, and health care utilization for older adults in rural and small urban areas*. 2010. Available: <http://www.ugpti.org/pubs/pdf/DP236.pdf> (Accessed 25 February 2018).
- 20** Flaherty JH, Stalvey B, Rubenstein L. A consensus statement on nonemergent medical transportation services for older persons. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 2003; **58(9)**: M826-M831. <https://doi.org/10.1093/gerona/58.9.M826> PMID:14528039
- 21** Wallace R, Hughes-Cromwick P, Mull H. Cost-effectiveness of access to nonemergency medical transportation: comparison of transportation and health care costs and benefits. *Transportation Research Record* 2006; **1956**: 86-93. <https://doi.org/10.3141/1956-11>
- 22** Towne Jr SD, Smith ML, Ahn S, Ory MG. The reach of chronic-disease self-management education programs to rural populations. *Frontiers in Public Health* 2015; **2**: 172. <https://doi.org/10.3389/fpubh.2014.00172>
- 23** Smith ML, Towne Jr SD, Herrera-Venson A, Cameron K, Kulinski KP, Lorig K, et al. Dissemination of chronic disease self-management education (CDSME) programs in the United States: intervention delivery by rurality. *International Journal of Environmental Research and Public Health* 2017; **14(6)**: 638. <https://doi.org/10.3390/ijerph14060638> PMID:28613257
- 24** Towne Jr SD, Pulczynski J, Lee C, Ory MG. *Older adults. Rural Health People 2020: a companion document to Healthy People 2020*. College Station, TX: Southwest Rural Health Research Center, School of Public Health, Texas A&M University System Health Science Center, 2014.

- 25** Pettus AJ, Mendez-Luck CA, Bergeron CD, Ahn S, Towne Jr SD, Ory MG, et al. Internet-based resources for disease self-care among middle-aged and older women with chronic conditions. *Journal of Women's Health* 2017; **26(3)**: 222-233. <https://doi.org/10.1089/jwh.2016.5843> PMID:27779440
- 26** Vollmer Dahlke D, Ory MG. mHealth applications use and potential for older adults, overview of. In: NA Pachana (Ed.). *Encyclopedia of Geropsychology*. Singapore: Springer, 2015.
- 27** Smith ML, Prohaska TR, Macleod KE, Ory MG, Eisenstein AR, Ragland DR, et al. Non-emergency medical transportation needs of middle-aged and older adults: a rural-urban comparison in Delaware, USA. *International Journal of Environmental Research and Public Health* 2017; **14(2)**: 174. <https://doi.org/10.3390/ijerph14020174> PMID:28208610
- 28** Towne Jr SD, Smith ML, Ahn S, Belza B, Altpeter M, Kulinski KP, et al. National dissemination of multiple evidence-based disease prevention programs: reach to vulnerable older adults. *Frontiers in Public Health* 2015; **2**: 156. <https://doi.org/10.3389/fpubh.2014.00156>
- 29** Kaushal M, Patel K, Darling M, Samuels K, McClellan M. *Closing the rural health connectivity gap: how broadband funding can better improve care*. *Health Affairs Blog*. 2015 Available: <https://www.healthaffairs.org/doi/10.1377/hblog20150401.045856/full/> (Accessed 25 February 2018).
- 30** Whitacre BE, Wheeler D, Landgraf C. What can the national broadband map tell us about the health care connectivity gap? *Journal of Rural Health* 2017; **33(3)**: 284-289. <https://doi.org/10.1111/jrh.12177> PMID:26934373
- 31** Federal Communications Commission. *Broadband progress report and notice of inquiry on immediate action to accelerate deployment*. 2015. Available: https://apps.fcc.gov/edocs_public/attachmatch/FCC-15-10A1.pdf (Accessed 25 February 2018).
- 32** Tarlow K, McCord C, Du Y, Hammett J, Wills T. Does distance matter? Geographic isolation and telemental health service utilization. *Journal of Clinical Psychology* 2018 (in press).

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