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The Relationship Between Community Health Worker Supply and the Rate Of Preventable Hospitalizations of Rural Latinos With Diabetes

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THE RELATIONSHIP BETWEEN COMMUNITY HEALTH WORKER SUPPLY AND THE RATE OF PREVENTABLE HOSPITALIZATIONS OF RURAL LATINOS WITH DIABETES

by

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ABSTRACT

The ever-increasing prevalence of diabetes mellitus and its associated healthcare costs in the United States has led to our healthcare system's need for cost-effective health resources and chronic disease management. The interventions of Community Health Workers (CHWs) can cost-effectively improve population health and prevent the unnecessary utilization of some medical services especially in rural, low-income, minority populations, where there is often limited access to healthcare. The purpose of this study is to investigate the relationship between the number of total CHWs in rural counties and the mean diabetes-related preventable hospitalization rates in Latino patients diagnosed with diabetes in those rural counties. The main goal of this research study is to contribute to the existing literature about the importance of CHWs especially in rural counties and the effect their presence has on diabetes-related preventable hospitalizations. Quantitative rural county data sets were analyzed to determine the correlation between the number of CHWs per rural county and the rate of diabetes-related preventable hospitalizations per rural county. Due to the COVID-19 pandemic outbreak, this research project was modified to be completed in a timely manner. A statistically insignificant moderately negative linear relationship was found between the two variables. Therefore, there was not enough statistical evidence in the sample to say that this correlation exists in the rural America population. Future research is needed to investigate this relationship more thoroughly.

Key Words: Community Health Workers, Promotoras, Diabetes Mellitus, Latinos, rural health, preventable hospitalizations, Florida, rural counties

DEDICATION

To my mother, who developed gestational diabetes while pregnant with me, and has been living with type 2 diabetes ever since. You are the reason for my success and the reason I will become an Endocrinologist.

To my father, whose unconditional encouragement and love is the reason I have excelled this far. Thank you for teaching me to never settle for average and for always pushing me to be great.

I hope to always make you guys proud.

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INTRODUCTION

The ever-increasing prevalence of diabetes mellitus and its associated healthcare costs in the United States has led to the healthcare system's need for cost-effective health resources and chronic disease management. The prevalence of diabetes is especially increasing in rural, low income, minority populations, where there's often limited access to healthcare. By providing patients with the appropriate health resources, the number of diabetes-related preventable hospitalizations and unnecessary emergency room visits may decline, thereby reducing healthcare costs.

There is a growing body of evidence that establishes Community Health Workers (CHWs) as public health workers who can cost-effectively improve health outcomes, reduce chronic disease disparities in high prevalence communities, and prevent unnecessary utilization of medical services (Viswanathan et al., 2010; Kim, et al., 2016; Jack, Arabadjis, Sun, Sullivan, & Phillips, 2016). By addressing issues such as language barriers, limited transportation options, poor health literacy and lack of social support, CHWs can identify certain risk factors and directly provide health education to patients in the community. However, the uptake of CHWs in the United States healthcare system has been slow and CHWs remain underutilized.

CHWs are not only helpful in the prevention and management of chronic disease, but increasingly, they are seen as a critical component of the healthcare system. Over the past decade, compelling evidence has proven their ability to effectively improve population health especially in areas where there is limited access to health resources and where large racial and ethnic health disparities exist (Perry, Zulliger, & Rogers, 2014; Murayama, Spencer, Sinco, Palmisano, & Kieffer, 2016; Mobula et. al., 2015).

The relationship between the number of CHWs and the rate of diabetes-related preventable hospitalizations experienced by Latino patients diagnosed with diabetes remains under-investigated. The purpose of this study is to investigate this relationship by determining the correlation between the number of total CHWs in rural counties and the mean diabetes-related preventable hospitalization rate experienced by Latino patients diagnosed with diabetes in rural counties. Understanding the real-life effectiveness of CHWs in the education, prevention, and management of this disease, may help our nation more appropriately allocate health care resources, and ultimately reduce the prevalence of diabetes in the United States.

LITERATURE REVIEW

Community Health Workers

A Community Health Worker (CHW) is a public health worker who is a member of and/or has a good understanding of the community in which they work (American Public Health Association [APHA], 2016). These frontline health workers usually share the same ethnicity, language, socioeconomic status, and life experiences as the members of the community they serve (National Institutes of Health [NIH], 2014). The relationships CHWs form with the community allow them to serve as liaisons between health and social services and the community, by enhancing the quality and cultural competence of health service delivery (APHA, 2016). As a result, CHWs can bridge cultural gaps between a diverse patient population and the healthcare system (Mobula et. al., 2015). CHWs may also be identified as lay health workers/advisors, promotores de salud, community health representatives/coaches, peer mentors, or peer navigators (Centers for Disease Control and Prevention [CDC], 2016). For this research study, the term "CHW" will be used for Community Health Worker.

The main functions of CHWs are health education, health promotion, and disease prevention. By educating patients and promoting access to health services, CHWs can aid in the prevention of chronic disease. A CHW's role primarily depends on the needs of the community they serve. CHWs offer interpretation services, advocate for community health needs, provide some direct health services, and decrease the need for emergency and specialty services, to ultimately reduce health disparities in underserved communities (U.S. Department of Health and Human Services, 2007). While they often don't possess a professional, para-professional certificate, or tertiary education degree (Perry et. al., 2014), CHWs can participate in the

management of hypertension, the reduction of cardiovascular risk factors, diabetes control, HIV management, and cancer screenings. Their work arrangements also vary broadly, from working in primary care clinics, to community centers, to patients' homes (Perry et. al., 2014).

Benefit of CHWs to the Community

Progressive increases in healthcare costs and demand have prompted the need for resource-saving approaches that improve access to and delivery of health services (Hartzler, Tuzzio, Hsu, & Wagner, 2018). CHWs have the potential to improve quality of care while simultaneously controlling or decreasing costs (National Conference of State Legislators [NCSL], 2015). Because of their focus on chronic disease management, CHWs can facilitate patients' self-management and provide access to the appropriate clinical services. As a result, they can decrease costs, unnecessary hospitalizations, urgent care and emergency room visits, and improve the quality of care (NCSL, 2015). CHWs' interventions show largely positive effects on health outcomes, particularly in hard-to-reach, underrepresented subpopulations, among low-income racial and ethnic minorities where there is less access to, and/or knowledge of health services (Perry et. al., 2014).

CHWs have a powerful effect on patients' health and health education, yet they remain underutilized. Underserved communities consisting mostly of racial and ethnic minority groups are at a higher risk for disease and poor health, yet aren't taking advantage of CHW's services (Nemcek, & Sabatier, 2003). The United States currently has an inadequate supply and uneven distribution of Primary Care Providers (PCPs) due to the aging baby-boomer population and increased demand for PCPs created by the enactment of the Affordable Care Act (NCSL, 2011). This geographic maldistribution of physicians predominantly impacts rural populations (Bureau of Health Professions, 2012). The presence of CHWs can complement the low supply of PCPs and

overworked healthcare providers, increasing the availability of, and access to, basic health services especially in hard-to-reach areas, thereby bridging the health equity gap (Olaniran, Smith, Unkels, Bar-Zeev & Broek, 2017).

CHWs play a critical role in addressing health inequities within their community. Because of their connection to the community, they are especially aware of the ethnic, linguistic, socioeconomic, cultural, and experiential factors that may influence that community's access to or use of healthcare services (Kim et al., 2016). CHWs can effectively deliver health education in a culturally relevant manner to disenfranchised communities (Arvey & Fernandez, 2012). Although CHWs' functions vary widely, they promote health by largely serving as physician extenders. (Satterfield, Burd, Valdez, Hosey, & Shield, 2002). CHWs' effectiveness has been shown through improved healthcare access, prenatal care, improved pregnancy and birth outcomes, client health status, and health- and screening-related behaviors, as well as reduced healthcare costs (Satterfield et.al., 2002). By utilizing CHWs in the management of chronic diseases, it is possible to achieve reductions in care utilization and cost savings (Jack et.al., 2016). With the appropriate selection, training, and supervision of CHWs and supply of the appropriate supplies, medicines, and equipment, CHWs can extend key services, strengthen the relationship between the community and health services, and improve health-related behaviors. One study conducted a targeted intervention for an underserved Latino population in Chicago, Illinois. The researchers used CHWs as "healthy lifestyle coaches" to deliver the Diabetes Prevention Program (DPP). Over the 12-month period, their participants showed improved physical activity and dietary scores and improved body mass indices (Ruggiero, Oros & Choi, 2011).

The integration of CHWs can also reduce healthcare costs and patient visits to the emergency room and hospital admissions (Shahbazi, Kumar, Mawson, Lavigine, & Dove, 2018). By addressing the community's social determinants of health, CHWs can improve the quality of healthcare and reduce healthcare costs from reduced hospital admissions, reduced emergency room visits, and fewer doctors' visits (Shahbazi et.al., 2018). With adequate support, CHWs can play a foundational role in reaching at-risk households to provide education on healthy behaviors, essential services, and referrals so patients can access necessary services in a convenient, high-quality, and cost-effective manner (Perry et. al., 2014).

The success of CHWs lies in the commonalities they share with the community they serve (Hill, Peer, Oldenburg, & Kengne, 2017). One study found that non-Hispanic Black patients were interested in learning more about the impact of diabetes from providers who shared their racial/ethnic background (Taylor, Davis, Mahabaleshwarkar, & Spencer, 2018). Understanding the effects of having shared identities between CHWs and their patients, could contribute to more effective health program designs (Murayama et.al., 2016).

The Impact of Diabetes and Rural Health Outcomes

In 2012, diabetes was the eighth-leading cause of death with an estimated 1.5 million deaths worldwide directly related to diabetes (World Health Organization, 2016). During 2015, an estimated 30.3 million people in the United States were diagnosed with diabetes and this number has continued to grow since then (Center for Disease Control, 2017). This rapid increase in patients has also brought an increase in inpatient healthcare costs due to diabetes. The Agency for Healthcare Research and Quality identifies four diabetes-related conditions that result in

preventable hospitalizations: short-term complications, long-term complications, uncontrolled diabetes, and lower-extremity amputations (Shrestha et al., 2019).

Within the United States, children and adults residing in rural communities experience a 17% higher diabetes prevalence rate than their urban counterparts (Massey, Appel, Buchanan, & Cherrington, 2010). Rural risk factors that contribute to these health disparities include geographic isolation, lower socioeconomic status, higher rates of health risk behaviors, limited access to healthcare specialists, and limited job opportunities. (Rural Health Information Hub, 2019). Cultural and communication barriers, physician mistrust, and high rates of health illiteracy also play a role. Interventions with CHWs integrated into the care team trend toward better outcomes (Jack et al., 2016).

CHWs can improve health outcomes for many chronic diseases and health conditions (Viswanathan et al., 2010). Ethnic and racial minority groups may experience greater disease burden and complications that are more prevalent in their community, such as higher rates of obesity and sedentary lifestyles. CHWs can improve health outcomes for many chronic diseases and health conditions (Viswanathan et al., 2010). Because CHWs usually reside in the communities they serve and share the same culture, traditions, economic, and linguistic characteristics as their patients, CHWs can identify familiar risk factors that PCPs wouldn't anticipate or that the patient wouldn't openly share with their PCP. CHWs are a cost-effective, intervention model for certain health conditions or behaviors for low-income, underserved, and racial and ethnic minority communities (Kim et al., 2016).

CHWs' Effect on Diabetes-Related Preventable Hospitalizations

CHWs have been proven to help with the management of diabetes (Norris, et al., 2006). Evidence shows that CHWs are effective in improving glycemic control among patients with poorly managed diabetes (Palmas et al., 2015; Carrasquillo, et al., 2017). One study found that CHWs have a positive impact on members of the community through assisting with medication reductions, increasing medication adherence, and improving blood glucose levels and overall health. (Shahbazi et.al., 2018). CHWs can address various social determinants of health in low-income, ethnic minority neighborhoods that may create barriers to optimal diabetes self-management (Chiu, Xia, Sharp, & Gerber, 2019). CHWs can help patients overcome obstacles such as gaps in diabetes knowledge and self-management skills, socioeconomic conditions, and the complex navigation of the healthcare system, to gain optimal disease control (Silverman, Krieger, Sayre, & Nelson, 2018).

Hospital admission rates for patients with diabetes have been reported to be up to six times higher than in patients without diabetes (Gómez-Huelgas et al., 2019). According to the National Health Interview Survey (NHIS) data, a total of 5,399,199 diabetes-related preventable hospitalizations were reported during 2005 - 2014 (Rubens et al., 2018). One study found that from 2001 to 2014, the estimated total cost of diabetes-related preventable hospitalizations increased annually by 1.6%, 75% of this increase was due to the increase in the number of hospitalizations while the other 25% was due to the increase in cost per admission (Shrestha et al., 2019). Another study observed that 42% of the RCTs that measured emergency department or urgent care visits, or hospitalizations found that the CHWs interventions resulted in a statistically significant decrease in the use of at least one of those services relative to the control group (Jack et al., 2016). CHWs'

interventions lead to substantial and sustained improvements in perceived quality of primary care and reductions in hospital use.

To my knowledge there isn't a substantial amount of literature examining the relationship between the number of CHWs and the rate of preventable hospitalizations. To fill this literature gap, this study sets out to investigate the relationship between the number of total CHWs in rural counties and the mean diabetes-related preventable hospitalization rates in Latino patients diagnosed with diabetes in rural Florida counties. This investigation will be conducted by determining a correlation between the number of CHWs per rural county and the rate of diabetes-related preventable hospitalizations per rural county in the state of Florida.

METHODS

Study Design

This research study used a cross-sectional study design to investigate the connection between the number of CHWs per county and the number of diabetes-related preventable hospitalizations experienced by Latinos residing in rural counties who are diagnosed with diabetes. The goal of the study was to determine if rural counties in Florida with more CHWs have a lower rate of diabetes-related preventable hospitalizations among Latinos diagnosed with diabetes. This research study contributes to the larger project of *Factors Associated with Reducing Diabetes-Related Disparities of Rural Latinos* conducted by the Rural Health Research Group at the University of Central Florida.

Data Sources

The study population was Latino patients diagnosed with diabetes, living in rural counties in the state of Florida. Two secondary data sets were used to conduct this analysis. The quantitative rural county data was analyzed from the Florida Department of Health. The Florida Department of Health reports data on the number of CHWs in the 30 rural counties in the state of Florida, as of the 2010 Census. The Centers for Medicare & Medicaid Services' Chronic Conditions Data Warehouse was used to determine the number of diabetes-related preventable hospitalizations for each of the 30 rural counties in Florida.

Data Analysis

The data analysis was conducted on the *Statistical Package for the Social Science* (SPSS) application. The relationship between the variables was analyzed using summary statistics and correlations. The number of CHWs in a certain county was compared to that county's rate of

diabetes-related preventable hospitalizations experienced by Latino patients with diabetes. First, the total number of CHWs was determined for each rural county in Florida in 2015. Afterward, the mean diabetes-related preventable hospitalization rate for each of the 30 rural counties across Florida was determined for each rural county in Florida in 2015. The mean diabetes-related preventable hospitalization rate was determined by the observed number of discharges with ICD-9-CM principal diagnosis code for Hispanic patients with diabetes, divided by the risk-adjusted expected number of discharges for Hispanic patients. For counties that reported more than one diabetes-related preventable hospitalization rate, the average of those rates was used for the analysis. Based on the descriptive statistics, a correlation coefficient was calculated to better demonstrate the strength of the relationship between the total number of CHWs and the mean diabetes-related preventable hospitalization rates. The statistical analysis was conducted on the counties that reported data. Counties that did not report a diabetes-related preventable hospitalizations rate were not included in any analysis.

RESULTS

Figure 1 shows that 30 out of the 67 counties in Florida were considered rural per the 2010 Census and their geographical location. As defined by the Florida Department of Health, a rural county possesses less than 100 persons per square mile. As seen in Table 1, 23 counties did not report an average diabetes-related preventable hospitalizations rate. The counties (n=7) with reported data include DeSoto County with 2 CHWs and a preventable hospitalization rate of 0.0401, Hendry County with 0 CHWs and a preventable hospitalization rate of 0.0446, Highlands County with 6 CHWs and a preventable hospitalization rate of 0.0402, Holmes County with 0 CHWs and a preventable hospitalization rate of 0.0710, Jackson County with 1 CHW and a preventable hospitalization rate of 0.0138, Levy County with 1 CHW and a preventable hospitalization rate of 0.0250, and Suwannee County with 2 CHWs and a preventable hospitalization rate of 0.0912.

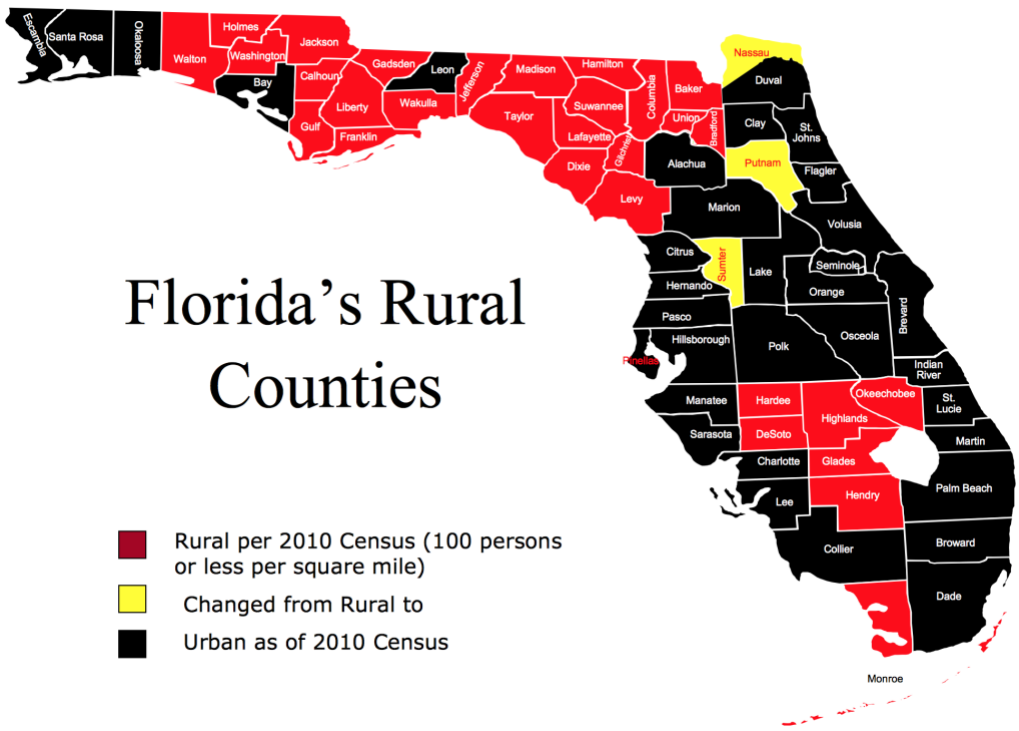

Figure 1: Florida County Map
Source: Florida Department of Health (2010) *Florida's Rural Counties.* Retrieved from http://www.floridahealth.gov/programs-and-services/community-health/rural-health/_documents/ruralcountiespdf.12.pdf

Rural County	Total Number of CHWs	Average Diabetes-Related Preventable Hospitalizations Rate
Baker	0	
Bradford	0	
Calhoun	0	
Columbia	3	
DeSoto	2	0.0401
Dixie	1	
Franklin	0	
Gadsden	7	
Gilchrist	2	
Glades	0	
Gulf	1	
Hamilton	0	
Hardee	3	
Hendry	0	0.0445
Highlands	6	0.0402
Holmes	0	0.0710
Jackson	1	0.0138
Jefferson	1	
Lafayette	0	
Levy	1	0.0250
Liberty	0	
Madison	0	
Monroe	3	
Okeechobee	0	
Suwannee	2	0.0912
Taylor	1	
Union	0	
Wakulla	0	
Walton	0	
Washington	0	
TOTAL	**34**	

Table 1: Total Number of CHWs and Number and Rate of Diabetes-Related Preventable Hospitalization in Rural Counties in Florida
Source: Health Resources and Services Administration (2010) *List of Rural Counties and Designated Eligible Census Tracts in Metropolitan Counties.* Retrieved from https://www.hrsa.gov/sites/default/files/ruralhealth/resources/forhpeligibleareas.pdf
Florida Department of Health (2010) *Florida's Rural Counties.* Retrieved from www.floridahealth.gov/provider-and-partner-resources/community-health-workers/health-professional-shortage-designations/Rural%20Counties%20Map%202016.pdf

Figure 2 presents the trend of diabetes-related preventable hospitalizations as compared to the number of CHWs. A positive or negative linear trend was not found based on the data. The average number of CHWs in rural counties that reported a diabetes-related preventable

hospitalization rate was 1.13, with a maximum value of 6, a minimum value of 0, and a median of 1.00. The average preventable hospitalizations rate was 1.06, with a maximum value of 0.0912, a minimum value of 0.0138, and a median of 0.0402. The correlation between the total CHWs in each rural county and the mean preventable hospitalization rates in each rural county is presented in Figure 3. The Pearson correlation coefficient was found to be -0.49 with a significance value of 0.917.

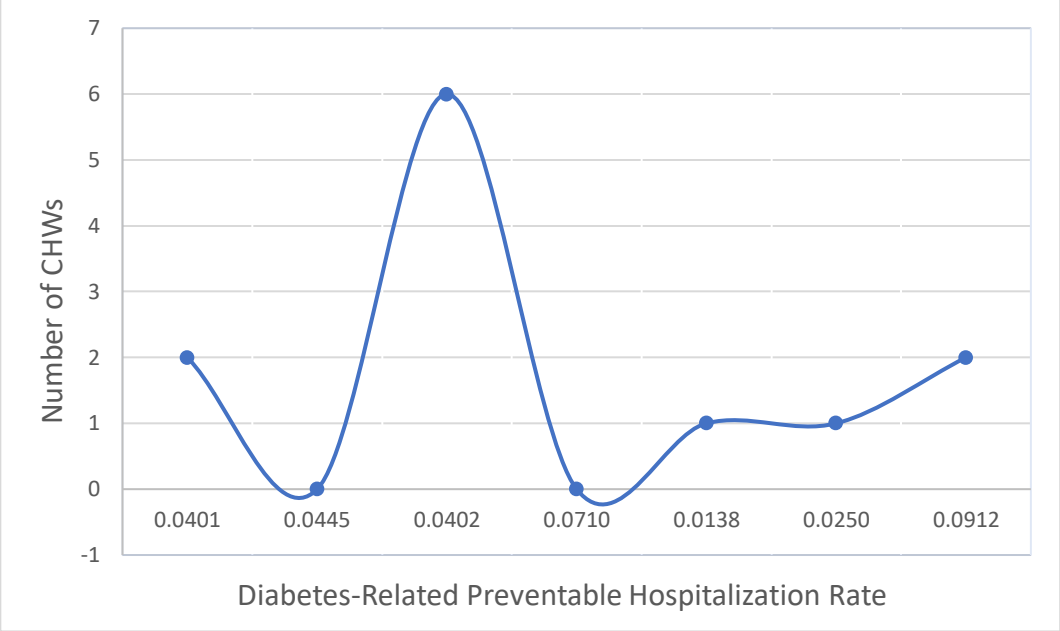

Figure 2. Total Diabetes-Related Preventable Hospitalization Rate per Total Number of CHWs in Rural Counties in Florida in 2015

Correlations

		2015 CHW Total	Preventable Hospitalization Rate
2015 CHW Total	Pearson Correlation	1	-.049
	Sig. (2-tailed)		.917
	N	30	7
Preventable Hospitalization Rate	Pearson Correlation	-.049	1
	Sig. (2-tailed)	.917	
	N	7	7

Table 2: Pearson's R Correlation Coefficient

DISCUSSION

As the findings were statistically insignificant, I cannot conclude that the number of CHWs and the rate of diabetes-related preventable hospitalizations are statistically related. Because my correlation is negative, this shows a moderately negative linear relationship between the two variables. However, as the significance value is greater than the level of significance (0.05), this finding is statistically insignificant. Due to the fact that not enough statistical evidence from one sample was presented, firm conclusions aren't able to be drawn about the association between the number Community Health Workers per county population and the rate of diabetes-related preventable hospitalizations in Hispanic patients with diabetes. Therefore, I cannot reject the null hypothesis.

The data shows a low total number of CHWs in the rural counties of Florida. This may be due to the community's low knowledge of CHWs and their services. The underutilization exists due to lack of understanding of the CHWs role, especially in the Hispanic/Latino community. A common term for community health workers in the Latino community is "Promotora de Salud" (literally translates to female promoter of health) or simply "Promotora" (Schwingel et.al., 2017). In one study, researchers found that Latinas in the United States were unfamiliar with the term or defined a promotora as an event organizer or salesperson in the community rather than a health worker (Schwingel et.al., 2017). Misconceptions and the lack of education on the role of CHWs is a potential reason for their underutilization. Health professionals' perceptions of CHWs' roles in the healthcare system can also limit the integration of CHWs. It is important for providers to be aware of the value of CHWs' interventions, how these interventions can benefit their patients, and work with them in underrepresented communities.

The study population is only specific to rural counties in Florida. The original intent was to examine the rural counties in Florida, Texas, and California, to get a more geographically diverse study population, and to determine if larger states like Texas and California with more rural counties would have a larger total number of CHWs. But due to the COVID-19 pandemic this was not able to be executed. Because of this, the research is not be representative of all Latinos patients diagnosed with diabetes in the rural United States. The study is also limited by the analysis of data only from 7 Florida counties in the year of 2015. Because a greater number of CHWs has been integrated into rural health clinics recently, these results may vary from this in subsequent years. The integration of CHWs into rural counties may or may not have an impact on those counties over time.

Future research is needed to analyze the relationship between all 30 rural counties in Florida and how the increase in CHWs over time may affect the number of diabetes-related preventable hospitalizations in those rural counties over time. Because of this research study's time limitations, these analyses were not able to be conducted. This study was a correlation study and does not infer causation. Rural counties with more CHWs such as Highlands County saw the same rate of diabetes-related preventable hospitalizations as a rural county with less CHWs such as DeSoto County. I recommend this study be repeated with more data on the state of Florida to determine if the data used includes outliers. Future research is needed to conduct a randomized controlled trial to determine if CHWs make a direct impact on their patients and if those patients seen by CHWs are utilizing fewer medical services.

CONCLUSION

This research study aimed to investigate the relationship between the number of total CHWs in rural counties and the mean diabetes-related preventable hospitalization rates in Latino patients diagnosed with diabetes in rural Florida counties. Unfortunately, there was not enough statistical evidence to say that this correlation exists in the rural America population. Due to this, firm conclusions aren't able to be drawn about the effects of CHWs' interventions on non-urgent healthcare utilization. I hope that future studies may build off of this study to further the research on the effects of CHWs.

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