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Assessing School-based Telehealth Utilization in Medically Underserved Communities

Danielle Wesley
Walden University

Walden University

College of Health Sciences

This is to certify that the doctoral study by

Danielle Wesley

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Claire Robb, Committee Chairperson, Public Health Faculty
Dr. Susan Nyanzi, Committee Member, Public Health Faculty
Dr. Kai Stewart, University Reviewer, Public Health Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
2020

Abstract

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by

Danielle Wesley

MHA, University of Iowa, 1996

BA, North Carolina Central University, 1994

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Public Health

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Abstract

Medically underserved communities face challenges accessing health care services, and millions of Americans have no access to primary care. In many areas of the United States, the supply of primary care providers cannot keep up with the demand for health services. Newer healthcare delivery models are needed to address the issue. Using telehealth can augment the physician workforce shortages. The purpose of this quantitative dissertation is to examine the associations of telehealth utilization using a pediatric school-based telehealth model in Health Professional Shortage Areas (HPSAs) in North Texas. Texas has many counties without a primary care provider, making them medically underserved. The study uses data from a program designed by Children's Health, serving school-aged children (ages 0-18) in 148 school sites across 5 counties. Approximately 12,471 telehealth visits occurred during the study period. The results revealed that telehealth utilization was significantly higher in HPSA zip code schools, and significant differences were observed in utilization patterns by race, age group, and school type. Additionally, provider status and insurance status were significantly associated with telehealth utilization. The significance of the study underscores the importance of telehealth and its value in serving medically underserved areas. School-based telehealth programs can promote positive societal change by addressing provider shortages and increasing access for underserved populations. The socioecological framework offers insights into social and environmental mediating factors. Additional research is needed to examine school-based telehealth program interventions further.

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Dedication

This dissertation is dedicated to my family and friends, who have taught me that love and patience will always prevail. This work would not have been possible without their unyielding encouragement and support. To my husband, Kerry: your belief in my dreams kept me going. I am honored, humbled, and grateful that you have allowed me to walk in my purpose. To my children: you have been my biggest motivation for this amazing journey, and I hope it has been an inspiration to you. I am stronger and wiser because of this experience. The work was both demanding and enjoyable at the same time. The journey is a living testament that perseverance is a muscle, which must be exercised!

Acknowledgments

The acknowledgment of the dissertation committee cannot go unrecognized. First and foremost, I would like to thank Dr. Claire Robb, my 1st committee chair, for the tremendous amount of support and guidance provided throughout the process. I am equally grateful for the support of my 2nd committee member, Dr. Susan Nyanzi. I have dreamed of this day for a long time. Being able to cross the finish line is a dream come true. I was blessed to have a support team of angels who surrounded me and provided great encouragement and motivation. I am hopeful that I will be able to “pay it forward” in the same manner in the future.

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Section 1: Foundation of the Study and Literature Review

Introduction

Primary and preventive care are important for improving and maintaining health and reducing health care costs. However, access to preventive and primary health care is a major challenge in many parts of the United States (US) due to provider shortages. These areas in the US are designated by the Health Resources and Services Administration (HRSA) as health professional shortage areas (HPSAs). More than 4,000 HPSAs are classified as medically underserved (Paul & McDaniel, 2016), and approximately 20% of the US population resides in a primary care HPSA (HRSA, 2019). Residents of HPSAs have lower access or lack of access to health care services. The consequences of millions of Americans not having access to primary care are poor health outcomes (Arora et al., 2011). Moreover, medically underserved children and adolescents experience poorer health (Slashcheva, Rader & Sulkes, 2016) due to provider scarcity.

Despite many recent federal and state attempts to address inequities in primary care access, the problem still exists. One common understanding of this health disparity appears to be “access.” Millions of Americans in various demographic groups (rural, low-income, non-English speaking, homeless, etc.) that live in HPSAs face economic, cultural, and linguistic barriers to health care access (Slashcheva et al., 2016). These medically underserved communities lack not only primary health care but dental and mental care services as well (HRSA, 2019). For instance, while 17% of the US population lives in rural communities, only 9% of the physician workforce practice in rural communities (Kash et al., 2017). With an aging and globally expanding population, the situation is likely to worsen. Experts purport that the shortage of the number of primary care providers (PCPs) is expected to increase from 39,000 in 2015 to 125,000 in 2025 (Lykke et al., 2013). The primary care workforce will continue to fail to keep pace with the nation's growing healthcare demands.

According to Healthy People 2020, access to primary care is important for physical, social, and mental health; and prevention of disease, detection, and treatment of illness; and promotion of life (Rural Health Information Hub, n.d.). The Affordable Care Act of 2010 emphasized the benefits of preventive care, chronic disease management, care coordination, caring for at-risk populations, and electronic health records, which were all major factors to increasing health and wellness (IOM, 2012). Ideally, Americans should be able to conveniently and confidently access primary, preventative, and emergency health services.

Consequently, improving the quantity and quality of primary health care requires new health delivery models (Toledo, Triola, Ruppert, & Siminerio, 2012). Increasing access cannot be done without adopting new health care delivery and distribution systems (Kvedar, Coye, & Everett, 2014). The provider shortage challenge is creating opportunities for health organizations and providers to embrace telemedicine (telehealth) to expand outreach and fill the health care access gaps. As a result, telehealth is an emerging and innovative tool to address provider shortages in areas where patients face access challenges (Kash et al., 2017). Telehealth can leverage existing provider pools to expand access. In 2015, the American Academy of Pediatrics (AAP) released a policy statement supporting the use of telemedicine to increase access and address physician shortages. When adequately implemented, this delivery model has the potential to address barriers in HPSA areas, and thereby improve the quality of care in HPSA geographies (Rural Health Information Hub, n.d.). As published by the Public Health Institute Journal, telehealth is empowering caregivers to interact with patients, which greatly improves the efficiency and affordability of healthcare (Sanyal et al., 2018). Advocates exclaim that a national health focus needs to shift to include telehealth to augment the scarcity of primary care providers. Considering the significant disparity in the geographic distribution of pediatric physicians across the US, experts suggest that telehealth can be used to address shortages and increase care (AAP, 2015). Increasing primary care access points to improve health care access and reduce health care costs should be a national priority to help patients reach their full health potential.

Background

Telemedicine is not a new term. Telemedicine is medical information exchanged electronically from one site to another (AHA, 2015). The term was coined in the 1970s and was meant “to heal at a distance”, emphasizing the use of information technology and communication mechanisms (WHO, 2010). Many define telemedicine as telecommunications technology used to send data, graphics, audio, or images between participants for clinical care. Although there is no single commonly accepted definition of the term, the use of technology to improve patient care by increasing access, quality, and costs is the underlying theme used in many professional definitions (Kvedar, Coye, & Everett, 2014). The World Health Organization (WHO), for instance, defines telemedicine as the remote delivery of medical services and exchange of diagnostic, instructional, and evaluative information via communication technologies (Mahar, Rosencrance, & Rasmussen, 2018).

During the 1970s and 1980s, there was little advancement in telemedicine primarily due to cost constraints. Since then, there have been major technological advancements in telecommunication and computer technology that have improved telemedicine capabilities. The costs of telemedicine equipment has drastically decreased since the 1980s (Smith, 2005). The resurgence of telemedicine in the 1990s was seen as an opportunity to improve access to health care for vulnerable populations. During the 2000s, the literature provided evidence of telemedicine within and outside of the US. According to WHO (2010), there are four elements germane to telemedicine:

- The purpose of telemedicine is to provide clinical support.
- Telemedicine is intended to address geographical barriers by connecting users that are not in the same physical location.
- Various types of information technology and communication exchange are used in telemedicine.
- The goal of telemedicine is to improve health outcomes.

Telemedicine services can include education, evaluation, assessment, diagnosis, intervention, consultation, research, and monitoring across a distance (AHA, 2015). While telemedicine applications have proven to be feasible and scalable in medically underserved communities, these applications have not been widely adopted on a significant scale due to a variety of barriers (Mahar, Rosencrance, & Rasmussen, 2018).

Despite the need for expanding health care access across the US, telemedicine utilization rates remain relatively low, and few telemedicine projects have been initiated and sustained (Broens et al., 2007).

Problem Statement

Texas has a significant provider shortage issue (Kash et al., 2017), which impacts access to primary and preventive health care. As the second largest state in the US, Texas serves over 28 million people (US Census, 2018). Although primary and preventative care are necessary for health and wellness, Texas suffers from inadequate provider supply and lacks sufficient growth in the physician workforce. As seen in Figure 1, Texas has approximately 409 primary care HPSA designations in the state (HRSA, 2019), which represents 16% of the overall US provider shortage (Scarbrough & Shelton, 2015). There are roughly 35 counties in the state without a single physician and 80 counties with five or fewer physicians (Kash et al., 2017). Texas has 63,000 licensed physicians in the state, but only 46,953 actively see patients (Kash et al., 2017). In other words, only 75% of the physician workforce provides health services in the state.

The researchers further reported that over 78% of Texas physicians stated they are at full capacity or overworked/overextended. This further exacerbates the workforce deficit and the issue of accessing health services. It is clear why the vast majority of Texas counties are designated as medically underserved. Therefore, meeting the primary health care needs of the underserved communities of Texas warrants attention.

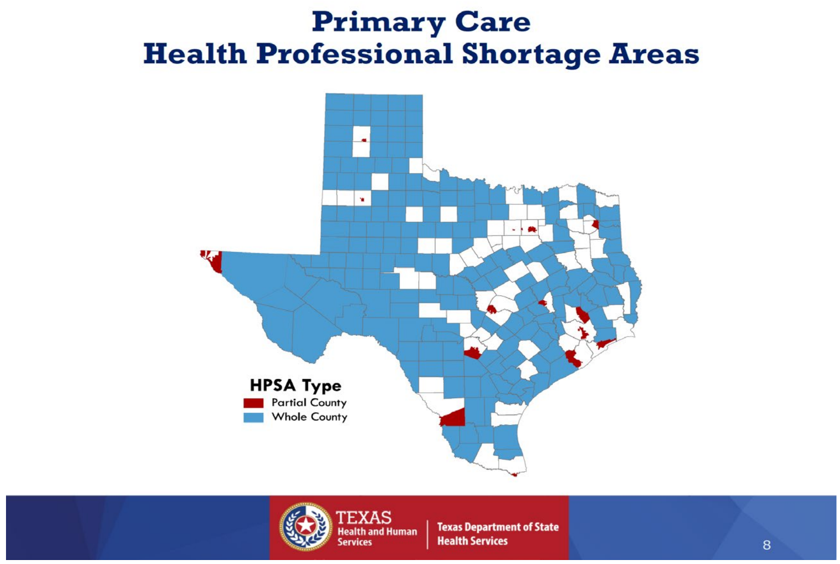

Figure 1. Texas Primary Care HPSA Map. Texas Health & Human Services (2018).

PCPs are on the front lines of health delivery and are integral to promoting health and prevention of disease. Having enough of them to meet the health demand in Texas should be a public priority. Access problems create health disparities that could be addressed through innovative social solutions (Kash et al., 2017). As such, health care organizations and providers are turning to technological strategies like telehealth to see patients. Telehealth may not solve the problem of the shortage of physicians, but it will bridge the gap of inequitable access. These and other meaningful solutions may be achieved when invested community stakeholders develop collaborative and coordinated types of health access interventions. In the end, the greatest value of health innovations like telehealth is helping people enhance their health and well-being.

Purpose of the Study

For individuals living in primary care physician shortage areas, especially those in rural and lower-income geographies in North Texas, the effects of health disparities are pervasive. Unfortunately, the primary care physician shortage continues to widen the gap in health care for pediatric patients in the state. This research focused on a pediatric school-based telehealth program (SBtH) in North Texas. The SBtH is a public health initiative built to develop community capacity in North Texas to support sustainable pediatric access. The SBtH was designed and developed by Children's Health in Dallas, Texas, to improve access to pediatric health care in medically underserved communities. A program service area map is located in Appendix A. The purpose of this research was to examine the utilization patterns of the SBtH program.

Even though there is much in the literature about the use of school-based telehealth, little has been written that examines the related impacts on primary care physician shortages. In addition, there is little written regarding the effects on the pediatric population. Telehealth programs can offer a solution to issues of access for pediatric patients. A study by Marcin et al. (2004) observed how telehealth supported the pediatric population in a rural underserved community. The results showed that 98% of the parents reported the desire to continue the program due to reduced travel time and missed work time. Despite telehealth advantages, there is little evidence shown on the its benefits regarding maximizing health access and supporting the physician workforce.
To address this knowledge gap, this quantitative study included an examination of the impact of the SBtH program designed by Children's Health and its influence on access to care for the pediatric population in medically underserved communities in North Texas. The intention was to test the effectiveness of the SBtH intervention and its impact, specifically on the HPSA geographies. Schools can be a perfect environment to meet

pediatric primary care health care needs, particularly for those living in medically underserved areas. This research helps to fill the gap in the limited studies on school-based telehealth programs and potential remedies to address HPSA geographies.

Research Questions and Hypotheses

This research examines how the SBtH is designed to address and impact the pediatric medically underserved population in North Texas. The following research questions examine the relationships and associations to SBtH program utilization:

RQ1: What is the relationship between HPSA zip code schools and the utilization of telehealth by school among pediatric patients in North Texas? The dependent variable is the utilization of telehealth, and the independent variable is HPSA zip code schools. The test will control for age, race, and gender.

$H_1$1: There is a statistically significant difference in HPSA zip code schools and the utilization of telehealth.

$H_0$1: There is not a statistically significant difference in HPSA zip code schools and the utilization of telehealth.

RQ2: What is the relationship between PCP status and the utilization of telehealth by school among pediatric patients in North Texas in HPSA zip code schools? The dependent variable is the utilization of telehealth, and the independent variable is PCP status.

$H_1$2: There is a statistically significant difference between PCP status and utilization of telehealth.

$H_0$2: There is not a statistically significant difference between PCP status and utilization of telehealth.

RQ3: What is the relationship between insurance status and utilization of telehealth by school among pediatric patients in North Texas in HPSA zip code schools? The dependent variable is the utilization of telehealth, and the independent variable is insurance status.

$H_1$3: There is a statistically significant difference between insurance status and utilization of telehealth.

$H_0$3: There is not a statistically significant difference between insurance status and utilization of telehealth.

Theoretical Framework

Increasingly, public health practitioners are designing interventions that incorporate the socio-ecological model (SEM) to promote health and prevent disease. The SEM model emphasizes the interaction between, and interdependence of factors within and across all levels of the health problem (Grim & Hortz, 2017) and provides a life-style approach to disease prevention. The theory explores how social systems function to address multiple influences. No one theory can explain utilization influences. However, the SEM model provides valuable insights into this ecology. This theory was chosen because it considers many contextual factors that influence pediatric health. Since the nature of the SBtH program is within a community-oriented setting, the SEM approach is most useful in understanding both personal health behaviors and contextual health factors within the pediatric population. Many theorists believe that multi-level interventions are more effective than a single-level intervention (Glanz, Rimer & Viswanath, 2015). The framework is comprehensive for the evaluation of health outcomes related to school-based telehealth programs.

Various ecological models have been developed to map multiple levels of health promotion and behaviors. The origin of the ecological theory was developed by Brofenbrenner in 1979 (Glanz, Rimer, & Viswanath, 2008). McLeroy et al. (1988) further advanced the model to suggest that there are interactions and dependencies at many levels, and the knowledge of these links should be leveraged for the effectiveness of interventions. There are two key concepts of the SEM perspective: (1) individual behavior is influenced by multiple levels, and (2) individual behaviors can shape the social environment (National Cancer Institute, 2005). Specifically, McLeroy et al.'s model posits that prevention strategies must include systematic changes, environmental influences, and individual changes. The theorist further expounded that multi-level approaches work best to reach special or vulnerable populations like the elderly, inner-city and rural inhabitants, and children (McLeroy et al., 1988). Figure 2 depicts the SEM framework and its multiple levels of influence. Therefore, the SEM context can be analyzed at various levels, such as the local, regional, national and global. There are a myriad of factors that contribute to disease and health disparities, many of which are linked to the social and physical environment. The implicit assumption of SEM is that a multi-component approach may work best to tackle issues dealing with health disparities (Grim & Hortz, 2017).

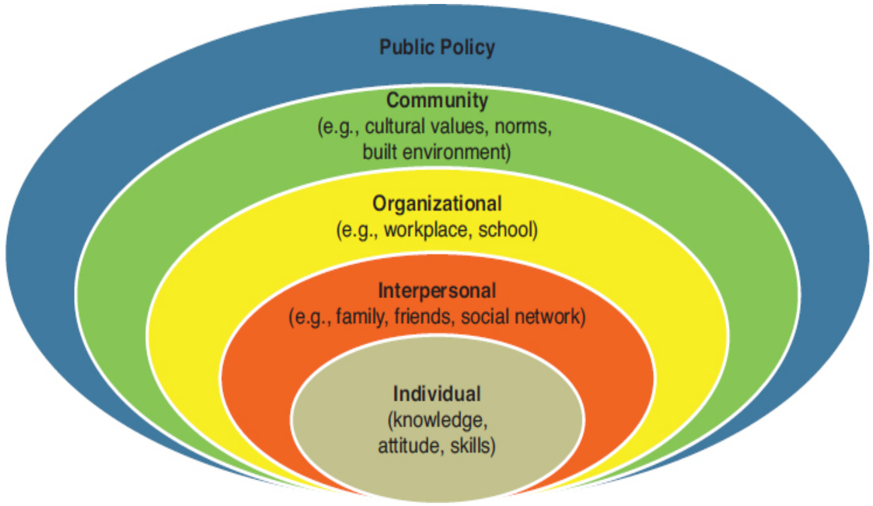

Figure 2. The Socioecological Model. Adapted from McLeroy et al. (1988).

The school environment is essential for promoting health and provides the opportunity to explore the impact of a SEM approach. Schools provide many opportunities for children to make healthy or unhealthy choices. When creating interventions for children in the school setting, the SEM theory offers a rationale for the importance of identifying interdependent relationships, policies, structures, and processes that exist. Moreover, schools are where children spend more than 50% of their time (Naylor et al., 2006). Through school nurses, school-based health centers, and other school-related health programs, schools provide a variety of health services to children who may otherwise go without such care opportunities (Kattlove, 2009).

Schools reach children from many different backgrounds and communities. Providing access to health services in schools can improve health outcomes for children and increase the use of health care services, especially among hard-to-reach populations such as adolescents and minorities. These population subgroups tend to live in medically underserved areas, and therefore the SEM approach best supports health access for these groups. The school-based telehealth interventions target multiple levels of influence, including children, parents/family, school staff and teachers, providers, and hospitals. The affiliations and relationships with the school and the support from the community enable program effectiveness. Therefore, these collaborative partnerships must contribute not only on the individual level, but the organizational (schools), community, and policy level as well. Collaborative partnerships allow for ongoing engagement and are associated with increased relevance, feasibility, and long-term sustainability (Paul & McDaniel, 2016).

Some settings are ideal for specific health promotion programs. However, choosing the right setting is an important element for designing interventions. For instance, some places can exert significant influence on one's health, positively or negatively. To this point, schools and local communities offer supportive environments to promote prevention and long-term health improvements (Birch, 2017). Furthermore, schools can be proactive agents in behavioral prevention and behavior modeling (Bowles et al., 2016). For school-based telehealth programs, the social environment is modified to include expanded access to health services. Barriers that impede access to services, such as transportation and parental work schedules, are therefore mitigated (Langer et al., 2015). Another benefit is that students can receive care in a familiar setting (AACAP, n.d.), and these types of programs extend the reach of limited providers in hard to serve communities (Langer et al., 2015). SEM ensures that the strategies developed to improve health outcomes are implemented across a society by understanding how multiple factors (and people) influence behavior (CDC, n.d.). The following is an explanation of the

SEM processes operating at each level and how they affect behaviors that influence the utilization of the SBtH intervention.

Individual Level

In the first level of the SEM framework, the focus is on the individual. The individual level involves personal factors or individual characteristics (McLeroy et al., 1988). While children and adolescents are at the individual level, most do not make decisions for health care access on their own. However, school-based telehealth programs can influence the individual level through education, marketing, and media to target individual attitudes, knowledge, and behaviors. This approach can be best leveraged to meet the adolescent population, since the provision of health services to minors requires parental engagement and consent.

Interpersonal Level

The next level of SEM focuses on interpersonal influences. The interpersonal level consists of formal or informal social networks and relationships (McLeroy et al., 1988). The influence of parents, teachers, and school leaders can impact access and utilization for children and adolescents. Parents play the lead role in managing their child's health (Kattlove, 2009), whether in school or a physician's office. These social networks and support systems are essential to reinforcing preventive health behaviors and mediating health risks for children (McLeroy et al., 1988). Again, the school-based telehealth programs seek to support telehealth use by influencing the relationships and social norms, attitudes, knowledge, and behaviors in children and those who influence them.

Organizational Level

The third level of the SEM framework recognizes the influences of institutions and organizations. The organizational level consists of structures, processes, rules, and practices (McLeroy et al., 1988). Organizations can have a positive or negative effect on health. School-based telehealth programs are environmental and structural determinants of behavior; by changing the environment, the program can positively influence use and increase access. As a partnership between a Children's Health and several local school districts, organizational characteristics are leveraged to support pediatric health behaviors. The organizational levels are important for the uptake in telehealth diffusion, both from the providing organization and the receiving organization. It is hypothesized that multi-sectoral partnerships, such as school-based telehealth programs, achieve macro-level changes that positively influence health and wellness (Kattlove, 2009).

Community Level

The fourth level is the community level. The community level expands on the organizational level by exploring relationships between systems and organizations (McLeroy et al., 1988). Communities are considered important mediating structures. Moreover, community-level partnerships offer the increased collaboration, coordination, and coalition-building necessary to support the long-term sustainability of health interventions. The community in the SBtH program is the aggregate of individuals in and around the school environment. The culture of the environment influences the acceptability of the SBtH program. As the built environment is modified to support health, so will the cultural norms and attitudes towards health and well-being.

Policy Level

The last level of SEM is the policy level. The policy level deals with policies and regulations (McLeroy et al., 1988). The policy-level in the SEM framework can significantly impact the SBtH program. For instance, some schools have changed policies to support pediatric health because of the need to expand health access. For example, school absenteeism and sick policies are affected when these types of programs are offered. On a broader level, local, state, and national policies can also be impacted by the introduction of school-based telehealth interventions. After the latest school shooting occurrence in Santa Fe, Texas, Governor Greg Abbott claimed that school-based telehealth legislation was the solution to remedy mental health challenges in Texas ("After the Santa Fe Shooting…", 2018). The Governor stated that through such programs, necessary screenings and early interventions will help avert mental health incidences and provide students with the resources and care they need, when they need it ("After the Santa Fe Shooting…", 2018). Government mandates can affect the use and access to health care services in schools.

Nature of the Study

This study includes a quantitative evaluation of the SBtH program in North Texas, which intends to assess the impact on the pediatric medically underserved population in HPSA zip codes. The objectives were to assess differences in utilization among students seen in the SBtH program. The analytical aim was to determine the significance of differences in utilization patterns and to compare the differences in HPSA zip code schools. The study will show how the SBtH program influenced access to health care services and the use of telehealth for pediatric patients in North Texas.

Children's Health has operated the school-based telehealth program since 2014, roughly seven years. From 2014 to 2019, the program expanded to over 150 school sites, representing independent school districts and charter school networks in North Texas. The program is facilitated by the school nurse in each school location. Within the program, student health information is collected from the parents directly or via online enrollment. Upon receipt by Children's Health, the pediatric providers can access the information during the telehealth visit. The key study variables include schools served by the SBtH program, schools located in HPSA zip codes, utilization patterns of students that used the program in HPSA zip codes and non-HPSA zip codes, students PCP status (as reported by parent or school nurse), and insurance status of the students (as reported by parent or school nurse). These variables help demonstrate the value of school-based telehealth innovations in conveniently and effectively filling a health care access gap for the pediatric population.

Quantitative data in the study included demographic, geographic, and utilization data. These data were collected from the schools, parents, nurses, or at time of visit by the SBtH providers. Also, data are recorded in the electronic medical record (EMR). The demographic data are collected as part of the enrollment process. Race, ethnicity, gender, zip code, county, and city information are examples of demographic and geographic data. The clinical data included symptoms, diagnoses, medications, and procedural information from the telehealth encounters, as documented by the SBtH providers. The EMR houses the data. These data sets provided the necessary variables and associations for this study and the evaluation.

There are two secondary data sources used for the study. The first data set is a list of Texas HPSA zip codes, which was obtained from the HRSA website. This list contains HPSA locations in Texas, designated by HRSA, as having primary care physician shortages. The list was used to determine which SBtH schools are served by the program and in HPSA designated zip codes. The information was downloaded from the HRSA website and used for study purposes.

The second data source is the SBtH utilization information. This information was obtained from the Children's Health EMR. The Children's Health organizational request and approval processes were followed. However, the data file does not contain any patient health information (PHI). Many students live in HPSA classified zip codes. These two data sources are imperative to the research on the impact of the SBtH program in addressing the PCP shortages in North Texas HPSA communities.

Literature Search Strategy

A review of available literature was conducted, and various databases were used to establish the literary content for the study. Studies had to include the evaluation of school-based telehealth programs to school-aged children to meet the criteria. Google Scholar and Walden University's library were the primary search engines. The databases available in the Walden University Library used for the search include MEDLINE with Full Text, Pub Med, Science Direct, and CINAHUL Plus with Full Text. Few articles from magazines, newspapers, and other trade publications were used, unless found pertinent to the research. The search terms and key words included a combination of the varying terms: *school telemedicine*, *school telecare*, *school telehealth*, *school-based telemedicine, school-based telehealth*, *health provider shortage areas*, *(HPSAs), medically underserved areas (MUAs), rural telemedicine*, *pediatric telehealth chronic disease management*, and the *socio-ecological model (SEM).* Most literature sources used were peer-reviewed. However, there is limited literature available on the specific research subjects and relevant research variables. Publications required specificity of implementation of telehealth in school-based settings (i.e., early childhood, elementary, middle, or high schools) and inclusive of telehealth context in use, health status improvement, and clinical care processes. Using Google Scholar provided the most literary content on the subject through a review of other school-based telehealth programs across the US. The search time was expanded to include research published in the last 15 years, between 2004 to 2019.

Literature Review

The use of medicine in schools dates to the 1900s. The first school nurse, Lina Suthers, used medicine to manage contagious illnesses of students with the goal of "keeping the children in the classroom, while under treatment" (Robert Wood Johnson Foundation, 2010). Since this time, the role of school nursing and school health has expanded dramatically. Today, school nurses provide a wide variety of clinical services, including immunization compliance, hearing and vision screenings, illness diagnosis, medication administration, and handling of medical emergencies. With millions of students and teachers, and other staff personnel in attendance in schools regularly, school nurses are on the front lines of managing and promoting health and wellness in the school settings (Robert Wood Johnson Foundation, 2010).

Furthermore, the current school population is more medically diverse. The traditional school nurse role has been extended to include care for disabled students and those with medical complexities and dependence on devices such as gastrostomy tubes, insulin pumps, and urinary catheters (Robert Wood Johnson Foundation, 2010). Moreover, the increase of chronic conditions, such as asthma and diabetes among children, is forcing an increase in medical attention in schools. Often, school nurses find themselves with limited scope of medical practice when working between the divide of education and health care.

History of School-based Telehealth Programs

With the introduction of telehealth, school nurses are best positioned to play a pivotal role in improving health to make children ready to learn. In 1997, the University of Kansas Medical School launched a school-based telehealth program, TeleKidcare, which became one of the first school-based telehealth programs (Mackert & Whitten, 2007; Nelson et al., 2006; Nelson, 2007; Wicklund, 2015). Initially, the program launched in four inner-city schools. Trained school nurses were connected to off-site physicians at the University's Pediatric Clinic for medical consultations. State of the art technology equipped with a digital otoscope and stethoscope placed in the school nurse's office allowed for a wide variety of conditions to be diagnosed at school (Nelson, 2007). The program transformed the school nurse's office to a place of care to reduce time away from the classroom for acute illnesses. Interviews and group results showed that the teachers, administrators, school nurses, and parents supported the program, and it became a mechanism to deliver care to underserved children. Asthma and Attention Deficit Hyperactivity Disorder (ADHD) were among the most prevalent conditions. In 2007, the program rapidly expanded to over 20 urban and rural schools statewide. Approximately 4,000 consults were provided in elementary, middle, and high schools in Kansas (Nelson, 2007). Outcomes included decreased absences and high satisfaction across patients and providers (Nelson et al., 2006).

Since 1998, many school-based telehealth models have been generated around the country in primary and secondary schools. The programs delivered a variety of health care and specialty services to school-aged children. The cost-effectiveness of telehealth technology has made the innovation economically practical for health care access interventions. Additionally, policymakers have promoted telehealth in schools due to increasing sentiments of health as a social right, especially among children who have little or no access to care (Doolittle, Williams, Cook, 2003). School-based telehealth programs are seen in rural populations as well as in urban areas.

California School-based Telehealth Advancements

California was one of the first pioneers in telehealth with programs as early as the 1990s. Additionally, California was one of the first states to enact telehealth laws in 1996. The first school-based telehealth model in the state was the Asthma Telemedicine Program, which was a two-year pilot project that ended in 2005. The program connected students in three San Francisco elementary schools with medical experts at the San Francisco General Hospital. The program demonstrated significant improvements in childhood asthma and increased asthma knowledge for children and parents (Kattlove, 2009).

Between 2007 and 2008, the Children's Hospital of Los Angeles partnered with three school districts in rural Tulare County to meet the oral health care needs of underserved migrant children. Dentists from the hospital screened children for oral health disease, provided remote oral examinations and patient education, supervised an on-site dental hygienist, and developed treatment plans for participating children (Kattlove, 2009). Another program in the state, delivered by the University of California at Davis, partnered with The Children's Partnership and California's School Health Centers Association to assess the feasibility of implementing telehealth in Fresno and Plumas counties. The feasibility study underscored the need to engage a range of community stakeholders in developing the program. The partnership created systems of communication between schools and community partners, and ensured that the program maximized existing local resources, while building community capacity through telehealth. The program showed linkages to various levels of the SEM model which was a credit to program success.

By 2009, more school-based telehealth programs were seen across the state. In March 2009, a program was initiated to serve kindergarten through 8th-grade students in Smith River, California, run by the Open Door Community Health Centers (Kattlove, 2009). The program connected students to acute care and specialty care. Also, the program was available to students when school was not in session. The Open Door program expanded to include connecting students to behavioral health experts. The consultations were helpful to the school nurse and other school staff to evaluate how to treat children with behavioral health issues at school more productively.

School-based Telehealth Models Across the US

The results of the literature review on school-based telehealth programs demonstrated the effective use of telehealth in the school settings. These types of programs can be a cost-effective and efficient way to increase access to care to school-aged children. In many studies, results included improved access to health for students and less time away from work for parents. Several themes emerged from literature on the effectiveness and benefits of school-based telehealth programs.

Improved Access / Utilization. One of the effectiveness themes found in the literature on school-based telehealth programs was improved access. In 2001, a program in Rochester, New York, provided utilization insights on school-based telehealth. The program model was designed to improve access to the child's PCP. In this study, research showed a 63% reduction in absence rates and high levels of parent satisfaction (McConnochie et al., 2005; McConnochie et al., 2010). Additionally, among the children who used the program, results showed 22% fewer emergency department visits than those in a matched control group (McConnochie et al., 2005; McConnochie et al., 2010).

In the same study, authors purported that providers were a dominant influence on the telehealth adoption. It was hypothesized that providers were able to complete a large proportion of telehealth visits with high levels of continuity of care. Approximately, 6,511 telehealth visits were completed via the program. To further assess continuity of care, 82% of the visits were from children with a physician practice located in the inner-city, and 18% were from children with a physician practice located in the suburbs (McConnochie et al., 2010). The authors reported that roughly 61% of visits were from children whose physicians participated in the program. Utilization rates for children who had access to telehealth was 23% higher than children without access to telehealth, and their emergency department utilization was 22% less (McConnochie et al., 2010). Lastly, it was concluded that 28% of all visits to emergency departments could be avoided with better use of primary care through telehealth (McConnochie et al., 2010). The results further demonstrated the benefits of school-based telehealth programs.

According to Cormack et al. (2016), school-based telehealth programs in the southeastern US have shown to be effective in providing high-quality care to children with developmental disabilities. The integration of telehealth and education with students that had medical complexities offered enhanced collaboration between medical providers and the education and therapy teams at school. Twenty schools participated in the program, which included one local charter school, exclusively serving children with medical complexities (Cormack et al., 2016). Travel was identified as a barrier to providing optimal care for this population. The program improved access and quality by using telehealth with a pediatric primary care provider (Cormack et al., 2016). After the initial pilot period, the results showed that the use of the program was high. Among 13 schools, the review revealed that the odds of having a telehealth visit for children with medical complexities was 24% higher (Cormack et al., 2016). Additionally, the feedback from parents and staff who participated in the program was overwhelmingly positive. The comparatively high utilization rate of telehealth at the school with medically complex students suggested that primary care and specialty care can be conducted in schools with a high degree of confidence, quality, and satisfaction.

Improved Care. Another theme shown in literature was the management of a child's chronic condition. Studies revealed that school nurses spend many hours managing the special health needs of children, such as asthma, diabetes, and ADHD. A school-based telehealth program that was focused on diabetes management was established in Syracuse, New York, in 16 schools. The schools ranged from kindergarten through 12th grades. The school nurses connected students every month to discuss diabetes care, review test results, and adjust treatment plans with providers at Joslin Diabetes Center. A review of the program, as reported by the school nurse and parents, found improved management of diabetes, including fewer diabetes-related emergency room visits, fewer hospitalizations, and fewer urgent visits (Izquierdo et al., 2009). The collaborative communication between the school nurses and providers resulted in improved diabetes outcomes for children. Furthermore, the program enabled the school nurses to better assist students in managing their disease during the school day.

In other studies, researchers found improved care for asthmatic children. Telehealth access to an asthma specialist during school resulted in better control of asthma symptoms and improvements in health status. Romano et al. (2001) reported that children receiving telehealth consultations for asthma care increased their symptom-free days by 83% and reduced symptom scores by 44%. In this rural school-based telehealth program, the clinical improvements were similar in results to face-to-face office visits (Romano et al., 2001). The research showed a reduction in asthma attacks. Additionally, Bergman et al. (2008) reported improvements in lung functions from a school-based telehealth intervention in San Francisco, California. The authors demonstrated that asthma management via telehealth can be effective with the assistance of the school nurses who can make care readily available.

Another program in rural Arkansas was the Telehealth KIDS Asthma Telemonitoring Project. Students were connected to providers 100 miles away at the University of Arkansas for Medical Sciences (UAMS) (Bynum et al., 2002). The UAMS Center for Distance Health staffed a school nurse in the schools to conduct lung function testing. The results of the tests were sent to UAMS for evaluation, and the providers forwarded the treatment recommendations back to the school nurse. Additional visits were scheduled with the primary care physicians as necessary. The project resulted in decreased asthma-related hospital admissions, reduced school absences, fewer asthmas symptom days, and significant improvement in inhaler use techniques (Bynum et al., 2002). The project also used telehealth to educate parents and teachers about asthma management. The educational sessions were particularly successful in helping parents understand the seriousness of asthma, the importance of medication compliance, and ways to reduce asthma triggers.

In Hawaii, children that participated in a telehealth program for ADHD showed improvements in behaviors and impulsivity. Gallagher (2004) evaluated the use of telehealth to improve behavior for children with behavior disabilities. According to parent and teacher perceptions, child behavior improvements were seen post-treatment. Classroom behaviors indicated improvements on the ACTeRS rating scales and the

ADHD-1V rating scales. This was considered an important outcome because the impairment of attention is an obstacle in student learning and achievement (Gallagher, 2004). The authors reported that social skills were also improved. In this study, the outcomes included increased timeliness, accessibility, and availability of ADHD evaluations and treatment in schools.

Absence and Travel Benefits. Another theme found in the literature suggested the positive impacts of school-based telehealth programs on absenteeism and travel. Families benefit from school-based telehealth programs because time away from school and work can be minimized. Setia and DelliFraine (2010) assessed the practicality of a school-based telehealth program in eight-day care centers in rural Pennsylvania. Staff at the daycare centers sent an average of 4.7 children home each month because of illnesses (Setia & DelliFraine, 2010). In the study, researchers assessed the need for telemedicine, along with participant knowledge. The authors concluded that adopting a school-based telehealth program in the rural daycare centers would reduce absenteeism, save parents time, and money while improving health care for children in rural areas.

Decreased absences, mileage savings, and increased convenience were reported as substantial benefits of school-based telehealth programs. In two different studies, parents highlighted not missing work as a convenience (McConnochie et al., 2010). McConnochie et al. (2005) and McConnochie et al. (2010) reported a 63% reduction in school related absences from a program in Rochester, New York. The authors demonstrated that such programs can reduce the need for missed school days and parent work days. Parents reported satisfaction from not missing work and not having to travel to see a provider. The studies reflected that 94% of problems managed by the school-based telehealth program would otherwise need an office or emergency room visit (McConnochie et al., 2005; McConnochie et al., 2010). Another study on parental perceptions with children with developmental disabilities found that 85% of parents could remain at work because of the convenience (Langkamp et al., 2015).

Telehealth can build on the existing capacity in school-based health centers to bring additional services. The state of New Mexico implemented telehealth in 19 schools that had health centers. The capacity provided the school-based health centers with access to child psychiatrists and other specialty providers. With the expanded connectivity, the University of New Mexico used telehealth to provide education, training, and case consultation on obesity prevention, nutrition counseling, behavioral health, and improved clinical practices (Cordova, 2009).

Satisfaction. Parent and school staff satisfaction was also cited as a significant result of school-based telehealth programs. In the Rochester, New York program, 96% of parents reported that the program was helpful (Halterman et al., 2018). The school nurses also reported that because the program focused on prevention, they were happy to support the program. In a small study in South Dakota, Damgaard and Young (2014) reported improvements on parental perceptions of trust and satisfaction in diabetes management. The study assessed the effectiveness of a school-based telehealth program in providing care to diabetic students in public and private schools. In another study by Grogan-Johnson et al. (2010), researchers found positive attitudes from teachers, principals, and parents. The study evaluated the effectiveness of a school-based telehealth program in rural Ohio in delivering speech therapy to K-6th grade students. Parental satisfaction from the convenience and the time saved influenced utilization and the uptake of telehealth.

Definitions

The dependent variable for this research is the utilization of telehealth, and the independent variables were HPSA zip code schools, PCP status, and insurance status of the students. Definitions of the variables are examined.

Electronic Medical Record (EMR): The term used to describe the electronic records archiving system for patient record-keeping (Jones, Weiner, Shah, & Stewart, 2015).

Health Professional Shortage Area (HPSA): The definition is a geographic area, population, or facility with a shortage of primary care, dental, or mental health providers and services (HRSA, n.d.). Shortages can be defined by the following:

- Geographic Area – a shortage of providers for an entire population in a designated area (HRSA, n.d.).
- Population Groups – a shortage of providers for a specific population group(s) within a geographic area (HRSA, n.d.).
- Facilities – public or non-profit medical facilities serving a population or geographic area designated as a HPSA, including correctional facilities, state mental hospitals, federally qualified health centers, Indian health facilities, tribal clinics/hospitals, and certified rural health clinics (HRSA, n.d.).

Insurance Status: Students that have used the SBtH program and have an insurance type recorded on the enrollment form, as reported by the school nurse or parent.

PCP Status: Students that have used the SBtH program with a PCP listed on the enrollment form, as reported by the parent or school nurse.

Telemedicine or Telehealth: The terms are often interchanged. The definition is the use of electronic information and communications technologies to deliver and support health from a distance (Paul & McDaniel, 2016). The World Health Organization (WHO) defines telehealth as "the delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities" (Mahar, Rosencrance, & Rasmussen, 2018). Generally, there are 2 types of telemedicine:

- *Synchronous programs* take place in real-time by live, 2-way interaction between the patient and health professional (Mahar, Rosencrance, & Rasmussen, 2018). An example of this includes virtual clinical appointments conducted using the patient's smartphone, tablet, or computer with a camera with the health care provider. For this research, the SBtH provides synchronous encounters in the schools.

- *Asynchronous programs*, also known as “store and forward” applications, are not live and involve the transfer of images, videos, and other clinical information that a provider can view and respond at a later time. In this example, patients may wear medical devices to monitor and track health information (e.g., blood pressure) that can be forwarded and sent to the healthcare provider.

Assumptions

The main assumption regarding this research was the belief that due to provider shortages, health care access is limited. The reasons for the provider shortage are multidimensional and complex. Another assumption was that students that use the SBtH program lacks access to primary care and that this population can benefit from telehealth. Other assumptions involved the data. The data set provided for analysis of the study presented the biggest opportunity regarding assumptions. First, it was assumed that student/patient information provided by the parent/guardian was accurate. Second, it was assumed that the information transcribed and recorded in the EMR database was accurate. The responses obtained and reported by parents and school nurses was critical to this research. Lastly, it is assumed that the coded data file used for analytical purposes was coded correctly. The data set obtained, transcribed, and coded for this research, from Children’s Health, was vital to the research results.

Scope and Delimitation

The application of telehealth to provide primary care services, as well as specialty consultations to pediatric populations in school settings is a promising approach to improve access, eliminate transportation barriers, decrease time away from work for parents, and improve satisfaction of health care (McConnochie et al., 2010). The opportunities that present for school-based telehealth programs are numerous. However, there is the realization that telehealth adoption rates are slow. Using the data obtained provides promise how these types of programs can increase access to health services among underserved pediatric populations. Additionally, the study can offer insights into addressing HPSA geographies. In alignment with the SEM model as the theoretical foundation, utilization patterns are examined to demonstrate how this multi-level intervention influences access to health care. The scope includes the students and the school sites served by the SBtH program. Obvious exclusions include schools and children not served by the SBtH program. Since this study is purely quantitative, there are no qualitative inferences. One consideration of threats to external validity in the study is the data collection and reporting processes. Student enrollment forms can be both paper and electronic. The data is then transcribed into the EMR system by data entry personnel. Therefore, this threat could not be eliminated in the study.

Significance

Approximately 79 million Americans live in HPSA designated areas (HRSA, 2019). These medically underserved areas, designated by HRSA (HRSA), are communities with a high unmet need. Residents in HPSAs have lower access to health, including lack of source of care and inability to get care when needed, especially preventative care (Allen et al., 2011). Allen et al. (2011) further stated that HPSA geographies have an insufficient capacity of primary care physicians with a ratio of less than or at least 3,500:1. Generally, primary care providers in contiguous neighborhoods are over-utilized, extremely distant, and inaccessible to the unmet population.

Telehealth promotes social change. The federal government purports that telehealth is a newer model and strategic opportunity available to enhance access to health and leverage the provider workforce more efficiently (Paul & McDaniel, 2016). Currently, the US telehealth market has grown. Over the past four decades, telehealth has become a cost-effective alternative to face-to-face care (Kvedar, Coye, & Everett, 2014). In 2016, an estimated 50% of US hospitals used telehealth (Mahar, Rosencrance, and Rasmussen, 2018). Using telehealth has been perceived to increase health care delivery and improve outcomes, particularly where access to healthcare is fraught with barriers (Paul & McDaniel, 2016). The telehealth delivery model, coupled with medical innovation, may reduce medically underserved disparities. Programs, like school-based telehealth, can serve as a public health intervention model to remedy access to the medically underserved.

Summary

School-based telehealth offers a unique and perfect opportunity to address primary care workforce challenges and access issues. This chapter focused on describing the problem and summarizing the study purpose. The nature of the study was given, and a review of the current literature was also provided. Current literature points to numerous examples of how school-based telehealth programs increased access, eliminated transportation barriers, and improved health outcomes for the pediatric population. The

SEM theoretical framework was used to explore interpersonal, community, and policy influences of school-based telehealth programs.

The significance of the study presented insights in addressing provider shortages in medically underserved areas. Contributions from the study can fill gaps in knowledge on how telehealth can help augment provider shortages and increase access for the pediatric population. The study findings provide benefit to advance public health knowledge. The results may be applicable for other communities of interest. Chapter 1 introduced the study significance, scope, purpose, and theoretical framework. The next chapter describes the research design and data variables used for the study.

Section 2: Research Design and Data Collection

Introduction

As shared in Section 1, the SBtH program developed by Children's Health was designed to increase health care access capacity for the pediatric population in North Texas. Using data obtained from Children's Health, the study provides information on the benefits of this program and how the program influences access and use, and supports underserved communities. By addressing provider shortages and improving health care access, school-based telehealth programs can help mediate many public health challenges. A quantitative analysis assessed the utilization patterns for students that used the SBtH program. The descriptive objectives of the study were to assess differences in utilization among students seen in the SBtH program. The analytical aim of the study was to determine the significance of differences in utilization patterns and compare the differences among HPSA zip code schools. The sections in this chapter outline the research design and data collection methods. It is important to describe the data design to ensure alignment to research questions and statistical inferences. Also, research validity, threats, and ethical concerns regarding the study is addressed in this chapter.

Research Variables Operationalization

The primary study variables include the schools served by the SBtH program, schools located in HPSA zip codes, utilization patterns in HPSA zip codes and non-HPSA zip codes, PCP status (as reported by parent or school nurse), and insurance status of the students (as reported by parent or school nurse). These variables were reported and documented in the Children's Health EMR. Using the data file provided, utilization rates were categorized by school location, controlling for age, gender, race and school type. Approximately 12,471 telehealth visits have occurred between August 1, 2014 and June 1, 2019. Utilization of telehealth by the schools in the SBtH program is the dependent and nominal variable in the study.

Utilization by Schools

The sample size for the study includes 148 schools served by the SBtH program. The program serves approximately 20 school districts. *School ID* is the representation of each school in the program by a school ID number. The data are captured in the EMR. The values for *School ID* range from values 1 to 148.

Schools in HPSA Zip Codes

The study sample focuses on schools in HPSA zip codes, which is an independent variable. Of the 148 schools, approximately 111 schools are located in HPSA zip codes, representing 75% of the SBtH program locations. The variable *HPSA* denotes if a school is located in a HPSA zip code. The field is not captured in the EMR, and therefore was created and coded in the data set using information from the HRSA website. The values for this variable are 1 = Non-HPSA and 2 = HPSA. Table 1 provides the output by utilization of this variable.

Table 1

Schools in HPSA Zip Codes

	Number	Percentage
Non-HPSA	3066	24.6%
HPSA	8379	75.4%
Total	12,471	100%

School Type

The sample included a variety of school types from public to charter schools, which is an independent variable. The variable *School Type* denotes what type of school the program is provided. The data is captured in the EMR. The values for this variable are 1 = Pre-K/ Elementary, 2 = Intermediate/Middle, 3 = High, and 4 = Charter School. The values are important because a charter school may represent grades K-12, in some cases. Table 2 provides the output by utilization of this variable.

Table 2

School Type

	Number	Percentage
Pre-K / elementary	7459	59.8%
Intermediate / middle	1120	9.0%
High	1037	8.3%
Charter	2855	22.9%
Total	12,471	100%

PCP Status

Of the total number of visits, some students have reported that they do not have a PCP (as reported by parent or school nurse). This variable is an independent variable. The data is captured in the EMR. *PCP* means if a primary care provider was listed in the EMR for the student. The values for this variable are 1 = No PCP and 2 = PCP. Table 3 provides the output by utilization of this variable.

Table 3

PCP Status

	Number	Percentage
No PCP	4254	34.1%
PCP	8217	65.9%
Total	12,471	100%

Insurance Status

During program enrollment, insurance information is captured. This variable is an independent variable. The data is captured in the EMR. *Insurance* provides information on source of payment for the telehealth consultation (as reported by parent or school nurse). The values for this variable are 1 = Commercial, 2 = Medicaid/CHIP, and 3 = No Insurance. Table 4 provides the output by utilization of this variable.

Table 4

Insurance Status

	Number	Percentage
Commercial	1289	10.3%
Medicaid / CHIP	3977	31.9%
No Insurance	7205	57.8%
Total	12,471	100%

Research Design

The study represents a quantitative, cross-sectional approach. Data was abstracted and collected from a point in time to investigate the influences and relationships associated with SBtH utilization. Specifically, this type of design was appropriate for the study to show how school-based telehealth programs address and impact the pediatric population during the study period. Cross-sectional studies have many benefits to the field of public health. This type of study analyzes data collected at a point in time to examine multiple associations and outcomes at the same time (Aschengrau & Seage, 2013). Additionally, these types of studies allow for comparisons of relationships between variables to determine statistical significance. Based on the outcomes of this study, knowledge in the field of public health and factors to address the physician shortage can be advanced. Further, this research increases knowledge for potential opportunities to increase health care access in underserved communities. Given that school-based telehealth programs serve the pediatric population, this research supports child health and telehealth programs. The results of this study are helpful to public health and policy making.

Data Resource Constraint and Timeline

This study used secondary data. The data was collected by and recorded in the EMR at Children's Health. The data had to be coded for the study's analytical use. However, the data does not include identifiable patient information. Once the data file was obtained, a review and data coding plan were created. Most of the data was nominal data, such as school names, gender, race, PCP names, and insurance/payment carriers. Therefore, the data had to be reconstructed and coded to meet design and analytical needs. The categorical values were recoded to make distinctions between different groups, such as HPSA zip codes schools and non-HPSA zip code schools. Nevertheless, it was important to ensure proper coding techniques and procedures were followed to ensure integrity of the data and interpretation of the data. Lastly, due to the data file size, a significant amount of time was spent on data coding.

Research Methodology

Study Population

The pediatric population included in the study were children aged 0-18. The study population included school-aged children served by the Children's Health SBtH program from August 1, 2014 – June 1, 2019. The program data was captured from approximately 148 school sites across five counties in North Texas. The total number of encounters captured in the data set was approximately 12,471. However, the number of unique patients was unknown as students may been seen multiple times. The program was primarily provided on Pre-K/elementary school campuses. There are some middle school, high school, and charter school locations (Grades K-12) recorded in the data set. This distinction is important to denote as it represents the age ranges for the students that used the program. The five counties in North Texas included in the data set are Collin, Dallas, Grayson, Fannin, and Tarrant. The program map showing the counties in the North Texas geography represented in the data set is included in the Appendix. Another important data factor were the demographics of each county represented in the data set. However, this information was not included in the data set from Children's Health. The information was obtained from the US Census Bureau website. Table 5 provides the North Texas county demographics in the data set, which were Collin, Dallas, Grayson, Fannin, and Tarrant.

Table 5

County Demographic Data of Participating Schools

	Collin	Dallas	Grayson	Fannin	Tarrant
Population estimates, July 1, 2018, (V2018)	1,005,146	2,637,772	133,991	35,286	2,084,931
Population per square mile, 2010	930	2,718.0	129.6	38.1	2,094.7
Persons under 18 years, percent	25.9%	26.1%	23.8%	21.5%	26.3%
White alone, percent	70.0%	66.7%	87.6%	88.9%	73.0%
Black or African American alone, percent **(a)**	10.5%	23.5%	6.3%	6.6%	17.5%
Hispanic or Latino, percent **(b)**	5.0%	40.5%	13.8%	11.6%	29.2%
Households, 2013-2017	323,905	906,179	47,550	12,027	689,921
High school graduate or higher, % persons 25 years+, 2013-2017	93.6%	78.3%	88.2%	85.2%	85.4%
Persons without health insurance, under age 65 years, percent	12.4%	23.0%	19.5%	21.9%	18.4%
Persons in poverty, percent	5.9%	14.8%	13.4%	12.9%	11.6%

Notes
(a) Includes persons reporting only one race
(b) Hispanics may be of any race, so are included in applicable race categories

Note. U.S. Census Bureau. Adapted from https://www.census.gov/quickfacts/collincountytexas

Sampling Procedures

A data file of all completed visits between August 1, 2014 – June 1, 2019 was provided. The sample included students who used the SBtH program across 148 school sites. This sampling method represented an appropriate random sample of the population in rural, suburban, and urban counties in North Texas, as the program serves these geographical distinctions. Moreover, the program was provided approximately 20 school districts. However, not every school in every school district was selected to participate. School selection and inclusion for participation resulted in a variety of factors discussed and agreed upon by Children's Health and school administrative staff. Examples of school selection criteria used for inclusion may be the following:

- School nurse/clinical resource must be a certified or licensed professional.
- School nurse had interest in program and comfort with using technology.
- Availability of adequate school clinic space (must have privacy screens, curtains, or doors) at school location.
- Availability of high speed internet connectivity at school location.
- Commitment and support from school campus (principals and administrators).
- Campus enrollment must be at least 300 students at the school location.

Once the schools were selected to participate, the school nurses were trained to use the telemedicine equipment. Additionally, parents opted to enroll the students in the program, as participation and utilization was strictly optional. The enrollment form included as Appendix B, captures the demographic, medical history, insurance, and PCP information from each student. The parental consent form also provided authority from the parent to allow the student to use the SBtH program to be observed, diagnosed, and treated. Both, the enrollment form and consent form can be completed online or sent to the school nurse from the parent. This was typically done at the beginning of the school year. However, when a medical need arose throughout the school year, parents could complete and send the form at any time.

Upon receipt of the proper documents, the school nurse initiates the telehealth consultation. The school nurse contacts Children's Health for clinic appointment at time of need. The following procedures were followed when students used the program:

- Children's Health ensured completion of enrollment form with medical history.
- Children's Health ensured completion of parental consent for triage, diagnosis and treatment.
- Children's Health entered the data into the EMR at time of service.
- Student presented to school nurse upon illness.
- School nurse contacted parent as a courtesy notification.
- School nurse contacted the appointment line to schedule appointment.
- School nurse obtained vital signs at time of service and provides at time of appointment.
- SBtH provider initiated the video connection, completed the consultation, and documented in EMR.
- SBtH provider sent the after visit summary to school nurse and parent from the EMR.

Permissions for Use

The required permissions processes were followed to obtain the data set from Children's Health. The approval letter is included as Appendix C. Since the program was developed and is provided by Children's Health, this is the only and most appropriate data set to use for this research. A request was submitted on June 6, 2019 to the Children's Health Data Analytics Team. The utilization data file was delivered on September 16, 2019. During September to November 2019, the data file was coded for analysis with assistance from a Children's Health data analyst. The data was ready for use on November 6, 2019.

Power Analysis

Upon completion of assessing the strength of the association across the variables, the effect size and power must be determined (CDC, 2013) based on the number of categories of the variables. An online statistical calculator was used to determine the appropriate power level required. A priori power calculator was used for multiple regression. The calculator was obtained via *Freestatisticscalculators.com*, version 4.0. The model determined the minimum required sample size for a multiple regression study, given the desired probability level, the number of predictors in the model, the anticipated effect size, and the desired statistical power level (Soper, 2006). Given the desired statistical power of 95% with an alpha level of 0.05 and an effect size of 0.02, the minimum sample size required was 859. The study sample size was sufficient and met the minimum requirements for the statistical tests.

Data Analysis Plan

To test the study hypotheses, IBM SPSS Statistical Software, version 25.0 was used. Given that the data is secondary data, minimal data cleansing was needed. Only variables pertinent to the study were requested and provided. However, the data was coded for study analytical purposes. The following research questions and hypotheses were used to examine the relationships and associations:

RQ1: What is the relationship between HPSA zip code schools and the utilization of telehealth by school among pediatric patients in North Texas? The dependent variable is the utilization of telehealth, and the independent variable is HPSA zip code schools. The test will control for age, race, and gender.

$H_1$1: There is a statistically significant difference in HPSA zip code schools and the utilization of telehealth.

$H_0$1: There is not a statistically significant difference in HPSA zip code schools and the utilization of telehealth.

RQ2: What is the relationship between PCP status and the utilization of telehealth by school among pediatric patients in North Texas in HPSA zip code schools? The dependent variable is the utilization of telehealth, and the independent variable is PCP status.

$H_1$2: There is a statistically significant difference between PCP status and utilization of telehealth.

$H_0$2: There is not a statistically significant difference between PCP status and utilization of telehealth.

RQ3: What is the relationship between insurance status and utilization of telehealth by school among pediatric patients in North Texas in HPSA zip code schools? The dependent variable is the utilization of telehealth, and the independent variable is insurance status.

*H_1*3: There is a statistically significant difference between insurance status and utilization of telehealth.

*H_0*3: There is not a statistically significant difference between insurance status and utilization of telehealth.

The study used multiple statistical methods. Descriptive statistics was used to describe the data, such as the frequencies, percentages, and averages. Descriptive statistics can also compare baseline characteristics of the variables to compare differences in means and proportions about the observed sample (Simpson, 2015). Likewise, inferential statistics were used to make comparisons and draw conclusions. Literature states that inferential statistics allows the study to be generalizable (Simpson, 2015).

In research question 1 (RQ1), a chi square test measured the differences in utilization between schools in HPSA zip codes and schools in non-HPSA zip codes. Additionally, the chi square test was used because the variables are independent observations and there were no observed relationships between schools in HPSA zip codes and schools in non-HPSA zip codes. The contribution of each of the covariates (age, gender, race, and school type) was also explained. Next, multiple regression were used to determine whether the variables differ by statistical significance, using the corresponding *p-value*, set at an alpha level of 0.05.

In research question 2 (RQ2) and 3 (RQ3), the sample was stratified to include only schools in HPSA zip codes. Non-HPSA schools were filtered out of the sample. For these questions, multiple regression was used to predict study outcomes. The test helped to determine the amount of variance that *PCP* status and *Insurance* status accounted for. The variables were examined individually and collectively. The results were described by the level of variability between groups and among groups, using degrees of freedom, and *F* and *p-value* estimations, set at an alpha level of 0.05. The output of the results were interpreted and visually displayed and using SPSS model summary tables and pie charts.

Threats to Validity

There are many threats to study validity. While it is impossible to remove all possible chances of errors, threats can be controlled and addressed. For instance, study selection, confounding, testing, and instrumentation can impact study validity (Boston University, n.d.). Internal validity deals with casual relationships and external validity ensures the results are generalizable and applicable to other populations (Frankfort-Nachimias, 2008). Given that this study is a retrospective study, the internal threats are limited. One example of eliminating internal validity was controlling for confounding variables. Another way internal validity was addressed was in the data collection methods. There were no new instruments used to design the study. The data was provided by parents and school nurses via online or paper enrollment, which helped to minimize threats to validity. The enrollment form was a critical instrument and provided sufficient information to assess validity. Likewise, one of the ways the study's external validity was addressed, was that the data represented over 148 schools among tens of thousands of students in North Texas. The population spanned across various counties and school types. The study sample offers generalizability for various school communities.

On the other hand, construct validity seeks to ensure the study measured the intended outcomes and assesses the validity of measurement procedures (Frankfort-Nachimias, 2008). Using the data set provided by Children's Health appropriately program answers the intended questions. Additionally, the measurement procedures using SPSS and its specific statistical tests proved for strong construct validity.

Ethical Procedures

Study design must have ethics in mind. Researchers must protect the rights of human subjects (Office of Research Integrity, n.d.) and the participants must voluntarily participate in research (Babbie, 2017). This study used secondary data and does not include any participant/patient identifiable information. There was no direct participation in the sample selection and data collection methods in the research. The appropriate enrollment and consent forms were collected by Children's Health for all participants during the study timeframe. It is assumed that these ethical procedures at Children's Health were followed. Lastly, protection and safeguards of data is important. Researchers must ensure appropriate protocols to protect patient privacy, confidentiality, and data/information (Langarizadeh, Moghbeli, & Aliabadi, 2017). Again, it was assumed that these safeguards were in place at Children's Health. Further, since there was no direct participant information obtained, this requirement was met. Therefore, ethical standards set forth by Walden University were adhered to as appropriate. The specific dissertation processes were followed, which included the application submission to the Walden University Institutional Review Board.

Summary

This chapter identified and described the study design. The research methodology and other research components, such as the study population, sampling procedures, data collection, and data analysis procedures were defined. A quantitative approach was used to analyze secondary data from Children's Health SBtH program in North Texas. The sample included approximately 12, 471 encounters completed across 148 schools. Due to the retrospective nature of the study, internal validity was minimized. In addition, ethical concerns were eliminated because the study does not include any participant/patient identifiable information. It was assumed that Children's Health received parental consent from program participants, and therefore, the data meets regulatory and ethical requirements. Chapter 2 provided the study research design and data collection methods. The next chapter provides the study findings.

Section 3: Presentation of Results and Findings

Introduction

The objectives of the study were to further the understanding of the utilization patterns for the SBtH program. There were three research questions that guided the research. Using secondary data, the research questions were designed to evaluate school telehealth utilization trends in HPSA zip code geographies. The study inquiries were addressed based on the study variables in the data set. The moderating variables were race, gender, age, and school type. This section will provide the results of the research questions, and whether to reject the null hypothesis for each research question. The specific research questions and hypothesis that guided the study were as follows:

RQ1: What is the relationship between HPSA zip code schools and the utilization of telehealth by school among pediatric patients in North Texas? The dependent variable is the utilization of telehealth, and the independent variable is HPSA zip code schools. The test will control for age, race, and gender.

$H_1$1: There is a statistically significant difference in HPSA zip code schools and the utilization of telehealth.

$H_0$1: There is not a statistically significant difference in HPSA zip code schools and the utilization of telehealth.

RQ2: What is the relationship between PCP status and the utilization of telehealth by school among pediatric patients in North Texas in HPSA zip code schools? The dependent variable is the utilization of telehealth, and the independent variable is PCP status.

$H_1$2: There is a statistically significant difference between PCP status and utilization of telehealth.

$H_0$2: There is not a statistically significant difference between PCP status and utilization of telehealth.

RQ3: What is the relationship between insurance status and utilization of telehealth by school among pediatric patients in North Texas in HPSA zip code schools? The dependent variable is the utilization of telehealth, and the independent variable is insurance status.

$H_1$3: There is a statistically significant difference between insurance status and utilization of telehealth.

$H_0$3: There is not a statistically significant difference between insurance status and utilization of telehealth.

Data Collection of Secondary Data Set

This study used secondary data provided by Children's Health. Since the program was developed by Children's Health, the data was requested for use in the research study. The data file included completed telehealth visits between August 1, 2014 and June 1, 2019. The data were captured from approximately 148 school sites in North Texas. The total number of encounters included in the data set was approximately 12,471. When the data file was obtained, a review and data coding plan was created. The data was coded for analytical use.

Descriptive Statistics for Covariates

The study inquiries were addressed based on the information in the data set. The sample for the study was representative of 12,471 encounters completed by school aged children. The results contain descriptive statistics for the dependent variable (*School ID - Utilization by School*), the independent variables (*HPSA*, *PCP*, and *Insurance*) and covariates (*Race*, *Gender*, *Age Group*, and *School Type*).

Race

The output for the variable *Race* is depicted below. Table 6 and Figure 3 show the frequency distribution of the student population by *Race* for the 12,471 telehealth encounters that occurred during the study period. Approximately 50% (6,351) of the telehealth visits were completed by White or Caucasian students, 35% (4,343) of the telehealth visits were completed by Black or African American students, 6% (744) were completed by Hispanic or Latino students, and 8% (1,033) were completed by Unknown (Race not recorded during the visit in the study).

Table 6

Descriptive Statistics - Race

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	White or Caucasian	6351	50.9	50.9	50.9
	Black or African American	4343	34.8	34.8	85.8
	Hispanic or Latino	744	6.0	6.0	91.7
	Unknown	1033	8.3	8.3	100.0
	Total	12471	100.0	100.0	

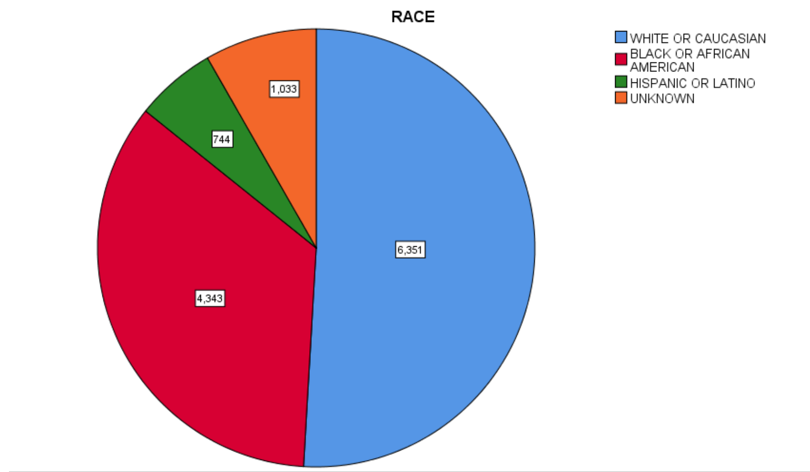

Figure 3. Student race proportion.

Gender

The output for the variable *Gender* is shown below. Table 7 and Figure 4 provide the gender distribution of the telehealth encounters during the study period. Amongst the sample, 52% (6,527) of the students were female and 48% (5,944) of the students were male. The results showed that the gender distribution was comparable in the study.

Table 7

Descriptive Statistics - Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	6527	52.3	52.3	52.3
	Male	5944	47.7	47.7	100.0
	Total	12471	100.0	100.0	

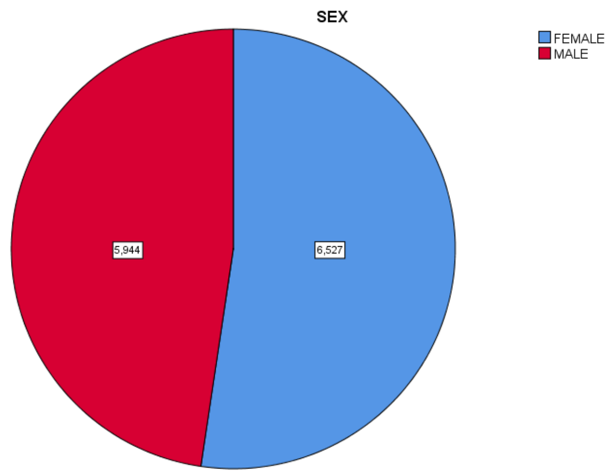

Figure 4. Study gender proportion.

Age Group

The output for the variable *Age Group* is described below. The values in the *Age* variable represent ages from 0-18. *Age Group* was recoded from the *Age* variable and merged into two distinct age categories. The new categories were Children (ages 0-12) and Teens (ages from 13-18). Table 8 and Figure 5 represent the frequency distribution of the telehealth encounters during the study. As shown in Table 8, of all the completed visits, Children completed 82% (10,275) of the telehealth encounters and Teens completed 18% (2,176) of the telehealth encounters. As a large majority of the school sites were on Pre-K/Elementary campuses, the data reflection was representative of the program.

Table 8

Descriptive Statistics – Age Group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Children	10275	82.4	82.4	82.4
	Teens	2196	17.6	17.6	100.0
	Total	12471	100.0	100.0	

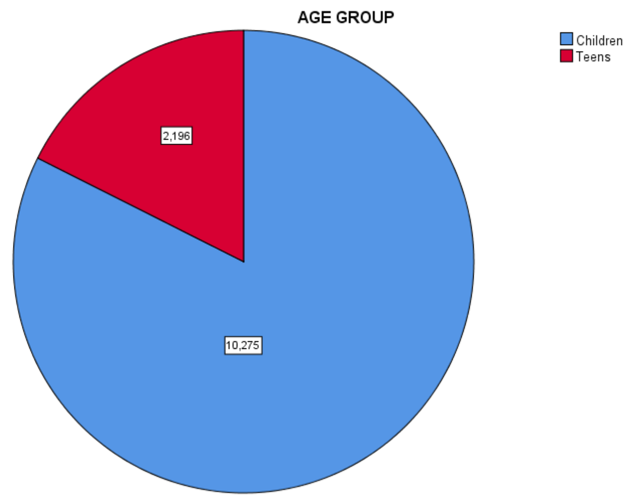

Figure 5. Study age group proportion.

School Type

The output for the variable *School Type* is depicted below. As it relates to the number of telehealth visits by type of school, Table 9 and Figure 6 provide the study distribution proportions. As shown in Table 9, 60% (7,459) of all telehealth visits were completed in a Pre-K/elementary campus. Approximately, 9% (1,120) of the utilization was completed by students in the Immediate/middle schools, 8% (1,037) of the utilization was completed by students in High Schools, and 23% (2,855) was completed by students in Charter schools.

Table 9

Descriptive Statistics – School Type

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Pre-K/elementary	7459	59.8	59.8	59.8
	Intermediate/middle	1120	9.0	9.0	68.8
	High School	1037	8.3	8.3	77.1
	Charter	2855	22.9	22.9	100.0
	Total	12471	100.0	100.0	

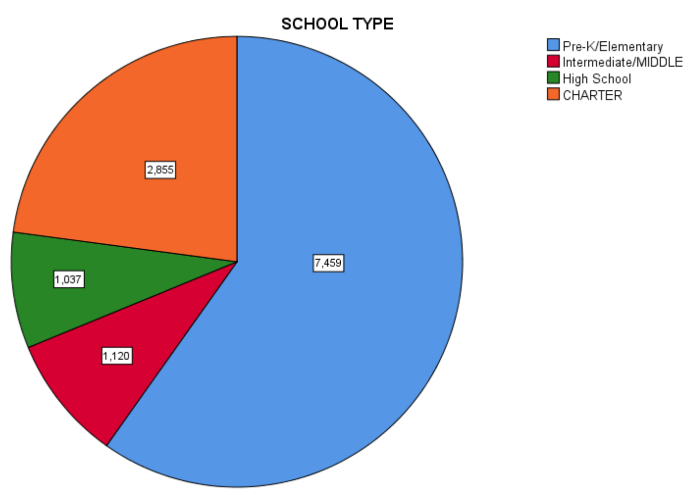

Figure 6. School type proportion.

Descriptive Statistics for Primary Variables

Schools in HPSA Zip Codes

The output for the variable *HPSA* is illustrated below. The values include HPSA zip codes and Non-HPSA zip codes. A total of 8, 379 telehealth visits were completed in schools designated in a HPSA zip code, representing 67% of the total telehealth visits completed during the study period. HPSA zip codes are classified as geographies that have a shortage of primary care health professionals (HRSA, 2019). Conversely, 4,092 (33%) of the telehealth visits were in schools in which the zip code was not classified as HPSA zip code. Table 10 and Figure 7 visually represent the study distribution proportion.

Table 10

Descriptive Statistics – HPSA

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Non-HPSA	4092	32.8	32.8	32.8
	HPSA	8379	67.2	67.2	100.0
	Total	12471	100.0	100.0	

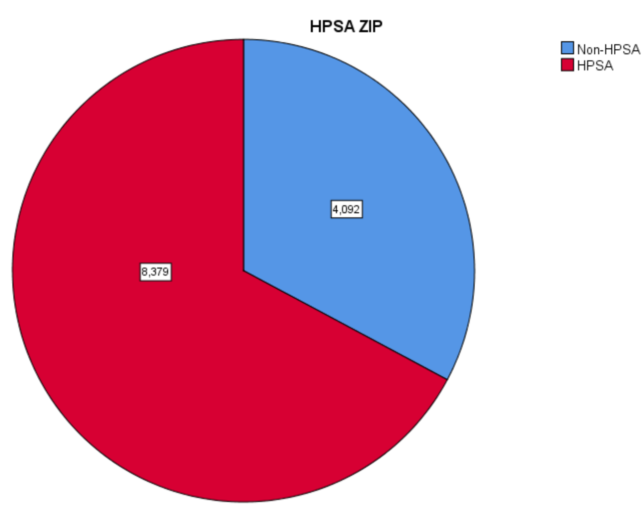

Figure 7. Utilization in HPSA zip codes.

PCP Status

The output for the variable *PCP* is documented below. The data was reported by the parents or school nurses before or during the telehealth visit. The information indicates if a student reported having a primary care provider. A total of 4,254 telehealth visits were completed without a PCP listed in the EMR, representing 34% of the total encounters during the study period. On the other hand, 66% (8,217) of the telehealth visits were completed with a PCP listed in the EMR. Table 11 and Figure 8 visually represent the study distribution proportion.

Table 11

Descriptive Statistics – PCP Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No PCP	4254	34.1	34.1	34.1
	PCP	8217	65.9	65.9	100.0
	Total	12471	100.0	100.0	

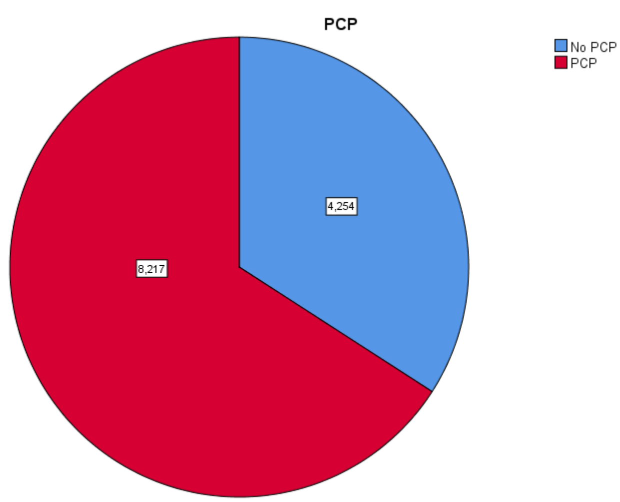

Figure 8. Utilization by PCP status.

Insurance Status

The output for the variable *Insurance* is represented below. The variable provides a breakdown of the utilization by insurance carrier as reported by the parents or school nurses before or during the telehealth visit. While having insurance was not a requirement to use the program, the findings provide significant value in serving underserved populations. A total of 1,289 telehealth visits were completed with a form of Commercial Insurance, representing only 10% of total encounters during the study period. Approximately, 32% (3,977) of the total of the telehealth visits were completed with Medicaid or CHIP as the insurance. Lastly, a majority of the visits, 58% or 7,205, were completed with No Insurance recorded. Table 12 and Figure 9 visually represent the distribution proportion.

Table 12

Descriptive Statistics – Insurance Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Commercial	1289	10.3	10.3	10.3
	Medicaid/CHIP	3977	31.9	31.9	42.2
	No Insurance	7205	57.8	57.8	100.0
	Total	12471	100.0	100.0	

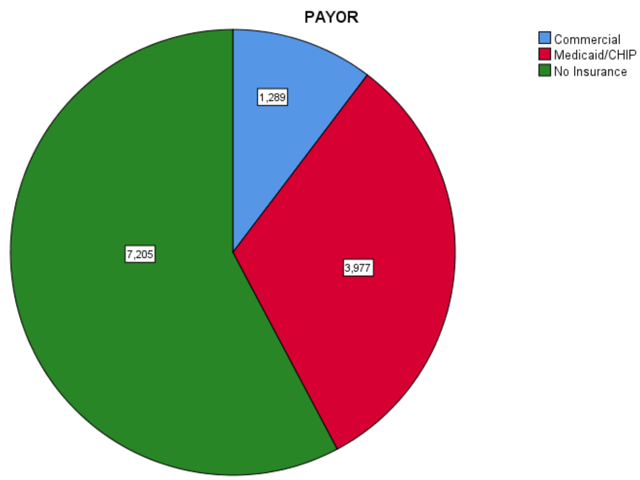

Figure 9. Utilization by insurance status.

Inferential Statistics for Primary Variables

The following section provides inferences and conclusions regarding the research variables and questions. The results contain inferential statistics for the dependent variable (*School ID - Utilization by School*), the independent variables (*HPSA*, *PCP*, and *Insurance*) and covariates (*Race*, *Gender*, *Age Group*, and *School Type*). The research inquiries are presented below.

Research Question 1.

RQ1: What is the relationship between HPSA zip code schools and the utilization of telehealth by school among pediatric patients in North Texas? The dependent variable is the utilization of telehealth, and the independent variable is HPSA zip code schools. The test will control for age, race, and gender.

$H_1$1: There is a statistically significant difference in HPSA zip code schools and the utilization of telehealth.

$H_0$1: There is not a statistically significant difference in HPSA zip code schools and the utilization of telehealth.

To determine the variation among telehealth utilization by school in HPSA zip codes and those in Non-HPSA zip codes, a series of chi square statistical tests were performed to conduct comparisons. The comparisons showed some distinct differences in the utilization patterns among the student populations in HPSA zip codes and Non-HPSA zip codes. The crosstabulation tables are included to visually display the study output for the sample.

Race. Table 13 provides the output for the variables *HPSA* and *Race*. Approximately 1,193 (29%) of the telehealth visits were completed by White/Caucasian students in Non-HPSA zip codes, 2,592 (63%) of the telehealth visits were completed by Black/African-American students in Non-HPSA zip codes, 85 (2%) of the telehealth visits were completed by Hispanic students in Non-HPSA zip codes, and 222 (6%) of the telehealth visits were completed by students classified as Unknown in Non-HPSA zip codes during the study. In contrast, 5,158 (62%) of the telehealth visits were completed by White/Caucasian students in HPSA zip codes, 1,751 (21%) of the telehealth visits were completed by Black/African-American students in HPSA zip codes, 659 (8%) of the telehealth visits were completed by Hispanic students in HPSA zip codes, and 811 (10%) of the telehealth visits were completed by students classified as Unknown in HPSA zip codes during the study. The results showed that telehealth utilization by schools in both HPSA and Non-HPSA zip codes differed by *Race* among the student populations.

According to the statistical test, the Pearson Chi-Square estimate returned the value of 2203.646, with 3 degrees of freedom, and a *p* value of .000. The relationship between *HPSA* and *Race* is statistically significant (X^2 = 2203.646, p > .05). Although, a statistical relationship was revealed, based on the Cramer's V statistic of .420, *Race* had a very strong statistical effect on telehealth utilization by schools in HPSA and Non-HPSA zip codes.

Table 13

Crosstabulation Table – HPSA and Race

			White	Black	Hispanic	Unknown	Total
HPSA ZIP	Non-HPSA	Count	1193	2592	85	222	4092
		Expected Count	2083.9	1425.0	244.1	338.9	4092.0
		% within HPSA ZIP	29.2%	63.3%	2.1%	5.4%	100.0%
	HPSA	Count	5158	1751	659	811	8379
		Expected Count	4267.1	2918.0	499.9	694.1	8379.0
		% within HPSA ZIP	61.6%	20.9%	7.9%	9.7%	100.0%
Total		Count	6351	4343	744	1033	12471
		Expected Count	6351.0	4343.0	744.0	1033.0	12471.0
		% within HPSA ZIP	50.9%	34.8%	6.0%	8.3%	100.0%

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2203.646[a]	3	.000
Likelihood Ratio	2187.588	3	.000

Linear-by-Linear Association	109.993	1	.000
N of Valid Cases	12471		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 244.12.

		Value	Approximate Significance
Nominal by Nominal	Phi	.420	.000
	Cramer's V	.420	.000
N of Valid Cases		12471	

Gender. Table 14 provides the output for the variables *HPSA* and *Gender*. Approximately 2,101 or 51% of the telehealth visits were completed by Female students in Non-HPSA zip codes. Whereas, 1,991 or 48% of the telehealth visits were completed by Male students in Non-HPSA zip codes. Likewise, 4,426 or 53% of the telehealth visits were completed by Female students in HPSA zip codes; and 3,953 or 47% of the telehealth visits were completed by Male students in HPSA zip codes during the study. The results showed that telehealth utilization by schools in both HPSA and Non-HPSA zip codes were comparable by *Gender*, although slightly higher for Female students.

According to the statistical test, the Pearson Chi-Square estimate returned the value of 2.409, with 1 degrees of freedom, and a *p* value of .121. The relationship between *HPSA* and *Gender* is not statistically significant ($X^2 = 2.409$, $p > .05$). The Cramer's V statistic of .014, revealed that *Gender* had no effect on telehealth utilization by schools in HPSA and Non-HPSA zip codes.

Table 14

Crosstabulation Table – HPSA and Gender

			Gender		Total
			Female	Male	
HPSA ZIP	Non-HPSA	Count	2101	1991	4092
		% within HPSA ZIP	51.3%	48.7%	100.0%
	HPSA	Count	4426	3953	8379
		% within HPSA ZIP	52.8%	47.2%	100.0%
Total		Count	6527	5944	12471
		% within HPSA ZIP	52.3%	47.7%	100.0%

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.409[a]	1	.121		
Continuity Correction[b]	2.350	1	.125		
Likelihood Ratio	2.408	1	.121		
Fisher's Exact Test				.122	.063
Linear-by-Linear Association	2.409	1	.121		
N of Valid Cases	12471				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 1950.35.

b. Computed only for a 2x2 table

		Value	Approximate Significance
Nominal by Nominal	Phi	-.014	.121
	Cramer's V	.014	.121
N of Valid Cases		12471	

Age Group. Table 15 provides the output for the variables *HPSA* and *Age Group.* Again, Children represents students between the ages of 0-12, and Teens are representative of students from the ages of 13 and up. Approximately 3,116 (76%) of the telehealth visits were completed by Children in Non-HPSA zip codes, and 976 (24%) of the telehealth visits were completed by Teens in Non-HPSA zip codes. In contrast, 7,159 (85%) of the telehealth visits were completed by Children in HPSA zip codes, and 1,200 (15%) of the telehealth were completed by Teens in HPSA zip codes. The results showed that telehealth utilization by schools in both HPSA and Non-HPSA zip codes differed according to *Age Group*.

According to the statistical test, the Pearson Chi-Square estimate returned the value of 163.59, with 1 degrees of freedom, and a *p* value of .000. The relationship between *HPSA* and *Age Group* is statistically significant ($X^2 = 163.59$, $p > .05$). Although, a statistical relationship was revealed, based on the Cramer's V statistic of .115, *Age Group* had a moderate statistical effect on telehealth utilization by schools in HPSA and Non-HPSA zip codes

Table 15

Crosstabulation Table – HPSA and Age Group

			Children	Teens	Total
HPSA ZIP	Non-HPSA	Count	3116	976	4092
		% within HPSA ZIP	76.1%	23.9%	100.0%
	HPSA	Count	7159	1220	8379
		% within HPSA ZIP	85.4%	14.6%	100.0%
Total		Count	10275	2196	12471
		% within HPSA ZIP	82.4%	17.6%	100.0%

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	163.591[a]	1	.000		
Continuity Correction[b]	162.951	1	.000		
Likelihood Ratio	157.652	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	163.578	1	.000		
N of Valid Cases	12471				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 720.55.
b. Computed only for a 2x2 table

		Value	Approximate Significance
Nominal by Nominal	Phi	-.115	.000
	Cramer's V	.115	.000
N of Valid Cases		12471	

School Type. Table 16 provides the output for the variables *HPSA* and *School Type*. Approximately 2,854 (70%) of the telehealth visits were completed in Pre-

K/Elementary Schools by students in Non-HPSA zip codes, 465 (11%) of the telehealth visits were completed in Intermediate/Middle Schools by students in Non-HPSA zip codes, 630 (15%) telehealth visits were completed in High Schools by students in Non-HPSA zip codes, and 143 (4%) of the telehealth visits were completed in Charter Schools by students in Non-HPSA zip codes. On the other hand, 4,605 (55%) of the telehealth visits were completed in Pre-K/Elementary Schools by students in HPSA zip codes, 655 (8%) of the telehealth visits were completed in Intermediate/Middle Schools by students in HPSA zip codes, 407 (5%) of the telehealth visits were completed in High Schools by students in HPSA zip codes, and 2712 (32%) of the telehealth visits were completed in Charter Schools by students in HPSA zip codes during the study.

According to the statistical test, the Pearson Chi-Square estimate returned the value of 1507.314, with 1 degrees of freedom, and a *p* value of .000. The relationship between *HPSA* and *School Type* is statistically significant ($X^2 = 1507.314$, $p > .05$). Although, a statistical relationship was revealed, based on the Cramer's V statistic of .348, *School Type* had a very strong statistical effect on telehealth utilization in *HPSA* and *Non-HPSA* zip codes.

Table 16

Crosstabulation Table – HPSA and School Type

			Pre-K/ Elementary	Middle	High School	Charter	Total
HPSA ZIP	Non-HPSA	Count	2854	465	630	143	4092
		% within HPSA ZIP	69.7%	11.4%	15.4%	3.5%	100.0%
	HPSA	Count	4605	655	407	2712	8379
		% within HPSA ZIP	55.0%	7.8%	4.9%	32.4%	100.0%
Total		Count	7459	1120	1037	2855	12471
		% within HPSA ZIP	59.8%	9.0%	8.3%	22.9%	100.0%

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1507.314[a]	3	.000
Likelihood Ratio	1814.326	3	.000
Linear-by-Linear Association	662.913	1	.000
N of Valid Cases	12471		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 340.26.

		Value	Approximate Significance
Nominal by Nominal	Phi	.348	.000
	Cramer's V	.348	.000
N of Valid Cases		12471	

Lastly, multiple regression was conducted to determine the amount of variability in telehealth utilization by school that the independent variables accounted for as a group. It was important to look at the variables collectively and individually, as well as, control for *Race*, *Gender*, *Age Groups*. The model summary obtained from the statistical test described the relationships. The results revealed in Table 17, show a relationship between Utilization by School (*School ID*) and *HPSA*, while controlling for *Race*, *Gender*, and *Age Group*. The R^2 and adjusted R^2 estimates were the about the same for *HPSA* (.024) *Race* (.025), and *Gender* (.025). On average, only 2% of variability in Utilization by School (*School ID)* is explained by a combination of the variables, *HPSA, Race, and Gender*. The R^2 and adjusted R^2 estimate for *Age Group* was .058. Based on the estimate, approximately 6% of variability in Utilization by School (*School ID*) is explained by *Age Group*.

The associated ANOVA table demonstrates the significance of the regression model. The test significance is at .000, which is below alpha level of .05. Therefore, we reject the null hypothesis that there is not a statistically significant relationship between Utilization by School (*School ID*) and *HPSA*. We accept the alternative hypothesis that there is a statistically significant relationship between Utilization by School (*School ID*) and *HPSA*. The regression model is statistically significant, F ((4, 12466) = 191.17, $p > .001$, $R^2 = .058$).

The Coefficients output provides the results of the predictor variables. In the first model, the results show that *HPSA* is a predictor of Utilization by School (*School ID*). The output showed that *HPSA* is a statistically significant relationship with an associated *p* value of .000, which is below the alpha level of .05. In simple terms, *HPSA* had a positive predictive effect on Utilization by School (*School ID*) at a 15.4 unit increase. In the second model, *Race* was added. The results showed that the positive predictive effect of HPSA slightly decreased from 15.7 to 15.4. However, the confidence interval range is so wide, that the slight decrease is not important. Therefore, *Race* had no effect on *HPSA* and the Utilization by School (*School ID*). In the third model, the variable *Gender* was added, and the positive predictive effect had no change. In the last model, the variable *Age Group* was added. However, the addition of the variable had a negative predictive effect on *HPSA* and Utilization by School (*School ID*), at 23 fewer units of increase. Overall, the statistical models revealed a statistically significant relationship between HPSA zip code schools and the utilization of telehealth by school among pediatric patients in North Texas.

Table 17

Relationship Between Utilization by School and HPSA

Model	R	R Square	Adjusted R Square	F Change	df1	df2	Sig. F Change
1	.154[a]	.024	.024	302.372	1	12469	.000
2	.157[b]	.025	.025	13.053	1	12468	.000
3	.157[c]	.025	.024	.121	1	12467	.728
4	.240[d]	.058	.057	437.796	1	12466	.000

a. Predictors: (Constant), HPSA ZIP
b. Predictors: (Constant), HPSA ZIP, RACE
c. Predictors: (Constant), HPSA ZIP, RACE, GENDER
d. Predictors: (Constant), HPSA ZIP, RACE, GENDER, AGE GROUP
e. Dependent Variable: SCHOOL ID

ANOVA[a]

Model		df	Mean Square	F	Sig.	
1	Regression	1	675513.015	302.372	.000[b]	
	Residual	12469	2234.045			
	Total	12470				
2	Regression	2	352323.422	157.859	.000[c]	
	Residual	12468	2231.888			
	Total	12470				
3	Regression	704916.884	3	234972.295	105.272	.000[d]
	Residual	12467	2232.045			

	Total	12470			
4	Regression	4	412254.829	191.169	.000[e]
	Residual	12466	2156.490		
	Total	12470			

a. Dependent Variable: SCHOOL ID
b. Predictors: (Constant), HPSA ZIP
c. Predictors: (Constant), HPSA ZIP, RACE
d. Predictors: (Constant), HPSA ZIP, RACE, GENDER
e. Predictors: (Constant), HPSA ZIP, RACE, GENDER, AGE GROUP

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	22.594	1.565		14.433	.000
	HPSA ZIP	15.675	.901	.154	17.389	.000
2	(Constant)	26.017	1.829		14.223	.000
	HPSA ZIP	15.368	.905	.151	16.981	.000
	RACE	-1.696	.469	-.032	-3.613	.000
3	(Constant)	25.563	2.247		11.377	.000
	HPSA ZIP	15.373	.905	.151	16.984	.000
	RACE	-1.690	.470	-.032	-3.599	.000
	GENDER	.295	.848	.003	.348	.728
4	(Constant)	56.163	2.649		21.202	.000
	HPSA ZIP	13.295	.895	.131	14.851	.000
	RACE	-1.317	.462	-.025	-2.850	.004
	GENDER	-.174	.833	-.002	-.209	.835
	AGE GROUP	-23.021	1.100	-.183	-20.924	.000

a. Dependent Variable: SCHOOL ID

Research Question 2.

RQ2: What is the relationship between PCP status and the utilization of telehealth by school among pediatric patients in North Texas in HPSA zip code schools? The dependent variable is the utilization of telehealth, and the independent variable is PCP status.

$H_1$2: There is a statistically significant difference between PCP status and utilization of telehealth.

$H_0$2: There is not a statistically significant difference between PCP status and utilization of telehealth.

In order to determine the relationship between PCP status and utilization of telehealth by schools among the students in HPSA zip codes, the following tests provided insights into these relationships. Table 18 provides the output for the variables *HPSA* and *PCP*. Approximately 1,498 or 37% of the telehealth visits were completed with No PCP reported in the EMR, in Non-HPSA zip codes and 2,594 or 63% of the telehealth visits were completed with No PCP reported in the EMR, in Non-HPSA zip codes. Similarly, 2,756 or 33% of the telehealth visits were completed with No PCP reported in the EMR, in HPSA zip codes and 5,623 or 67% of the telehealth visits were completed with No PCP reported in the EMR, in HPSA zip codes. The results showed that utilization by schools in both HPSA and Non-HPSA zip codes differed among students by *PCP* status.

According to the statistical test, the Pearson Chi-Square estimate returned the value of 16.9, with 1 degrees of freedom, and a *p* value of .000. The relationship between *HPSA* and *PCP* is statistically significant ($X^2 = 16.9$, $p > .05$). However, based on the

Cramer's V statistic of .037, *PCP* had no effect on telehealth utilization by schools in HPSA and Non-HPSA zip codes.

Table 18

Crosstabulation Table – HPSA and PCP

			No PCP	PCP	Total
HPSA ZIP	Non-HPSA	Count	1498	2594	4092
		% within HPSA ZIP	36.6%	63.4%	100.0%
	HPSA	Count	2756	5623	8379
		% within HPSA ZIP	32.9%	67.1%	100.0%
Total		Count	4254	8217	12471
		% within HPSA ZIP	34.1%	65.9%	100.0%

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	16.894[a]	1	.000		
Continuity Correction[b]	16.729	1	.000		
Likelihood Ratio	16.800	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	16.893	1	.000		
N of Valid Cases	12471				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 1395.83.
b. Computed only for a 2x2 table

		Value	Approximate Significance
Nominal by Nominal	Phi	.037	.000
	Cramer's V	.037	.000
N of Valid Cases		12471	

To determine utilization differences among students who reported a PCP in only HPSA zip codes, the data set was filtered to provide results on this subset of the population. In SPSS, the cases were split to denote the stratification of the encounters. In this statistical test, the sample represents 8,379 encounters in only HPSA zip codes. Again, to test the variation among students that reported a PCP among schools in HPSA zip codes, multiple regression was performed. The model summary obtained from the statistical test described these relationships.

The results revealed in Table 19, indicated a relationship between Utilization by School (*School ID*) in HPSA zip codes and *PCP*. The R^2 and adjusted R^2 estimates were the same for *PCP* (.001) *Race* (.001), and *Gender* (.001). There is no variability in Utilization by School (*School ID)* in HPSA zip codes that is explained by a combination of the variables, *PCP, Race, and Gender*. The R^2 and adjusted R^2 estimate for *Age Group* was .017. Based on the estimate, approximately 2% of variability in Utilization by School (*School ID*) in HPSA zip codes is explained by *Age Group*.

The associated ANOVA table demonstrates the significance of the regression model. The test significance is at .000, which is below alpha level of .05. Therefore, we reject the null hypothesis that there is not a statistically significant relationship between Utilization by School (*School ID*) and *PCP* in HPSA zip codes. We accept the alternative hypothesis that there is a statistically significant relationship between Utilization by School (*School ID*) and *PCP* in HPSA zip codes. The regression model is statistically significant, F ((4, 8374) = 36.5, $p > .001$, $R^2 = .017$).

The Coefficients output provides the results of the predictor variables. In the first model, the results show that *PCP* is a predictor of Utilization by School (*School ID*) in HPSA zip codes. The output showed that *PCP* was statistically significant with an associated p value of .025, which is below the alpha level of .05. In simple terms, *PCP* had a positive predictive effect on Utilization by School (*School ID*) in HPSA zip codes at a 2.4 unit increase. In the second model, *Race* was added. The results demonstrated the positive predictive effect slightly decreased from 2.476 to 2.459. However, the confidence interval range is so wide, that the slight decrease is not important. Therefore, *Race* had no effect on Utilization by School (*School ID*) and *PCP* in HPSA zip codes. In the third model, the variable *Gender* was added. Similar to *Race*, *Gender* had a negligible decrease. Again, no effect on Utilization by School (*School ID*) and *PCP* in HPSA zip codes. In the last model, the variable *Age Group* was added. However, the addition of the variable had a negative predictive effect on Utilization by School (*School ID*) and *PCP* in HPSA zip codes, at 17 fewer units of increase. Overall, the statistical models revealed a statistically significant relationship between PCP status and the utilization of telehealth by school among pediatric patients in North Texas in only HPSA zip codes.

Table 19

Relationship Between Utilization by School in HPSA Zip Codes and PCP

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.024[a]	.001	.000	47.651	
2	.031[b]	.001	.001	47.646	
3	.031[c]	.001	.001	47.649	
4	.131[d]	.017	.017	47.264	1.677

a. Predictors: (Constant), PCP
b. Predictors: (Constant), PCP, RACE
c. Predictors: (Constant), PCP, RACE, SEX
d. Predictors: (Constant), PCP, RACE, SEX, AGE GROUP
e. Dependent Variable: SCHOOL ID

ANOVA[a]

Model		df	Mean Square	F	Sig.
1	Regression	1	11342.101	4.995	.025[b]
	Residual	8377	2270.656		
	Total	8378			
2	Regression	2	8896.993	3.919	.020[c]
	Residual	8376	2270.157		
	Total	8378			
3	Regression	3	6040.620	2.661	.046[d]
	Residual	8375	2270.389		
	Total	8378			
4	Regression	4	81509.213	36.488	.000[e]
	Residual	8374	2233.889		
	Total	8378			

a. Dependent Variable: SCHOOL ID
b. Predictors: (Constant), PCP
c. Predictors: (Constant), PCP, RACE
d. Predictors: (Constant), PCP, RACE, SEX
e. Predictors: (Constant), PCP, RACE, SEX, AGE GROUP

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	49.805	1.923		25.895	.000
	PCP	2.476	1.108	.024	2.235	.025
2	(Constant)	48.353	2.107		22.946	.000
	PCP	2.459	1.108	.024	2.220	.026
	RACE	.894	.530	.018	1.686	.092
3	(Constant)	48.937	2.608		18.761	.000
	PCP	2.466	1.108	.024	2.225	.026
	RACE	.887	.531	.018	1.671	.095
	SEX	-.397	1.044	-.004	-.380	.704
4	(Constant)	70.250	3.161		22.226	.000
	PCP	1.537	1.102	.015	1.395	.163
	RACE	1.001	.526	.021	1.901	.057
	SEX	-.536	1.035	-.006	-.517	.605
	AGE GROUP	-17.236	1.468	-.128	-11.740	.000

a. Dependent Variable: SCHOOL ID

Research Question 3.

RQ3: What is the relationship between insurance status and utilization of telehealth by school among pediatric patients in North Texas in HPSA zip code schools? The dependent variable is the utilization of telehealth, and the independent variable is insurance status.

$H_1$3: There is a statistically significant difference between insurance status and utilization of telehealth.

$H_0$3: There is not a statistically significant difference between insurance status and utilization of telehealth

In order to determine the relationship between insurance status and utilization of telehealth by schools among the students in HPSA zip codes, the following tests provided insights into the relationship. Table 20 provides the output for the variables *HPSA* and *Insurance*. Approximately 503 (12%) of the telehealth visits were completed by students with Commercial insurance in Non-HPSA zip codes, 1,556 (38%) of the telehealth visits were completed by students with CHIP/Medicaid insurance in Non-HPSA zip codes, and 2,033 (50%) of the telehealth visits were completed by students whom reported no insurance in Non-HPSA zip codes. Conversely, 786 (9%) of the telehealth visits were completed by students with Commercial insurance in HPSA zip codes, 2,421 (29%) of the telehealth visits were completed by students with CHIP/Medicaid insurance in HPSA zip codes, and 5,172 (61%) of telehealth visits were completed by students with No Insurance in HPSA Zip codes during the study. The results showed that utilization by schools in both HPSA and Non-HPSA zip codes differed among students by insurance type and status.

According to the test, the Pearson chi square returned the value of 163.47, with 2 degrees of freedom, and a *p* value of .000. The relationship is statistically significant ($X^2 = 163.47$, $p > .05$). Although, a statistical relationship was revealed, based on the Cramer's V statistic of .114, *Insurance* had a moderate effect on utilization by school in HPSA and Non-HPSA zip codes.

Table 20

Crosstabulation Table – HPSA and Insurance

			Commercial	Medicaid /CHIP	No Insurance	Total
HPSA ZIP	Non-HPSA	Count	503	1556	2033	4092
		% within HPSA ZIP	12.3%	38.0%	49.7%	100.0%
	HPSA	Count	786	2421	5172	8379
		% within HPSA ZIP	9.4%	28.9%	61.7%	100.0%
Total		Count	1289	3977	7205	12471
		% within HPSA ZIP	10.3%	31.9%	57.8%	100.0%

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	163.466[a]	2	.000
Likelihood Ratio	162.607	2	.000
Linear-by-Linear Association	134.818	1	.000
N of Valid Cases	12471		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 422.95.

		Value	Approximate Significance
Nominal by Nominal	Phi	.114	.000
	Cramer's V	.114	.000
N of Valid Cases		12471	

Again, to test the research question to determine variation among students in utilization among schools in HPSA zip codes, multiple regression was performed. The question sought to determine the relationship of payor (Insurance Status) and utilization of telehealth among students in HPSA zip codes. To determine utilization differences among students based on insurance status in only HPSA zip codes, the data set was filtered to provide results on this subset of the population. In SPSS, the cases were split to denote the stratification of the encounters. In this statistical test, the sample represents 8,379 encounters in only HPSA zip codes. The model summary obtained from the statistical test described the relationships.

The results revealed in Table 21, indicated a relationship between Utilization by School (*School ID*) in HPSA zip codes and *Insurance*. The R^2 and adjusted R^2 estimates were about the same for *Insurance* (.035) *Race* (.036), and *Gender* (.036). Roughly, 4% of variability in Utilization by School (*School ID)* in HPSA zip codes was explained by a combination of the variables, *Insurance, Race, and Gender*. The R^2 and adjusted R^2 estimate for *Age Group* was .052. Based on the estimate, approximately 5% of variability in Utilization by School (*School ID*) in HPSA zip codes is explained by *Age Group*.

The associated ANOVA table demonstrates the significance of the regression model. The test significance is at .000, which is below alpha level of .05. Therefore, we reject the null hypothesis that there is not a statistically significant relationship between Utilization by School (*School ID*) and *Insurance* in HPSA zip codes. We accept the alternative hypothesis that there is a statistically significant relationship between Utilization by School (*School ID*) and *Insurance* in HPSA zip codes. The regression model is statistically significant, F ((4, 8374) = 114.2, $p > .001$, $R^2 = .052$).

The Coefficients output provides the results of the predictor variables. In the first model, the results show that *Insurance* as a predictor of Utilization by School (*School ID*) in HPSA zip codes. The output reveal that *Insurance* was statistically significant with an associated p value of .000, which is below the alpha level of .05. Although a significant relationship exists, *Insurance* had a negative predictive effect on Utilization by School (*School ID*) in HPSA zip codes at a -13.5 unit decrease. In the second model, *Race* was added, with no change. Therefore, *Race* had no effect on Utilization by School (*School ID*) and *Insurance* in HPSA zip codes. In the third model, the variable *Gender* was added. The predictive effect had a negligible decrease. Again, similar to *Race*, *Gender* had no effect on Utilization by School (*School ID*) and *Insurance* in HPSA zip codes. In the last model, the variable *Age Group* was added. However, the addition of the variable had a negative predictive effect on Utilization by School (*School ID*) and *Insurance* in HPSA zip codes, at 17 fewer units of increase. Overall, the statistical models revealed a statistically significant relationship between insurance status and the utilization of telehealth by school among pediatric patients in North Texas in only HPSA zip codes.

Table 21

Relationship Between Utilization by School in HPSA Zip Codes and Insurance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.188[a]	.035	.035	46.819	
2	.189[b]	.036	.035	46.812	
3	.189[c]	.036	.035	46.815	
4	.227[d]	.052	.051	46.425	1.679

a. Predictors: (Constant), PAYOR
b. Predictors: (Constant), PAYOR, RACE
c. Predictors: (Constant), PAYOR, RACE, SEX
d. Predictors: (Constant), PAYOR, RACE, SEX, AGE GROUP
e. Dependent Variable: SCHOOL ID

ANOVA[a]

Model		df	Mean Square	F	Sig.
1	Regression	1	11342.101	4.995	.025[b]

	Residual	8377	2270.656		
	Total	8378			
2	Regression	2	8896.993	3.919	.020[c]
	Residual	8376	2270.157		
	Total	8378			
3	Regression	3	6040.620	2.661	.046[d]
	Residual	8375	2270.389		
	Total	8378			
4	Regression	4	81509.213	36.488	.000[e]
	Residual	8374	2233.889		
	Total	8378			

a. Dependent Variable: SCHOOL ID

b. Predictors: (Constant), PCP

c. Predictors: (Constant), PCP, RACE

d. Predictors: (Constant), PCP, RACE, SEX

e. Predictors: (Constant), PCP, RACE, SEX, AGE GROUP

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	49.805	1.923		25.895	.000
	PCP	2.476	1.108	.024	2.235	.025
2	(Constant)	48.353	2.107		22.946	.000
	PCP	2.459	1.108	.024	2.220	.026
	RACE	.894	.530	.018	1.686	.092
3	(Constant)	48.937	2.608		18.761	.000
	PCP	2.466	1.108	.024	2.225	.026
	RACE	.887	.531	.018	1.671	.095
	SEX	-.397	1.044	-.004	-.380	.704
4	(Constant)	70.250	3.161		22.226	.000
	PCP	1.537	1.102	.015	1.395	.163
	RACE	1.001	.526	.021	1.901	.057
	SEX	-.536	1.035	-.006	-.517	.605
	AGE GROUP	-17.236	1.468	-.128	-11.740	.000

a. Dependent Variable: SCHOOL ID

Summary

The study questions sought to analyze utilization patterns for the Children's Health SBtH program. The sample size included approximately 12,471 school telehealth encounters that occurred between August 1, 2014 and June 1, 2019. Utilization of the SBtH program was captured in 148 schools, representing 20 school districts.

The questions examined the relationships of school telehealth utilization and HPSA zip codes. There were three research questions that guided this study. Using secondary data from Children's Health, school telehealth utilization trends were evaluated in HPSA zip code geographies. Data contained in the data set was used to conduct the descriptive and inferential analyses. IBM SPSS software standard version 25.0 was used to conduct the statistical analyses.

For RQ1, both chi-square and multiple regression results described the relationship between HPSA zip code schools and the utilization of telehealth by school among pediatric patients in North Texas. The results showed that telehealth utilization by schools in both HPSA and Non-HPSA zip codes differed by *Race*. However, utilization by schools in both HPSA and Non-HPSA zip codes were comparable by *Gender*. In contrast, telehealth utilization by schools in both HPSA and Non-HPSA zip codes differed according to *Age Group*. Approximately, 85% of the telehealth visits in HPSA zip codes were completed by Children. Finally, *School Type* showed a very strong statistical effect on telehealth utilization in *HPSA* and *Non-HPSA* zip codes. There was a statistical relationship observed between Utilization by School (*School ID*) and *HPSA*.

The output showed an associated *p* value of .000, which is below the alpha level of .05. Therefore, the null hypothesis was rejected.

For RQ2, both chi-square and multiple regression results described the relationship between PCP status and the utilization of telehealth by school among pediatric patients in North Texas in HPSA zip code schools. To describe the relationship, the data set was filtered to provide results ONLY in HPSA zip codes. There was a statistical relationship observed between Utilization by School (*School ID*) ONLY in HPSA zip codes and *PCP*. The test significance is at .000, which is below alpha level of .05. Therefore, the null hypothesis was rejected that there was not a statistically significant relationship between Utilization by School (*School ID*) and *PCP*.

For RQ3, both chi-square and multiple regression results described the relationship between insurance status and the utilization of telehealth by school among pediatric patients in North Texas in HPSA zip code schools. Like RQ2, RQ3 used the filtered data set to provide results ONLY in HPSA zip codes. The associated statistical tests demonstrated the significance in the observed relationship between Utilization by School (*School ID*) and *Insurance* in HPSA zip codes. The test significance is at .000, which is below alpha level of .05. Therefore, the null hypothesis that there is not a statistically significant relationship was rejected.

The results and output of the research study provide insights into the pediatric population in North Texas. Given the relationships that were observed, the results showed that telehealth utilization can be predicted by many variables. Chapter 3 provided the results of the research questions. In the next chapter, the interpretation of the study findings will be shared. Additionally, the application to professional practice and implications for social change will be discussed.

Section 4: Application to Professional Practice and Implications for Social Change

Introduction

For individuals living in primary care shortage areas, the effects of health inequities are huge. Unfortunately, throughout the US, the shortage of PCPs continues to increase. For children and adolescents, not having access to primary care makes it difficult to develop and maintain healthy habits. Health care organizations have turned to technological solutions, like telehealth, to address primary care provider gaps. The use of telehealth in schools provides increased access to health care (Love et al., 2019). School-based telehealth can minimize the provider shortage gap.

This research focused on the utilization patterns of the SBtH program in medically underserved areas in North Texas. There is little evidence on the impacts of telehealth on primary care physician shortages, specifically addressing the pediatric population. The approach for the study was a retrospective and quantitative analysis assessing utilization among students in HPSA zip code schools. Secondary data was used from Children's Health, in Dallas, Texas. The variables used to determine any statistical associations were utilization by schools, schools in HPSA zip codes, school type, PCP status and insurance status. Chi square and multiple regression statistical tests were performed.

The study results revealed statistically significant differences in utilization patterns. The relationship between HPSA zip code schools and the utilization of telehealth by school was measured, along with controlling for race, gender, age, and school type. The descriptive and inferential statistics provided detailed insights into the utilization trends in the study population.

Interpretation of the Findings

The results of the study are consistent with other studies on school-based telehealth programs. While there are no comparable studies that examine telehealth utilization patterns among the pediatric population in HPSA zip codes, there are study commonalities with several former studies on school-based telehealth programs. Geographic and demographic data on school populations provided insights worth comparing and noting.

For RQ1, the results showed that telehealth utilization in both HPSA and Non-HPSA zip codes differed by *Race*, but not by *Gender*. However, utilization in both HPSA and Non-HPSA zip codes differed according to *Age Group*. Finally, *School Type* predicted utilization in *HPSA* and *Non-HPSA* zip codes. A statistical relationship was observed between Utilization by School (*School ID*) and *HPSA* among pediatric patients in North Texas.

The study results yielded interesting commonalities about student race amongst school-based telehealth utilization. Among students that live in Non-HPSA zip codes, the utilization of telehealth was 29% for White/Caucasian students, 63% for Black/African-American students, 2% for Hispanic students, and 6% for students of an Unknown race. In contrast, among students that live in HPSA zip codes, majority of the utilization of telehealth visits were completed by White/Caucasian students; roughly 62%. Whereas, 21% of the visits were completed by Black/African-American students, 8% by Hispanic students, and 10% by students of an Unknown race. The study characteristics of the geographic location and population served were comparable to a recent study that captured data on school-based telehealth programs conducted by Love et al. in 2019. The authors provided detailed demographic accounts across 291 schools. The study reported the following racial composition across the 291 school-based telehealth programs: 26% Hispanic, 40% White, 29% Black, and 5% Other. Based on the study results and the Love et al. study, most of the students that have access to and/or received services from the school-based telehealth programs were on average White/Caucasian.

In analyzing gender distributions, the study results were fairly consistent amongst Females and Males. Approximately 52% of the telehealth visits were completed by Females and 48% were completed by Males. Data are limited in the literature on gender composition of school-based telehealth programs. In a study that analyzed use of school-based telehealth in a rural Arkansas community, the results were similar. While the program only served a small and rural population, the program was implemented in several elementary, middle, and high schools. The results revealed comparable use among gender, i.e., 50% Females and 50% Males, with the study sample size of 56 students (Bynum et al., 2011).

As far as age proportions, approximately 82% of all telehealth visits were completed by Children and only 18% were completed by Teens. One barometer that offered insights into age is the school type. Amongst the study population, the data showed that 60% of all telehealth visits were completed in a Pre-K/Elementary campus.

Approximately 9% of the utilization was completed in the Immediate/Middle schools and 8% (1,037) of the utilization in High schools. Previous studies have not accounted for Charter schools.

However, the results are rather consistent with other studies on the subject that recognized the school type in research. In the Love et al. (2019) study, roughly 51% of the 291 schools served elementary campuses. In the same study, the distribution in Middle schools was 16% and High schools was 14%. Similarly, in the Bynum e al. (2011) study, the results showed that the student population was comprised of 86% in Elementary schools, 10% in Middle schools, and 4% in High schools. Based on this information, on average, the majority of the school-based telehealth programs found in the literature likely served the elementary school population. The commonality is certainly worth noting for replication purposes.

As a comparison of underserved communities, there were no studies found in the literature that analyzed school-based telehealth programs in HPSA areas. However, this variable provides insights into the utilization trends in the study population representing underserved communities. Again, a total of 8,379 telehealth visits were completed in schools designated as a HPSA zip code school, representing 67% of the total telehealth visits completed during the study period. For reference, the variable HPSA, is defined by the US government and classified as geographies that have a shortage of primary care health professionals; a universal measure for a medically underserved community.

Similar barometers that were extrapolated in literature on other measures of disadvantaged populations were Title 1 schools and free or reduced lunch. The Love et al. study provided detailed accounts of student populations and measures that indicated these socio-economic status indicators. According to the study, of the 291 schools, nearly all schools with access to school-based telehealth services (92%) were eligible for the Title I program. The Title 1 program is a federally funded program that provided financial assistance to schools that have high percentages of children from low-income families (Love et al., 2019). Similarly, in the same study, the authors provided information on students that were eligible for free or reduced lunch. Free or reduced lunch is also a federal program that provides aid to eligible low-income students. Approximately 78% of the student population across the 291 schools were eligible for free or reduced lunch. The details from this study provide observations on how school-based telehealth programs can provide increased access to health care, especially in underserved and vulnerable communities.

For RQ2, the study results demonstrated a statistical relationship between Utilization by School (*School ID*) in HPSA zip codes and *PCP*. The primary variable, *PCP*, was defined as the student reporting having a primary care provider during the study period. In relation to the importance of the PCP and school-based telehealth utilization, there were no former studies available in current literature that analyzed this association. However, this relationship provides insights into the utilization trends in the study population. Experts in the public health field suggest that not having a PCP leads to increased risks of poor health outcomes (Arora et al., 2011). With respect to the PCP proportion in the study, 34% of the total telehealth visits were completed without a PCP during the study period.

Of the currently available literature with inclusion of the importance of the PCP, a study reported by Perry and Turner (2019) reported on the impact of PCP engagement. According to the study, a lack of PCP engagement significantly negatively impacted a study in a rural community on school-based telehealth for asthma management. "To maximize the impact of future school-based telehealth programs, there should be collaboration with the PCP. Engagement with the PCP will not only ensure continuity of care but also maximize effectiveness of the program" (Perry & Turner, 2019). The results of this study further substantiate the importance of the role of the PCP in maximizing both access and quality of health care.

For RQ3, the study yielded a statistical relationship between Utilization by School (*School ID*) in HPSA zip codes and *Insurance*. The primary variable, *Insurance* was defined as the insurance type the student reported during the study period. The study data showed that only 10% of the telehealth encounters had commercial insurance and 32% had Medicaid/CHIP. Therefore, the majority of the telehealth visits (58%) were completed with No Insurance reported during the study. In relation to the importance of insurance and school-based telehealth programs, there were no former studies available in current literature that analyzed this association. However, this relationship provides insights into the utilization trends in the study population.

The literature is very clear and consistent with respect to the burden that a lack of insurance places on individuals. Not only does the lack of insurance place burdens on individuals, but the lack of insurance reimbursement for telehealth programs is considered a financial barrier on telehealth programs (AAP, 2015). The AAP policy statement reported that while there is increasing evidence of how telehealth can help address access, quality, and pediatric physician workforce issues, barriers still exist in many state and federal policies. The current laws and policies are inconsistent across the US on insurance reimbursement for telehealth services. Additionally, telehealth projects are difficult to sustain without consistent reimbursement by public and private insurance companies (AAP, 2015). The results of this policy statement issued by AAP further validates and strengthens the argument for supportive reimbursement policies for school-based telehealth programs.

As previously mentioned, there is limited evidence of previous research studies on the demonstrated value of school-based telehealth programs to address provider shortages. However, the study results go beyond reported findings on school-based telehealth programs and addressing provider shortages in HPSA zip codes. The evidence from this study provides support that school-based telehealth programs can increase access to health care to medically underserved populations, while addressing provider shortages. In fact, the findings in the study indicate a need to look further at these type of relationships and programs in supporting the pediatric population.

Interpretation of the Alignment to the Theoretical Framework

The SEM model was used because it offers the multi-level framework to evaluate school-based telehealth programs. Literature findings reinforce the importance of school-based telehealth in community settings. Yet there is lack of literature examining its context to the significance in addressing primary provider shortages in underserved communities. However, it is clear that school-based telehealth can be an effective strategy to improve access to health care for the pediatric population. Many studies have found that the pediatric providers, school nurses, parents, and students all found satisfaction and effectiveness in school-based telehealth programs. Underserved urban and rural areas should consider telehealth care as a model to improve access to medical and mental health care (Kattlove, 2009).

Individual Level

The individual level of SEM and alignment to telehealth utilization focuses on individual influence. Literature showed that successful school-based telehealth programs depend on many factors, including the setting and culture (Sanchez et al., 2019) of the school. Although, there is little evidence observed that show how individual attitudes and knowledge impact utilization. Cormack et al. (2016) report that mission, culture and practices of the school and parents tend to influence high adoption of telehealth and utilization.

For RQ1, the results showed that telehealth utilization in both HPSA and Non-HPSA zip codes differed. Amongst the age categories, Children had the highest telehealth utilization. Also, telehealth utilization was highest in Pre-K/elementary schools. The important note to make on these results is that generally children are not decision-makings in their own health needs and health care access. Teens or adolescents may generally have more leverage in making decisions in their own health. Therefore, the individual level likely provides less influence on telehealth utilization among the North Texas pediatric population.

Interpersonal and Organizational Level

The interpersonal and organizational levels of SEM focus on interpersonal and environmental influences. In relation to the influence of parents, teachers, and the school environment, telehealth utilization can be impacted positively or negatively. Some of the main themes observed in the literature is the importance of parents and school nurses. As mentioned previously, primary care physicians play a critical role as well. Enhanced communication among multiple stakeholders, like school nurses, parents, school staff, and providers was seen as a benefit, especially in underserved communities (Reynolds & Maughan, 2015). Likewise, Sanchez, et al (2019) suggested that parent, provider, and school staff telehealth rates of approval and satisfaction influenced program success in 7 of 20 studies that assessed satisfaction in their study.

For the interpersonal and organizational alignment, RQ2 is provided as an observation within this context. For RQ2, the study results demonstrated a statistical relationship between utilization in HPSA zip codes and having a PCP. Majority of the utilization in HPSA zip codes were among students that had a PCP. This finding can support expert opinions regarding the PCP as an important stakeholder in school-telehealth programs. Experts purport that the collaboration with the PCP is an important factor of school-based telehealth effectiveness and high levels of satisfaction (Cormack et al. (2016). Improving the opportunity for collaboration with the providers, parents and school staff was noted in clinical adherence guidelines and increased quality of health among other school-based telehealth programs (Nelson et al., 2012).

Policy Level

The last level of the SEM framework is the policy level. Policies can impact health care access; hence, they can impact school-based telehealth utilization. Neta et al. (2015) argued that the historical and policy context are typically missing from studies on school-based telehealth programs. There were no studies found that demonstrated how policy interventions influence school-based telehealth utilization. Although, some studies provided a limited context suggesting that some policy are considered barriers to implementation. For example, Damgaard & Young (2014) described that policy and regulatory issues drove demand for a school telehealth program due to the limited access for diabetes care in South Dakota. The authors reported on the legal barriers with delegation and supervision of insulin administration to students in the schools. The model was used to support policy changes regarding diabetes care management in the school setting in the state. In another study, Halterman et al. (2018) discussed barriers to implementation in an asthma care school-based telehealth program concerning school nurse staffing policies and reimburse structures in the state of New York. These studies demonstrate that policies can in fact influence school-based telehealth adoption and utilization.

For the policy alignment, RQ3 is provided as an observation within this context. For RQ3, the study results revealed a statistical relationship between utilization in HPSA zip codes and insurance status. Only 10% of students overall had commercial insurance, while 32% of students had Medicaid/CHIP. However, majority of the telehealth utilization in HPSA zip codes were among students that did not have a source of insurance. Again, having insurance was not a requirement for use. The fact that over one half of all telehealth visits were completed without students having insurance is substantial to these findings. The results can be used to support advocacy for such programs as a potential mechanism to increase health care access for underserved populations. The study outcomes show a significant need to address vulnerable populations and health care access issues.

Study Limitations

The findings in the study extends the knowledge of school-based telehealth programs. The study was conducted with a pediatric population sample in North Texas using data from Children's Health, Dallas, Texas. The scope included students that have used the school-based telehealth program and the respective utilization was captured across 148 school sites during 2014-2019. The sample excluded any students that did not use the school-based telehealth program.

One of the study limitations is generalizability. When practitioners are interested in adopting and replicating interventions, the context of the intervention is important to understand and to determine if findings are generalizable (Neta et al., 2015). The program served students across many urban, suburban, and rural North Texas communities. The population included primarily elementary students; but middle and high school students also participated. Yet, the results may be difficult to be generalized outside of this geography.

The study evaluation intended to address access issues in North Texas by examining utilization patterns in HPSA zip code schools. While the data analyses focused on these utilization patterns, the findings fail to conclude any causal relationships in school-based telehealth utilization. Additionally, the study results cannot conclude or infer that telehealth utilization improved any clinical outcomes or health status. These and other outcomes related to school-based telehealth programs will warrant further investigation, which may be important criteria for broader adoption and program effectiveness.

Lastly, in general, most school districts and health care organizations budgets are constrained. This may prove to be a barrier to start school-based telehealth programs. Additionally, many decision-makers and law makers may desire evidence of health care outcomes, quality measures, and cost-effectiveness metrics for ongoing investments in the implementations of school-based telehealth programs. Few studies have provided this level of research on school-based telehealth programs. This study does not address clinical effectiveness, program efficiencies, or cost considerations for school-based telehealth programs.

Study Recommendations

Despite the noted limitations, this study provides one of the first investigations to our knowledge on the analyses of school-based telehealth utilization in HPSA geographies. Additionally, the study expands the knowledge of school-based telehealth programs, in which limited research exists today. Based on the results, many factors contribute to influence telehealth utilization in HPSA geographies, including age, school type, PCP and insurance. Results from this study show promise in how school-based telehealth programs have the potential to mitigate provider shortages and increase access to care for pediatric populations.

The nature of school-based telehealth programs is to connect students with health care providers at a distance. These programs have also been shown to enable underserved communities to have increased access to health care and eliminate barriers, like transportation (Sanyal et al., 2018). Further research is needed on the subject to increase the understanding of telehealth technology, impacts in the school settings, impacts on transportation barriers, and impacts on care and outcomes. Although telemedicine is not widely integrated in schools at this time, one recommendation is to incorporate these programs in new and existing school health programs to expand access. Many studies have shown that school-based telehealth programs can be used to address underserved populations; in both rural and urban settings. Experts suggest that the benefit of school-based telehealth in urban settings can reduce the overuse of the emergency care settings, for low acuity and minor health conditions (Perry & Turner, 2019).

Another point for recommendation consideration is that schools are not generally considered health care delivery sites, with the exception being schools that have a school-based health center (Perry & Turner, 2019). Therefore, legal and regulatory standards can vary. What is clear, is that school-based telehealth programs must comply with state and local guidelines, including the Health Insurance Portability and Accountability Act (HIPAA) privacy requirements and Family Educational Rights and Privacy Act (FERPA) protections. These regulatory mandates must be considered by school leaders and health organization leaders. Lastly, there must be a contractual relationship established between the health care organization and the school.

Further research is necessary to examine school-based telehealth interventions. To demonstrate its value, school-based telehealth implementations and research must continue. Feasibility and adoption of such innovations reflect many factors and depends on community specific attributes. However public health practitioners must embrace the furtherance of telehealth technologies and its application to advance health promotion and prevention.

Implications to Professional Practice

Schools can be important settings to integrate medical and behavioral health; thereby, promoting organizational change and improvements. Additionally, schools can be the best environment for preventative practices and policies. Because children spend seven or more hours a day at school, schools can become the source of where healthy living practices are learned and practiced. Schools are proactive agents in behavioral prevention and behavior modeling for adolescents (Bowles et al., 2016). Barriers that impede access to services, such as, transportation and parental work schedules, are mitigated with school-based telehealth programs (Langer et al., 2015). Another benefit is that children and adolescents receive care in a familiar setting (AACAP, n.d.). These programs can extend the reach of health care providers to underserved communities (Langer et al., 2015). Partnering with the local schools provides a great reach for public health initiatives and fostering cross-sector collaboration.

Telehealth is a rapidly growing health delivery method that uses electronic communications and information technology to connect patients to providers at a distance. The range of services can include education, diagnosis, intervention, consultation, and monitoring across a distance (AHA, 2015). Telehealth encompasses three delivery types: real-time, store and forward, and remote monitoring (AHA, 2015). Telehealth promotes social change by addressing issues of provider shortages and increasing access for underserved populations.

The study provides evidence on variables relevant to mitigating health access in HPSA geographies; access to PCPs and health insurance status. The organizational and societal contributions from the study could fill gaps in knowledge on how telehealth can help augment provider shortages and increase access for the pediatric population in underserved communities. School-based telehealth programs offer a unique and perfect opportunity to address primary care workforce challenges and access issues.

In 2018, Texas Governor, Greg Abbott, offered that school-based telehealth is a solution to access issues for students with mental health needs (Wesley, 2018; “After the Santa Fe Shooting…”, 2018). As such, in 2019, the Texas legislature passed Senate Bill 11 to address school safety and part of the bill provided access to telehealth services in the schools (TEA, 2019). Through telehealth, behavioral health screenings and access to behavioral health care specialist are made available to students in schools. While this example addresses behavioral health care needs, school-based telehealth is being used to minimize risk factors and to increase health care access across the state for pediatric mental health.

While, there is little published data on telehealth that examines utilization among the pediatric population, there is continued growth of telehealth in schools across the nation. According to Love et al., (2019), in 2016-2017, approximately 19% of existing school health centers (brick and mortar) reported using telehealth. Also, in the study, the authors reported on the rise of school-based telehealth programs by sponsored health clinics, hospitals, or medical centers. Nearly half of school-based telehealth programs, 48%, were sponsored by hospitals (Love et al., 2019). This demonstrates the increased value and benefits that hospitals and health care organization see associated with these programs.

Conclusion

Primary and preventive care are important maintaining and improving health. However, many families struggle with access to preventive and primary health care due to provider shortages. Approximately, 20% of the US lives in primary care shortage areas (HRSA, 2019). When children and adolescents have lack of access to primary care, they tend experience poor health (Slashcheva, Rader & Sulkes, 2016). However, the problem of provider shortages is getting worse instead of better, and the issue of provider shortages is significant in Texas. As the second largest state, Texas represents 16% of the overall provider shortage across the US (US Census, 2018). Furthermore, many of the state's counties are without a physician. These areas are medically underserved.

Because primary care physicians are on the front lines of health delivery and are integral to prevention, having enough of them to meet the health demand in Texas is a public health priority. As a result of provider shortages, health care organizations are developing innovative and newer ways to deliver care. Children and youth face great need for access to health care and often experience the most barriers. Specifically, school-based telehealth models certainly can address the issue of access for pediatric patients. Yet, little has been written that examines these related impacts of school-based telehealth.

The study included a quantitative, cross-sectional evaluation of a school-based telehealth program in North Texas. The analytical aim was to determine the significance of differences in utilization patterns among HPSA zip code schools. Study variables included telehealth utilization by schools, schools located in HPSA zip codes, PCP status and insurance status of the students. The study population included school-aged children, representing across 148 school sites, in 20 school districts, in five counties in urban, suburban, and rural areas in North Texas. About, 111 schools were located in HPSA zip codes. The total number of encounters that occurred between August 1, 2014 through June 1, 2019 was 12,471. Primarily, the program was provided on Pre-K/Elementary campuses; however, some middle school, high school, and charter schools were represented. The study sample size was sufficient and met the minimum requirement for the statistical tests. The study was guided by three questions that examined the telehealth utilization among HPSA zip code schools. Chi square and multiple regression tests was used to determine variation among students of telehealth utilization.

The study results demonstrated statistical significance between the study variables. The observed relationships between HPSA zip codes, PCP status and Insurance status showed that telehealth utilization can be predicted by many variables. The findings offer insights towards the value of telehealth in addressing access and provider shortage challenges. As such, school-based telehealth programs can be a perfect opportunity to address primary care workforce challenges and pediatric access issues in medically underserved communities.

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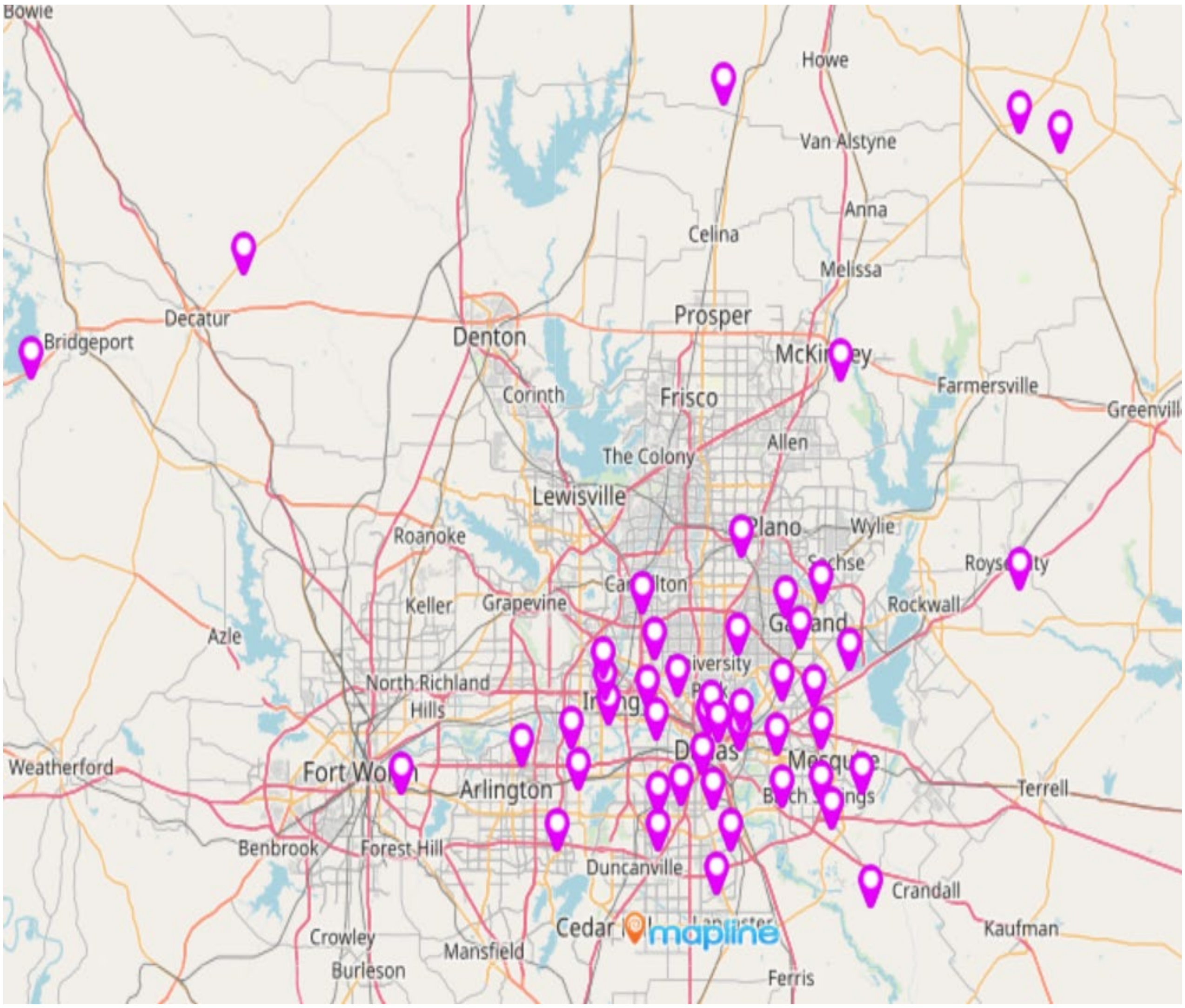
Appendix A: Map of North Texas Zip Codes



Appendix B: Program Enrollment Form

children's health Pediatric Group

2019-2020 School Telehealth Patient Information Form

School Name:___________________________

School District: __________________________

PATIENT INFORMATION

Child's Name (Last Name, First Name, Middle Name): ________________________________

Date of Birth (Month/Day/Year)_______/_______/________ Male (☐) Female (☐) SSN #_________-_______-________

Child's Street Address (City, State, Zip Code): ________________________________

Child Lives With: ☐ Mother ☐ Father ☐ Guardian/Other:__________________Phone #:____________________________

Preferred Pharmacy Name:___________________________Cross Streets: ________________________________

Pediatrician / PCP:___________________________ PCP Phone #: __________________________

Race/Ethnicity (Please select appropriate group): ☐ Asian ☐ Black or African American ☐ Latino/Hispanic ☐ White or Caucasian ☐ Other

Medication Allergies: _____________________________________ Medical History: ____

PARENT/GUARDIAN INFORMATION

Parent/Guardian's Name:____ **Relationship:** ____________________________

Address: ☐ Same As Child ☐ Other (City, State, Zip Code)________________________________

Primary Phone:____________________________ Alternate Phone:______________________________________

Guardian's Date of Birth______/______/_________ Email: ____

OPT Out of email contact: ◻ YES

EMERGENCY CONTACT- In case of an emergency, who should we contact?

Name______________________________Relationship_________________________Phone _____________________________

Children's Health Pediatric Group may disclose *Medical* and *Billing* information to this contact. ◻ YES ◻ NO

INSURANCE INFORMATION

Is the patient covered by insurance? ☐YES ☐ NO

Is the Patient covered by Medicaid Insurance: ☐ YES ☐ NO

Name of Person Responsible for Paying the Bill ◻ Mother ◻ Father ◻ Other _____________________________________

Street Address: ☐ Same As Child ☐ Other (City, State, Zip Code)____

Primary Phone Number________________________

PRIMARY INSURANCE

Policy Holder's Name ◻ Child ◻ Mother ◻ Father ◻ Other ____________________________Date of Birth ______/_______/_____

Insurance Name____ Phone ____________________________

Insurance ID#-___________________________________ Group # ___________________

Revised: March 2019

Appendix C: Data Permission Use Letter

children'shealth

November 14, 2019

To whom it may concern:

Children's Health operates a school-based telehealth program in Dallas, Texas. Danielle Wesley has requested to use data from the program to analyze and report utilization outcomes related to the program for dissertation purposes at Walden University.

Children's Health authorizes the use of the program data for the referenced purposes. The data does not contain private, patient health information (PHI). We are excited to learn about the outcomes for analytical purposes and the completion of the study.

If you need any additional information, please do not hesitate to contact me.

Sincerely,

Julie Hall-Barrow, Ed.D.
Senior Vice President, Network Development and Innovation
Children's Health System of Texas