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Texas Medicaid Factors Associated with Childhood Vaccination Nonadherence: A Regression-Based Statistical Analysis with Moderation

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Abstract

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Proposal Submitted in Partial Fulfillment

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Abstract

Childhood vaccine adherence continues to erode over time in Texas. Little is known about the relationship between demographic, behavioral, and structural variables and childhood vaccine adherence. Texas Health and Human Services data from Medicaid beneficiaries aged 4 to 7 were analyzed to examine associations between social determinants of health (SDoH) and vaccine adherence. Research questions were guided by the Ryvicker model and used to explore relationships between these variables and childhood vaccine adherence. Findings indicated that age, proximity to care facilities, and psychosocial circumstances significantly influenced childhood vaccination adherence, and physical distance between Texas Medicaid members and providers had a moderating effect on the relationship between SDoH and vaccination status. However, there was no significant relationship between other social determinants including type of Medicaid, literacy, education levels, employment, housing, social support, and primary support and childhood vaccination adherence. Study findings suggest that policy interventions that help improve access to care may enhance vaccination rates and public health outcomes. Findings of this study may lead to positive social change through targeted outreach for families with children that are most vulnerable to nonadherence to vaccine schedules and direct limited public health funding resources where they will have the greatest impact on child health.

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Chapter 1: Introduction to the Study

Vaccination rates for Medicaid enrollees vary by population (Galewitz, 2021). Children continue to not be adherent to recommended vaccine schedules despite outbreaks of vaccine-preventable diseases (Freeman et al., 2022; Hargreaves et al., 2020; Kubin, 2019). Childhood vaccination coverage for children enrolled in the Medicaid program is low compared to children with private coverage in 2020, at between 2.5% and 12% lower depending on the type of vaccination (Hill et al., 2020). A correlation exists between SDoH and low vaccination rates (Balaj et al., 2021; Hosseinpoor et al., 2019; Morrison et al., 2020; National Academies of Sciences et al., 2019). SDoHs are economic, social, and behavioral conditions influencing one's ability to practice healthy living (Sensmeier, 2020). However, specific variables associated with low childhood vaccinations rate in the Texas Medicaid population are unknown. This study involved addressing this knowledge gap on low vaccination rates among children who rely on the Medicaid program. There was no specific empirical evidence that could be used to identify vaccination trends among Medicaid children that were needed to develop impactful policies in order to address their nonadherence to vaccination. The knowledge gap left public health stakeholders without evidence-based tools and models that were needed to identify factors that influence healthcare decisions for vaccination of Medicaid children.

Variables included in desired information from Medicaid enrollees include demographic, behavioral, and structural variables. Advancing technology is a critical resource for studying healthcare trends based on the volume and quality of medical data

via certified electronic records (Messino et al., 2020). Recent improvements in public health infrastructure through technology have improved adherence to vaccination schedules (Hadjipanayis, 2018).

While children's vaccine adherence is largely influenced by SDoHs, health technologies, such as electronic health records, have become instrumental tools for addressing barriers associated with SDoH and access to healthcare services (Sensmeier, 2020). Moreover, there is a correlation between collecting enrollee medical information and improvements in health services adherence (Brown et al., 2021). Medicaid uses various types of information technologies, such as telehealth, to overcome SDoH barriers and improve enrollees' access to healthcare and reduce costs (Uscher-Pines et al., 2020).

The objective of the proposed study was to determine the relationship between SDoH and childhood vaccination adherence in the Texas Medicaid population. Study outcomes could generate positive implications in healthcare practice and social change. In practice, study findings could substantially improve vaccination adherence among Medicaid-covered children. Since one in five American children are Medicaid enrollees, implementing study outcomes in the Medicaid program could improve children's access to vaccination, and ultimately, health conditions of American children and the general health of society. American society could also benefit from improved access to medical care and reduced costs of healthcare through healthcare technologies. Additionally, increased children's vaccination could lead to a healthy society. Chapter 1 includes the background, problem statement, purpose, research questions, theoretical framework, nature of the study, definitions, assumptions, and scope and delimitations.

Background

The Medicaid vaccination program is provided to uninsured American children through the age of 18 at no cost. The Medicaid Vaccines for Children (VFC) program was established via the Omnibus Reconciliation Act of 1993 and officially launched in October 1994 to serve eligible American children (Whitney et al., 2014). The VFC program was created in response to the measles epidemic of 1989-1991 in the U.S. that resulted in over 55,000 measles cases and 11,000 related hospitalizations, as well as 123 deaths (CDC, 2016). Surveys indicated half of the affected children were not vaccinated against measles (Centers for Disease Control & Prevention [CDC], 2005). The VFC program was a major vaccine finance reform focused on reducing cost barriers to vaccination and improving vaccination coverage to eligible uninsured American children (CDC, 2016). Medicaid is a social good program that effectively addresses SDoH and economic disparities in the U.S. (Montoya et al., 2020).

According to Ghaswalla et al. (2021), only 55% of Medicaid children complete the Rotavirus vaccination. Between 67.2% and 77.3% of vaccinations are incomplete among uninsured and Medicaid insured versus privately insured children and Black and Hispanic children against Whites. Krishnarajah et al. (2018) found that Medicaid-insured children had a completion rate between 14.4% and 37.4% of vaccinations and low completion rates compared to commercially insured children which were between 47.5% and 67.2% adherent. Kampe et al. (2022) acknowledged that a high vaccination rate for Rotavirus is not being achieved among American children enrolled in Medicaid. Payne et

al. (2021) revealed that vaccination rates for influenza among Medicaid-insured children were comparatively lower than privately insured children.

Key factors impacting access and adherence to healthcare and creating significant disparities in preventive care include environment, individual characteristics, social factors, personal health practices, and provider choice (Smith et al., 2021). Students in the Houston school district indicated disparities in vaccine adherence based on English not being their primary language (Rajan et al., 2020). Inclusion of ethnicity in reseach may have an impact on research validity and generalizability. Demographic and socioeconomic determinants are significantly associated with vaccine adherence (Rajan et al., 2020).

There is a lack of research incorporating the SDoH variables as a key factor determining low immunization coverage among all Texas Medicaid-insured children. Understanding of the potential relationship between SDoH and vaccine adherence within the Texas Medicaid population was lacking. Research on social determinant factors was needed to evaluate any relationship between these SDoH variables and childhood vaccination adherence. Nuzhath et al. (2021) emphasized the importance of gaining a better understanding of factors related to undervaccination as children's exposure increases as they enter school age, thereby increasing the risk of exposure to preventable diseases. Since SDoH create barriers to the Medicaid population I sought to determine whether SDoH factors are correlated with vaccination noncompliance among Texas Medicaid-insured children.

Problem Statement

The research problem was that specific SDoH variables contributing to undervaccination of Texas Medicaid children remain unknown. Nearly half of uninsured and U.S. Medicaid-eligible children neither comply with nor complete their vaccination series (Ghaswalla et al., 2022; Krishnarajah et al., 2018). Research shows vaccination compliance and completion rates are comparatively higher among privately insured children. Brown et al. (2021) suggested suboptimal uptake of vaccinations among children enrolled in Medicaid programs led to increased risks of contracting preventable illnesses. Medicaid recipients are a vulnerable population in terms of social and economic status and have hindered access to quality healthcare and vaccinations (Cole & Nguyen, 2020). SDoH-related barriers contribute to low vaccination rates among vulnerable populations (Balaj et al., 2021; Hosseinpoor et al., 2019). Olaniyan et al. (2020) found that SDoH influence individual-level decisions to vaccinate children fully. Social, economic, environmental, and demographic factors are essential determinants of vaccination compliance and completion. Smith et al. (2021) found that built environment, individual characteristics, social environment, personal health practices, and provider choice generate disparities in terms of vaccination compliance. Addressing the problem of undervaccination in Medicaid children will reduce cases of preventable diseases and improve the overall health and wellbeing of the community.

Purpose of the Study

The purpose of this quantitative retrospective cohort study was to examine the relationship between variables associated with SDoH and vaccination adherence among

Texas Medicaid-insured children. Vaccination adherence is defined as complying with the vaccination timetable to completion. I focused on testing relationships between specific SDoH factors associated with completing childhood vaccinations among Texas Medicaid recipients. The dependent variable was childhood adherence to vaccination, while SDoH factors were the independent variables. Data from children aged 4 to 7 enrolled in Texas Medicaid STAR and STAR Kids programs for 2021 and 2022 were used in the study. Population enrollment and claims data were obtained from the Texas Health and Human Services (HHS). Research findings will contribute to the body of knowledge by filling the existing gap in research and examining readily available factors and any potential relationship with childhood vaccine adherence.

Research Questions and Hypotheses

In this study, I used the following research questions and hypotheses:

RQ1: Is there a statistically significant relationship between person-in-environment elements (education, employment, housing, social support, family support, psychological and psychosocial circumstances, age range, income limitations, ethnicity, type of Medicaid region, and population density) and childhood vaccination adherence?

$H_0$1: There is no statistically significant relationship between person-in-environment elements (education, employment, housing, social support, family support, psychological and psychosocial circumstances, age range, income limitations, ethnicity, type of Medicaid region, and population density) and childhood vaccination adherence.

H_a1: There is a statistically significant relationship between person-in-environment elements (education, employment, housing, social support, family support,

psychological and psychosocial circumstances, age range, income limitations, ethnicity, type of Medicaid region, and population density) and childhood vaccination adherence.

RQ2: Is there a statistically significant relationship between health behaviors (relationship with the primary care physician (PCP), number of PCP visits, and accessing emergency care services) and childhood vaccination adherence?

$H_0$2: There is no statistically significant relationship between health behaviors (relationship with the PCP, number of PCP visits, and accessing emergency care services) and childhood vaccination adherence.

H_a2: There is a statistically significant relationship between health behaviors (relationship with the PCP, number of PCP visits, and accessing emergency care services) and childhood vaccination adherence.

RQ3: Is there a statistically significant relationship between physician choice and childhood vaccination adherence?

$H_0$3: There is no statistically significant relationship between physician choice and childhood vaccination adherence.

H_a3: There is a statistically significant relationship between physician choice and childhood vaccination adherence.

RQ4: Did physical distance between members and providers moderate the effect between education, employment, housing, social support, family support, psychological and psychosocial circumstances, ethnicity, type of Medicaid, region, population density, relationship with the provider, accessing emergency care services, and availability of other physicians and childhood vaccination status?

$H_0$4: Physical distance between members and providers did not moderate the effect between education, employment, housing, social support, family support, psychological and psychosocial circumstances, ethnicity, type of Medicaid, region, population density, relationships with providers, accessing emergency care services, and availability of other physicians and childhood vaccination status.

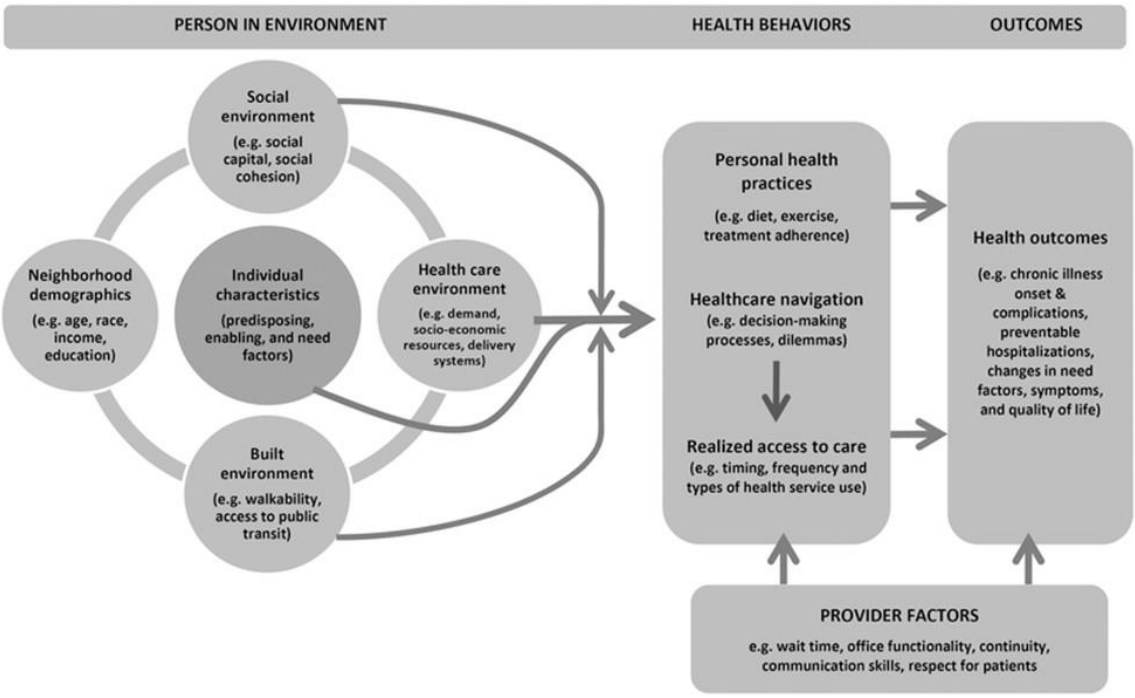
H_a4: Physical distance between members and providers had a moderating effect between education, employment, housing, social support, family support, psychological and psychosocial circumstances, ethnicity, type of Medicaid, region, population density, relationships with providers, accessing emergency care services, and availability of other physicians and childhood vaccination status.

Conceptual Framework

Concepts that grounded this study included the behavioral-ecological framework of healthcare access and navigation developed by Ryvicker that involved addressing environmental, behavioral, and provider factors impacting health outcomes of a person. According to Ryvicker (2018), a person in an environment is characterized by social environment, built environment, healthcare environment, and individual characteristics (see Figure 1). Health behaviors in the model encompassed service location choice, provider relationship, and access to care, while provider factors consist of physician choice and distance to care.

Figure 1

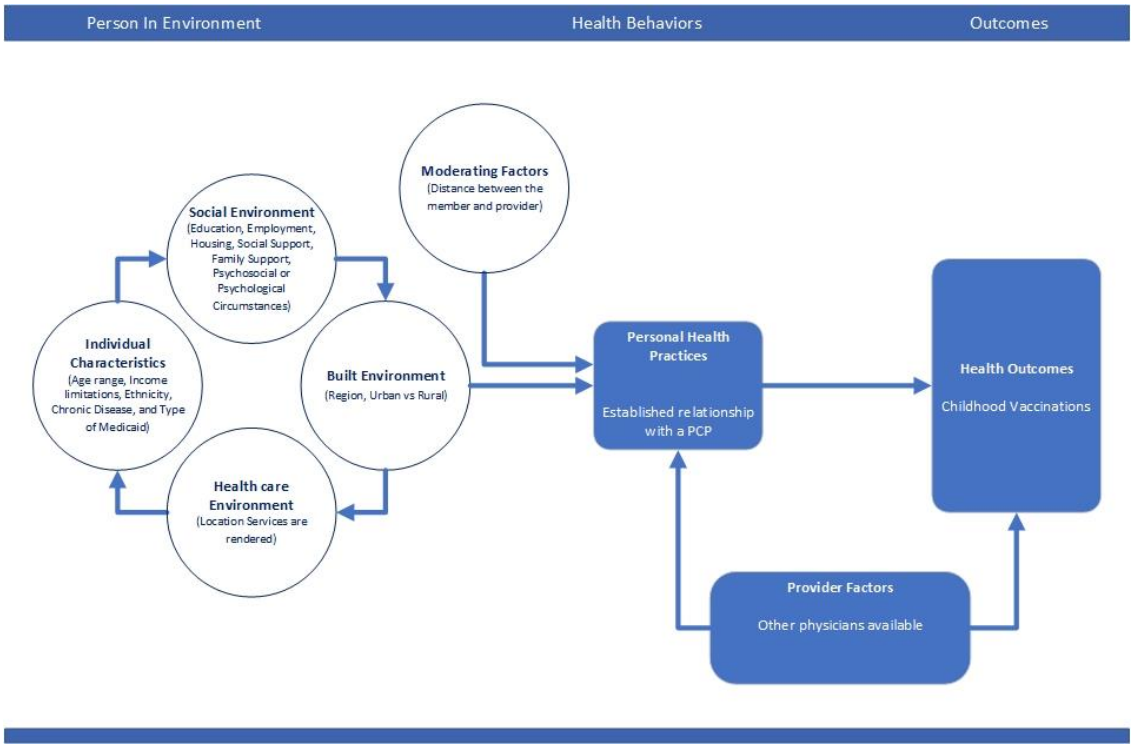
Ryvicker Model of Healthcare Access



I adopted this model to identify a gap in knowledge regarding the relationship between person-in-environment, health behaviors, and provider favots and childhood vaccine completion. Research reviewed in Chapter 2 includes explanations of how this study built upon existing research and solutions for addressing Texas Medicaid childhood vaccination rates.

Figure 2

Adapted Ryvicker Model of Healthcare Access



Note. Adapted from *A conceptual framework for examining healthcare access and navigation: A behavioral-ecological perspective*. *Social Theory & Health, 16*(3), 224–240 by Ryvicker, 2018.

I explored the relationship between Ryvicker's model factors and childhood vaccination rates. There was close alignment between the model and the data in this research studyThe model includes specific factors that influence or moderate health outcomes that are closely linked with seeking vaccination services according to the existing research. The Ryvicker framework was applied in previous studies to determine factors that foster or deter health service-seeking behaviors (Chevillard et al., 2021; Kearns et al., 2021; and Sohahong-Kombet, 2021). I used the Ryvicker framework to

analyze relationships between targeted factors in the adapted model and childhood vaccination rates as health outcomes. Information about these variables was lacking in research and was necessary to provide insights regarding factors hindering vaccination using readily available Texas Medicaid data. This model was used to view environmental, behavioral, and provider factors that influence health action. Results of this research will inform state policymakers on potential metrics in the Medicaid program to improve adherence to immunization schedule.

Nature of the Study

I used a quantitative retrospective cohort research design for examining the relationship between targeted factors in the adapted model and vaccination rates among children on Texas Medicaid. The retrospective cohort design is a type of nonexperimental longitudinal approach that is used to determine existing correlations between independent and dependent variables based on historical data and information (Curtis et al., 2016). The selected research design method was vital in terms of determining relationships between children's vaccination rates and targeted SDoH factors in Texas Medicaid. I relied on secondary data obtained from Medicaid claims and enrollment data from the Texas HHS. The specific data elements and variable operationalization were included in the requested data from Texas HHS. This secondary data required Texas HHS approval due to the agency's requirements on data requested by employees. There were no barriers from either the Texas HHS or Walden University IRB to access this data. All data used in this analysis was summary level and deidentified as required by the Texas HHS. I used the Statistical Package for Social Sciences (SPSS).

Populations without insurance or covered by commercial insurance plans were not included in the study. Also, children not between 4 and 7 were not included in this study. Independent variables included ethnicity, type of Medicaid coverage, urban versus rural identification, Texas Medicaid regions, and specific SDoH diagnosis codes identified as Z diagnosis codes related to education, employment, housing, social support, family support, and psychological and psychosocial circumstances. Service location, relationship with PCPs, ratio of PCPs to emergent care services, distance to PCPs, and availability of other physicians were included as independent variables. The dependent variable in this study was childhood vaccine adherence with specific reference to CDC-recommended vaccines for children between 4 and 7. I focused on childhood vaccination schedules recommended by the CDC in this population. I considered childhood vaccination compliance as a whole and not based on specific vaccines. Diphtheria, tetanus, and pertussis (DTaP), inactivated polio virus (IPV), measles, mumps and rubella (MMR), and varicella (VAR) vaccines were evaluated for childhood vaccine adherence based on CDC (2022a) recommendations.

Definitions

Medicaid Enrollees: Individuals who are enrolled in any Medicaid program at any given time of the year. Medicaid is a social good program that has been effective in terms of addressing SDoH and economic disparities in the U.S. (Montoya et al., 2020).

Social Determinants of Health (SDoH): Conditions in environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes (Health.gov, n.d.). Special diagnosis codes

were developed based on medical claims to identify specific social risk factors and unmet needs (CMS, 2021).

Vaccine for Children (VFC): Federally-funded service that is provided to uninsured American children through the age of 18 at no cost. The VFC program is a major vaccine finance reform focused on reducing cost barriers to vaccination and improving vaccination coverage to eligible uninsured American children.

Vaccination nonadherence: Noncompliance to the vaccine requirements in the childhood vaccination schedule recommended by CDC in the Texas Medicaid population. Children continue to not be adherent to the recommended vaccine schedule despite outbreaks of these vaccine-preventable diseases (Freeman et al., 2022).

Assumptions

Healthcare claims databases are a primary source of data in healthcare analytics (Allen et al., 2018). Utilizing this source in public health research has a wide range of applications (Shilo et al., 2020). A researcher utilizing claims data for research may encounter issues when evaluating data. Assumptions allow for the normalization of data to address some of these issues. This study included six primary assumptions. I assumed physicians correctly coded procedure and diagnosis codes for claims. Incorrect claims would not result in reimbursement for services rendered.

Additionally, I assumed claims were filed for every service. Without submitting a claim, a physician cannot be reimbursed for their services, so it is assumed that providers complete claim submissions. I also assumed all managed care organizations (MCOs) reported all encounters. This assumption was made because of the requirement that

MCOs submits all encounters to the Texas HHS. I also assumed that member and provider demographic data were accurate and that data were recorded correctly. These assumptions were based on the foundation that the data was necessary to administer the Medicaid program and, therefore, should have been accurate. Finally, I also assumed studies in the literature review were accurate.

Scope and Delimitations

I analyzed existing Medicaid records for the fiscal years 2021 and 2022 to identify factors influencing childhood vaccination adherence in Texas. I focused on Medicaid populations enrolled in STAR and STAR Kids programs during these years. I examined relationships between these factors and childhood vaccination adherence based on the childhood vaccination schedule recommended by CDC for Texas populations on Medicaid between 4 and 7. This age group was selected because it is during the transition to school. By conducting this research, I developed metrics that can be implemented to target outreach programs that will improve childhood vaccination adherence in this population. Populations without insurance or covered by commercial insurance plans were not included in the study since publicly available data did not include them. Also, children outside of this age bracket were not included in this study. Results of this study are highly generalizable to other Medicaid populations in future studies, but generalizations for greater childhood populations may be limited due to the nuances of the Medicaid program.

Limitations

The global limitations of secondary data research may include relevance and accuracy. Data were already collected through claims submissions. Secondary research is limited to only questions that existing data can answer. As such, this limited the relevance of data as contextual questions could not be obtained. Additionally, secondary data requires primary data collection to be complete and accurate. Study design, sampling methods, and timeliness of data are all factors that may influence accuracy.

One challenge of this retrospective cohort study involved accurate reporting of data. I relied on accuracy of primary data collection. I relied on providers to submit correct claims and for the Texas HHS to collect, process, and store data correctly. Due to my background in healthcare data analytics, there was a possibility of selection and confirmation biases. Since the entire available Texas Medicaid population was used, there is a minimized chance confirmation bias occurred while conducting this study. I also did not take into consideration any aspects of vaccine hesitancy.

Some aspects of medical billing for Medicaid members are important mitigation factors. Bills not paid by Medicaid were excluded from analysis because they were not available in the Texas Medicaid data set. This is important because I was focused on determining other factors that impact childhood vaccination of Medicaid enrollees. Additionally, the appeal timeline for Texas Medicaid is 120 days after a claim is adjudicated (Texas Medicaid & Healthcare Partnership, 2022). Threat of errors during collection, processing, and storage of data was minimized, considering providers are reimbursed and would appeal for any errors as well as errors impacting federal matching

funds received by the Medicaid program. Given these factors and the known timeline for claims appeals or resubmissions, there was a low probability that accuracy was a factor in terms of the internal validity of this study.

Potential selection and confirmation biases did not impact internal and external validity of the study. The sample included all eligible services provided to members which were used to obtain a representative sample. This study did exclude any foster care services due to additional factors that may impact their service delivery, such as changing regions and transitioning back to parental care before a vaccine could be administered. Additionally, any confirmation bias was mitigated through thresholds set during statistical analysis. By using the entire Texas Medicaid population in the 4 to 7 age group, confirmation bias was minimized.

Finally, I did not address complications due to vaccine hesitancy. Much research has been and continues to be conducted on hesitancy. I focused on identifying the relationship between standard data and nonadherence to the childhood vaccine schedule. Through implementation of metrics that are highlighted by this study, additional outreach may be necessary to address any vaccine hesitancy.

Significance

Findings of the current study fill the knowledge gap regarding the relationship between SDoH factors and vaccination nonadherence among Medicaid-insured children. This study is significant to medical practices, academic research, and American society in general. Findings of this study can be used to inform changes in Texas Medicaid policy in addressing identified outreach possibilities using the program's existing data. By

addressing these factors, new resources can be targeted to improve vaccination rates of children in Texas, thereby protecting children and contributing to positive social change.

Findings of this study have the potential to have significant implications for positive social change. These include increased vaccination rates, decreased risk of vaccine-preventable diseases, decreased risk of vulnerable and childhood population mortality, improvement in terms of future quality of life, more engagement with healthcare, and improved health literacy. These are significant opportunities to improve the lives of Texas Medicaid children and communities.

Summary

Nonadherence to the vaccination schedule puts children and vulnerable populations at risk of contracting preventable diseases and poor health outcomes. Identifying factors related to vaccination schedule nonadherence will help researchers and policymakers better understand barriers that need to be addressed. Studies show that with baseline data, Texas Medicaid childhood vaccination rates can be improved. To improve these rates, researchers need to understand the relationship between childhood vaccination factors by examining baseline data to make conclusions and model policies. This study provides researchers, policymakers, and stakeholders with information needed to improve the vaccination rate of children enrolled in Texas Medicaid.

Chapter 2: Literature Review

This literature review involves addressing the relationship between SDoH factors and childhood vaccination adherence. Specifically, the review was focused on person-in-environment, health behaviors, and provider-related factors impacting childhood vaccination adherence. I address the conceptual framework, SDoH factors, (c) and links between SDoH factors and vaccination nonadherence.

The issue driving this literature review was the low immunization rate of children who are Medicaid beneficiaries in the state of Texas. There has been a decrease in childhood vaccination completion, which has been exacerbated by parental decision to delay health-seeking behaviors during the COVID-19 pandemic (Hacker & Briss, 2021; McMorrow et al., 2020; Olusanyo et al., 2021; Santoli et al., 2020; Smith et al., 2021). However, these disparities existed according to data published by the Texas HHS before the pandemic. There was a lack of research using specific claims and enrollment data that may identify disparities in childhood vaccine series completion as a care-seeking behavior among Medicaid recipients.

Literature Search Strategy

Although researchers continue to investigate this issue, the topic has not been explored in terms of the relationship between demographic, geographic, and behavioral factors and childhood vaccine series completion among Texas Medicaid recipients. This literature review includes current research on vaccine schedule adherence in order to highlight the necessity for examining the situation from a new data perspective. These themes are used to establish an understanding of the lack of an empirical evidence base,

including indicators, methods, and tools, to examine the impact and outcomes of vaccination adherence.

The literature review was conducted using Google Scholar in addition to MEDLINE, PubMed, and SAGE Journals databases via the Walden University Library. The following search terms were used: *health outcomes, low adherence to childhood immunizations, risks of low childhood immunizations, cost savings for childhood immunizations, structural barriers to childhood vaccinations, measles outbreaks, pertussis outbreaks, school immunization requirements, vaccine exemption,* and *impact of SDoH diagnosis on childhood vaccinations in Texas*.

Conceptual Foundation

Multifaceted forces involved in healthcare outcomes cannot be fully realized using the traditional unidirectional behavioral ecological models (Preiser et al., 2018). Smith et al. (2021) identified factors including the built environment, individual characteristics, social environment, personal health practices, and provider choice create significant disparities in terms of preventive care. The behavioral-ecological framework of healthcare access and navigation can be used to understand how interrelated model factors impact healthcare outcomes (Ryvicker, 2018). The Ryvicker framework incorporates a multifaceted rather than unidirectional approach to health outcomes and moderating effects of the five stages of the traditional behavior ecological model.

The Ryvicker framework consists of person-in-environment, health behaviors, and provider factor tenets and their impact on outcomes. These factors can be classified into intrapersonal, interpersonal, organizational, community, environmental, and policy

groups. The behavioral-ecological framework is most applicable to address relationships between model factors and vaccination adherence. Olaniyan et al. (2020) discovered SDoH impacted individual elements from all other socioeconomic mode (SEM) levels, which highlighted the importance of factors at the individual level in the decision to vaccinate children fully. I identified and integrated evaluation of factors at the individual level as elements in childhood vaccination completion rates that have not previously been studied. The person-in-environment tenet involves social, healthcare, and built environment in addition to neighborhood demographics and individual characteristics, while health behaviors involve healthcare navigation and access to care. The provider factor involves wait times, continuity of care, and perceived respect and functionality. These model tenets manifest in terms of outcomes where disease and illness prevention are measured.

Identifying relationships between factors used to navigate and access healthcare services may be formative for policy development. Specifically, identifying those relationships may be the impetus that is needed to increase vaccination rates, reduce vaccine-preventable diseases, and improve overall population health. Individually, in combination, or in total, these variables are lacking in research and may provide insights regarding undervaccination in spite of being readily available as data. My goal was to understand the relationship between model factors and undervaccination. Once relationships between model factors are understood, healthcare policy can improve vaccination rates to minimize vaccine-preventable disease outbreaks.

Variables and Factors Used in Existing Research

Some of the primary national health measurement rating systems include the Consumer Assessment of Health Plans (CAHPS), Healthcare Effectiveness Data and Information Set (HEDIS), and National Survey of Children's Health (NSCH) (Texas HHSC, 2021; see Table 1).

Table 1

Independent Study Variables

Person-in-Environment	Health Behavior	Provider
SDoH Diagnosis Codes Type of Medicaid Age Geographic Location Distance to PCP (Moderator)	Access to Emergent Care Services Provider Relationship	Physician Choice

Distance between Texas Medicaid members and providers was evaluated as a moderator between independent and dependent variables. Childhood vaccine schedule adherence is the dependent variable for all four research questions. Research on improving health outcomes must involve identifying social, economic, environmental, and demographic factors in order to better identify potential disparities. Variances in terms of what data are collected and how they are analyzed is necessary to understanding benefits of each data collection method. I addressed how variables are collected and used differently than previous research and why the specific model variables are critical to this current research.

The U.S. is on a path that may see a re-emergence of measles due to a lack of childhood vaccination. The lack of vaccination adherence is evident in Texas schools,

where some schools' vaccination rates have dropped below 80% (Wootton et al., 2019). Perceived control over factors including travel distance and time creates higher intention (54.3%) than other health-related behaviors (Xiao & Wong, 2020). As Conner et al. (2016) concluded, the extent of intention is a significant moderator of the intention and behavior relationship. Further, Hobani and Alhalal (2022) concluded the lack of adherence to the CDC-recommended vaccination schedule is related to inaccessibility (6.1% of parents). Texas is the second-largest state and currently ranks above the national average in the percent of the population at or below the federal poverty line (U.S. Census Bureau, 2022). Due to the geographic diversity in Texas, incorporating geographic access to a physician, care location, and the SDoH diagnosis codes is essential in understanding the issues of vaccine adherence.

The distance between the member and a PCP has shown to be a health disparity for Medicaid members (Goins, 2019). Luo et al. (2016) indicated that patients located far away from hospitals are the most vulnerable within the healthcare system. Distance may become a barrier to seeking health services with socioeconomically disadvantaged populations, such as the Medicaid population. Engagement in pediatric preventive care is lower in rural areas when compared to urban communities, which may be explained by the availability of providers or other disparities (Hardy et al., 2021). Access to quality care may be due to the concentration of the population. Given the possible impacts on health-seeking behaviors, evaluation of the distance from a Texas Medicaid member to their assigned PCP may impact vaccine adherence.

The justification of the factors used in this study is founded on recently published literature. Prior improvements in public health infrastructure through technology have improved adherence to vaccination schedules, but delays and variations to the vaccine schedule elevate risks (Hadjipanayis, 2018). Correspondingly, increased unmet needs have decreased access and quality of care (Cole & Nguyen, 2020; Jackson & Harrison, 2019). An analysis of recent literature is necessary to understand the factors used in research and the necessity of evaluating factors in this study.

In these studies, the common theme is a lack of data or analysis at the individual variable level. The studies rely on aggregated or generalized data across the population. As seen in the research presented, there is a lack of evaluation at the data collection level, specifically in the Health Behavior and Provider factors. The benefit of using data at the claim and eligibility level is the ability to evaluate the population for all three aspects more accurately from an individual level, regardless of geographic challenges. The research also allows for assessing all three factors in a single analysis, which has not been conducted in current research. Therefore, evaluating the importance and benefits of the combination of factors in the study is necessary.

Person-in-Environment Variables

Most Medicaid services in Texas are delivered through the Managed Care model. Franco Montoya et al. (2020) found that Medicaid HMOs are a cornerstone of effective public health service delivery yet quality measures need further refinement. Information-only interventions lack the efficacy of more direct interventions on vaccine adherence due to SDoH barriers (Brown et al., 2021). This research supported the previous research

by Chisolm et al. (2019) that managed care models should have performance measures incorporated into contracts. Developing a standardized method for identifying a population at risk is participatory to developing effective performance measurements. After developing a methodology to identify members, policy changes can be made to improve further and measure vaccination adherence.

More recently, both McMorrow et al. (2021) and Santoli et al. (2020) found a significant drop in vaccination rates for children before the pandemic. Research conducted in other states has shown substantial differences in health outcomes based on racial and ethnic variables (Smith et al., 2021). Research in other states is substantiated by multiple studies that identified a relationship between vulnerable individuals facing barriers and how those challenges might negatively impact health outcomes; negative health outcomes influence decision-making and behavior concerning healthcare utilization (Barghadouch et al., 2021; Mahmudiono et al., 2021; Morehouse, 2021). These studies evaluated factors that may be barriers to vulnerable populations. As Medicaid recipients are a vulnerable population, specific research is necessary to assess these factors.

Tran et al. (2021) included a similar variable analysis with a breakout for the 6 to 11 years of age category. However, this study did not consider the distance between the member and provider nor the number of providers within a specific geographic proximity. The results also appear not representative of the Medicaid population, given the income and education levels reported in the study. Therefore, this study's findings cannot be generalized to the larger Medicaid population. However, Nuzhath et al. (2021)

indicated that measles, mumps, and rubella (MMR) vaccination rates have decreased in Texas since 2015. Further, the 16-month age range is below 80 percent. The contradiction of current research within published dashboards has impeded the production of research addressing the impact of vaccine decline on the Texas Medicaid population. Understanding the factors related to under-vaccination is vital as children's exposure increases as they enter school age. Children are likely to interact with a more diverse social group because the classroom setting provides children with an opportunity to come into contact with a diverse range of people, thereby multiplying the child's exposure risk. Expanded engagement may also increase the potential of children to be exposed to new viruses. Understanding under-vaccination in children entering school age is aided by evaluating the person in the environment, health behaviors, and provider tenants.

Prior research indicates the importance of each variable in this study, but research does not exist that incorporates all these variable factors. While specific demographic variables have been shown to influence health behavior, understanding is lacking in evaluating any relationship within the Texas Medicaid population. Research is needed to assess any relationship between these variables and childhood vaccination status.

Type of Medicaid

Given the socioeconomic status of the population that qualifies for Medicaid, it is considered a vulnerable population. The stratified Medicaid populations with children are STAR and STAR Kids, which are being studied in this research. The STAR Kids Medicaid eligibility program is designed for children with a disability (Texas HHS, 2016a). The STAR Medicaid eligibility program is designed based solely on income

limitations (Texas HHS, 2016a). While both programs provide Medicaid eligibility for children, the populations in each program have vastly different needs and circumstances. The STAR Kids population qualified for services due to chronic conditions which require regular physician care, while the STAR population qualified based on the income threshold for the family. Because of this disparity in the population, it is important to understand if the type of Medicaid impacts childhood vaccination adherence.

Geographic Location

Regional geographic density may be of greater importance in a state that covers such a vast area. It is also important to understand geographic clustering within these regions. Geographic clustering of the population is a key feature of the decennial census due to the multitude of disparities between the two groups (Albers et al., 2022; U.S. Census Bureau, 2022b). The census identified that a population should be categorized according to population size because rural populations and urban populations require different needs. The plethora of discrepancies between the urban and the rural populations compel the need to understand the population's geographic clustering, which may impact vaccine adherence. As seen with other vaccines, there is a variance between urban and rural vaccine adherence (Koskan et al., 2021). The existing research establishes geographic clustering as a factor in vaccine adherence. However, existing research has not yet studied the relationship between geographic clustering and childhood vaccine adherence in Texas Medicaid.

Distance to PCP

Geographic barriers between a patient and a PCP may impact the frequency and type of healthcare services sought. The distance between the member and a PCP has shown to be a health disparity for Medicaid members (Goins, 2019). Distance may become a barrier to seeking health services with socioeconomically disadvantaged populations, such as the Medicaid population. Engagement in pediatric preventive care is lower in rural areas when compared to urban communities, which may be explained by the availability of providers or other disparities (Hardy et al., 2021). Access to quality care may be due to the concentration of the population. Given the possible impacts on health-seeking behaviors, evaluation of the distance from a Texas Medicaid member to their assigned PCP may impact vaccine adherence.

SDoH Diagnosis Codes

Underlying disparities, limitations, and challenges are specific SDoH that may influence health-seeking behavior. Special diagnosis codes were developed based on medical claims to identify specific social risk factors and unmet needs (CMS, 2021). Patients with a documented social risk factor or unmet need have shown a 400% increase in adverse health consequences that increased costs by 930% (Bensken et al., 2021). Browne et al. (2021) found that information-only interventions like those found outside a primary care physician's office were less effective in addressing SDoH barriers. They found that greater participation in providing resources to overcome barriers led to improvements in adherence. This research study will evaluate the relationship between factors and childhood vaccination completion to address adherence to the vaccine

schedule through possible policy changes. Hacker and Briss (2021) called for SDoH to be addressed as health disparities due to a lack of preventive care, which this proposed research study will evaluate through service utilization and an established relationship with a primary care physician (PCP). This study will evaluate the specific factors that may relate to childhood vaccine adherence in available data.

The specific diagnosis code range of Z55 through Z65 targets SDoH specific to the person in the environment pillar. The Z55 diagnosis code range reports challenges related to education and literacy, the Z56 diagnosis code range is specific to issues with employment, and the Z59 diagnosis code range is specific to housing which all address demographic factors. Demographic factors have been shown to impact the risk of lower health literacy and navigation (Vardell, 2019). The Z60 & Z62 diagnosis code range is specific to social support, the Z63 diagnosis code range is specific to primary support, and the Z64 through Z65 diagnosis code range is specific to psychosocial circumstances. Non-health-related factors also impact health outcomes and contribute up to 80% towards successful outcomes (Magoon, 2022). These SDoH codes all relate to potential issues that would impact health-seeking behaviors leading to delayed preventive care and childhood vaccination adherence. These factors are included in the first research question to evaluate a person-in-environmental factors and their relationship to childhood vaccine adherence.

After reviewing the recent research on SDoH, the body of evidence purports that there is a lack of research incorporating these variable factors. While the research indicates a relationship between demographic variables and health-seeking behavior, an

understanding of the potential relationship within the Texas Medicaid population is lacking. Research including social determinate factors is needed to evaluate if there is any relationship between these variables and childhood vaccination status.

Behavioral Variables

Researchers conducting a study specifically for the Houston Independent School District in Texas found that demographic and socioeconomic determinates were significantly associated with vaccine adherence (Rajan et al., 2020). This study highlights the foundational need to include person-in-environment factors but was limited to the data collected by the school district, so factors of Health Behavior and Provider were not included. Conversely, since Houston is a metropolitan geographic city, distance and access to providers may not have been a significant enough measurement for the limited geographic area of this study.

Since Texas is the second largest state by area, understanding the unique spatial access challenges of the population is important. The distance to a PCP may be a normal factor of life in some communities. Most Texas Medicaid members are covered by managed care. This research proposal examined vaccine adherence factors across traditional and managed care as critical variables in this proposed research, as informed by the study completed by Franco Montoya et al. (2020). As the data set contains the latitude and longitude for members and providers, the distance between these two can be calculated using a standard geography function applying the principles of an arc tangent. Between 2015 and 2020, Texas vaccine data showed a continual decline in vaccination rates during the COVID-19 pandemic and a discrepancy between rural and urban

childhood vaccine rates (Nuzhath et al., 2021; McMorrow et al., 2020). Travel time to access health services is negatively associated with childhood vaccine adherence (Ozawa, 2019). Masters et al. (2021) found that relying on school-reported data introduces significant biases and does not yield precise results that can be generalized geographically. The research points to a necessity to understand spatial variations in vaccine adherence. The research also indicates a need to understand the distance to access a healthcare provider within health behaviors.

In parallel to Rajan et al. (2020), the research conducted by Wiggins (2019) utilized aggregate-level population data to evaluate person-in-environment factors which showed statistical significance in the relationship between socioeconomic variables and adherence to the vaccination schedule. As the data available in this study was at an aggregate level, only a generalization could be made that excluded Heath Behavior and Provider factors. Cardinal et al. (2019) utilized geographic clustering to identify non-adherence to recommended vaccines, which resulted in similar conclusions.

It is important to understand that the availability of access to care, the type, and the location of care is critical in vaccine adherence. Retrospective research shows that just over half of families with low socioeconomic statuses complete an annual well-child visit, with the three to five-year-old range dropping sharply (Wolf et al., 2018). Santoli et al. (2020) found that vaccine administration decreased starting in January 2020, which had an extraordinarily negative primary impact on children over two. The research reviewed for spatial variables establishes the importance of each presented, but there is a lack of research incorporating these variable factors. While the research indicates a

relationship between spatial variables and health-seeking behavior, understanding of this relationship within the Texas Medicaid population is lacking. This researchwas needed to evaluate any relationship between these variables and childhood vaccination status.

Established PCP Relationship

A medical home is an established relationship with a PCP where a person engages for their health concerns and needs. Direct interventions, a PCP's engagement, and incentives have been shown to help increase adherence to well-child visits (Bunik et al., 2021; Moseley et al., 2019). Getting the population to their visits is a key element of vaccine adherence programs and missing well-child visits directly negatively impacts vaccination rates (Kempe et al., 2022).

However, contrary research has indicated that an established PCP does not impact immunization status (Papis & Clavien, 2021). Unmet needs and structural barriers are limiting factors in adherence to well-child visits (Fenick et al., 2020). These factors may contribute to a lack of relationship with a PCP, further negatively impacting childhood vaccine adherence. Understanding if a Texas Medicaid member has an established relationship with a PCP and the relationship to vaccination adherence is necessary, given the incongruent research.

Accessing Emergent Care Services

In addition to the service location and relationship to the PCP, the frequency that children access the services of the PCP can be evaluated. Vaccine data indicates children who qualify for Medicaid are 8% less likely to have a preventive visit and missed vaccine delivery is dependent on the type of service accessed (Rand & Goldstein, 2018). By understanding the distribution of services accessed in the Texas Medicaid population, service utilization may give an indication of risk of non-vaccination. Understanding where the Medicaid population seeks healthcare services may provide a greater understanding for future vaccination adherence.

Provider Variables

Texas has implemented a managed care model with specific performance that indicates the average distance to a PCP must be 30 miles or less in urban areas and 60 miles or less in rural areas (Texas HHS, 2022). Chisolm et al. (2019) highlighted the need to establish baseline data among the Medicaid population due to the lack of evidence-based performance measures. Diversion of non-emergent services back to a PCP is not currently in place due to the complexities of risk. The spatial diversity of Texas may drive decreased access to primary care within the required 30-mile radius for rural communities. Due to the spatial challenges, this population may seek health services through non-emergent locations. The MCO contract for Texas indicates an average of 30 miles which may be in place, so county-level requirements do not have to be developed due to 172 of the 254 counties in Texas being classified as rural (White et al., 2017). Using an average distance may conceal broader issues at the rural level. Given this

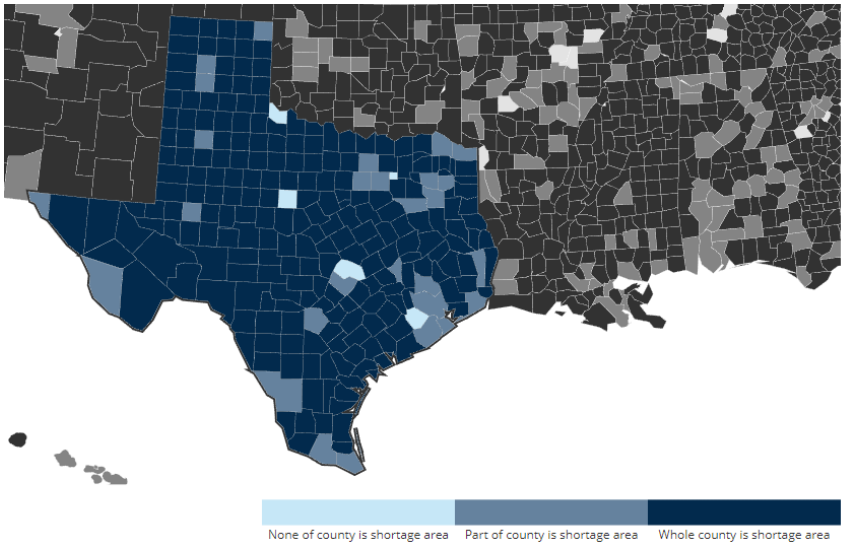
potential barrier to care, it is vital to understand if there is a relationship between distance and the number of providers available to choose for care at a member level. As there may be potential issues with distance to a provider, other atypical service providers may be meeting the general healthcare needs of the population. Understanding where the population interacts with healthcare providers may be necessary for understanding vaccination adherence.

Physician Choice Available

The availability of physician choice may depend on population density, negatively impacting choice and access to care. Increased access to a PCP significantly positively affects all-cause mortality (Amiri et al., 2019). Insufficient access to a PCP may lead to a lack of care or care when needed to prevent further disease or injury. Many states are experiencing a physician shortage which may further impact the level and access to care available (Slone, n.d.). Texas is experiencing a state-wide shortage of PCPs, as seen in Figure 3 from the public data presented by Rural Health Information Hub (2022) obtained from the Health Resources & Services Administration.

Figure 3

Physician Shortage by Texas County



The physician shortage continues to grow yearly in Texas, decreasing physician choice for all Texans (Rural Health Information Hub, 2022). Given the impact a lack of access to a PCP has on health outcomes and adherence, in addition to the future trends of PCP availability, the availability of a PCP is an important factor for current and future research.

Summary

Incomplete childhood immunizations place under or nonvaccinated populations at risk of vaccine-preventable diseases. Vaccines protect public health and reduce transmission risk (CDC, 2019; CDC, 2022a). Completed childhood immunizations support public health due to decreased risk of infection from close contact while attending school (CDC, 2022b; Magoon, 2022). The Texas HHS (2018) claimed Texas

Medicaid covers over half of all births in Texas and 44% of Texas children receive Medicaid or CHIP benefits (p. 2).

Texas Medicaid uses HMOs for their cost savings and quality improvement capabilities. From the literature review, most vaccination data came from disparate sources such as school, city, or county-level reported data. Factors from these sources tend to be based on demographic variables. While identifying individuals at greater risk for decreased vaccine adherence using individual factors is essential, siloed data sources make it more difficult to generalize research findings.

Disparity in terms of preventive care involve many disparate factors. Using the behavioral-ecological framework of healthcare access and navigation conceptual model by Ryvicker (2018) allowed for assigning these disparate factors into person in environment, health behaviors, and provider factors. Vast amount of data collected by the Texas Medicaid program allowed for a systematic evaluation of the relationship between these factors and vaccine adherence. Nonadherence to the childhood vaccination schedule creates cracks in herd immunity which allow vaccine-preventable outbreaks to occur. As vaccination rates continue to decline, understanding relationships between factors may assist Medicaid policy development in terms of combating future vaccine-preventable outbreaks.

The current body of knowledge has not approached vaccine adherence by evaluating this issue across a person-in-environment, health behaviors, and provider factors. Given the impact research has shown these additional factors can have on

preventive health behaviors, there was a need to understand the impact they may have on the Texas Medicaid population.

Chapter 3: Research Method

This is the first study conducted to examine the relationship between person in the environment, behavior, and provider factors and childhood vaccine adherence in the Texas Medicaid population. This prior lack of research may be due to current state and federal reporting on vaccine adherence in schools. There appear to be significant discrepancies in terms of publicly available school vaccination data reported in Texas (Nuzhath et al., 2021). There is a general lack of quantitative evidence evaluating environmental, demographic, behavioral, spatial, and provider factors that may influence adherence to the childhood vaccine schedule, possible effect these factors may have on vaccine adherence, and standardized metrics to track and report outcomes (Koschmann et al., 2021; Morrison et al., 2020; National Academies of Sciences et al., 2019). Research contributes to the body of knowledge by filling an existing gap in research involving examining readily available model factors and potential relationships with childhood vaccine adherence in the Texas Medicaid population for those between 4 and 7.

This research identifies relationships and establishes a new metric for planning outreach efforts to improve adherence to the vaccination schedule. I address the methodology, sampling procedures, how secondary data were accessed, definitions of variables, data analysis plan, and research questions with associated hypotheses. Finally, threats to validity and ethical procedures are addressed.

Research Design and Rationale

The goal of this study was to gain deeper insights regarding possible relationship between model factors involving Texas Medicaid and childhood vaccination adherence

rates. This research explored this relationship and generated a potential set of metrics that can be used to manage current childhood vaccination rates. I used Ryvicker's behavioral-ecological framework of healthcare access and navigation in order to evaluate individual characteristics, social and built environments, personal health practices, and provider factors and the impact they have on health outcomes.

Data included any child between 4 and 7 during 2021 and 2022. Claims were evaluated back to their fourth birthday to ensure the full scope of time was included in analysis. Currently, no research was found using these variables, although research was ongoing to improve vaccination rates. Results of this research will inform state policymakers about potential metrics for outreach in the Medicaid program to improve adherence to the vaccine schedule.

Study Variables

The dichotomous dependent variable for this study was childhood vaccination adherence. Independent variables are included in Tables 3 to 5, reflecting all the study variables. Variable, category, variable type, and data source are provided for each.

Table 2

Person-in-Environment Variables, Types, and Data Sources

Person-in-Environment Variables	Type of Variable	Data Source
Z55 Diagnosis range (Education and Literacy)	Nominal	Claim Data
Z56 Diagnosis range (Employment)	Nominal	Claim Data
Z59 Diagnosis range (Housing)	Nominal	Claim Data
Z60 & Z62 Diagnosis ranges (Social Support)	Nominal	Claim Data

Z63 Diagnosis range (Primary Support)	Nominal	Claim Data
Z64 & Z65 Diagnosis ranges (Psychosocial Circumstances)	Nominal	Claim Data
Type of Medicaid	Nominal	Enrollment Data
Region	Nominal	Enrollment Data
Age	Nominal	Enrollment Data
Distance to PCP	Continuous	Claim & Enrollment Data
Urban, Metro, or Rural	Nominal	Enrollment Data

Table 3

Behavioral Variables, Types, and Data Sources

Behavioral Variables	Type of Variable	Data Source
Access to Emergent Care Services	Dichotomous	Medicaid Claims
Established PCP Relationship	Dichotomous	Medicaid Claims

Table 4

Provider Variable, Type, and Data Source

Provider Variables	Type of Variable	Data Source
Physician Choice Available	Nominal	Medicaid Providers

Methodology

Population

The target population for this study was children between the ages of 4 and 7 enrolled in the Texas Medicaid program. The study did not include children covered under CHIP, private health coverage, or who were uninsured.

Population Sampling and Sampling Procedures

The sample included the entire Medicaid population enrolled in STAR and STAR Kids between 2021 and 2022. Population enrollment and claims data were obtained from the Texas HHS. All paid or denied claims were included and considered an encounter to reduce selection bias. For children who were 7, 4 years of claims data were requested, followed by 3 years of claims for children who were 6, 2 years of claims for children who were 5, and 1 year of claims was requested for children who were 4. Medicaid program type was determined based on claim details at the time of adjudication. The study sample was evaluated for childhood vaccination compliance as a whole and not based on specific vaccines. DTaP, IPV, MMR, and VAR vaccine claims were evaluated for childhood vaccine adherence based on CDC (2022a) recommended complete childhood vaccinations. Using a range of 30 days before and after the Texas Medicaid member's birth month, claims were evaluated with a status of yes if all vaccines were received within the birth month or no if not. Research questions were then evaluated using identified variables from secondary data, and the derived dependent variable of childhood vaccine adherence.

Inclusion and exclusion criteria for this study helped control for possible confounding variables during analysis. It was assumed that all data requested from the Texas HHSC was provided and included State Fiscal Year 2021 for children 7, 2020 through 2021 for children who were 6, State Fiscal Years 2019 through 2021 for children who were 5, and State Fiscal Years 2018 through 2021 for children who were 4 years. Data for Medicaid recipients for those ages not in inclusion criteria were not part of the received data set and excluded from this study. Every claim was considered an encounter regardless of adjudication status. No claim statuses were excluded from study analysis. Only Medicaid members eligible for the entire birth month were eligible for inclusion.

Because exclusion criteria were applied, it is necessary to calculate the minimum sample size necessary for estimating an entire population (Kang, 2021). To calculate the sample size necessary for statistical significance, G*Power 3.1.9.7 statistical software was used. By using G*Power 3.1. 9.7, an a priori sample size analysis was used to determine the minimum sample size required to test the study hypothesis. Results of the analysis indicated that the required sample size to achieve 95% power for detecting a small effect (0.02) at a significance criterion of $\alpha = 0.05$ was a minimum sample size of 543 for multiple regression.

Access to Secondary Data

All data used were secondary data, which were collected retrospectively from Texas HHSC. The specific data elements and variable operationalization were included in the requested data from HHSC to limit identifiable data. While no primary data collection was required for this study, collecting, preparing, and analyzing the secondary data was

the primary focus. According to the HHS Circular C-055, an internal employee review process, in addition to the HHSC IRB for a data request, was followed to gain access to the secondary data. This process required approval from the direct manager, ethics office, unit information owner, unit information custodian, information owner, the Office of General Counsel, privacy & security council, and finally, the Executive Commissioner. Data was requested in CSV format to preserve data types. The data was stored in tables using Microsoft SQL Server 2019 on a secured Amazon RDS server. SQL Server Management Studio software was used to cleanse and access the stored data.

Variable Operationalization

Population density was based on the United States Census Bureau's (2022) definitions of an urban area based on detailed housing criteria. Population density for defining urban versus rural was achieved using the county of the member's physical address compared to the data collected by the United States Census Bureau. The resulting data was classified as a dichotomous variable with values of "Rural" and "Urban".

The PCP relationship was the evaluation of an encounter claim by the selected or assigned PCP to a Medicaid member. Defining the PCP relationship was achieved using billed claims compared to the PCP on file. The evaluation utilized the PCP as of the birth month and any encounter with the PCP on file. The resulting data was classified as dichotomous variables with "Yes" and "No" values.

The distance to PCP was the calculated distance between the member and the PCP on a vaccine encounter claim. Distance was calculated using the difference in latitude and longitude between the member and the PCP. The resulting distance

calculation was categorized as a nominal variable with values of "0 to 15 miles", "between 15 and 30 miles", "between 31 and 60 miles", and "more than 60 miles".

The variable of another PCP available was based on the availability of provider choice to evaluate any effect of access to care on health behaviors. The evaluation excluded the assigned PCP and identified if another PCP was available within 30 miles if the member was classified as urban or 60 miles if the member was classified as rural. The resulting data was classified as dichotomous variables with "Yes" and "No" values.

Data Analysis Plan

The secondary data utilized in this research study were initially collected to administer Medicaid eligibility and pay claims for services rendered to members. The source for each variable can be seen in Tables 2 through 4. Once data was loaded into the server, operationalization was achieved using SQL Server Management Studio. The analysis was conducted using the Statistical Package for the Social Sciences (SPSS) version 28.

The dependent variable in this study relied on the completion of multiple elements for complete vaccination adherence, which necessitated defining the procedure used to identify complete vaccination adherence with the childhood vaccination schedule. The age limitations on the data were any child between 4 and 7 years of age. All claims were requested to identify if the vaccines were administered between the ages of 4 and 6. Any child vaccinated within 30 days of their birthday was considered adherent. Adherence to the vaccine schedule included individual and combined vaccine procedure codes defined by the Texas Department of State Health Services (2021). Descriptive statistics and

individual regression models were constructed for each research question. Compliance with the vaccine schedule for diphtheria, tetanus, & acellular pertussis (DT/DTaP) was identified using the procedure codes found in Table 5.

Table 5

Procedure Codes for DT/DTaP

90702	DT
90700	DTaP
90723	DTaP - Hep B - IPV
90698	DTaP - Hib - IPV
90696	DTaP - IPV

Compliance with the vaccine schedule for IPV was identified using the procedure codes in Table 6.

Table 6

Procedure Codes for IPV

90713	IPV
90723	DTaP - Hep B - IPV
90698	DTaP - Hib - IPV
90696	DTaP - IPV

Compliance with the vaccine schedule for measles, mumps, & rubella (MMR) was be identified using the procedure codes 90707 (MMR) and 90710 (MMRV). Compliance with the vaccine schedule for varicella (VAR) was identified using the procedure codes 90710 (MMRV) and 90716 (Varicella).

The first three research questions were evaluated using binomial logistic regression. Statistical significance of the model fit, Nagelkerke R Square to explain the

model's variation, the predicted classification's effectiveness, correlation matric to evaluate multicollinearity, and the odds ratio were all be evaluated during the statistical analysis. The variables for each research question can be found in Tables 2 through 4. The first research question analyzed the collected data using the selected person-in-environment variables, the second analyzed the collected data using selected behavioral variables, and the third analyzed the provider variable. In the fourth research question, the moderator effect of distance was evaluated using all independent variables in the study. In all research questions, the dependent variable was childhood vaccine adherence.

Research Questions and Hypotheses

A binomial logistic regression was be used for RQ1 to predict the probability that one of the categorical independent demographic factor variables fell into one of the two categories of the dichotomous dependent variable of complete recommended childhood vaccines.

RQ1: Is there a statistically significant relationship between person-in-environment elements (education, employment, housing, social support, family support, psychological and psychosocial circumstances, age range, income limitations, ethnicity, type of Medicaid region, and population density) and childhood vaccination adherence?

$H_0$1: There is no statistically significant relationship between person-in-environment elements (education, employment, housing, social support, family support, psychological and psychosocial circumstances, age range, income limitations, ethnicity, type of Medicaid region, and population density) and childhood vaccination adherence.

H_a1: There is a statistically significant relationship between person-in-environment elements (education, employment, housing, social support, family support, psychological and psychosocial circumstances, age range, income limitations, ethnicity, type of Medicaid region, and population density) and childhood vaccination adherence.

RQ2: Is there a statistically significant relationship between health behaviors (relationship with the PCP, number of PCP visits, and accessing emergency care services) and childhood vaccination adherence?

$H_0 2$: There is no statistically significant relationship between health behaviors (relationship with the PCP, number of PCP visits, and accessing emergency care services) and childhood vaccination adherence.

$H_a 2$: There is a statistically significant relationship between health behaviors (relationship with the PCP, number of PCP visits, and accessing emergency care services) and childhood vaccination adherence.

RQ3: Is there a statistically significant relationship between physician choice and childhood vaccination adherence?

$H_0 3$: There is no statistically significant relationship between physician choice and childhood vaccination adherence.

$H_a 3$: There is a statistically significant relationship between physician choice and childhood vaccination adherence.

RQ4: Did distance between members and providers moderate the effect between education, employment, housing, social support, family support, psychological and psychosocial circumstances, ethnicity, type of Medicaid, region, population density,

relationship with the provider, accessing emergency care services, and availability of other physicians and childhood vaccination status?

$H_0$4: Distance between members and providers did not moderate the effect between education, employment, housing, social support, family support, psychological and psychosocial circumstances, ethnicity, type of Medicaid, region, population density, relationships with providers, accessing emergency care services, and availability of other physicians and childhood vaccination status.

H_a4: Distance between members and providers had a moderating effect between education, employment, housing, social support, family support, psychological and psychosocial circumstances, ethnicity, type of Medicaid, region, population density, relationships with providers, accessing emergency care services, and availability of other physicians and childhood vaccination status.

Threats to Validity

This study utilized secondary data from the entire Texas Medicaid population for the specified ages. Even as the entire population was evaluated, there remain threats to external validity. The primary threat to external validity was selection bias which may affect generalizability. To improve generalizability, any encounter that is paid or denied was considered for determining vaccine completion. Payment of a claim has no bearing on the claim indicating the service was performed. Children may receive the recommended vaccinations later than 30 days from their birthday. However, this study is focused on identifying a relationship between factors and those children who are not vaccinated per the clinically recommended schedule. Since no primary data collection

occurred in this study and only secondary data were utilized, no significant threats to internal validity were identified.

Ethical Procedures

This study was based solely on secondary data. There was no active recruitment of participants, but protected health information was utilized. This data was collected to administer eligibility and payment in the Medicaid program, so it is assumed that no individual written informed consent for participation is necessary. Based on the variable analysis requested of the secondary data, the data collected was anonymous and confidential.

The Texas HHS application for the data request, research, and publication derived from agency data and Walden IRB reviewed this research proposal. All data is stored on a secured external drive and maintained in a locked cabinet. Data will be retained for a minimum of 3 years. I received training through the Collaborative Institutional Training Initiative (CITI) on Responsible Conduct of Research and Human Subjects Research, focusing on research involving children and disadvantaged groups.

Summary

A retrospective study was conducted to explore the relationship between person in the environment, behavior, and provider factors and completed childhood vaccination rates. I used binomial logistic regression to determine how these model factors explain much in terms of childhood vaccination adherence. The population in this study was children who were 4 to 7 years and enrolled via Texas Medicaid in STAR or STAR Kids programs. Any bias was minimized by using data from the entire Texas Medicaid

population instead of using a random sampling method to recruit a representative sample for the study. Data are publicly available through open records requests. Before accessing data, I participated in an internal employee review process to access HHSC data which was reviewed by the Walden IRB. All data were analyzed using SPSS. Chapter 4 includes an analysis of data.

Chapter 4: Results

For this quantitative retrospective cohort study, I aimed to examine associations between SDoH and vaccine adherence among Texas Medicaid-insured children. Vaccine adherence was defined as the percentage of Medicaid-eligible children between the ages of 4 and 7 who completed the vaccine schedule. Research findings will add to the body of knowledge by assessing readily available parameters and their associations with children's vaccine adherence in the Texas Medicaid population.

In this study, I used the following research questions:

RQ1: Is there a statistically significant relationship between person-in-environment elements (education, employment, housing, social support, family support, psychological and psychosocial circumstances, age range, income limitations, ethnicity, type of Medicaid region, and population density) and childhood vaccination adherence?

$H_0$1: There is no statistically significant relationship between person-in-environment elements (education, employment, housing, social support, family support, psychological and psychosocial circumstances, age range, income limitations, ethnicity, type of Medicaid region, and population density) and childhood vaccination adherence.

H_a1: There is a statistically significant relationship between person-in-environment elements (education, employment, housing, social support, family support, psychological and psychosocial circumstances, age range, income limitations, ethnicity, type of Medicaid region, and population density) and childhood vaccination adherence.

RQ2: Is there a statistically significant relationship between health behaviors (relationship with the PCP, number of PCP visits, and accessing emergency care services) and childhood vaccination adherence?

$H_0$2: There is no statistically significant relationship between health behaviors (relationship with the PCP, number of PCP visits, and accessing emergency care services) and childhood vaccination adherence.

H_a2: There is a statistically significant relationship between health behaviors (relationship with the PCP, number of PCP visits, and accessing emergency care services) and childhood vaccination adherence.

RQ3: Is there a statistically significant relationship between physician choice and childhood vaccination adherence?

$H_0$3: There is no statistically significant relationship between physician choice and childhood vaccination adherence.

H_a3: There is a statistically significant relationship between physician choice and childhood vaccination adherence.

RQ4: Did physical distance between members and providers moderate the effect between education, employment, housing, social support, family support, psychological and psychosocial circumstances, ethnicity, type of Medicaid, region, population density, relationship with the provider, accessing emergency care services, and availability of other physicians and childhood vaccination status?

$H_0$4: Physical distance between members and providers did not moderate the effect between education, employment, housing, social support, family support,

psychological and psychosocial circumstances, ethnicity, type of Medicaid, region, population density, relationships with providers, accessing emergency care services, and availability of other physicians and childhood vaccination status.

H_a4: Physical distance between members and providers had a moderating effect between education, employment, housing, social support, family support, psychological and psychosocial circumstances, ethnicity, type of Medicaid, region, population density, relationships with providers, accessing emergency care services, and availability of other physicians and childhood vaccination status.

This chapter includes study findings, a description of the sample population's demographic characteristics, descriptive statistics for key variables, and analysis of statistical assumptions logistical regression. Chapter 4 includes information about the sample population, assumptions, results, and a summary.

Data Collection

I examined data from children between 4 and 7 participating in Medicaid STAR and STAR Kids for 2021 and 2022. There were no discrepancies in data collection from the plan presented in Chapter 3. The Texas HHS provided the population enrollment and claims data (see Table 7). Those who were 5 were 28.4% of the study population compared to those who were 4 at 18.6%. Those covered by the STAR Medicaid type predominated, accounting for 96.7% of all participants. The majority of participants who took part were from Harris (23.6%) and Dallas (14.9%) regions. Eighty-four percent were from the metro area, with 72.5% of participants coming from within a 15-mile radius of the Texas Medicaid member's PCP.

Table 7

Demographic Characteristics

	N	%
Age		
Age 4	80,236	18.6
Age 5	122,373	28.4
Age 6	115,950	26.9
Age 7	112,865	26.2
MEDICAID Type		
CHIP	106	.0
STAR	391,260	96.7
STAR Health	9	.0
STAR Kids	13,055	3.2
STAR Plus	2	.0
Region		
Bexar	37,271	8.6
Dallas	64,458	14.9
El Paso	16,743	3.9
Foster Care Statewide	6	.0
Harris	101,820	23.6
Hidalgo	53,677	12.4
Jefferson	11,903	2.8
Lubbock	10,349	2.4
Mrsa Central	20,062	4.7
Mrsa Northeast	25,073	5.8
Mrsa West	20,767	4.8
Nueces	13,031	3.0
Tarrant	36,667	8.5
Travis	19,597	4.5
Proximity		
Metro	363,045	84.2
Micro	24,960	5.8
Rural	43,419	10.1
PCP Distance		
0 - 15 Miles	312,713	72.5
16 - 30 Miles	59,547	13.8
31 - 60 Miles	22,543	5.2
More than 60 Miles	36,590	8.5

Assumptions Analysis

For inferential analysis involving the dependent and independent variables, the binomial logistic regression analysis was proposed to determine whether there was any statistically significant relationship between specific SDoH factors and completing childhood vaccinations among Texas Medicaid recipients. However, in order to perform binomial logical regression analysis decisively and receive acceptable results, some assumptions must always be met. Although these regression analyses are generally robust, it is common practice to evaluate the quality of the results by assessing the degree of deviation from these assumptions. For the binomial logistic regression, the following assumptions were tested: observational independence, no multicollinearity, a linear relationship between any continuous independent variables and the logit transformation of the dependent variable, and no significant outliers, high leverage points, or highly influential points.

Under the assumption of observational independence, a Durban-Watson statistic was generated. This assumption states that the data observations are independent of one another, which means that the value of one observation has no effect on the value of another. Durban-Watson also addresses the error independence theory. This statistic has a value range of .0 to 4.0, with 2.0 indicating that there is no connection between the residuals. Values less than 1.0 and greater than 3.0 are considered problematic and indicate serial correlation in the model. Durban-Watson's d-statistic for this data was 1.999, suggesting that the assumption was not violated.

According to the second assumption, the data shouldn't be multicollinear, which implies that the independent variables shouldn't be connected. I employed the Variance Inflation Factor (VIF) to check for multicollinearity. Multicollinearity raises the expected regression coefficient's variance for an independent variable, as determined by the VIF. A VIF score of 1 indicates that there is no multicollinearity between the variables, but a score of 10 or above demonstrates that the assumption is not met since the multicollinearity is significant. The assumption was satisfied because all of the VIF values in the data fell well within the range of 2, indicating that there was no collinearity in the data (see Table 8).

Table 8

Collinearity Statistics

	Tolerance	**VIF**
Age	.996	1.004
Medicaid Type	.998	1.002
Proximity	.977	1.023
PCP Distance	.976	1.025

The relationship between each continuous independent variable and the outcome logit (also known as the log-odds) is linear, which is one of the main premises of logistic regression. This assumption was unnecessary because the study's analysis lacked a continuous variable. Additionally, sample size has a role in this situation as well, thus skipping the assumption test should not be a major problem given the enormous sample sizes of the data. Age was still continuous in the analysis, although there were ages ranging from 4 to 7 years. This gives the impression that it was categorical, but it wasn't. To make the interpretation clearer, I specified the variable as categorical in the logistical

regression analysis and used age 4 as the reference group. It is possible to update to a continuous variable, but the conclusion would then be that as age increases, so does vaccine adherence. However, this is not accurate because age 7 was not as adherent compared to age 4. Ages 5 and 6 were more likely than age 4 to follow the vaccine regimen. Given that the child is eligible for the vaccination between ages 4 and 7 this is congruent to what would be expected – as the child has more time opportunity to become compliant, they do.

Logistical regression's last assumption was that there should not be any significant outliers, high leverage points, or particularly influential locations. Cook's distance was utilized to determine whether outliers had an unduly significant influence on the analysis. The Cook's distance range for this model ranged from .000 to .000. The study's model was consistent with the notion that values of 1.0 or higher are problematic.

Results

This study examined the association between several SDoH elements and Medicaid recipients in Texas who have completed their child's vaccines. Childhood vaccine compliance was the dependent variable, whereas SDoH factors were the independent variables. The analysis was conducted using binomial logistic regression. and in this section, the analysis' results are reported.

RQ1

The question: was there a relationship between Person- in- Environment elements (education, employment, housing, social support, family support, psychological and

psychosocial circumstances, age range, income limitations, type of Medicaid region, and population density) and childhood vaccination adherence?

RQ1 involved examining whether there was an association between the Person in the Environment and the state of childhood vaccination adherence. The association was established using a binary logistic regression, and the model had a statistically significant p-value of < .001 for X^2 (17, n = 404,432) = 16,540.607. The model accurately predicted 79.8% of instances and provided an explanation for 6.3% (Nagelkerke R Square) of the variation in childhood vaccination adherence status. According to the Hosmer and Lemeshow goodness-of-fit test, there was no discernible difference between the observed and anticipated proportions. (p = .293). The results of the multivariate analysis are listed in Table 9.

Participants aged 5 (OR = 1.388, 95% CI [1.357, 1.419]) and 6 (OR = 1.728, 95% CI [1.689, 1.767]) were more likely to follow through with vaccinations than the participants aged 4. However, in terms of vaccination adherence, children aged seven (OR =.401, 95% CI [.390,.413]) fared worse than those aged 4. Individuals living in micro (OR = 1.388, 95% CI [1.357, 1.419]) and rural (OR = 1.728, 95% CI [1.689, 1.767]) proximity were more likely than individuals living in metro proximity to experience adherence problems. Individuals who received psycho-social circumstances had a better possibility of adhering to vaccinations than those who did not. (OR = 1.363, 95% CI [1.038, 1.790]). There was no relationship between the kind of Medicaid, literacy and education levels, work, housing, social support, and primary support, and the probability of vaccination adherence.

Table 9

Logistics Regression Analysis of Relationship Between Person-in-Environment Elements and Childhood Vaccination Adherence Status

			95% CI for OR			
	OR	**SE**	**Lower**	**Upper**	**Z**	**p**
Age						
Age 4			Reference			
Age 5	1.388	.012	1.357	1.419	803.157	< .001
Age 6	1.728	.011	1.689	1.767	2264.887	
Age 7	.401	.015	.390	.413	3953.488	
MEDICAID Type						
CHIP			Reference			
STAR	1.105	.265	.657	1.859	.142	< .001
STAR Health	3.594	.786	.770	16.779	2.649	
STAR Kids	.958	.266	.568	1.615	.026	
Star Plus	.000	28420.722	.000		.000	
Education and Literacy	.982	.078	.843	1.144	.053	.818
Employment	.000	40192.970	.000		.000	1.000
Housing	.691	.275	.403	1.185	1.806	.179
Social Support (60)	1.049	.169	.754	1.461	.082	.775
Social Support (62)	.921	.069	.804	1.055	1.399	.237
Primary Support	.895	.067	.785	1.020	2.747	.097
Psycho-social Circumstances (64)	.000	40192.970	.000		.000	1.000
Psycho-social Circumstances (65)	1.363	.139	1.038	1.790	4.952	.026
Proximity						
Metro			Reference			< .001
Micro	.853	.018	.824	.884	79.549	
Rural	.838	.014	.815	.861	163.660	

RQ2

The question: was there a relationship between Health Behaviors elements (relationship with the PCP, number of PCP visits, and accessing emergency care services) and childhood vaccination adherence?

RQ2 involved determining if there was a relationship between health behaviors elements and childhood vaccination status. A logistic regression was performed to ascertain the effects of health behaviors elements on childhood vaccination status. The logistic regression model was statistically significant, $\chi^2(5) = 5{,}314{,}366$ $p < .001$. The model explained 1.70% (Nagelkerke R^2) of the variance in childhood vaccination status and correctly classified 80.50% of cases. Those accessing emergency care services shows a decreased odds of adherence to vaccinations by .920 than those without one. The children with a relationship with the PCP shows a decreased odds of adherence to vaccinations by.719 than those without one. office visits have increasing odds through six visits before we see diminishing returns (see Table 10). The highest odds of adhereing to vaccinations at 1.008 are those members that see their PCP twice.

Table 10

Health Behaviors Elements and Childhood Vaccination Status

								95% C.I.for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	office_Count			32686.897	10	.000			
	office_Count(1)	-.850	.007	16065.911	1	.000	.427	.422	.433
	office_Count(2)	.008	.005	2.068	1	.150	1.008	.997	1.018
	office_Count(3)	-.244	.006	1441.775	1	.000	.783	.773	.793
	office_Count(4)	-.164	.006	705.899	1	<.001	.848	.838	.859
	office_Count(5)	-.107	.006	296.530	1	<.001	.899	.888	.910
	office_Count(6)	-.058	.006	88.263	1	<.001	.943	.932	.955
	office_Count(7)	-.064	.006	102.960	1	<.001	.938	.926	.949
	office_Count(8)	-.085	.006	173.080	1	<.001	.919	.907	.930

office_Count(9)	-.037	.007	32.006	1	<.001	.963	.951	.976
office_Count(10)	-.071	.007	111.562	1	<.001	.931	.919	.944
NonEmergent_ER	-.084	.002	1466.601	1	.000	.920	.916	.924
PCP_Relationship	-.330	.002	21698.633	1	.000	.719	.716	.722
Constant	-1.002	.005	37892.608	1	.000	.367		

a. Variable(s) entered on step 1: office_Count, NonEmergent_ER, PCP_Relationship.

RQ3

The question: Was there a statistically significant relationship between Provider Factors (physician choice available) and childhood vaccination adherence?

RQ3 involved ascertaining whether there was a statistically significant relationship between provider factors and children's vaccination status. The number of PCPs eligible to be selected by the individual was used to calculate the provider factors. A logistic regression was used to determine the influence of provider factors on the likelihood of participants adhering to childhood vaccinations. The logistic regression model was not statistically significant (p =.350, 2(1) =.873). The model explained 0.0% of the variance in vaccine adherence (Nagelkerke R2) and properly identified 79.8% of cases. Increasing the number of PCPs did not increase the likelihood of improved vaccination adherence (OR = 1.005, 95% CI [.994, 1.016]).

Table 11

Logistics Regression Analysis of Relationship Provider Factors and Childhood Vaccination Adherence Status

			95% CI for OR			
	OR	**SE**	**Lower**	**Upper**	**z**	**P**
Number of PCPs	1.005	.006	.994	1.016	.873	.350

RQ4

The question: Did the distance between the member and provider moderate the effect between these factors (education, employment, housing, social support, family support, psychological and psychosocial circumstances, type of Medicaid, region, population density, relationship with the provider, accessing emergency care services, and other physicians available) and childhood vaccination status?

RQ4 involved establishing whether the distance between the member and provider moderated the effect between aforementioned factors and childhood vaccination status. Two binary logistical regression models were developed: the first model did not account for the distance between the member and provider, while the second model did. This allowed the researcher to ascertain the moderating impact of the distance between the member and provider. Comparing two models of binary logistic regression involved assessing their goodness-of-fit and evaluating how well they predicted the binary outcome.

The first model without the factor of distance between the member and provider had the association established using a binary logistic regression, and the model had a statistically significant p-value of < .001 for X^2 (17, n = 404,403) = 16,533.330. The model accurately predicted 79% of instances and provided an explanation for 8.7% (Nagelkerke R Square) of the variation in childhood vaccination adherence status. According to the Hosmer and Lemeshow goodness-of-fit test, there was no discernible difference between the observed and anticipated proportions. (p = .291).

The second model with the factor of distance between the member and provider had also the association established using a binary logistic regression, and the model as well had a statistically significant p-value of < .001 for X2 (20, n = 404,403) = 16,533.330. Similar to the first model, the second one correctly predicted 79% of cases and explained 8.9% (Nagelkerke R Square) of the variation in the status of childhood vaccination adherence. The observed and expected proportions did not significantly differ, according to the Hosmer and Lemeshow goodness-of-fit test. (p = .078).

The researcher came to the conclusion from the two models that the distance between the member and provider had no effect on how the variables mentioned in research questions 1 to 3 and childhood vaccination status moderated.

Summary

With regard to Medicaid-insured children in Texas, the objective of this quantitative retrospective cohort study was to investigate relationships between SDoH and vaccination adherence. Results from logistic regression analyses showed there were some influences on degree of childhood vaccination adherence. Three factors that were

statistically significant predictors of adherence were child's age, proximity, and distance from care facilities. The odds of vaccination if there was a PCP relationship is .719; the greater the number of office visits, the greater the odds of vaccination. If there is access to ER services, the odds of vaccination are equivalent to having five or more office visits with the PCP. Children's vaccination adherence is moderated in part by distance from care. There was no connection between kind of Medicaid, literacy and education levels, employment, housing, social support, and main support and likelihood of immunization adherence.

In Chapter 5, results are described, interpreted, and summarized including acknowledgment of any shortcomings. The study's advantages will also be covered along with suggestions for future research. Implications for positive social change and conclusions are also included in Chapter 5.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this quantitative retrospective cohort study was to examine the relationship between variables associated with SDoH and vaccination adherence among Texas Medicaid-insured children. I sought to investigate determinants linked to completion of childhood vaccinations among this cohort. Analysis was conducted using data from children between 4 and 7 who were enrolled in Medicaid STAR and STAR Kids for 2021 and 2022. The dependent variable was adherence to childhood vaccination, while the independent variable was SDoH factors. I employed a retrospective cohort design with a quantitative approach and scrutinized past data to establish associations between independent and dependent variables. The Texas HHSC procured Medicaid claims and enrollment data. I used summary-level and deidentified data to safeguard confidentiality and adhere to regulations set forth by the Texas HHSC. The study's population encompasses the entire population eligible for the Texas Medicaid program, specifically focusing on children between the 4 and 7. Variables included urban or rural identification, ethnicity, type of Medicaid, Texas Medicaid regions, primary language, and specific diagnosis codes associated with SDoH involving employment, education, family and social support, housing, and psychosocial and psychological scenarios.

I highlighted several significant findings concerning adherence to childhood vaccination among Texas Medicaid recipients. Adherence was significantly predicted by age, proximity to healthcare facilities, and psychosocial circumstances. Findings of this study indicate that children in the age range of five to six exhibited a higher

likelihood of complying with vaccination protocols, whereas children who were seven demonstrated comparatively lower rates of adherence. Residing in micro or rural regions was positively associated with adherence, while individuals with psychosocial circumstances exhibited greater adherence. Health-related conduct involving establishing PCP relationships and proximity to medical care were also significant determinants. Establishment of a PCP relationship was found to have a positive impact on adherence, whereas individuals residing farther from healthcare facilities exhibited lower adherence rates, except those living beyond a 60-mile radius, who demonstrated higher adherence rates. Nonetheless, I did not observe a significant influence of PCPs on adherence. These research findings suggest that proximity to healthcare facilities partially mediated the association between SDoH, health behaviors, and adherence to vaccination. This underscores the moderating impact of distance on these variables.

Interpretation of Findings

Results obtained from this investigation validate and broaden prior scholarly works. The study incorporates a range of variables, including SDoH, diagnosis codes, service location, physician selection, provider relationship, distance to care, age, ethnicity, language, geographic location, population density, and type of Medicaid with the factors that have been previously identified in scholarly literature, including the Consumer Assessment of Health Plans (CAHPS), Healthcare Effectiveness Data and Information Set (HEDIS), and the National Survey of Children's Health (NSCH), which have been employed in national health measurement rating systems (Honsberger et al., 2018).

Research validates the extant body of literature by examining the moderating effect of distance on the relationship between independent and dependent variables, particularly in terms of adherence to childhood vaccine schedules. Healthcare access may be impeded by geographical distance, especially for marginalized groups such as Medicaid beneficiaries (Goins, 2019; Luo et al., 2016).

Additionally, research is consistent with prior studies in terms of underscoring the significance of comprehending social, economic, environmental, and demographic determinants in order to detect possible inequalities and improve health consequences. Incorporating variables about social determinants of health, demographic factors, and language corroborates the conclusions drawn from the research conducted by Diamond et al. (2019), which emphasize the influence of these factors on health consequences and adherence to vaccination. Furthermore, the investigation recognizes the inequities in health consequences that are influenced by racial and ethnic factors, as evidenced by the studies conducted by Smith et al. (2021) and Rajan et al. (2020). The study affirms the necessity of addressing ethnic disparities and their impact on completion of childhood vaccinations by considering ethnicity as a variable.

This research expands upon prior academic works by conducting a comprehensive examination at the individual level, using data gathered from both claims and eligibility data. This methodology facilitates a precise appraisal of the population across diverse variables and permits the evaluation of the triad components (i.e., the person in provider, environment, and health behavior) in a unified analysis. Prior research has used either aggregated or generalized data, potentially constraining comprehension of the

impact of variables on vaccine adherence at an individual level. Hence, the investigation outcomes make a valuable addition to the existing body of knowledge by emphasizing the advantages of employing data at the individual level and conducting a simultaneous analysis of multiple factors.

The research findings are consistent with the Ryvicker theoretical framework, as they examine the impact of individual-level factors (Person in Environment) on the rates of childhood vaccination completion. Incorporating factors such as social determinants of health, individual attributes, and built environment is consistent with the person-in-environment principle of the framework. This confirms previous research by Olaniyan et al. (2020), which emphasized the impact of social determinants of health on individual decision-making regarding vaccination. The study's results pertain to the Health Behaviors principle of the Ryvicker framework, as it investigates the impact of healthcare navigation and access to care on vaccination compliance. The inclusion of variables such as distance to care and service location align with this tenet, confirming previous research by Preiser et al. (2018) and Smith et al. (2021), which highlighted the importance of healthcare access and navigation in healthcare outcomes.

The study's findings also correspond to the provider factors tenet of the Ryvicker framework. Including provider choice, provider relationship, and continuity of care variables align with the provider factors tenet, confirming the relevance of provider-related factors in vaccination adherence. The assertion above corroborates the findings of Smith et al. (2021) established that selecting healthcare providers is a crucial determinant of disparities observed in preventive healthcare. The present study's results consistently

enhance comprehension of the Ryvicker framework by examining and evaluating variables at the personal level, healthcare navigation, and provider-related factors. By identifying the associations between the factors above and adherence to vaccination, this study offers significant insights that can potentially guide healthcare policies and interventions to enhance vaccination rates and mitigate vaccine-preventable illnesses. This aligns with the goals of the Ryvicker framework and its application in previous research studies (Chevillard et al., 2021; Kearns et al., 2021).

Limitations of the Study

I used secondary data, and as such, relevance of data is constrained by the scope of research questions that can be addressed using available data. Additionally, the accuracy of the secondary data is subject to potential limitations, which may impact the validity of the study's findings. Possible study limitations may arise from the availability and precision of pertinent variables in capturing the intended information. The efficacy of the researcher's study is contingent upon the comprehensiveness and precision of the primary data acquisition, which encompasses the study's structure, sampling techniques, and promptness of data collection. The precision of primary data collection is crucial for this investigation, as it depends on the data gathered by healthcare providers and the HHSC. Errors in data reporting, such as inaccuracies in claims submission or data processing and storage, can potentially introduce biases that can compromise the validity of a study's findings.

The research could potentially be influenced by selection and confirmation biases. Random sampling techniques are used to mitigate selection bias, but it is still conceivable

that specific populations or aspects may be lacking or more prevalent in the sample. The potential for confirmation bias can be reduced by implementing predetermined thresholds during statistical analysis. However, it is important to note that there remains a risk of bias when interpreting the outcomes. The analysis is restricted in the scope of this study as it does not directly examine vaccine hesitancy, a crucial determinant of vaccination behaviors. The study's failure to account for vaccine hesitancy may result in an incomplete understanding of the multifaceted determinants of childhood vaccination rates, thereby constraining the applicability of the results to populations with high levels of vaccine hesitancy.

Recommendations for Future Research

It is imperative to conduct additional research on vaccine hesitancy and its ramifications on vaccination rates among children. This investigation did not specifically examine the phenomenon of vaccine hesitancy, a crucial determinant of vaccination compliance. Qualitative research may investigate the underlying factors contributing to vaccine hesitancy among diverse groups, whereas quantitative research may be utilized to examine the correlation between vaccine hesitancy and adherence to vaccination. Furthermore, implementing longitudinal studies would yield significant contributions toward understanding vaccination patterns and adherence over an extended duration. The present investigation employed retrospective cohort data, providing a momentary view of vaccination conduct at a particular point. Using longitudinal studies could facilitate the exploration of variables that affect modifications in vaccination behavior and the enduring consequences of interventions.

In order to improve the generalizability of findings, it is recommended that future research endeavors undertake comparative analyses across diverse populations. The proposed study aims to investigate childhood vaccination rates and related factors among diverse populations, encompassing various geographical regions and socio-economic strata. Kearns et al. (2021) suggested that customized interventions can be formulated to mitigate discrepancies in vaccination compliance by identifying fluctuations in vaccination rates and the underlying factors that contribute to them. The utilization of mixed methods approaches, which combine quantitative analysis and qualitative methods, may offer a comprehensive comprehension of the intricate factors that impact childhood vaccination. Although quantitative data can offer statistical insights, qualitative research can provide a deeper understanding of individual experiences, beliefs, and contextual factors that quantitative data may not fully capture (Levitt, 2021). The integration of both methodologies can yield a more comprehensive comprehension of the factors that impede or promote adherence to vaccination protocols. Moreover, performing a comparative analysis of healthcare systems may illuminate the influence of policy, healthcare accessibility, and provider-related factors on vaccination compliance. Conducting cross-regional analyses to compare diverse healthcare systems and their effects on childhood vaccination rates could offer valuable insights into optimal practices and policy suggestions for enhancing vaccination rates in different healthcare settings.

Distance should be studied in further depth. It may be that children that have to travel to access healthcare greater distances tend to get more care in one visit than those close to care with ease of access. Additionally, ease of access appeared not to be

impacted by the number of PCP's available, but the availability of one to be assigned. This relationship should be studied further to determine if there are provider quality variables confounding these research findings.

It is feasible to perform validation and reliability analyses to enhance the credibility of future research, given the dependence on secondary data. The validity of findings can be enhanced by evaluating the accuracy and comprehensiveness of the primary data collection procedures, which encompass claims submission and data processing (Moon, 2019). The process of validating and evaluating the dependability of the data sources employed in the investigation would enhance the general standard of research in this field).

Implications

Enhanced comprehension of the determinants that impact adherence to childhood vaccination at the individual level can pave the way for focused interventions and educational initiatives to mitigate vaccine hesitancy, correct misapprehensions, and advocate for the advantages of vaccinations. Providing immunization information can potentially enhance the ability of individuals to make informed decisions, resulting in a rise in vaccination rates and better health outcomes at the individual level (Diamond et al., 2019; Rajan et al., 2020).

Research outcomes can provide valuable insights to healthcare providers, public health organizations, and policymakers regarding the significance of endorsing and facilitating childhood immunization at the family level. By examining the determinants that impact vaccination decision-making processes within households, including

healthcare accessibility, socio-economic considerations, and cultural values, it is possible to develop targeted interventions that can effectively overcome obstacles and promote vaccine acceptance. Vaccinating children against preventable diseases and alleviating the responsibilities of parents and caregivers can positively impact the general health and welfare of families, as supported by scholarly sources (Pérez-Stable, 2021; Rajan et al., 2020).

Healthcare organizations, clinics, and providers can leverage research findings to enhance their vaccination services at the organizational level. This may entail implementing various strategies to augment vaccine accessibility, mitigating obstacles to vaccination, and enhancing the quality of communication and education dispensed to parents and caregivers. The development of organizational policies can effectively facilitate the timely and accurate administration of vaccines, prioritize vaccination reminders, and promote best practices for immunization. Such endeavors can potentially enhance vaccination rates and overall public health outcomes, as evidenced by sources such as Hargreaves et al. (2020).

At the societal and policy level, the study of childhood vaccination can provide insights for the creation and execution of policies and programs that are grounded in empirical evidence. Policymakers can utilize research findings to formulate legislation that mandates vaccinations, improves vaccine accessibility, and advances public awareness campaigns. Implementing these policies has the potential to yield significant societal benefits such as mitigating the incidence of vaccine-preventable illnesses,

safeguarding susceptible groups, and enhancing the community's general health (Albers et al., 2022).

The present study employs a quantitative retrospective cohort design as its research methodology, which has significant methodological implications for investigating the correlation between specific factors and vaccination rates among children enrolled in Texas Medicaid. This design facilitates the examination of past data and the investigation of associations between independent and dependent variables (Curtis et al., 2016). This methodology presents a cost-efficient and effective approach to examining vaccination adherence by leveraging pre-existing data. Ensuring the precision and excellence of the accessible data is imperative for researchers to prevent potential biases.

The study's theoretical implications are based on the behavioral-ecological framework of healthcare access and navigation. The framework acknowledges that healthcare outcomes are impacted by many complex factors at various levels, encompassing intrapersonal, interpersonal, organizational, community, environmental, and policy factors. Integrating the Ryvicker framework, which comprises the domains of a Person in Environment, Health Behaviors, and Provider Factors, can facilitate a comprehensive comprehension of the association between these factors and vaccination adherence outcomes (Ryvicker, 2018). Moreover, the present study expands upon prior research by integrating the assessment of individual-level variables that have not been previously investigated regarding the achievement of childhood vaccination completion rates.

The study's empirical implications entail utilizing Texas Medicaid data to scrutinize the correlation between specific factors and adherence to vaccination. Using easily accessible data enables one to acquire pragmatic insights to potentially guide healthcare policies and interventions. Results possess the capacity to discern associations between healthcare access, navigation factors, and under-vaccination rates. Acquiring this knowledge can prove to be pivotal in formulating interventions and policies geared toward enhancing vaccination rates and mitigating the incidence of vaccine-preventable ailments. Using the Ryvicker framework to examine the correlation between principles and health consequences adds to the expanding pool of information on the variables that enable or constrain healthcare-seeking behaviors (Chevillard et al., 2021; Kearns et al., 2021).

Recommendations for Practice

A crucial recommendation is to devise and execute focused interventions and educational initiatives that tackle vaccine hesitancy, misconceptions, and apprehensions. The primary objective of these initiatives should be to emphasize the advantages of vaccinations and provide effective information, enabling individuals to make well-informed choices regarding immunization. Olson et al. (2020) emphasized the importance of customized interventions and communication tactics in mitigating vaccine hesitancy and enhancing vaccination rates.

An additional recommendation is to offer instruction and materials to healthcare professionals to augment their expertise and aptitude in immunizations for children. Augmenting expertise and aptitude entails providing evidence-based information to

parents and caregivers while addressing commonly raised concerns. Promoting vaccines is healthcare providers' critical responsibility. Healthcare providers can benefit from training programs that provide them with effective strategies to address parental concerns. Nuwarda et al. (2022) revealed that healthcare-provider education on vaccine communication and management of parental apprehensions positively influenced vaccination rates among patients.

It is imperative to endeavor to augment the accessibility of vaccines, especially in marginalized communities and demographics. One potential strategy is to broaden the scope of vaccination services by establishing them in community health centers, schools, and other conveniently located venues. Furthermore, it is obligatory to implement measures to mitigate financial obstacles by guaranteeing the cost-effective or cost-free availability of vaccines. Ozawa et al. (2019) acknowledged the significance of comprehending the demographic groups that have proven challenging to access through vaccination campaigns, with the aim of broadening the scope of vaccination benefits to all eligible individuals. They noted that it is imperative to distinguish between demographic groups that are hard to reach and demographic groups that present difficulties in terms of administering vaccinations. The extant literature inadequately delineated these demographic groups, and unambiguous standards or benchmarks for their classification were absent. Consequently, there exists a necessity to enhance the quantification of the magnitude and influence of populations that are hard to reach and scrutinize interventions that overcome obstacles linked to each distinct mechanism.

One crucial recommendation is to consider the cultural beliefs and practices that could potentially impact decisions regarding vaccination. It is imperative to provide healthcare providers with cultural competence training in order to facilitate effective communication with diverse populations and customize interventions to meet their unique requirements. Olusanya et al. (2021) found that healthcare providers have been recognized as possessing a distinctive position to enhance vaccination rates by providing efficacious recommendations utilizing presumptive language. The research proposed a number of optimal methodologies, such as the provision of quality improvement coaching to healthcare providers, implementation of vaccination reminder recall systems, and compliance to standardized safety procedures.

Conclusion

This quantitative retrospective cohort study elucidates significant findings about compliance with childhood immunization protocols among beneficiaries of Texas Medicaid. The research identifies factors influencing adherence, such as age, proximity to healthcare facilities, psychosocial circumstances, health behaviors, and provider-related aspects. Findings suggest that children within the age range of five- to-six years exhibit greater levels of adherence, whereas those who are seven years old display comparatively lower rates. Improved adherence is linked to favorable psychosocial circumstances and residing in micro or rural regions. Establishing a PCP relationship positively impacts adherence to medical treatment, and the proximity of healthcare facilities plays a moderating role in this relationship. This investigation affirms the pre-existing body of literature that underscores the impact of SDoH, demographic variables, and language

proficiency on vaccination compliance. This statement underscores the importance of effectively understanding these factors to tackle health disparities. This research builds upon previous studies by analyzing data at the individual level and exploring various factors concurrently. The results are consistent with the Ryvicker theoretical model, highlighting the influence of individual, environmental, and provider-related factors on adherence to vaccination. This framework comprehensively comprehends the various factors that impact vaccination behaviors.

Understanding the relationship between variables in Medicaid claims and childhood vaccination can promote positive social change by promoting more informed decision-making about vaccinations. This knowledge can bring clarity to assumptions currently being executed in vaccine outreach strategies, which can ultimately lead to an increase in vaccination rates and improved public health outcomes. Additionally, understanding this relationship can help healthcare providers and public health officials develop more targeted and effective vaccine campaigns that address specific concerns or barriers individuals may have towards vaccinating. Ultimately, understanding the relationship between variables in claims and childhood vaccination can help to build trust in vaccines and foster a more informed and supportive community of public health advocates.

References

Albers, A. N., Thaker, J., & Newcomer, S. R. (2022). Barriers to and facilitators of early childhood immunization in rural areas of the United States: A systematic review of the literature. *Preventive Medicine Reports, 27*(6), 11-24. https://doi.org/10.1016/j.pmedr.2022.101804

Allen, A. M., Van Houten, H. K., Sangaralingham, L. R., Talwalkar, J. A., & McCoy, R. G. (2018). Healthcare cost and utilization in nonalcoholic fatty liver disease: Real-world data from a large US claims database. *Hepatology, 68*(6), 2230-2238. https://doi.org/10.1002/hep.30094

Barghadouch, A., & Norredam, M. (2022). Psychosocial responses to healthcare: A study on asylum-seeking families' experiences in Denmark. *Journal of Immigrant and Minority Health, 24*(2), 551–555. https://doi.org/10.1007/s10903-021-01183-x

Baron, R. M. & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173–1182. https://doi.org/10.1037/0022-3514.51.6.1173

Bensken, W. P., Alberti, P. M., Stange, K. C., Sajatovic, M., & Koroukian, S. M. (2022). ICD-10 Z-code health-related social needs and increased healthcare utilization. *American Journal of Preventive Medicine, 62*(4), e232–e241. https://doi.org/10.1016/j.amepre.2021.10.004

Browne, J., Mccurley, J. L., Fung, V., Levy, D. E., Clark, C. R., & Thorndike, A. N. (2021). Addressing social determinants of health identified by systematic

screening in a Medicaid accountable care organization: A qualitative study. *Journal of Primary Care & Community Health, 12*(6), 2-32. https://doi.org/10.1177/2150132721993651

Bunik, M., Galloway, K., Maughlin, M., & Hyman, D. (2021). "First Five" Quality Improvement Program Increases Adherence and Continuity with Well-child Care. Pediatric Quality & Safety, 6(6), e484. https://doi.org/10.1097/pq9.0000000000000484

Butler, A. M., Grabinski, V. F., Boloker, G. D., Newland, J. G., & Politi, M. C. (2020). A qualitative study examining pediatric clinicians' perceptions of delayed vaccine schedules. *Vaccine, 38*(30), 4740–4746. https://doi.org/10.1016/j.vaccine.2020.05.015

Cardinal, C., Scarbrough, A., & Ratnapradipa, D. (2019). Health policy considerations in Texas measles outbreaks past and present. *Health Behavior and Policy Review, 6*(5), 472–479. https://doi.org/10.14485/HBPR.6.5.6

Centers for Disease Control and Prevention. (2016). About VFC. https://www.cdc.gov/vaccines/programs/vfc/about/index.html#history

Centers for Disease Control and Prevention. (2019). Pertussis outbreaks. https://www.cdc.gov/pertussis/outbreaks.html

Centers for Disease and Prevention. (2022a). Child and adolescent immunization schedule. https://www.cdc.gov/vaccines/schedules/hcp/imz/child-adolescent.html

Centers for Disease Control and Prevention. (2022b). Measles cases and outbreaks. https://www.cdc.gov/measles/cases-outbreaks.html

Centers for Disease Control and Prevention. (2022c). Public health law. https://www.cdc.gov/phlp/docs/school-vaccinations.pdf

Centers for Disease Control and Prevention. (2005). *Epidemiology and prevention of vaccine-preventable diseases*. Author.

Chevillard, G., & Mousquès, J. (2021). Medically underserved areas: Are primary care teams efficient at attracting and retaining general practitioners? *Social Science & Medicine, 287*(6), 13-58. https://doi.org/10.1016/j.socscimed.2021.114358

Chisolm, D. J., Brook, D. L., Applegate, M. S., & Kelleher, K. J. (2019). Social determinants of health priorities of state Medicaid programs. *BMC Health Services Research, 19*(1), 1-7. https://doi.org/10.1186/s12913-019-3977-5

Claims processing: What is claims adjudication? (January 19, 2017). *Apex EDI*. https://apexedi.com/what-is-claims-adjudication/

Centers for Medicare & Medicaid Services. (2021). Using Z codes. https://www.cms.gov/files/document/zcodes-infographic.pdf

Cole, M. B., & Nguyen, K. H. (2020). Unmet social needs among low-income adults in the United States: Associations with health care access and quality. *Health Services Research, 55*(S2), 873–882. https://doi.org/10.1111/1475-6773.13555

Conner, M., McEachan, R., Lawton, R., & Gardner, P. (2016). Basis of intentions as a moderator of the intention-health behavior relationship. *Health Psychology, 35*(3), 219–227. https://doi.org/10.1037/hea0000261

Curtis, E. A., Comiskey, C., & Dempsey, O. (2016). Importance and use of correlational research. *Nurse Researcher*, 23(6), 2-22. https://doi.org/10.7748/nr.2016.e1382

Diamond, L., Izquierdo, K., Canfield, D., Matsoukas, K., & Gany, F. (2019). A systematic review of the impact of patient–physician Non-English language concordance on quality of care and outcomes. *Journal of General Internal Medicine, 34*(8), 1591–1606. https://doi.org/10.1007/s11606-019-04847-5

Fenick, A. M., Leventhal, J. M., Gilliam, W., & Rosenthal, M. S. (2020). A Randomized Controlled Trial of Group Well-Child Care: Improved Attendance and Vaccination Timeliness. Clinical Pediatrics, 59(7), 686–691. https://doi.org/10.1177/0009922820908582

Franco Montoya, D., Chehal, P. K., & Adams, E. K. (2020). Medicaid managed care's effects on costs, access, and quality: An update. *Annual Review of Public Health, 41*(1), 537–549. https://doi.org/10.1146/annurev-publhealth-040119-094345

Galewitz, P. (2021). Medicaid Vaccination Rates Founder as States Struggle to Immunize Their Poorest Residents. Kaiser Health News. https://khn.org/news/article/medicaid-vaccination-rates-founder-as-states-struggle-to-immunize-their-poorest-residents/

Ghaswalla, P. K., D'Angelo, J., & Abu-Elyazeed, R. (2021). Rotavirus vaccination in the US: a systematic review of vaccination coverage and completion. *Human Vaccines & Immunotherapeutics, 17*(3), 872-879. https://doi.org/10.1080/21645515.2020.1794440.

Goins, R. (2019). Geographic Barriers to Care: Are There Variations in Care for Medicaid Beneficiaries Who Cross State Borders? *MUSC Theses and Dissertations*. https://medica-musc.researchcommons.org/theses/211

Goyal, N. K., Brown, C. M., Folger, A. T., Hall, E. S., Van Ginkel, J. B., & Ammerman, R. T. (2020). Adherence to well-child care and home visiting enrollment associated with increased emergency department utilization. *Maternal and Child Health Journal, 24*(1), 73–81. https://doi.org/10.1007/s10995-019-02821-5

Hacker, K. A., & Briss, P. A. (2021). Non-peer reviewed: An ounce of prevention is still worth a pound of cure, especially in the time of COVID-19. *Preventing Chronic Disease, 2*(6), 18-30. https://dx.doi.org/10.5888%2Fpcd18.200627

Hadjipanayis, A. (2019). Compliance with vaccination schedules. *Human Vaccines & Immunotherapeutics, 15*(4), 1003–1004. https://doi.org/10.1080/21645515.2018.1556078

Hardy, R. Y., Liu, G. C., & Kelleher, K. (2021). Contribution of social determinant of health factors to rural-urban preventive care differences among Medicaid enrollees. *Academic Pediatrics, 21*(1), 93–100. https://doi.org/10.1016/j.acap.2020.08.022

Hargreaves, A. L., Nowak, G., Frew, P. M., Hinman, A. R., Orenstein, W. A., Mendel, J., Aikin, A., Nadeau, J. A., McNutt, L.-A., Chamberlain, A. T., Omer, S. B., Randall, L. A., & Bednarczyk, R. A. (2020). Adherence to timely vaccinations in the United States. *Pediatrics, 145*(3). https://doi.org/10.1542/peds.2019-0783

Health.gov. (n.d.). Social Determinants of Health—Healthy People 2030. Retrieved August 30, 2022, from https://health.gov/healthypeople/priority-areas/social-determinants-health

Hill, H. A., Yankey, D., Elam-Evans, L. D., Singleton, J. A., Pingali, S. C., & Santibanez, T. A. (2020). Vaccination coverage by age 24 months among children born in 2016 and 2017—National Immunization Survey-Child, United States, 2017–2019. *Morbidity and Mortality Weekly Report*, *69*(42), 1505. doi: 10.15585/mmwr.mm6942a1.

Hobani, F., & Alhalal, E. (2022). Factors related to parents' adherence to childhood immunization. *BMC Public Health, 22*(1), 819. https://doi.org/10.1186/s12889-022-13232-7

Honsberger, K., Holladay, S., Kim, E., & VanLandeghem, K. (2018). How States Use Medicaid Managed Care to Deliver Long-Term Services and Supports to Children with Special Health Care Needs. *National Academy for State Health Policy, November*.

ICD10data.com (n.d.). Persons with potential health hazards related to socioeconomic and psychosocial circumstances Z55-Z65. https://www.icd10data.com/ICD10CM/Codes/Z00-Z99/Z55-Z65

Jackson, M. A., & Harrison, C. (2019). On the Brink: Why the U.S. is in danger of losing measles elimination status. *Missouri Medicine, 116*(4), 260–264.

Kang, H. (2021). Sample size determination and power analysis using the G*Power software. *Journal of Educational Evaluation for Health Professions*, 18(2), 17. https://doi.org/10.3352/jeehp.2021.18.17

Kearns, S., Kroll, T., O'Shea, D., & Neff, K. (2021). Experiences of transgender and non-binary youth accessing gender-affirming care: A systematic review and meta-

ethnography. *PLOS ONE, 16*(9), 2-14. https://doi.org/10.1371/journal.pone.0257194

Kempe, A., O'Leary, S. T., Cortese, M. M., Crane, L. A., Cataldi, J. R., Brtnikova, M., Beaty, B. L., Hurley, L. P., Gorman, C., Tate, J. E., St. Pierre, J. L., & Lindley, M. C. (2022). Why aren't we achieving high vaccination rates for rotavirus vaccine in the united states? *Academic Pediatrics, 22*(4), 542–550. https://doi.org/10.1016/j.acap.2021.07.003

Kempe, A., O'Leary, S. T., Cortese, M. M., Crane, L. A., Cataldi, J. R., Brtnikova, M., & Lindley, M. C. (2022). Why Aren't We Achieving High Vaccination Rates for Rotavirus Vaccine in the United States?. *Academic Pediatrics, 22*(4), 542-550. https://doi.org/10.1016/j.acap.2021.07.003.

Koschmann, K. S., Peden-McAlpine, C. J., Chesney, M., Mason, S. M., & Hooke, M. C. (2021). Urban, low-income, African American parents' experiences and expectations of well-child care. *Journal of Pediatric Nursing, 60*(2), 24–30. https://doi.org/10.1016/j.pedn.2021.01.022

Koskan, A., Klasko-Foster, L., Stecher, C., Rodriguez, S., Helitzer, D., & Yoo, W. (2021). Human papillomavirus vaccine guideline adherence among Arizona's Medicaid beneficiaries. *Vaccine, 39*(4), 682–686. https://doi.org/10.1016/j.vaccine.2020.12.041

Krishnarajah, G., Malangone-Monaco, E., Palmer, L., Riehle, E., & Buck, P. O. (2018). Age-appropriate compliance and completion of up to five doses of pertussis

vaccine in US children. *Human Vaccines & Immunotherapeutics, 14*(12), 2932-2939. https://doi.org/10.1080/21645515.2018.1502526

Levitt, H. M. (2021). Qualitative generalization, not to the population but to the phenomenon: Reconceptualizing variation in qualitative research. *Qualitative Psychology, 8*(1), 95.

Luo, L., Luo, L., He, X., Zhang, X., & Shi, Y. (2016). Effects of distance on health seeking behaviors of outpatients in China's large hospitals: case of West China hospital of Sichuan university. *Int J Clin Exp Med, 9*(6), 11923-11933.

Magoon, V. (2022). Screening for Social Determinants of Health in Daily Practice. *Family Practice Management, 29*(2), 6–11.

Mahmudiono, T., & Laksono, A. D. (2021). Disparity in the hospitals utilization among regions in Indonesia | Open access Macedonian. *Journal of Medical Sciences, 2*(6), 12-20. https://oamjms.eu/index.php/mjms/article/view/7304

Masters, N. B., Delamater, P. L., Boulton, M. L., & Zelner, J. (2021). Measuring multiple dimensions and indices of nonvaccination clustering in Michigan, 2008–2018. *American Journal of Epidemiology, 190*(6), 1113–1121. https://doi.org/10.1093/aje/kwaa264

McMorrow, S., Gonzalez, D., Caraveo, C. A., & Kenney, G. M. (2020). Urgent Action Needed to Address Children's Unmet Health Care Needs during the Pandemic. Washington, DC: Urban Institute. https://www.urban.org/sites/default/files/publication/103090/urgent-action-needed-to-meet-childrens-unmet-health-care-needs_0.pdf

Messino, P. J., Kharrazi, H., Kim, J. M., & Lehmann, H. (2020). A method for measuring the effect of certified electronic health record technology on childhood immunization status scores among Medicaid managed care network providers. *Journal of Biomedical Informatics*, *110*(6), 103567. https://dx.doi.org/10.1016%2Fj.jbi.2020.103567

Moon, M. D. (2019). Triangulation: A method to increase validity, reliability, and legitimation in clinical research. *Journal of emergency nursing*, *45*(1), 103-105.

Morehouse, B. M. (2021). Accessing Specialty Healthcare Services in Southeast Alaska: A Narrative Inquiry [D.H.A., University of Phoenix]. https://www.proquest.com/docview/2511368658/abstract/DF17C06B27484F3BPQ/1

Morrison, A. K., Glick, A., & Yin, H. S. (2019). Health literacy: Implications for child health. *Pediatrics In Review*, *40*(6), 263–277. https://doi.org/10.1542/pir.2018-0027

Morrison, M., Castro, L. A., & Meyers, L. A. (2020). Conscientious vaccination exemptions in kindergarten to eighth-grade children across Texas schools from 2012 to 2018: A regression analysis. *PLOS Medicine, 17*(3), 10-49. https://doi.org/10.1371/journal.pmed.1003049

Moseley, C. A., Vulimiri, M., Saunders, R. S., Bleser, W. K., Perrin, E. M., Armstrong, S. C., Wang, G. X., Ubel, P. A., McClellan, M., & Wong, C. A. (2019). Medicaid and CHIP child health beneficiary incentives: Program landscape and stakeholder insights. *Pediatrics*, *144*(2), 20-26. https://doi.org/10.1542/peds.2018-3161

National Academies of Sciences, E., Division, H. and M., Practice, B. on P. H. and P. H., Approach, C. on A. N. and S.-B. S. from P. T. E. C. D. A. H. E., Negussie, Y., Geller, A., & DeVoe, J. E. (2019). Leveraging the Health Care System to Improve Outcomes and Promote Health Equity. In Vibrant and Healthy Kids: Aligning Science, Practice, and Policy to Advance Health Equity. *National Academies Press (US*). https://www.ncbi.nlm.nih.gov/books/NBK551477/

Nuwarda, R. F., Ramzan, I., Weekes, L., & Kayser, V. (2022). Vaccine hesitancy: Contemporary issues and historical background. *Vaccines*, *10*(10), 1595.

Nuzhath, T., Ajayi, K. V., Fan, Q., Hotez, P., Colwell, B., Callaghan, T., & Regan, A. K. (2021). Childhood immunization during the COVID-19 pandemic in Texas. *Vaccine, 39(*25), 3333–3337. https://doi.org/10.1016/j.vaccine.2021.04.050

Olaniyan, A., Isiguzo, C., & Hawk, M. (2021). The Socioecological Model as a framework for exploring factors influencing childhood immunization uptake in Lagos state, Nigeria. *BMC Public Health, 21*(1), 867. https://doi.org/10.1186/s12889-021-10922-6

Olson, O., Berry, C., & Kumar, N. (2020). Addressing parental vaccine hesitancy towards childhood vaccines in the United States: a systematic literature review of communication interventions and strategies. *Vaccines, 8*(4), 590.

Olusanya, O. A., Bednarczyk, R. A., Davis, R. L., & Shaban-Nejad, A. (2021). Addressing parental vaccine hesitancy and other barriers to childhood/adolescent vaccination uptake during the Coronavirus (COVID-19) Pandemic. *Frontiers in*

Immunology, *12*(6), 12-22 .https://www.frontiersin.org/article/10.3389/fimmu.2021.663074

Ozawa, S., Yemeke, T. T., Evans, D. R., Pallas, S. E., Wallace, A. S., & Lee, B. Y. (2019). Defining hard-to-reach populations for vaccination. *Vaccine*, *37*(37), 5525–5534. https://doi.org/10.1016/j.vaccine.2019.06.081

Papis, T., & Clavien, C. (2021). Do primary care physicians contribute to the immunization status of their adult patients? a story of patients' overconfidence coupled with physicians' passivity. *Frontiers in Medicine*, *8(1),* 45-57. https://doi.org/10.3389/fmed.2021.655734

Payne, A. B., Adamkiewicz, T. V., Grosse, S. D., Steffens, A., Shay, D. K., Reed, C., & Schieve, L. A. (2021). Influenza vaccination rates and hospitalizations among Medicaid enrollees with and without sickle cell disease, 2009–2015. *Pediatric Blood & Cancer*, *68*(12), 29-51. https://doi.org/10.1002/pbc.29351

Pérez-Stable, E. (2018). Communicating the Value of Race and Ethnicity in Research. National Institutes of Health (NIH). https://www.nih.gov/about-nih/what-we-do/science-health-public-trust/perspectives/science-health-public-trust/communicating-value-race-ethnicity-research

Preiser, R., Biggs, R., De Vos, A., & Folke, C. (2018). Social-ecological systems as complex adaptive systems: Organizing principles for advancing research methods and approaches. *Ecology and Society, 23*(4), 2-22. https://doi.org/10.5751/ES-10558-230446

Rajan, S. S., Roy, D., & Delgado, R. (2020). Factors associated with childhood vaccination adherence in kindergartens of the Houston Independent School District. *Journal of Public Health Management and Practice, 26*(2), 131–138. https://doi.org/10.1097/PHH.0000000000001093

Rand, C. M., & Goldstein, N. P. N. (2018). Patterns of Primary Care Physician Visits for US Adolescents in 2014: Implications for Vaccination. Academic Pediatrics, 18(2, Supplement), S72–S78. https://doi.org/10.1016/j.acap.2018.01.002

Rural Health Information Hub. (2022). Rural Data Explorer. https://www.ruralhealthinfo.org/data-explorer?id=210&state=TX

Ryvicker, M. (2018). A conceptual framework for examining healthcare access and navigation: A behavioral-ecological perspective. *Social Theory & Health, 16*(3), 224–240. http://dx.doi.org/10.1057/s41285-017-0053-2

Santoli, J. M., Lindley, M. C., DeSilva, M. B., Kharbanda, E. O., Daley, M. F., Galloway, L., Gee, J., Glover, M., Herring, B., Kang, Y., Lucas, P., Noblit, C., Tropper, J., Vogt, T., & Weintraub, E. (2020). Effects of the COVID-19 pandemic on routine pediatric vaccine ordering and administration - United States, 2020. MMWR. *Morbidity and Mortality Weekly Report, 69*(19), 591–593. https://doi.org/10.15585/mmwr.mm6919e2

Sensmeier, J. (2020). Achieving health equity through use of information technology to address social determinants of health. *CIN: Computers, Informatics, Nursing*, *38*(3), 116-119. https://doi.org/10.1097/CIN.0000000000000622.

Shilo, S., Rossman, H., & Segal, E. (2020). Axes of a revolution: challenges and promises of big data in healthcare. *Nature medicine*, *26*(1), 29-38. https://www.nature.com/articles/s41591-019-0727-5

Slone, L. (n.d.). Redesigning the health system / increasing access to primary care providers. *Let's Get Healthy California*. https://letsgethealthy.ca.gov/goals/redesigning-the-health-system/increasing-access-to-healthcare-providers/

Smith, M. A., Hendricks, K. A., Bednarz, L. M., Gigot, M., & Harburn, A. (2021). Identifying substantial racial and ethnic disparities in health outcomes and care in Wisconsin using electronic health record data. *Wisconsin Medical Journal*, S14. https://wmjonline.org/wp-content/uploads/2021/120/S1/S13.pdf

Sobel, M. E. (1982). Asymptotic intervals for indirect effects in structural equations models. In S. Leinhart (Ed.), Sociological methodology 1982 (pp.290-312). San Francisco: Jossey-Bass.

Sohahong-Kombet, N. (2021). The Significance of Affordable Care Act (ACA) on Healthcare Behaviors of Persons of Latino and African American Ethnicity Within the Middle Class in America [D.B.A., Northcentral University]. https://www.proquest.com/docview/2621654674/abstract/9A5F34B6E5CB4916PQ/1

Texas Demographic Center. (2021). Demographic Trends and Population Projections for Texas and the North Texas Region.

https://demographics.texas.gov/resources/presentations/osd/2021/2021_01_15_leadershipnorthtexas.pdf

Texas Department of State Health Services. (2021). Texas Vaccine for Children Program. https://www.dshs.texas.gov/region7/TVFC.pdf

Texas Health and Human Services. (2016a). Children's Medicaid & Chip. https://www.hhs.texas.gov/services/health/medicaid-chip/medicaid-chip-programs-services/programs-children-families/childrens-medicaid-chip

Texas Health and Human Services. (2016b). STAR Kids. https://www.hhs.texas.gov/services/health/medicaid-chip/medicaid-chip-members/star-kids

Texas Health and Human Services. (2018). Texas Medicaid and CHIP Reference Guide—Twelfth Edition. 232.

Texas Health and Human Services. (2022). Children's Medicaid & Chip. https://www.hhs.texas.gov/services/health/medicaid-chip/medicaid-chip-programs-services/programs-children-families/childrens-medicaid-chip

Texas HHS. (2022). Uniform Managed Care Terms & Conditions. https://www.hhs.texas.gov/sites/default/files/documents/services/health/medicaid-chip/programs/contracts/uniform-managed-care-contract.pdf

Texas Medicaid & Healthcare Partnership. (2022). Texas Medicaid Provider Procedures Manual. https://www.tmhp.com/resources/provider-manuals/tmppm

Tran, C. L., Selewski, D. T., Oh, G. J., Troost, J. P., Massengill, S. F., Al-Akash, S. I., Mahesh, S., Amin, R., Ashoor, I. F., Chanchlani, R., Kallash, M., Woroniecki, R.

P., & Gipson, D. S. (2021). Pediatric immunization practices in nephrotic syndrome: An Assessment of provider and parental knowledge. *Frontiers in Pediatrics, 8*(1), 1-11. https://www.frontiersin.org/article/10.3389/fped.2020.619548

U.S. Census Bureau. (2022a). Data. https://www.census.gov/data

U.S. Census Bureau. (2022b). Urban and Rural. https://www.census.gov/data

Uedufy (May 17, 2023) How To Run Mediation Analysis in SPSS [2 Methods]. Retrieved from https://uedufy.com/how-to-run-mediation-analysis-in-spss/

Uscher-Pines, L., Bouskill, K. E., Sousa, J., Shen, M., & Fischer, S. H. (2020). Experiences of Medicaid programs and health centers in implementing telehealth. *Rand Health Quarterly*, *8*(4), 9-20. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7302318/

Vardell, E. (2019). Health Insurance Literacy and Health Disparities in the United States: A Literature Review. The International Journal of Information, *Diversity & Inclusion (IJIDI)*, *3(*4), 23-43. https://doi.org/10.33137/ijidi.v3i4.33012

White, S., Potter, L. B., You, H., Valencia, L., Jordan, J. A., Pecotte, B., & Robinson, S. (n.d.). Migration could become the most important phenomenon shaping Texas in the 21st century. *Texas Demographic Center*. https://demographics.texas.gov/Resources/publications/2017/2017_08_21_UrbanTexas. df

Whitney, C. G., Zhou, F., Singleton, J., & Schuchat, A. (2014). Benefits from immunization during the vaccines for children program era—United States, 1994–

2013. *Morbidity and Mortality Weekly Report*, *63*(16), 352. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4584777/

Wiggins, A. (n.d.). Examining the Effect of Socioeconomic Factors on Kindergarten Vaccination Rates in Kentucky Counties. 31.

Wolf, E. R., Hochheimer, C. J., Sabo, R. T., DeVoe, J., Wasserman, R., Geissal, E., Opel, D. J., Warren, N., Puro, J., O'Neil, J., Pecsok, J., & Krist, A. H. (2018). Gaps in well-child care attendance among primary care clinics serving low-income families. *Pediatrics, 142*(5), e20174019. https://doi.org/10.1542/peds.2017-4019

Wootton, S., Hotez, P. J., & Boom, J. (2019). Texas: Averting Disease and Confronting a New Vaccine Refusal Hierarchy. 10, 5.

Xiao, X., & Wong, R. M. (2020). Vaccine hesitancy and perceived behavioral control: A meta-analysis. *Vaccine, 38*(33), 5131–5138. https://doi.org/10.1016/j.vaccine.2020.04.076