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Title Social and Political Determinants of Health and Health Services Use of US Immigrant Children

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Social and Political Determinants of Health and Health Services Use of US Immigrant Children

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Abstract

Social and Political Determinants of Health and Health Services Use
of US Immigrant Children
By Ye Ji Kim

Immigrant families' children make up about one in four children in the United States. Yet, our understanding of social and political determinants that influence the access and use of health services is limited within this vital group of our society. The **overall goal of this dissertation** was to evaluate and examine the relationships between social determinants at multiple levels – including the individual level, neighborhood level, and state policy level – with the health and health services use of US immigrant children.

In **Aim 1,** I conduct multiple group path analyses to estimate the mechanism of children's immigration status and multi-year prevalence of health services use by household socioeconomic status. There was an indirect association between household generation status and healthcare services use through uninsured status, among children in 1st generation families compared to non-immigrant families, particularly for children of low SES.

In **Aim 2,** I evaluate the impact of the state-level removal of the 5-year eligibility bar for federally funded programs on health indicators among foreign-born children from low-income households. Using difference-in-differences design, the removal of the 5-year bar increased the risk of poor health status and poor teeth condition and decreased the risk of asthma, though estimates were small. Further adjustment for political party of the state's governor, a proxy for the state-level immigrant climate context, did not meaningfully change the impact of the 5-year bar removal on health indicators.

In **Aim 3**, I define four ethnic structures of residence among foreign-born children – ethnic enclave, low-income ethnoburb, high-income ethnoburb, and other. I use generalized linear mixed models to estimate the association between ethnic structures of residence and odds of preventive healthcare services use over time, testing for differences by insurance type. I use median odds ratios to estimate the variation between neighborhoods. Majority of our study sample of foreign-born children lived in ethnic enclaves. Second, there was no evidence of an association between the ethnic structure of residence and use of preventive health services. Neighborhood level income inequality and unemployment rates explained much of the variance in children's use of preventive services between neighborhoods.

This dissertation contributes to the growing body of work demonstrating the need for insurance coverage and understanding of the neighborhood context among immigrant children. In addition, disparities in the health and use of health services persist despite state-level changes to broaden public program eligibilities. Future work should explore longer term effects of the 5-year bar on clinically diagnosed health conditions and differences across these sociopolitical factors of health services use and health conditions by documentation status.

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Table of Contents

Introduction

Immigrant families' children make up one in four children in the United States.[1] The population of children in immigrant families has grown steadily and they are a vital part of our social and economic society. Yet, immigrant families historically and persistently face barriers obtaining healthcare, which in turn have lasting consequences on their physical and mental health.[2,3] Immigrant children's health insurance coverage and use the healthcare services fall behind those of US-born children,[4–8] including preventive services.[11-13] For immigrant families, factors such as low socioeconomic status, immigration status, and resources in communities of residence complicate their access and use of healthcare services.[2, 14]

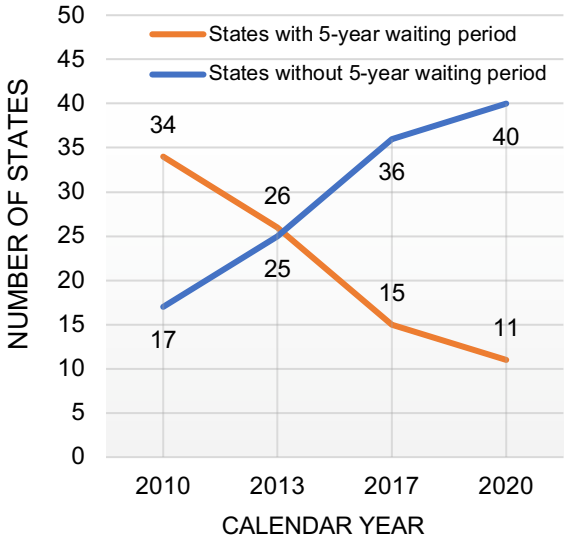
Understanding the health and use of health services among immigrant children should focus holistically on individual as well as macrostructural levels of influence. This dissertation is informed by the socioecological model, a framework that highlights multiple levels of influence, including levels at the individual, built environment, and policy. We selected the socioecological model for its widely established utility in understanding health services use[15-17] and its perspective that individuals are embedded within larger systems in which multiple levels of influence interact and reinforce one another. Each of the levels of influence of the socioecological model contribute to children's health services use and subsequently their health.

One potential explanation for the barriers in obtaining healthcare in the US may be due to the complicated history of public programs mixed with private, employment-based healthcare system. More specifically, policies of federally funded benefit programs, such as Medicaid and Children's Health Insurance Program (CHIP) are critical macrostructural factors that influence the health of immigrant children. While most US-born children from low-income households are eligible for CHIP, these programs are restrictive to immigrants, particularly for undocumented or recently migrated individuals.

Since the welfare reform in 1996 (i.e., Personal Responsibility and Work Opportunity Reconciliation Act, PRWORA), most states held a five-year waiting period for public benefits after establishing legal US residence (i.e., 5-year bar). In 2009, the Children's Health Insurance Program Reauthorization Act (CHIPRA) and the Legal Immigrant Children's Health Improvement Act (ICHIA) gave states the option to expand eligibility by using federal funding to cover lawfully residing immigrant pregnant women and children without imposing the 5-year waiting period. The removal of such a policy expanded eligibility for public insurance programs aimed to assist those unable to purchase private insurance.

As of January 2022, 41 states removed the 5-year waiting period over time.[9] Figure 1 depicts the distribution of states with and without the waiting period between 2010, one year after enactment of CHIPRA, and 2020. The expansion in the public benefits eligibility had positive impact on improving health insurance coverage among foreign-born children with low-income households.[10,11] Yet, studies examining the health impact of the 5-year bar among immigrant children are limited. While the focus of expansions in 1980s and 1990s through PRWORA were not specific to immigrants, this dissertation is informed by previous research that found improvements after Medicaid expansions in various health status, infant birth outcomes, and education outcomes of children.[12–14]

The Patient Protection and Affordable Care Act (ACA), a significant expansion of healthcare coverage, was signed into law in 2010. Its major provisions took effect in 2014. Some of these provisions included prohibiting plans by excluding people for preexisting



Data Source: Henry J. Kaiser Family Foundation annual reports on CHIP and Medicaid eligibility, enrollment, and cost sharing policies

Figure 1. Distribution of states and D.C. with and without the 5-year waiting period for CHIP eligibility among legal immigrants.

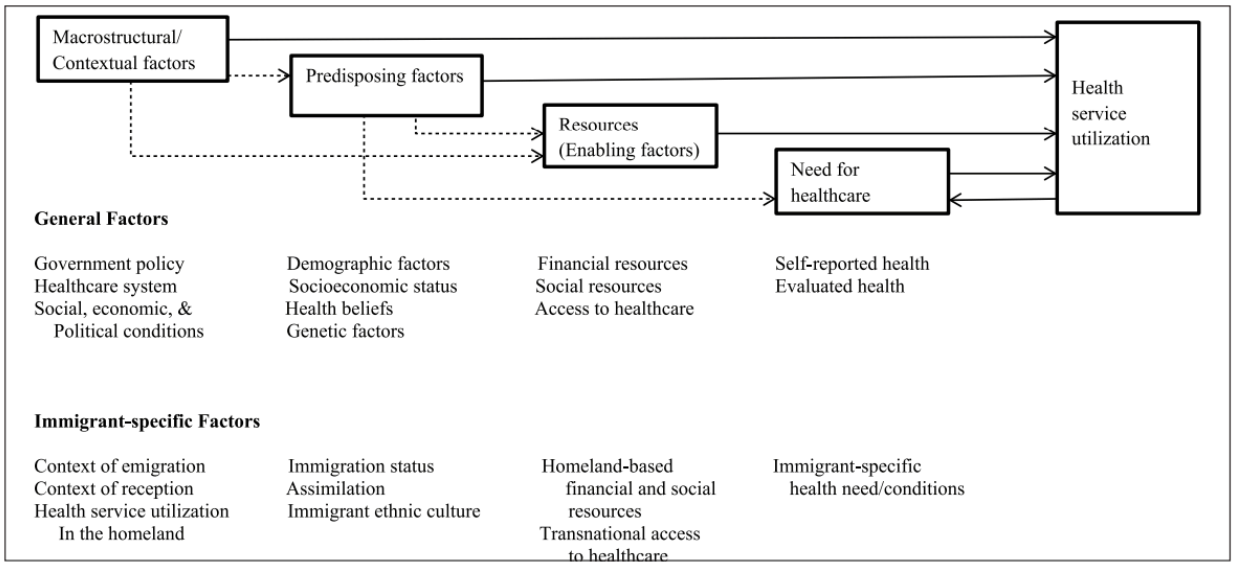
conditions, discriminating based on health status, and imposing annual monetary caps on coverage. It is no doubt that the ACA reduced some of the gaps in coverage across diverse populations in the US. Yet, undocumented immigrants remain ineligible to purchase insurance subsidies through the ACA Marketplaces and apply for Medicaid and CHIP.

Restrictive policies of federally funded programs are just one sociopolitical factor among many that limit immigrant population's access to healthcare services. Most often, factors beyond immigrant families' control make obtaining healthcare difficult. Immigration status, residential neighborhoods marked by poverty, stigma and marginalization all contribute to the security of health care for immigrant families.[2, 4]

The social context of arrival in the US among immigrant children and their families has been suggested to shape their incorporation into the American society. The spatial assimilation theory describes that an important outcome of assimilation and upward mobility in socioeconomic status is residential integration.[15,16] It has been further suggested that individuals are healthier when they reside in neighborhoods with higher concentration of their own racial and ethnic group, also known as the ethnic density effect.[17,18] This protective effect of ethnic density may be especially true for immigrant populations in which it aids for a smooth transition into the US society upon arrival. Thus, it is important to understand the ethnic structure of residence, a unique characteristic of spatial context and a categorization of ethnic density, for immigrant children's use of health services use.

Finally, this dissertation is informed by the Behavioral Model of Health Services Use (also known as the Socio-Behavioral Model or the Andersen model).[18-20] It is a theoretical framework for the access and use of health services. The Andersen model explains health services use by three factors: (1) predisposition to health services use, such as demographic characteristics, social structure and health beliefs, (2) enabling factors, including personal,

Figure 2. Yang and Hwang's adaptation of the Behavioral Model of Health Services Use for immigrants (2016)



family or community resources, and (3) need for care, defined as perceived and clinically evaluated needs. Andersen's model has been revised to incorporate more complex predictors including the health care system and environmental factors including physical, political and economic factors. This framework has been applied to studies of diverse populations, including immigrants.[12, 21-24] However, studies that apply the model often simplify the application to the early versions of the model despite subsequent contributions to integrate the healthcare system and health status outcomes for more effective and efficient access to health care.[25] For instance, only few studies examining health services use among immigrants[12, 23, 24] used predictors relevant to the population, such as English language or host-country language proficiency.

This theoretical framework of health service use has been adapted by Yang and Hwang.[26] It is an extension of the Andersen model that bridge the gaps in the literature to include immigrant-specific factors. This adapted model comprises of four categories of determinants: (1) predisposing factors, (2) enabling factors, (3) need for health care, and (4) macrosocial, structural or contextual conditions – factors within the larger society beyond the individual's control (Figure 2). Each of these domains further included immigrant specific factors.

For instance, context of reception is conceptualized as a contextual factor, and immigration status as a predisposing factor. In addition to these factors, Yang and Hwang hypothesize several pathways between some of the predisposing factors, such as immigration status, and macrostructural/ contextual factors influencing immigrant health services use through other variables. The theory of immigrant health services use guides this inquiry of hypothesized mechanism of child immigration status on their health services use, currently not yet studied among immigrant children.

The overall objective of this dissertation is to address gaps in our knowledge by better understanding social and political determinants that co-occur to influence the health and health services use of immigrant children in the US. In Aim 1, I estimate the indirect effects of children's household generation status on their health services utilization through two paths – first through children's need of health care services, and second through children's insurance status. In Aim 2, I evaluate the effect of the removal of a 5-year bar of public benefits on the health of foreign-born children in low-income households. Finally, in Aim 3, I estimate the association between ethnic structure of residence with the odds of annual preventive health services use over time among immigrant children.

Aim 1. Immigration Status and Use of Health Services Among Children: Multiple Samples Path Analyses of National Survey of Children's Health 2016-2017

Background

Immigrant children and children of mixed-status families experience lower levels of access and utilization compared to US-born children,[4,5,19–22] including preventive services.[6,7,23] Such reduced health insurance coverage and utilization of services among immigrants are also intertwined with factors such as low socioeconomic status (SES), immigration status and insured status.[2,24] When taking a closer look by ethnicity and citizenship status, Latino youth continue to have the worst patterns of access and utilization after implementation of the Patient Protection and Affordable Care Act[25] and noncitizen youth's uninsured status increased from 2007 and 2016.[8] Uninsured children have less access to medical care, including preventive services,[6,7,23] receive inappropriate and more costly care,[26,27] and consequently may forego needed care. Separate connections between health status, insurance coverage, and low SES with healthcare services use of children have been identified. Yet, the mechanism of child immigration status on their health services utilization in relation to these factors are poorly understood.

The Behavioral Model of Health Services Use (also known as the Socio-Behavioral Model or the Andersen model)[28,29] is a theoretical framework that explains health services utilization by three factors: (1) predisposition to health services utilization, such as demographic characteristics, social structure and health beliefs, (2) enabling factors, including personal, family or community resources, and (3) need for care, defined as perceived and clinically evaluated needs. Andersen's model has been revised to incorporate the health care system, environmental, physical, political, and economic factors. An extended framework of the Andersen model was developed for immigrants by Yang and Hwang[30] to bridge the gaps in the

literature and included immigrant-specific factors. For instance, immigration status is conceptualized as a predisposing factor.

Andersen's model has been applied to studies of diverse populations, including immigrants.[6,31–34] However, studies that apply the model often simplify the application to the early version of the model despite modifications that integrated the healthcare system and health status outcomes for understanding access and utilization of health care services.[35] The theory of immigrant health services utilization guides this inquiry of hypothesized mediated paths in the mechanisms of child immigration status on their health services utilization, currently not yet studied among immigrant children and adolescents. Two paths, (1) from children's immigration status to their need of services and consequently their use of services, and (2) from children's immigration status through their health insurance coverage then their use of services, are simultaneous paths unexamined to our knowledge in the literature. Children's need of health services is conceptualized as their health status, as sicker individuals are more likely to seek and use health services beyond preventive services. Children's insurance status, an enabling resource to health services utilization, is hypothesized to buffer children from lack of preventive and other medical services.

In this study, we aim to estimate the indirect effects of children's household generation status on their health services utilization through two paths – first through children's need of health care services, and second through children's insurance status. Immigrants, despite higher poverty rates, lower education levels, and less access to health services, have similar or better health outcomes than US-born Hispanics and non-Hispanic whites.[1] This phenomenon is known as the immigrant paradox. Thus, we hypothesize that 1st and 2nd generation immigrant children (1) have a reduced need for healthcare services than non-immigrant children. (2) Concurrently, immigrant children are more uninsured and therefore have lower prevalence of health services utilization than non-immigrant children. (3) Finally, because of the reduced need

and less insured status among immigrant children, we hypothesize that there is a net lower prevalence of utilization of healthcare services compared to non-immigrant children.

Methods

For this study, the data are from the 2016 and 2017 surveys of the National Survey of Children's Health (NSCH). NSCH provides nationally representative and publicly available data of the health and social determinants of health of non-institutionalized children ages 0 through 17 years. Surveys since 2016 were administered via web and mail and conducted annually by the US Census Bureau. All outreach was conducted in English and Spanish. We used combined, 2016 and 2017 NSCH data to examine the mechanism of children and adolescents' health services utilization. A total of 71,811 parents or caregivers of children completed the surveys for the combined 2016-2017 NSCH.

Due to study design, administration and question changes, annual data prior to 2016 and after 2017 (currently available up to 2020) are not comparable to the data from 2016 and 2017. NSCH data are fully cleaned, and codebooks are available through the Maternal and Child Health Bureau and US Census Bureau websites.

Measures

Household generation status

Household generation status is a derived variable from NSCH that is defined by both children's own nativity and that of their parents. Immigrant children are broadly defined as being born to one or both immigrant parents who are foreign-born. A 1st generation household includes families where the child and their parents are foreign-born. A 2nd generation household includes families where either (1) at least one parent is foreign-born, and the child is US-born; or (2) one parent is US-born, and the other parent and their child are foreign-born. A non-immigrant household includes families where all parents in the household are US-born.

Healthcare services utilization

Healthcare services utilization is defined as having a medical care visit, preventive dental care visit, and a usual source of care in the past 12 months. The use of these services was asked with binary responses, as no visit or at least one visit in the past 12 months. When estimating tetrachoric correlations between the health services utilization outcomes of interest, preventive medical care visit and medical care visit were perfectly correlated (r_{tet} = 1.0). Thus, preventive medical care visit was dropped from the analyses. Three measurements of health services utilization – medical care visit, preventive dental care visit, and usual source of care – were included in the multiple samples path analyses.

Need for healthcare services

The need for healthcare services among children is defined as the need for healthcare by parent-reported health conditions of the children. These conditions included parent-reported overall health status, overall condition of teeth, and weight status. Overall health status and overall condition of teeth are examined as 3-level ordinal variables (i.e. 0 = fair or poor, 1 = good, 2 = excellent or very good). Weight status is categorized using parent-reported height and weight which were then used to calculate the child's body mass index (BMI) in accordance with the Centers for Disease Control and Prevention (CDC) growth chart.[36] Weight status was defined as: 1) underweight, as BMI less than the 5th percentile , 2) healthy weight, as BMI between 5th percentile to less than the 85th percentile, 3) overweight, as BMI between 85th to less than the 95th percentile, and 4) obese as BMI equal to or greater than the 95th percentile of specific age and gender categories. In our analyses, we ordered weight status by its potential risk to use healthcare services. Healthy weight was our referent category, followed by underweight, overweight, then obese.

Insurance status

The NSCH measured current health insurance status as a binary variable. For sensitivity analyses, we substituted insurance status by insurance type and considered it as an ordinal

variable (i.e., currently uninsured, n = 17,186, public only, n = 38,389, public and private insurance, n = 2,844, and private only, n = 3,400).

Socioeconomic status

Socioeconomic status (SES) is considered as a potential modifier of the main paths of interest. SES is a 3-level, derived variable using the household percent federal poverty level and highest education of adult in the household (i.e., low, middle, high). (1) Low SES are families with low federal poverty level (FPL; below 200%) and parent's highest education is less than high school; (2) middle SES are families with low FPL and parent's highest education is more than high school or high FPL (200% or greater) and less than high school education; and (3) high SES are families with high FPL and parent's highest education is more than high school education.

Demographic information and relevant covariates

We considered variables that, according to the literature, may confound the relationships of interest. Potential confounders included child's age, race and ethnicity, and sex. Primary language spoken in the home mediates the path between household generation status and need for healthcare services. However, we did not adjust for it in our final model because it is a collider between household generation status and child's race and ethnicity. The conceptual model of how these social determinants of health relate to the main paths of interest and between each other are shown in Figure 1.

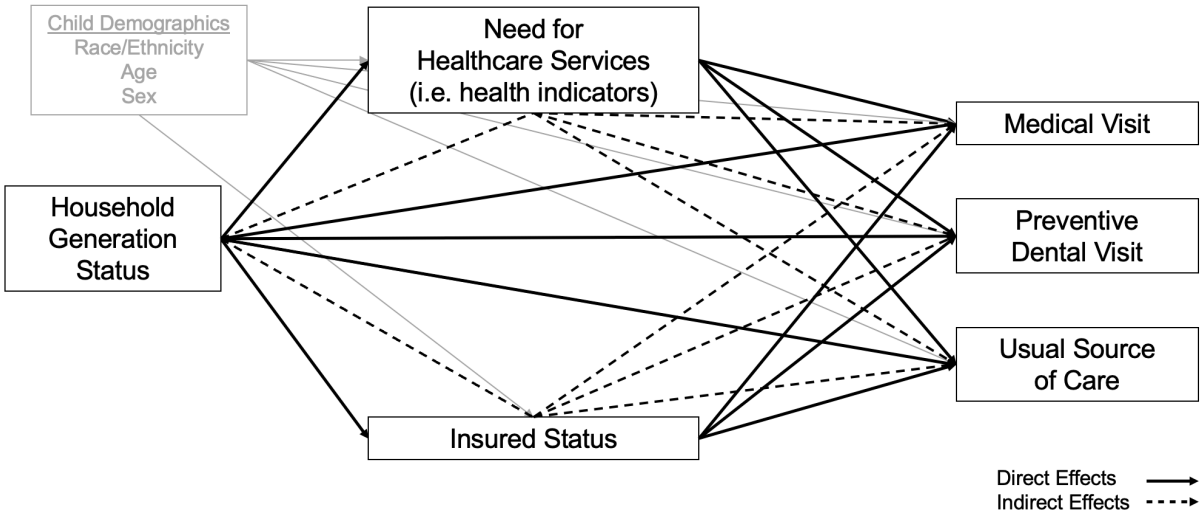


Figure 1. Conceptual model of household generation status and children's health services use

Analytic Sample

A flowchart of participant exclusions used to derive the analytics sample (N = 61,819) is depicted in Figure 2. Although the NSCH derived household generation status includes households labeled as other – child is US-born, and parent nativity is not listed – these children were excluded from the analyses (n = 3,627). Children missing household generation status (n = 807) and additional 1,152 children in 1st or 2nd generation households were excluded if the primary caregiver listed was their grandparents, aunts, uncles, or other. These exclusions were to reduce the heterogeneity of the home environment in the full sample.

Due to the availability of BMI categories available for children and adolescents only over the age of 10 in NSCH, analyses involving weight status are restricted to youth between the ages 10 and 17 (N = 31,780). Similarly, information on dental care services and teeth condition are available for children older than 1 year of age and analyses are restricted to children between the ages 1 and 17 (N = 61,652).

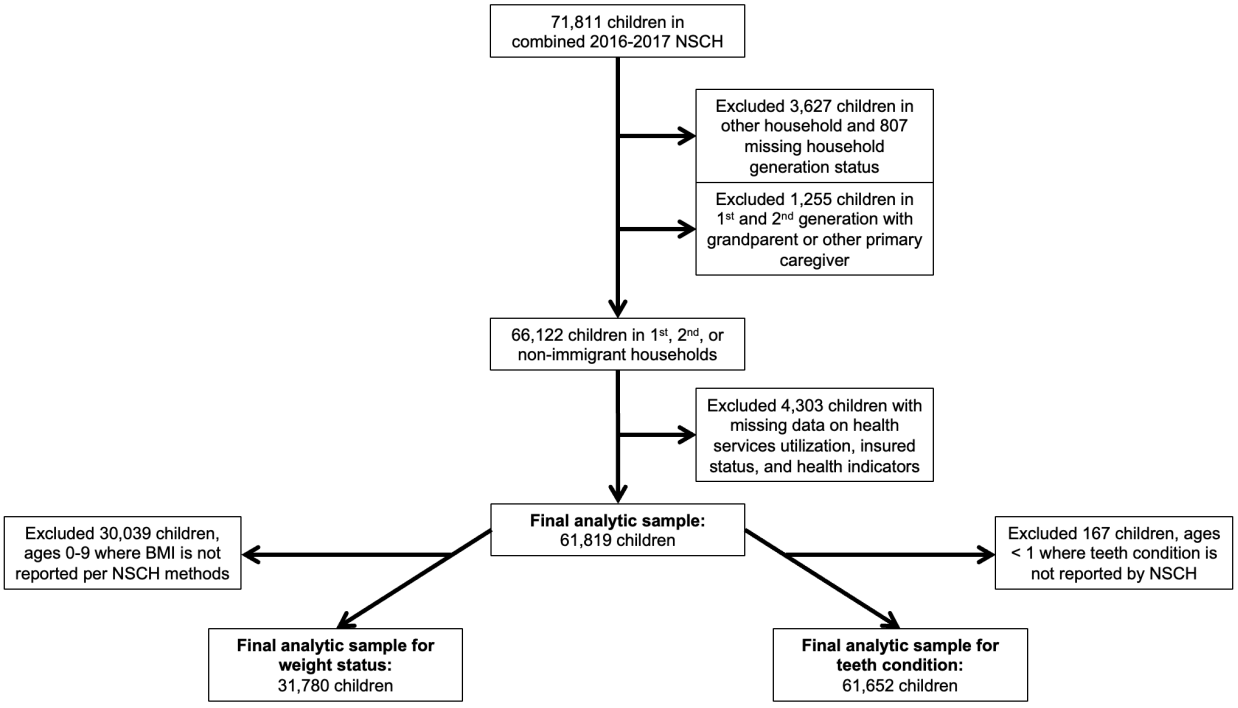


Figure 2. Flowchart of participant exclusions to derive analytic sample (N = 61,819)

Data Analyses

We pooled NSCH samples between 2016 and 2017 and the prevalence estimates represent a pooled, multi-year estimate. Individual year survey weight were adjusted to produce the correct weighted population sizes that reflect an average annual population rather than a cumulated or duplicated period population size, as outlined in the methodology guide to multi-year analysis from the US Census Bureau and NSCH.[37] We conducted univariate analyses and assessment of missingness of the variables of interest. Then we conducted bivariate analyses using Pearson's chi-squared tests to examine independence of various covariates by household generation.

Multiple group path analyses

We then used measured variable, multiple group path analysis to estimate the mechanism of children's immigration status and prevalence of health services utilization through two indirect paths: (1) children's immigration status to their health services utilization through

their need of health care services and (2) children's immigration status to their health services utilization through their insurance status. All three health services utilization outcomes were included in a single model.

The proposed mechanisms of health services utilization of immigrant children and adolescents may be vastly different for those immigrating to the US with higher SES than those of lower SES status. In our analyses, we examined whether the model parameter estimates of the indirect and direct paths vary appreciably across parental SES.

Children's household generation status is our main exogenous variable and we coded it as an indicator variable with the reference as children in non-immigrant household. All remaining endogenous variables are considered as binary or ordinal. We used the fully weighted matrix to compute robust standard errors, a mean and variance-adjusted test statistic, and diagonally weighted least squares to estimate the model parameters. These estimators allowed use of categorical and binary exogenous and endogenous variables. The two indirect associations were calculated as the product of the parameter estimates (path coefficients) along a given path. We estimated the confidence intervals for the indirect associations using Monte Carlo (MC) method with 5,000 samples drawn. The MC method is described in detail elsewhere.[38,39] Briefly, the MC method involves generation of a sampling distribution of the indirect associations by using the point estimates from the multiple samples analyses, along with the asymptotic covariance matrix of these estimates and assumptions about how the statistics are distributed. We included sociodemographic covariates including child age, race and ethnicity, and sex in our final model. We also allowed the residuals of health services utilization outcomes of interest to covary, with the assumption that there exist likely unmeasured factors that relate the use of medical services, use of preventive dental care services and having a usual source of care.

We assessed model fit using three recommended measures for goodness-of-fit: the Root Mean Square Error of Approximation (<0.05), the Comparative Fit Index (>0.95), and

Standardized Root Mean Square Residual (<0.08).[40] We also used the Satorra-Bentler chi-square difference test to compare the goodness-of-fit indices for our full models and nested models, in which at least one path from the full model was constrained to equal zero.

Statistical analyses were carried out using R 4.1.0,[41] the *lavaan.survey* package for the multiple samples path analyses accounting for complex survey weights,[42] and the *semTools* package for the Monte Carlo confidence intervals of the indirect paths.[43]

Sensitivity analyses

We hypothesize that there may be a dose-response relationship between insurance type and the use of healthcare services. There has been some evidence to suggest that extensiveness of coverage for preventive services in one's insurance is associated with the use of preventive and screening services.[44] We conceptualized insurance type as a marker for increased access to health insurance and other income-related services in two ways, in which having no insurance is the referent. The first ordering is no insurance, public insurance, public and private insurance, and private insurance. The second order is no insurance, public and private insurance, private insurance, and public insurance. The two ordering was created in recognition of instances where community centers are the primary clinic of care and public insurance may provide better coverage for preventive services than private insurance. Thus, we tested whether there is an indirect path through insurance type, instead of insurance status, between immigration status and health services utilization.

Second, as NSCH data are cross-sectional surveys, health condition and health services utilization were measured at the same time point. So, it is likely that health services utilization mediates the path between children's immigration status and health indicators, where those who use health services more have better health conditions. In a sensitivity analysis, we estimated the relationship between children's immigration status and need for health care services through four indirect paths: (1) through each of the three health services utilization outcomes and (2) through insurance status.

Results

Demographics

Table 1 describes the sample's sociodemographic and health services use characteristics in total sample and by household generation status. Our analytic sample included 61,819 children from the combined 2016-2017 NSCH data which 911 children were in 1st generation households and 9,207 were in 2nd generation households (14.9%). Across household generations, the distribution of race and ethnicities of the children varied (Figure 3a). About half of the children in 2nd generation households were Hispanic (52%), where most of the children in non-immigrant households were white, non-Hispanic (68%). Generally, children in 1st generation families were older (mean = 10.4 years) than the overall and other households (mean range = 8.9 – 9.0 years; Table 1). Children from 1st generation household, on average, lived in the US for five years and 2nd generation household for six years. Primary caregiver's age was on average 41 years (SD = 8.6). Among 1st generation households, more than 70% spoke a non-English language as the primary language spoken in the home (compared to 43.2% in 2nd generation and 1.5% in non-immigrant households). More children in the 1st generation households were of lower socioeconomic status than 2nd or non-immigrant households (Figure 3b).

Table 1. Weighted characteristics of child, parent and household of NSCH 2016-2017 participants by child/family immigration status, *N* = 61,819

	Total	Household generational status[a]			Chi-Square Test or Point-Biserial Correlation *p*-value
		1st Generation	2nd Generation	Non-immigrant	
Sample size, unweighted *N*	61,819	911	9,207	51,701	
Child characteristics					
Age, Mean (SD)	9.0 (4.9)	10.4 (4.6)	8.9 (4.7)	9.0 (4.9)	< 0.001
Female	49.3%	52.1%	50.3%	48.9%	0.58
Race/ Ethnicity					< 0.001
Hispanic	23.2%	34.9%	52.4%	13.7%	
Black, non-Hispanic	11.5%	15.1%	8.3%	12.4%	
Multi-racial/Other, non-Hispanic	10.4%	32.3%	21.7%	6.2%	
White, non-Hispanic	54.9%	17.7%	17.6%	67.7%	
Years lived in US, Mean (SD)	6.0 (4.8)	5.0 (4.5)	6.0 (12.3)	8.8 (8.7)	< 0.001
Child health status					< 0.001
Excellent or very good	90.5%	81.5%	87.4%	91.8%	
Good	8.2%	14.7%	11.4%	6.9%	
Fair or Poor	1.3%	3.8%	1.2%	1.3%	
Overall condition of teeth[b]					< 0.001
Excellent or very good	80.2%	65.6%	76.2%	81.9%	
Good	14.8%	21.3%	18.0%	13.6%	
Fair or Poor	5.0%	13.1%	5.8%	4.5%	
Current health condition ≥ 1	38.4%	16.4%	30.2%	41.7	< 0.001
Weight status, age 10-17 years only[c]					0.11
Underweight	6.3%	11.6%	6.4%	6.1%	
Healthy	64.2%	65.4%	62.5%	64.8%	
Overweight	14.6%	13.8%	14.6%	14.5%	
Obese	14.9%	9.2%	16.5%	14.6%	
Insurance type					< 0.001
Public only	27.8%	32.3%	38.1%	24.5%	
Private only	62.1%	43.9%	50.5%	66.3%	
Public and private	4.6%	3.6%	4.5%	4.6%	
Currently uninsured	5.5%	20.2%	6.9%	4.6%	

Healthcare services utilization in past 12 mos					
No medical care	13.7%	26.1%	18.6%	11.7%	< 0.001
No preventive care	17.0%	28.5%	21.4%	15.3%	< 0.001
No preventive dental care[b]	19.7%	32.4%	21.0%	19.1%	< 0.001
No usual source of care	19.2%	36.5%	24.6%	17.0%	< 0.001
Parent and household characteristics					
Age, Mean (SD)	40.7 (8.6)	42.1 (8.0)	41.3 (8.1)	40.4 (8.8)	< 0.001
Primary caregiver					< 0.001
Biological or adoptive parent	95.5%	94.4%	98.3%	94.6%	
Step-parent or foster parent	2.5%	5.6%	1.7%	2.7%	
Grandparent	1.7%	N/A	N/A	2.3%	
Other	0.3%	N/A	N/A	0.4%	
Below 200% FPL[d]	39.3%	57.5%	50.1%	35.4%	< 0.001
Socioeconomic Status					< 0.001
Low	18.7%	31.1%	30.0%	14.7%	
Middle	27.2%	32.0%	27.7%	27.0%	
High	54.1%	36.9%	42.3%	58.3%	
Non-English primary language	12.8%	72.0%	43.2%	1.5%	< 0.001
≤ HS education obtained	25.2%	36.6%	37.7%	21.0%	< 0.001

Abbreviations: NSCH, National Survey of Children's Health; SD, standard deviation; mos, months; FPL, federal poverty level; HS, high school; N/A, Not applicable.

[a] 1st generation household: child born abroad, no parent in household born in the US; 2nd generation household: at least one parent in the household born abroad and child born in the US; or one parent in the household born in US and another parent born abroad and child born abroad; Non-immigrant household: all parents in the household born in US, place of child's birth irrelevant

[b] 167 are children less than 1 year of age and are excluded from the overall teeth condition prevalence estimates. Total sample size for teeth condition is 61,652. Sample sizes by generation status are as follows: 1st generation = 910; 2nd generation = 9,181; Non-immigrant = 51,561.

[c] NSCH do not report BMI for children of ages less than 10 years. Therefore, children of ages 0-9 years are excluded from the BMI prevalence estimates (n = 30,039). Total sample size for weight status is 31,780. Sample sizes by generation status are as follows: 1st generation = 500; 2nd generation = 4,411; Non-immigrant = 26,869.

[d] Based on SCHIP qualification groups.

Back to page 15, Results

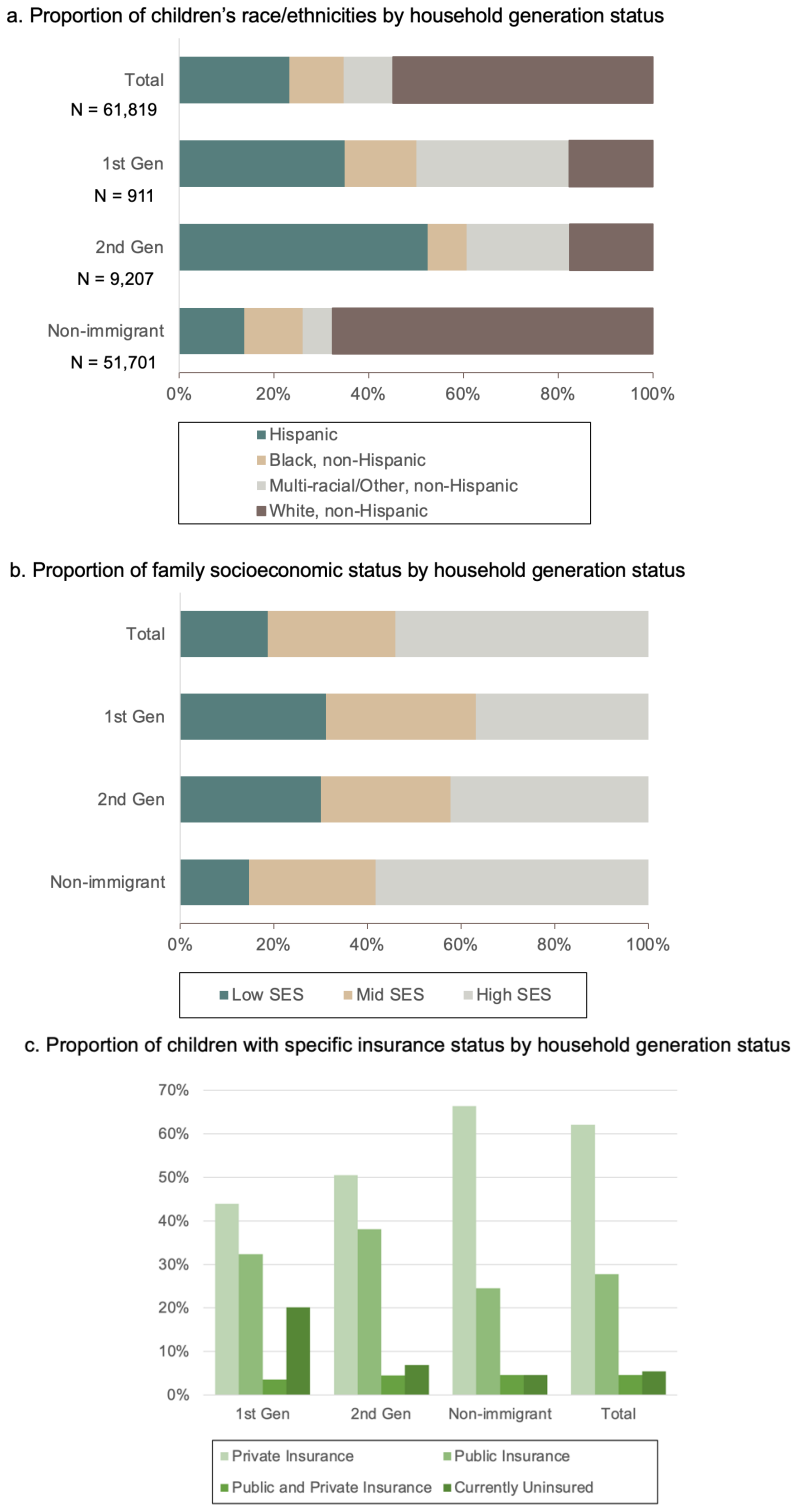


Figure 3. Demographic characteristics of children in analytic sample using NSCH 2016-2017 by household generation status (N = 61,819)

Back to page 15, Results

Overall, children were insured (95%) and when stratified by household generation status, 1st generation households were least insured (currently uninsured 20% versus less than 7% for second and non-immigrant families; Figure 3c). Most of the children reported excellent or very good health (91%) with more of the non-immigrant families (42%) reporting their child having at least one health condition than the 1st or 2nd generation households (16% and 30%, respectively). Greater proportion of 1st generation households reported lack of healthcare services use in the past year than 2nd generation or non-immigrant households.

Overall health status, teeth condition, having more than one current condition, uninsured status, insurance type, SES, race/ethnicity, use of non-English as primary language at home, and all health services utilization outcomes differed by household generation status (Chi-square tests of independence; $p < 0.001$). Children's weight status did not differ by household generation status. Weight status, uninsured status, overall teeth condition, and insurance type were associated with health services utilization. Child's health status was associated with having a usual source of care ($p < 0.01$) but no other measures of health services utilization.

Multiple groups path analysis

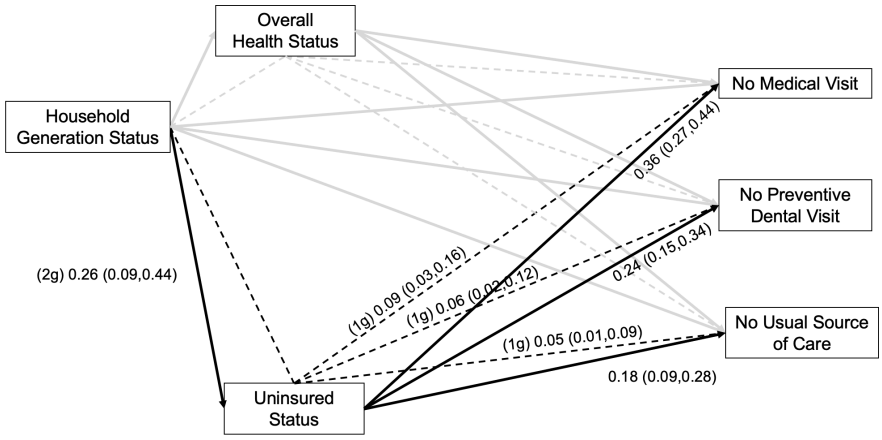
The fully unconstrained path models provided a good fit to the data (Model fit: $\chi^2(53) = 633.2$, RMSEA = 0.01, CFI = 0.95, SRMR = 0.01; Model fits of unconstrained and constrained in Supplementary Table 1). Constraining the structural parameters in our main model to be equal across the three SES groups resulted in a statistically significant worsening of overall model fit (Scaled chi-square test of difference between unconstrained and constrained models: $\chi^2(32) = 48.9$, $p < 0.001$; ΔCFI = 0.03). We rejected the null hypothesis that the direct and indirect paths between household generation status and healthcare services utilization outcomes (as a whole) are the same across the three SES groups. Thus, we report all findings of models by SES groups.

Figure 4 and Supplementary Table 2 shows the estimates of the direct and indirect effects by SES groups when considering current health status and uninsured status as potential

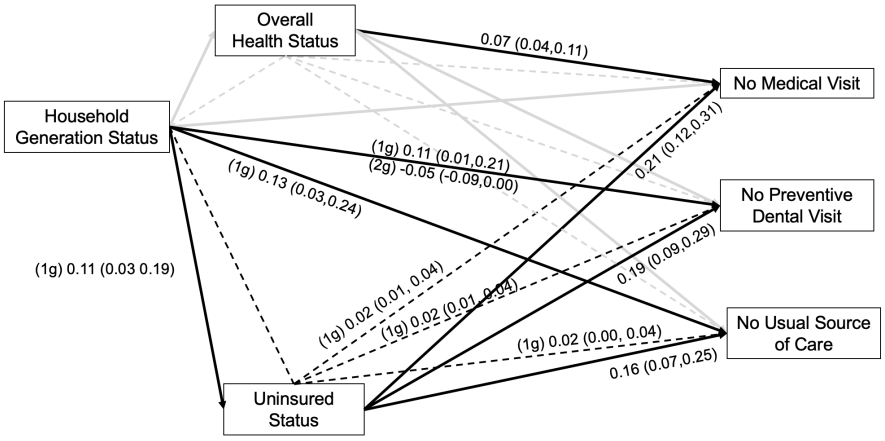
mediators between household generation status and healthcare services utilization outcomes, adjusted for children's age, sex, and race/ethnicity. We found that children in 1st generation households with mid and high SES had greater prevalence of uninsured status, no preventive dental care visit, and no usual source of care than children in non-immigrant households. In addition, for children in low SES group, we found no association between household generation status and healthcare services utilization outcomes. Across the SES groups, we found that uninsured status was positively associated with all healthcare services utilization outcomes. The paths between household generation status and all healthcare services utilization outcomes were mediated by uninsured status for children in 1st generation households compared to those in non-immigrant households – with the strength of the magnitude greatest for children in families with low SES. In all SES groups, we did not find any evidence of indirect associations through overall health status between household generation status and healthcare services utilization.

Unstandardized path coefficients of models that use weight status (Model set 2) and teeth condition (Model set 3) as the health indicators are provided in Supplementary Table 2. Children in 1st generation household in all SES groups had greater prevalence of underweight and normal weight status than those in non-immigrant households. Main findings of direct and indirect associations were similar to the model using overall health condition as the health indicator (Model set 1, Supplementary Table 2).

a. Unstandardized estimates of multiple samples analyses – low SES group (n = 4,624)



b. Unstandardized estimates of multiple samples analyses – middle SES group (n = 13,403)



c. Unstandardized estimates of multiple samples analyses – high SES group (n = 43,792)

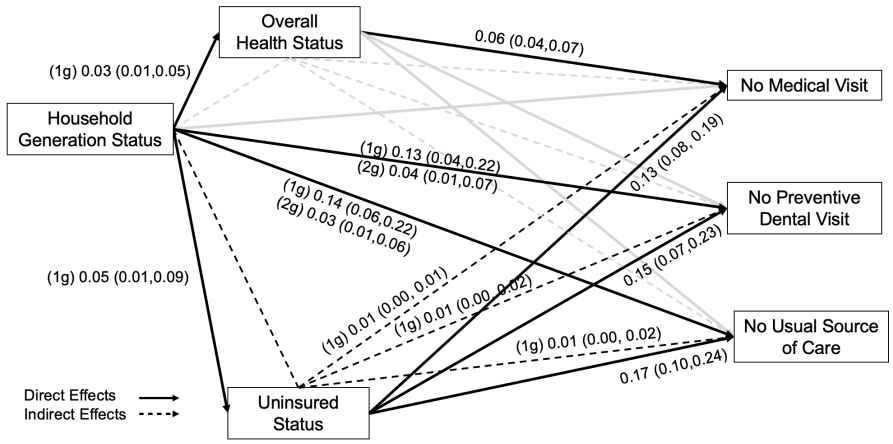


Figure 4. Unstandardized estimates of multiple samples analyses, by socioeconomic status, combined 2016-2017 NSCH estimates

Back to page 19, Multiple groups path analysis results

Sensitivity analyses

In our first set of sensitivity analyses, we changed our mediator of uninsured status to insurance type. Both ordering of insurance type estimated similar coefficients of paths of interest. Results of the models were similar to the model with uninsured status. (Model fit: $\chi^2(50)$ =860.4, RMSEA = 0.01, CFI = 0.91, SRMR = 0.01; Model fits of sensitivity models in Supplementary Table 3). Of note, the better the child's insurance type (both ordinal categorizations), they had lower prevalence of no medical care visit, no preventive dental care visit and no usual source of care (Figure 5). However, we found that there were no indirect paths through insurance type for children in middle and high SES groups for all healthcare services utilization outcomes (Figure 5b, 5c). For children in low SES group, insurance type mediated the association between household generation status (1st generation vs. non-immigrant) and medical care visit (Figure 5a). Findings were robust when using weight status and teeth condition as the health indicator (Supplementary Table 4).

In the second set of sensitivity analyses, we changed our outcomes to the indicators of need of healthcare services (i.e., current health status, weight status, and overall teeth condition) instead of healthcare services utilization as in our main analyses. Only among children in the high SES group, we found that children in 1st generation household had better health status than children in non-immigrant households. There were also no indirect associations through all healthcare services utilization outcomes and insurance status across all SES groups (Figure 6). Findings were robust when using teeth condition as the outcome. When using weight status as our outcome, we found that preventive dental care visit mediated the relationship between household generation status (1st generation vs. non-immigrant) and weight status (Supplementary Table 5).

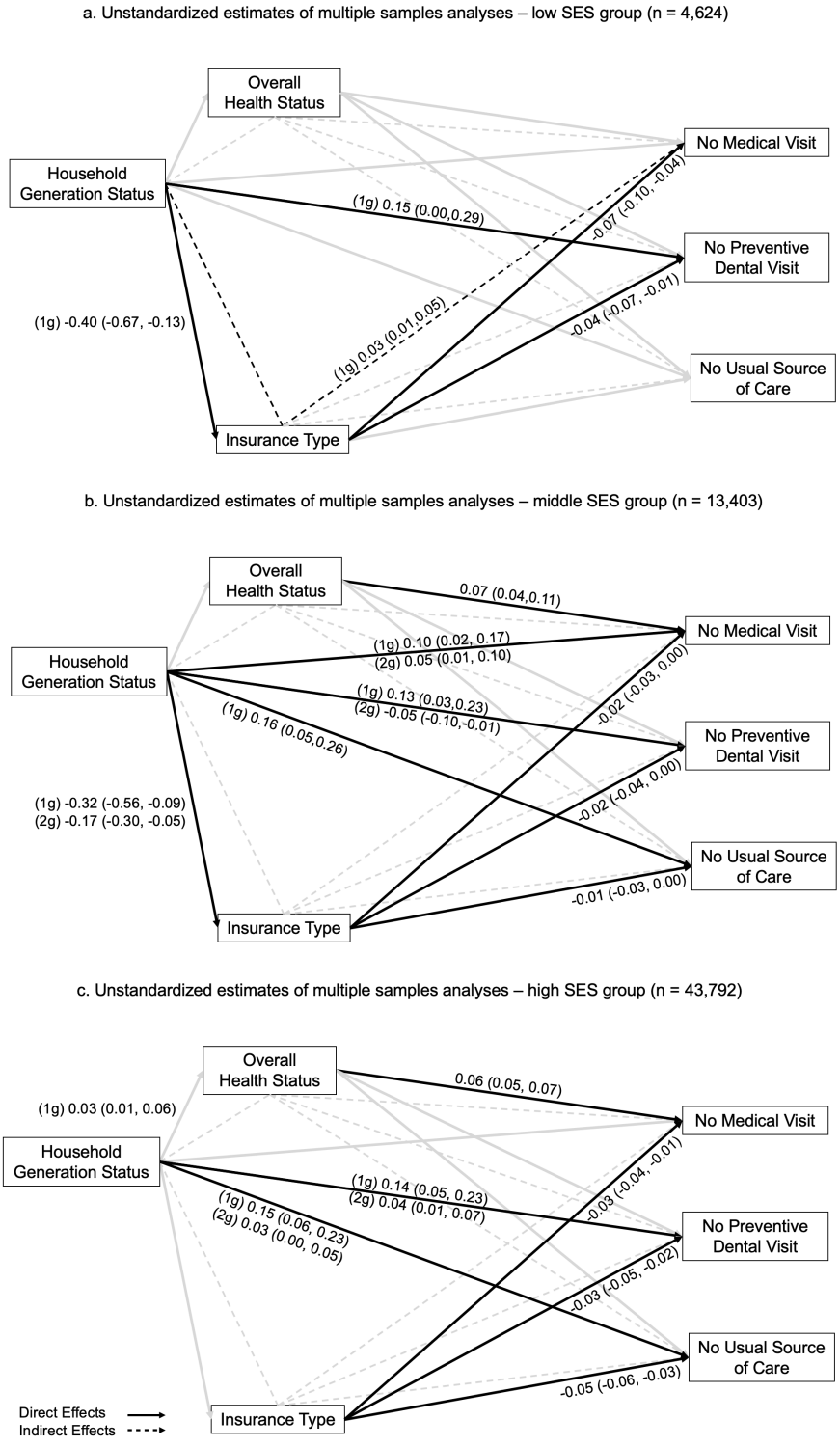


Figure 5. Unstandardized estimates of sensitivity analyses of insurance type as mediator, by socioeconomic status, combined 2016-2017 NSCH estimates

Back to page 22, Results

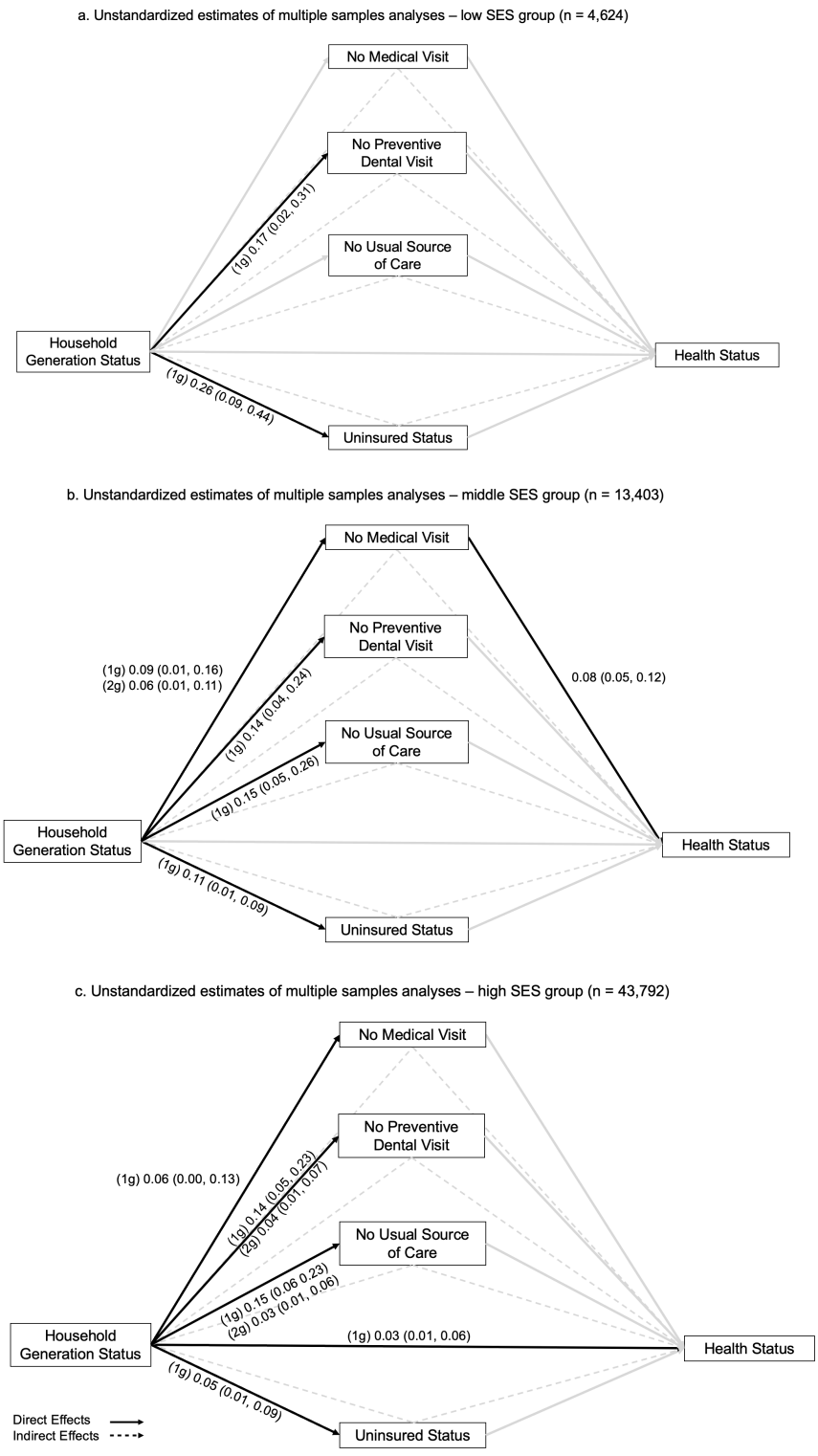


Figure 6. Unstandardized estimates of sensitivity analyses of health services use as mediator, by socioeconomic status, combined 2016-2017 NSCH estimates

Back to page 22, Results

Discussion

This study provides preliminary insight to two simultaneous mediating mechanisms through which household generation status is associated with healthcare services utilization in a nationally representative sample of children. Current uninsured status played an important mediating role between household generation status and healthcare services utilization while the need for healthcare services does not. This was true across families of all SES but the mediating role through uninsured status was strongest for 1st generation, low SES households. Current health condition, overall teeth condition, and weight status are not important pathways between household generation status and healthcare services utilization.

In 2020, 25% of all children (US and foreign born) living in the United States lived with at least one foreign-born parent.[45] The proportion of immigrant families are projected to grow, and they are a vital part of the country's dynamic, social and economic structure. There were also greater racial and ethnic variability among 1st generation families than 2nd or non-immigrant families. The differences in the composition of racial and ethnic groups across the household generations are critical to note with widening racial and ethnic gaps in health disparities and differential access to healthcare services in the US.[46,47]

Children in 1st generation families had higher prevalence of no healthcare services utilization in the past 12 months than those in second generation and non-immigrant families. However, when examining by SES groups, we saw no direct relation between household generation status and healthcare services use for families in low SES. This may be attributed to the slight improvement in insured status in children and youth post-ACA in the current study of nationally representative sample of children in 2016-2017.

We add to the current literature by incorporating two indirect paths through which household generation status is related to children's healthcare services utilization. Uninsured status play mediating role between household generation status and healthcare services utilization, particularly for children in 1st generation families with low SES. The type of insurance

is also important – again, particularly for children in 1st generation families with low SES – but less than current uninsured status.

From these findings, we note that the structure of families by household generation status is important to consider in understanding the use of healthcare services among children. Structural barriers to obtain insurance, particularly for households of low SES, deter insurance coverage for many 1st generation immigrant families. Citizenship and documentation statuses are critical, as insurance programs through the ACA Marketplace are not available for undocumented immigrant families. Public benefits, including insurance programs, are available to legal permanent residents. However, there are state-level restrictions to these public benefits for LPRs allowing states to set 5-year waiting periods before LPRs are eligible for these programs.

In the US, uninsured status can make obtaining care for immigrant families with low socioeconomic status especially difficult. In this current study, more children in 1st generation households were also in low socioeconomic households. In contrast, close to 72% of the non-immigrant households were in high socioeconomic status. Without insurance coverage and access to public benefits, all costs of healthcare services become direct out-of-pocket costs. The economic ability to cover such costs or have insurance coverage may be vastly different by the socioeconomic position of the child's parent(s) and whether they are eligible for public insurance programs. This study's results warrant future studies with longitudinal measurements to understand changes in insured status and types over time to influence children's healthcare services utilization by families' household generation status and SES.

This study provides preliminary insight of two simultaneous mediating mechanisms in which household generation status is associated with healthcare services utilization in a nationally representative sample of children. Along with its strengths to guide future work in reducing disparities in insured status and healthcare services utilization, this study has limitations. First, while we found no evidence of an indirect path through the need of healthcare

services (operationalized using current health status) across all SES groups, this may be because health status is self-reported and may not entirely represent the severity of children's health conditions, if any. This study is a cross-sectional survey of 2016-2017 prevalence and temporality may be imprecise. In a sensitivity analysis, we found robust findings when switching the ordering of current health status and healthcare services utilization, suggesting that the ordering of these two factors may not matter and that the focus of equity in healthcare services should be on improvement of insured status for immigrant families. Nevertheless, longitudinal studies are needed to replicate the current findings.

Other structural factors unmeasured in this study are important to note. The neighborhood of residence may be an implicit mechanism in which immigrant families, particularly those with low socioeconomic status, face spatial barriers in accessing healthcare facilities which may contribute subsequently to health disparities. Also, as previously mentioned, state level restrictions in eligibility of public benefits including health insurance programs are tied to legal status for immigrant children. Finally, survey data is limited in ethnic variability and future research would benefit from disaggregating the current study findings of healthcare services utilization mechanism by ethnic groups.

Conclusion

Findings from this study underscore the need for further research in insurance coverage and use of healthcare services among children in immigrant and mixed status households. Strategies to reach equity in use of healthcare services should focus on the intersection of insurance coverage and socioeconomic status of immigrant and mixed status families. Increased enrollment or elimination of state-level waiting periods for public benefits of insurance programs should also be areas to consider in establishing equity in use of healthcare services, particularly for children immigrant families.

Supplement

Supplementary Table 1. Model fit statistics of unconstrained and constrained multiple samples model by household socioeconomic status (SES) among children, combined 2016-2017 NSCH estimates

Model Set	Model Type	χ^2	χ^2 *p*-value	RMSEA	CFI	SRMR
1	Unconstrained	633.2 (53)	< 0.001	0.007 (0.007, 0.008)	0.95	0.01
	Constrained	1240.1 (85)	< 0.001	0.008 (0.007, 0.008)	0.92	0.01
	Difference	48.9 (32)	0.03	0	0.03	0.004
2	Unconstrained	432.8 (53)	< 0.001	0.026 (0.024, 0.028)	0.92	0.01
	Constrained	720.7 (85)	< 0.001	0.006 (0.005, 0.007)	0.93	0.01
	Difference	34.0 (32)	0.37	-0.001	0.013	0.004
3	Unconstrained	744.9 (53)	< 0.001	0.008 (0.008, 0.009)	0.95	0.01
	Constrained	1305.1 (85)	< 0.001	0.008 (0.008, 0.009)	0.92	0.01
	Difference	47.7 (32)	0.04	0	0.025	0.003

Abbreviations: RMSEA, Root Mean Square Error of Approximation; CFI, Comparative Fit Index; SRMR, Standardized Root Mean Square Residual

Back to page 19, Results

Supplementary Table 2. Unstandardized path coefficients of multiple samples path analyses models by household socioeconomic status among children, combined 2016-2017 NSCH estimates

Model Set	Outcomes	Paths		Direct Path of Household Generation Status (ref. = non-immigrant)			Indirect Path (ref. = non-immigrant)	
				1st gen	2nd gen		1st gen	2nd gen
1	No medical care visit in last 12 mos.		Low SES	0.04 (-0.09, 0.16)	0.05 (-0.01, 0.11)			
			Mid SES	0.07 (0.00, 0.15)	0.06 (0.00, 0.11)			
			High SES	0.05 (-0.01, 0.12)	-0.01 (-0.03, 0.01)			
		Through health status				Low SES	0.00 (-0.02, 0.01)	0.00 (-0.01, 0.00)
						Mid SES	-0.01 (-0.03, 0.00)	0.00 (0.00, 0.00)
						High SES	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
		Through uninsured status				Low SES	0.09 (0.03, 0.16)	-0.01 (-0.03, 0.00)
						Mid SES	0.02 (0.01, 0.04)	0.01 (0.00, 0.02)
						High SES	0.01 (0.00, 0.01)	0.00 (0.00, 0.00)
	No preventive dental care visit in last 12 mos.		Low SES	0.11 (-0.04, 0.25)	-0.01 (-0.08, 0.05)			
			Mid SES	0.11 (0.01, 0.21)	-0.05 (-0.09, 0.00)			
			High SES	0.13 (0.04, 0.22)	0.04 (0.01, 0.07)			
		Through health status				Low SES	0.00 (-0.01, 0.01)	0.00 (0.00, 0.00)
						Mid SES	0.01 (0.00, 0.02)	0.00 (0.00, 0.00)
						High SES	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
		Through uninsured status				Low SES	0.06 (0.02, 0.12)	-0.01 (-0.02, 0.00)
						Mid SES	0.02 (0.01, 0.04)	0.01 (0.00, 0.02)
						High SES	0.01 (0.00, 0.02)	0.00 (0.00, 0.01)

	Usual source of care		Low SES	0.04 (-0.11, 0.18)	0.00 (-0.07, 0.06)			
			Mid SES	0.13 (0.03, 0.24)	0.03 (-0.02, 0.08)			
			High SES	0.14 (0.06, 0.22)	0.03 (0.01, 0.06)			
		Through health status				Low SES	-0.01 (-0.02, 0.00)	0.00 (-0.01, 0.00)
						Mid SES	0.00 (0.00, 0.01)	0.00 (0.00, 0.00)
						High SES	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
		Through uninsured status				Low SES	0.05 (0.01, 0.09)	-0.01 (-0.02, 0.00)
						Mid SES	0.02 (0.00, 0.04)	0.01 (0.00, 0.01)
						High SES	0.01 (0.00, 0.02)	0.00 (0.00, 0.01)
	Health status		Low SES	-0.14 (-0.30, 0.02)	-0.04 (-0.11, 0.03)			
			Mid SES	-0.15 (-0.32, 0.01)	0.01 (-0.03, 0.05)			
			High SES	0.03 (0.01, 0.05)	0.01 (-0.01, 0.03)			
	Uninsured status		Low SES	0.26 (0.09, 0.44)	-0.04 (-0.08, 0.00)			
			Mid SES	0.11 (0.03, 0.19)	0.04 (-0.01, 0.08)			
			High SES	0.05 (0.01, 0.09)	0.01 (-0.01, 0.03)			
2	No medical care visit in last 12 mos.		Low SES	0.14 (-0.03, 0.31)	0.06 (-0.03, 0.15)			
			Mid SES	0.10 (-0.04, 0.23)	0.04 (-0.03, 0.11)			
			High SES	0.06 (-0.02, 0.13)	-0.01 (-0.04, 0.02)			
		Through weight status				Low SES	-0.01 (-0.03, 0.01)	0.00 (-0.01, 0.00)
						Mid SES	-0.01 (-0.01, 0.00)	0.00 (-0.01, 0.00)
						High SES	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
		Through uninsured status				Low SES	0.09 (0.01, 0.19)	-0.01 (-0.03, 0.01)
						Mid SES	0.04 (0.00, 0.07)	0.01 (-0.01, 0.03)
						High SES	0.01 (0.00, 0.02)	0.00 (0.00, 0.00)

No preventive dental care visit in last 12 mos.		Low SES	0.14 (-0.07, 0.35)	-0.04 (-0.12, 0.04)			
		Mid SES	0.10 (-0.03, 0.22)	-0.02 (-0.08, 0.04)			
		High SES	0.08 (-0.01, 0.16)	-0.01 (-0.04, 0.02)			
	Through weight status				Low SES	0.01 (-0.01, 0.02)	0.00 (0.00, 0.01)
					Mid SES	-0.01 (-0.02, 0.00)	0.00 (-0.01, 0.00)
					High SES	0.00 (-0.01, 0.00)	0.00 (0.00, 0.00)
	Through uninsured status				Low SES	0.05 (0.00, 0.11)	-0.01 (-0.03, 0.01)
					Mid SES	0.03 (0.00, 0.06)	0.01 (-0.01, 0.02)
					High SES	0.01 (0.00, 0.02)	0.00 (0.00, 0.00)
Usual source of care		Low SES	0.05 (-0.15, 0.25)	0.00 (-0.10, 0.09)			
		Mid SES	0.18 (0.02, 0.35)	0.02 (-0.05, 0.09)			
		High SES	0.11 (0.03, 0.20)	0.02 (-0.02, 0.05)			
	Through weight status				Low SES	-0.01 (-0.03, 0.01)	0.00 (-0.01, 0.00)
					Mid SES	0.00 (-0.01, 0.00)	0.00 (-0.01, 0.00)
					High SES	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
	Through uninsured status				Low SES	0.04 (0.00, 0.10)	-0.01 (-0.03, 0.00)
					Mid SES	0.02 (0.00, 0.06)	0.01 (0.00, 0.03)
					High SES	0.01 (0.00, 0.03)	0.00 (0.00, 0.00)
Weight status		Low SES	-0.46 (-0.86, -0.05)	-0.14 (-0.40, 0.12)			
		Mid SES	-0.31 (-0.62, 0.00)	-0.13 (-0.35, 0.08)			
		High SES	-0.12 (-0.32, 0.09)	-0.07 (-0.21, 0.07)			
Uninsured status		Low SES	0.27 (0.03, 0.51)	-0.04 (-0.10, 0.03)			
		Mid SES	0.13 (0.00, 0.25)	0.04 (-0.02, 0.09)			
		High SES	0.05 (0.00, 0.11)	-0.01 (-0.02, 0.01)			

3	No medical care visit in last 12 mos.		Low SES	0.03 (-0.09, 0.15)	0.04 (-0.02, 0.11)		
			Mid SES	0.06 (-0.01, 0.14)	0.06 (0.00, 0.11)		
			High SES	0.06 (-0.01, 0.12)	-0.01 (-0.03, 0.01)		
		Through teeth condition				Low SES	0.00 (-0.02, 0.01) 0.00 (0.00, 0.00)
						Mid SES	0.00 (-0.01, 0.00) 0.00 (0.00, 0.00)
						High SES	0.00 (0.00, 0.00) 0.00 (0.00, 0.00)
		Through uninsured status				Low SES	0.09 (0.03, 0.16) -0.01 (-0.03, 0.00)
						Mid SES	0.02 (0.01, 0.04) 0.01 (0.00, 0.02)
						High SES	0.01 (0.00, 0.01) 0.00 (0.00, 0.00)
	No preventive dental care visit in last 12 mos.		Low SES	0.10 (-0.05, 0.24)	-0.02 (-0.08, 0.04)		
			Mid SES	0.11 (0.02, 0.21)	-0.05 (-0.09, 0.00)		
			High SES	0.13 (0.04, 0.22)	0.04 (0.01, 0.07)		
		Through teeth condition				Low SES	0.01 (-0.01, 0.03) 0.00 (0.00, 0.01)
						Mid SES	0.00 (0.00, 0.01) 0.00 (0.00, 0.00)
						High SES	0.00 (0.00, 0.00) 0.00 (0.00, 0.00)
		Through uninsured status				Low SES	0.06 (0.02, 0.12) -0.01 (-0.02, 0.00)
						Mid SES	0.02 (0.01, 0.04) 0.01 (0.00, 0.02)
						High SES	0.01 (0.00, 0.02) 0.00 (0.00, 0.01)
	Usual source of care		Low SES	0.04 (-0.11, 0.18)	-0.01 (-0.07, 0.06)		
			Mid SES	0.14 (0.03, 0.24)	0.03 (-0.02, 0.08)		
			High SES	0.14 (0.05, 0.22)	0.03 (0.01, 0.06)		

	Through teeth condition				Low SES	-0.01 (-0.03, 0.01) 0.00 (-0.01, 0.00)
					Mid SES	0.00 (0.00, 0.01) 0.00 (0.00, 0.00)
					High SES	0.00 (0.00, 0.00) 0.00 (0.00, 0.00)
	Through uninsured status				Low SES	0.05 (0.01, 0.09) -0.01 (-0.02, 0.00)
					Mid SES	0.02 (0.00, 0.04) 0.01 (0.00, 0.01)
					High SES	0.01 (0.00, 0.02) 0.00 (0.00, 0.01)
Teeth condition		Low SES	-0.33 (-0.61, -0.05)	-0.05 (-0.15, 0.04)		
		Mid SES	-0.17 (-0.34, 0.01)	0.03 (-0.04, 0.09)		
		High SES	-0.06 (-0.12, 0.01)	-0.01 (-0.05, 0.03)		
Uninsured status		Low SES	0.26 (0.09, 0.44)	-0.04 (-0.08, 0.00)		
		Mid SES	0.11 (0.03, 0.19)	0.04 (-0.01, 0.08)		
		High SES	0.05 (0.01, 0.09)	0.01 (-0.01, 0.03)		

Notes: Number in parentheses are 95% confidence intervals. Monte Carlo confidence intervals with 5,000 samples are provided for indirect paths. Covariance between each of the healthcare services utilization outcomes. Child's racial/ethnic minority, age, and sex are adjusted as in Figure 1. All models fit were good with RMSEA (<0.05), CFI (>0.95), and SRMR (<0.08) and provided in detail in Supplementary Table 1.
Abbreviations: NSCH, National Survey of Children's Health; SES, socioeconomic status; mos, months.

Back to page 19, Results

Supplementary Table 3. Model fit statistics of unconstrained, multiple samples models by household socioeconomic status (SES) for sensitivity analyses among children, combined 2016-2017 NSCH estimates

Model Set	χ^2	χ^2 *p*-value	RMSEA	CFI	SRMR
4	860.4 (50)	< 0.001	0.011 (0.010, 0.012)	0.91	0.01
5	472.7 (50)	< 0.001	0.009 (0.008, 0.010)	0.86	0.01
6	844.2 (50)	< 0.001	0.011 (0.010, 0.012)	0.92	0.01
7	632.1 (50)	< 0.001	0.008 (0.007, 0.009)	0.94	0.01
8	421.8 (50)	< 0.001	0.007 (0.006, 0.008)	0.91	0.01
9	637.0 (50)	< 0.001	0.008 (0.007, 0.009)	0.94	0.01

Abbreviations: RMSEA, Root Mean Square Error of Approximation; CFI, Comparative Fit Index; SRMR, Standardized Root Mean Square Residual

Back to page 22, Results

Supplementary Table 4. Sensitivity analyses using insurance type as mediator: Unstandardized path coefficients of multiple samples model by household socioeconomic status among children, combined 2016-2017 NSCH estimates

Model Set	Outcomes	Paths		Direct Effect of Household Generation Status (ref. = non-immigrant)			Indirect Effect (ref. = non-immigrant)	
				1st gen	2nd gen		1st gen	2nd gen
4	No medical care visit in last 12 mos.		Low SES	0.09 (-0.06, 0.23)	0.03 (-0.03, 0.09)			
			Mid SES	0.10 (0.02, 0.17)	0.05 (0.01, 0.10)			
			High SES	0.06 (0.00, 0.12)	-0.01 (-0.03, 0.01)			
		Through health status				Low SES	0.00 (-0.02, 0.01)	0.00 (-0.01, 0.00)
						Mid SES	-0.01 (-0.03, 0.00)	0.00 (0.00, 0.00)
						High SES	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
		Through insurance type				Low SES	0.03 (0.01, 0.05)	-0.01 (-0.01, 0.00)
						Mid SES	0.01 (0.00, 0.01)	0.00 (0.00, 0.01)
						High SES	0.00 (0.00, 0.01)	0.00 (0.00, 0.00)
	No preventive dental care visit in last 12 mos.		Low SES	0.15 (0.00, 0.29)	-0.03 (-0.09, 0.04)			
			Mid SES	0.13 (0.03, 0.23)	-0.05 (-0.09, -0.01)			
			High SES	0.14 (0.05, 0.23)	0.04 (0.01, 0.07)			
		Through health status				Low SES	0.00 (-0.01, 0.01)	0.00 (0.00, 0.00)
						Mid SES	0.01 (0.00, 0.02)	0.00 (0.00, 0.00)
						High SES	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
		Through insurance type				Low SES	0.01 (0.00, 0.03)	0.00 (-0.01, 0.00)
						Mid SES	0.01 (0.00, 0.02)	0.00 (0.00, 0.01)
						High SES	0.00 (0.00, 0.01)	0.00 (0.00, 0.00)

	Usual source of care		Low SES	0.07 (-0.08, 0.21)	-0.01 (-0.08, 0.05)			
			Mid SES	0.16 (0.05, 0.26)	0.02 (-0.03, 0.07)			
			High SES	0.15 (0.06, 0.23)	0.03 (0.00, 0.05)			
		Through health status				Low SES	-0.01 (-0.02, 0.00)	0.00 (-0.01, 0.00)
						Mid SES	0.00 (0.00, 0.01)	0.00 (0.00, 0.00)
						High SES	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
		Through insurance type				Low SES	0.01 (0.00, 0.03)	0.00 (-0.01, 0.00)
						Mid SES	0.01 (0.00, 0.01)	0.00 (0.00, 0.01)
						High SES	0.01 (0.00, 0.01)	0.00 (0.00, 0.00)
	Health status		Low SES	-0.15 (-0.31, 0.02)	-0.05 (-0.12, 0.03)			
			Mid SES	-0.15 (-0.31, 0.02)	0.01 (-0.03, 0.05)			
			High SES	0.03 (0.01, 0.06)	0.01 (-0.01, 0.03)			
	Insurance type		Low SES	-0.40 (-0.67, -0.13)	0.07 (-0.05, 0.18)			
			Mid SES	-0.32 (-0.56, -0.09)	-0.17 (-0.30, -0.05)			
			High SES	-0.12 (-0.26, 0.01)	-0.01 (-0.09, 0.06)			
5	No medical care visit in last 12 mos.		Low SES	0.17 (-0.04, 0.38)	0.04 (-0.06, 0.13)			
			Mid SES	0.14 (0.01, 0.27)	0.05 (-0.02, 0.13)			
			High SES	0.06 (-0.02, 0.13)	-0.01 (-0.04, 0.02)			
		Through weight status				Low SES	-0.01 (-0.03, 0.01)	0.00 (-0.01, 0.00)
						Mid SES	0.00 (-0.01, 0.00)	0.00 (-0.01, 0.00)
						High SES	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
		Through insurance type				Low SES	0.04 (0.01, 0.08)	0.00 (-0.01, 0.00)
						Mid SES	0.00 (-0.01, 0.02)	0.00 (0.00, 0.01)
						High SES	0.01 (0.00, 0.02)	0.00 (0.00, 0.00)

No preventive dental care visit in last 12 mos.		Low SES	0.15 (-0.06, 0.35)	-0.05 (-0.13, 0.03)			
		Mid SES	0.11 (-0.02, 0.25)	-0.02 (-0.08, 0.04)			
		High SES	0.08 (-0.01, 0.17)	-0.01 (-0.04, 0.02)			
	Through weight status				Low SES	0.01 (0.00, 0.02)	0.00 (0.00, 0.01)
					Mid SES	-0.01 (-0.02, 0.00)	0.00 (-0.01, 0.00)
					High SES	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
	Through insurance type				Low SES	0.02 (0.00, 0.05)	0.00 (-0.01, 0.01)
					Mid SES	0.01 (0.00, 0.03)	0.01 (0.00, 0.02)
					High SES	0.01 (0.00, 0.02)	0.00 (0.00, 0.00)
Usual source of care		Low SES	0.08 (-0.12, 0.27)	-0.01 (-0.10, 0.09)			
		Mid SES	0.22 (0.05, 0.38)	0.03 (-0.04, 0.10)			
		High SES	0.11 (0.02, 0.20)	0.01 (-0.02, 0.05)			
	Through weight status				Low SES	-0.01 (-0.03, 0.00)	0.00 (-0.01, 0.00)
					Mid SES	0.00 (-0.02, 0.00)	0.00 (-0.01, 0.00)
					High SES	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
	Through insurance type				Low SES	0.01 (-0.02, 0.04)	0.00 (-0.01, 0.00)
					Mid SES	0.00 (-0.01, 0.02)	0.00 (0.00, 0.01)
					High SES	0.01 (0.00, 0.02)	0.00 (-0.01, 0.01)
Weight status		Low SES	-0.45 (-0.87, -0.03)	-0.15 (-0.41, 0.11)			
		Mid SES	-0.30 (-0.60, 0.02)	-0.12 (-0.33, 0.10)			
		High SES	-0.11 (-0.31, 0.10)	-0.07 (-0.21, 0.07)			
Insurance type		Low SES	-0.53 (-0.90, -0.15)	0.02 (-0.16, 0.19)			
		Mid SES	-0.40 (-0.76, -0.04)	-0.22 (-0.41, -0.03)			
		High SES	-0.23 (-0.44, -0.02)	0.01 (-0.09, 0.11)			

6	No medical care visit in last 12 mos.		Low SES	0.08 (-0.06, 0.23)	0.03 (-0.04, 0.09)		
			Mid SES	0.09 (0.01, 0.16)	0.05 (0.01, 0.10)		
			High SES	0.06 (0.00, 0.12)	-0.01 (-0.03, 0.01)		
		Through teeth condition				Low SES	0.00 (-0.02, 0.02) 0.00 (0.00, 0.00)
						Mid SES	0.00 (-0.01, 0.00) 0.00 (0.00, 0.00)
						High SES	0.00 (0.00, 0.00) 0.00 (0.00, 0.00)
		Through insurance type				Low SES	0.03 (0.01, 0.05) -0.01 (-0.01, 0.00)
						Mid SES	0.01 (0.00, 0.01) 0.00 (0.00, 0.01)
						High SES	0.00 (0.00, 0.01) 0.00 (0.00, 0.00)
	No preventive dental care visit in last 12 mos.		Low SES	0.14 (-0.01, 0.28)	-0.03 (-0.09, 0.04)		
			Mid SES	0.13 (0.03, 0.23)	-0.05 (-0.09, -0.01)		
			High SES	0.14 (0.05, 0.23)	0.04 (0.01, 0.07)		
		Through teeth condition				Low SES	0.01 (-0.01, 0.03) 0.00 (0.00, 0.01)
						Mid SES	0.00 (0.00, 0.01) 0.00 (0.00, 0.00)
						High SES	0.00 (0.00, 0.00) 0.00 (0.00, 0.00)
		Through insurance type				Low SES	0.01 (0.00, 0.03) 0.00 (-0.01, 0.00)
						Mid SES	0.01 (0.00, 0.02) 0.00 (0.00, 0.01)
						High SES	0.00 (0.00, 0.01) 0.00 (0.00, 0.00)
	Usual source of care		Low SES	0.07 (-0.08, 0.21)	-0.01 (-0.08, 0.05)		
			Mid SES	0.16 (0.05, 0.64)	0.02 (-0.03, 0.07)		
			High SES	0.14 (0.06, 0.23)	0.03 (0.00, 0.05)		

	Through teeth condition				Low SES	-0.01 (-0.02, 0.01) 0.00 (-0.01, 0.00)
					Mid SES	0.00 (0.00, 0.01) 0.00 (0.00, 0.00)
					High SES	0.00 (0.00, 0.00) 0.00 (0.00, 0.00)
	Through insurance type				Low SES	0.01 (0.00, 0.03) 0.00 (-0.01, 0.00)
					Mid SES	0.00 (0.00, 0.01) 0.00 (0.00, 0.01)
					High SES	0.01 (0.00, 0.01) 0.00 (0.00, 0.00)
Teeth condition		Low SES	-0.35 (-0.63, -0.06)	-0.06 (-0.16, 0.03)		
		Mid SES	-0.14 (-0.31, 0.02)	0.02 (-0.05, 0.09)		
		High SES	-0.05 (-0.12, 0.01)	-0.01 (-0.05, 0.03)		
Insurance type		Low SES	-0.40 (-0.67, -0.13)	0.07 (-0.05, 0.18)		
		Mid SES	-0.32 (-0.56, -0.09)	-0.17 (-0.30, -0.05)		
		High SES	-0.12 (-0.26, 0.01)	-0.02 (-0.09, 0.06)		

Notes: Number in parentheses are 95% confidence intervals. Monte Carlo confidence intervals with 5,000 samples are provided for indirect paths. Covariance between 1) each of the healthcare services utilization outcomes, and 2) between the outcomes and insurance type. Child's racial/ethnic minority, age, and sex are adjusted. All models fit were good with RMSEA (<0.05), CFI (>0.95), and SRMR (<0.08) and provided in detail in Supplementary Table 2.

Abbreviations: NSCH, National Survey of Children's Health; SES, socioeconomic status; mos, months.

Back to page 22, Results

Supplementary Table 5. Sensitivity analyses using healthcare services outcomes as mediator: Unstandardized path coefficients of multiple samples model by household socioeconomic status among children, combined 2016-2017 NSCH estimates

Model Set	Outcomes	Paths		Direct Effect of Household Generation Status (ref. = non-immigrant)			Indirect Effect (ref. = non-immigrant)	
				1st gen	2nd gen		1st gen	2nd gen
7	Health status		Low SES	-0.15 (-0.31, 0.01)	-0.04 (-0.12, 0.03)			
			Mid SES	-0.15 (-0.31, 0.02)	0.01 (-0.04, 0.05)			
			High SES	0.03 (0.01, 0.06)	0.01 (-0.01, 0.03)			
		Through no medical care visit in last 12 mos.						
						Low SES	0.00 (-0.01, 0.02)	0.00 (0.00, 0.01)
						Mid SES	0.01 (0.00, 0.02)	0.01 (0.00, 0.01)
						High SES	0.00 (0.00, 0.01)	0.00 (0.00, 0.00)
		Through no preventive dental care visit in last 12 mos.						
						Low SES	0.00 (-0.01, 0.02)	0.00 (-0.01, 0.00)
						Mid SES	0.00 (-0.01, 0.00)	0.00 (0.00, 0.00)
						High SES	0.00 (-0.01, 0.00)	0.00 (0.00, 0.00)
		Through usual source of care						
						Low SES	0.00 (0.00, 0.02)	0.00 (-0.01, 0.00)
						Mid SES	0.00 (-0.01, 0.00)	0.00 (0.00, 0.00)
						High SES	0.00 (-0.01, 0.00)	0.00 (0.00, 0.00)
		Through uninsured status						
						Low SES	0.00 (-0.02, 0.03)	0.00 (0.00, 0.00)
						Mid SES	0.00 (-0.01, 0.00)	0.00 (-0.01, 0.00)
						High SES	0.00 (-0.01, 0.00)	0.00 (0.00, 0.00)
	No medical care visit		Low SES	0.13 (-0.02, 0.28)	0.04 (-0.03, 0.10)			

	in last 12 mos.							
			Mid SES	0.09 (0.01, 0.16)	0.06 (0.01, 0.11)			
			High SES	0.06 (0.00, 0.13)	-0.01 (-0.03, 0.01)			
	No preventive dental care visit in last 12 mos.		Low SES	0.17 (0.02, 0.31)	-0.02 (-0.09, 0.04)			
			Mid SES	0.14 (0.04, 0.24)	-0.04 (-0.09, 0.01)			
			High SES	0.14 (0.05, 0.23)	0.04 (0.01, 0.07)			
	Usual source of care		Low SES	0.08 (-0.07, 0.22)	-0.01 (-0.08, 0.05)			
			Mid SES	0.15 (0.05, 0.26)	0.03 (-0.02, 0.08)			
			High SES	0.15 (0.06, 0.23)	0.03 (0.01, 0.06)			
	Uninsured status		Low SES	0.26 (0.09, 0.44)	-0.04 (-0.08, 0.00)			
			Mid SES	0.11 (0.03, 0.19)	0.04 (-0.01, 0.08)			
			High SES	0.05 (0.01, 0.09)	0.01 (-0.01, 0.03)			
8	Weight status		Low SES	-0.42 (-0.82, -0.01)	-0.16 (-0.41, 0.10)			
			Mid SES	-0.38 (-0.71, -0.05)	-0.14 (-0.35, 0.07)			
			High SES	-0.14 (-0.34, 0.07)	-0.07 (-0.21, 0.07)			
		Through no medical care visit in last 12 mos.				Low SES	0.03 (-0.03, 0.11)	0.01 (-0.01, 0.03)
						Mid SES	0.00 (-0.03, 0.03)	0.00 (-0.01, 0.01)
						High SES	0.00 (-0.02, 0.00)	0.00 (0.00, 0.00)
		Through no preventive dental care visit in last 12 mos.				Low SES	-0.03 (-0.11, 0.02)	0.01 (-0.01, 0.03)
						Mid SES	0.03 (0.00, 0.09)	0.00 (-0.02, 0.01)

						High SES	0.02 (0.00, 0.05)	0.00 (-0.01, 0.01)
		Through usual source of care				Low SES	0.01 (-0.02, 0.06)	0.00 (-0.02, 0.02)
						Mid SES	0.02 (-0.01, 0.06)	0.00 (0.00, 0.02)
						High SES	0.01 (-0.01, 0.02)	0.00 (0.00, 0.01)
		Through uninsured status				Low SES	-0.06 (-0.19, 0.03)	0.01 (-0.01, 0.03)
						Mid SES	0.01 (-0.03, 0.06)	0.00 (-0.01, 0.03)
						High SES	0.00 (-0.02, 0.01)	0.00 (0.00, 0.00)
	No medical care visit in last 12 mos.		Low SES	0.22 (0.01, 0.44)	0.05 (-0.05, 0.14)			
			Mid SES	0.13 (0.01, 0.26)	0.05 (-0.02, 0.13)			
			High SES	0.06 (-0.01, 0.14)	-0.01 (-0.04, 0.02)			
	No preventive dental care visit in last 12 mos.		Low SES	0.20 (-0.01, 0.40)	-0.05 (-0.12, 0.03)			
			Mid SES	0.12 (-0.01, 0.25)	-0.01 (-0.07, 0.04)			
			High SES	0.08 (-0.01, 0.17)	-0.01 (-0.04, 0.02)			
	Usual source of care		Low SES	0.09 (-0.10, 0.27)	-0.01 (-0.11, 0.08)			
			Mid SES	0.20 (0.05, 0.36)	0.03 (-0.05, 0.10)			
			High SES	0.12 (0.03, 0.21)	0.01 (-0.02, 0.05)			
	Uninsured status		Low SES	0.27 (0.03, 0.51)	-0.04 (-0.10, 0.03)			
			Mid SES	0.13 (0.00, 0.25)	0.04 (-0.02, 0.09)			
			High SES	0.05 (0.00, 0.11)	-0.01 (-0.02, 0.01)			
9	Teeth condition		Low SES	-0.31 (-0.58, -0.03)	-0.06 (-0.15, 0.04)			
			Mid SES	-0.15 (-0.32, 0.02)	0.03 (-0.04, 0.10)			

		High SES	-0.05 (-0.11, 0.02)	-0.01 (-0.04, 0.03)			
	Through no medical care visit in last 12 mos.				Low SES	0.00 (-0.02, 0.02)	0.00 (-0.01, 0.01)
					Mid SES	0.00 (0.00, 0.01)	0.00 (0.00, 0.01)
					High SES	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
	Through no preventive dental care visit in last 12 mos.				Low SES	0.00 (-0.02, 0.02)	0.00 (-0.01, 0.01)
					Mid SES	0.00 (-0.01, 0.00)	0.00 (0.00, 0.00)
					High SES	0.00 (0.00, 0.01)	0.00 (0.00, 0.00)
	Through usual source of care				Low SES	0.00 (-0.01, 0.02)	0.00 (-0.01, 0.01)
					Mid SES	0.00 (-0.02, 0.00)	0.00 (0.00, 0.00)
					High SES	0.00 (-0.01, 0.00)	0.00 (0.00, 0.00)
	Through uninsured status				Low SES	-0.03 (-0.07, 0.01)	0.00 (0.00, 0.01)
					Mid SES	-0.01 (-0.03, 0.00)	0.00 (-0.01, 0.00)
					High SES	-0.01 (-0.02, 0.00)	0.00 (-0.01, 0.00)
No medical care visit in last 12 mos.		Low SES	0.13 (-0.02, 0.28)	0.03 (-0.03, 0.10)			
		Mid SES	0.09 (0.01, 0.16)	0.06 (0.01, 0.11)			
		High SES	0.06 (0.00, 0.13)	-0.01 (-0.02, 0.01)			
No preventive dental care visit		Low SES	0.17 (0.02, 0.31)	-0.03 (-0.09, 0.04)			

in last 12 mos.			
	Mid SES	0.14 (0.04, 0.24)	-0.04 (-0.09, 0.01)
	High SES	0.14 (0.05, 0.23)	0.04 (0.01, 0.07)
Usual source of care	Low SES	0.08 (-0.07, 0.22)	-0.01 (-0.08, 0.05)
	Mid SES	0.15 (0.05, 0.26)	0.03 (-0.02, 0.08)
	High SES	0.15 (0.06, 0.23)	0.03 (0.01, 0.06)
Uninsured status	Low SES	0.26 (0.09, 0.44)	-0.04 (-0.08, 0.00)
	Mid SES	0.11 (0.03, 0.19)	0.04 (-0.01, 0.08)
	High SES	0.05 (0.01, 0.09)	0.01 (-0.01, 0.03)

Notes: Number in parentheses are 95% confidence intervals. Monte Carlo confidence intervals with 5,000 samples are provided for indirect paths. Covariance between 1) each of the healthcare services utilization outcomes, and 2) between the outcomes and insurance status. Child's racial/ethnic minority, age, and sex are adjusted. All models fit were good with RMSEA (<0.05), CFI (>0.95), and SRMR (<0.08) and provided in detail in Supplementary Table 2.
Abbreviations: NSCH, National Survey of Children's Health; SES, socioeconomic status; mos, months.

Back to page 22, Results.

Aim 2. Effects of Removing the 5-Year Eligibility Restrictions of Public Benefits on Immigrant Children's Health

Background

Policies of federally funded benefits such as Medicaid and Children's Health Insurance Program (CHIP) are critical macrostructural factors that influence the health of immigrant children. While most US-born, low-income children are eligible for CHIP, these programs are restrictive to immigrants, particularly for the undocumented or recently migrated individuals. Since the welfare reform in 1996 (i.e., Personal Responsibility and Work Opportunity Reconciliation Act, PRWORA), most states held a five-year waiting period for public benefits after establishing legal US residence (i.e., 5-year bar). In 2009, the Children's Health Insurance Program Reauthorization Act (CHIPRA) and the Legal Immigrant Children's Health Improvement Act (ICHIA) gave states the option to expand eligibility by using federal funding to cover lawfully residing immigrant pregnant women and children without imposing the 5-year waiting period. Such a policy removed the ambiguous restrictions to participate in public insurance programs which originally aimed to assist those unable to purchase private insurance.

As of January 2022, 41 states removed the 5-year waiting period over time.[9] The expansion in the public benefits eligibility had positive impact on improving health insurance coverage among foreign-born children with low-income households.[10,11] Yet, studies examining the health impact of the 5-year bar among immigrant children are limited. While the focus of Medicaid expansions in 1980s and 1990s through PRWORA were not specific to immigrants, our study is informed by previous research that found improvements after broader Medicaid expansions in coverage for children on various measures of health status, infant birth outcomes, and education outcomes of children.[12–14]

To our knowledge, only two studies have considered the CHIPRA option and its relationship to immigrant children's health. Spanning across the years of PRWORA through

CHIPRA, the expansions in eligibility for public health insurance increased insurance coverage, improved use of preventive and ambulatory health services, and improved children's overall health status and asthma attacks among children in immigrant families.[11] This study's findings show the immediate effects of removing the 5-year bar, with the study period ending in 2009. In another study using 1998-2013 birth and infant death data, they evaluated the effect of states' adoption of coverage policies (i.e., 1996 PRWORA, CHIP 2002 unborn child option, and the 2009 CHIPRA option) for pregnant, immigrant women. They found no change in most outcomes but an increase in prenatal care use.[48]

Notably, there is a lack of evidence in how the removal of the 5-year bar impacts immigrant children's health years after the policy change. We expand upon these studies to include years before and after 2009 to capture the longer-term policy effects on immigrant children's health. We conducted a natural experiment study using difference-in-differences models to estimate the effect of the removal of a 5-year bar of public benefits on the health of low-income, foreign-born children, using data from all 50 states and District of Columbia from 2007 and 2012. By 2011, a total of 25 states eliminated this barrier for immigrant children.

Methods

We evaluated the impact of the state-level removal of the 5-year waiting period for federally funded programs on health indicators among children across 50 states and the District of Columbia, using a difference-in-difference (DD) design. We used data from the 2007 and 2011/12 (data collection occurred between February 2011 and June 2012) surveys of the National Survey of Children's Health (NSCH) data of non-institutionalized children ages 0 through 17 years. Surveys were conducted via phone by the Centers for Disease Control and Prevention (CDC), National Center for Health Statistics. It is sponsored by the US Department of Health and Human Services, Health Resources, and Services Administration, Maternal and Child Health Bureau. NSCH data are fully cleaned, and codebooks are available through the Maternal and Child Health Bureau website. We linked information on the state-level removal of

the 5-year waiting period from publicly available data produced by the Urban Institute's State Immigration Policy Resource (Table 1).

Table 1. State Coverage of Medicaid and CHIP for Lawfully Residing Children Between 2007 and 2011

State	2007 - 2008 Pre-Policy*	2009 CHIPRA & ICHIA†	2010	2011 Post-Policy‡
Alabama	0	0	0	0
Alaska	0	0	0	0
Arizona	0	0	0	0
Arkansas	0	0	0	0
California	**1**	**1**	**1**	**1**
Colorado	0	0	0	0
Connecticut	**1**	**1**	**1**	**1**
District of Columbia	**1**	**1**	**1**	**1**
Delaware	**1**	**1**	**1**	**1**
Florida	0	0	0	0
Georgia	0	0	0	0
Hawaii	**1**	**1**	**1**	**1**
Idaho	0	0	0	0
Illinois	**1**	**1**	**1**	**1**
Indiana	0	0	0	0
Iowa	0	**1**	**1**	**1**
Kansas	0	0	0	0
Kentucky	0	0	0	0
Louisiana	0	0	0	0
Maine	**1**	**1**	**1**	**1**
Maryland	**1**	**1**	**1**	**1**
Massachusetts	**1**	**1**	**1**	**1**
Michigan	0	0	0	0
Minnesota	**1**	**1**	**1**	**1**
Mississippi	0	0	0	0
Missouri	0	0	0	0
Montana	0	0	**1**	**1**
Nebraska	**1**	**1**	**1**	**1**
Nevada	0	0	0	0
New Hampshire	0	0	0	0
New Jersey	**1**	**1**	**1**	**1**
New Mexico	0	**1**	**1**	**1**
New York	**1**	**1**	**1**	**1**
North Carolina	0	0	**1**	**1**
North Dakota	0	0	0	0
Ohio	0	0	0	0

Oklahoma	0	0	0	0
Oregon	0	**1**	**1**	**1**
Pennsylvania	**1**	**1**	**1**	**1**
Rhode Island	0	**1**	**1**	**1**
South Carolina	0	0	0	0
South Dakota	0	0	0	0
Tennessee	0	0	0	0
Texas	**1**	**1**	**1**	**1**
Utah	0	0	0	0
Vermont	0	0	0	**1**
Virginia	**1**	**1**	**1**	**1**
Washington	**1**	**1**	**1**	**1**
West Virginia	0	0	0	0
Wisconsin	0	**1**	**1**	**1**
Wyoming	0	0	0	0
Total No. of States	17	22	24	25

Note: Cells highlighted in green with bolded values of 1 indicate states that provided public benefits to legal permanent residents during the first five years of their residence for that year

Abbreviations: CHIP, Children's Health Insurance Program; CHIPRA, Children's Health Insurance Program Reauthorization Act; ICHIA, Legal Immigrant Children's Health Improvement Act; No., Number

* Pre-policy period is in correspondence with the 2007 NSCH survey for the current study. Prior to 2009 CHIPRA and ICHIA legislations, some states provided public benefits with state funds.

† CHIPRA and ICHIA were enacted in 2009 with states having the option to take up this option

‡ Post-policy period is in correspondence with the 2011/12 NSCH survey for the current study.

Health indicators

All health indicators included are parent-reported in the NSCH and are considered as separate, dependent variables. We included overall health status, weight status, overall teeth condition, having more than one chronic condition, asthma, and diabetes. As we were interested in examining whether the policy removal had any overall improvement of health indicators, we used binary categorization of outcomes. Overall health status and overall teeth condition are measured as 3-level ordinal variables (i.e., fair or poor; good; and excellent or very good). We then derived indicator variables for fair or poor health status and teeth condition.

Weight status is categorized using parent-reported height and weight which were then used to calculate the child's body mass index (BMI) percentiles in accordance with the CDC

growth chart.[36] Weight status was defined as: 1) underweight, as BMI less than the 5th percentile , 2) healthy weight, as BMI between 5th percentile to less than the 85th percentile, 3) overweight, as BMI between 85th to less than the 95th percentile, and 4) obese as BMI equal to or greater than the 95th percentile of specific age and gender categories. We derived an indicator variable for unhealthy weight status.

We also examined binary measures of parent-report of whether they have ever been told by a health care professional that the child has asthma or diabetes. We included asthma and diabetes because they are health conditions that we hypothesized to respond to ambulatory or preventive care. Finally, parent-report of the child ever having more than one chronic condition was categorized as binary.

Demographic information and state-level covariates

We included characteristics associated with the health indicators of interest: child's sex, age, family structure of children's household, household primary language, highest education level attained by caregiver in household, state unemployment rate, state poverty rate, and political party of state's governor. Child's family structure was measured as two parent household with biological or adopted parents, two parent household with stepparents, single mother household with no father present, and other family structure type. Household primary language was measured as English or non-English. Highest education level attained by the primary or secondary caregiver in household was measured as less than high school education, 12 years of high school graduate, or more than high school education.

State level unemployment, state level poverty rate and political affiliation of the Governor was obtained from the National Welfare Data of the University of Kentucky, Center for Poverty Research. Unemployment rate was measured as the percentage of individuals not in the labor force in the total population by state. Poverty rate was measured as the percentage of individuals below poverty, as defined by the US Census, in the total population by state. Political

party of state's governor, a proxy for the state-level immigrant climate context, was measured as Democrat or Republican and the National Welfare Data did not include the District of Columbia.

Analytic Samples

No single policy occurs in complete independence of other social policies. This presents a methodological challenge to isolate the effect of the removal of the 5-year bar. One analytic approach to address this issue is to define the research question on a subpopulation likely to be affected by the index policy but no other co-occurring policies.[49] For this study, those most likely to be affected by the removal of the waiting period on public benefits are foreign-born children in low-income households. Because the range of CHIP income eligibility in 2011 was between 140% (Arizona) and 400% (New York) FPL, we used a cutoff of FPL 300% to capture most of the children during the post-policy period who would be affected by this policy change. Thus, we restricted our analyses to children who are foreign-born and live in a household of FPL below 300% (*n* = 2,681).

Data analyses

We pooled NSCH survey samples of 2007 and 2011/12. Individual year survey weights were adjusted to produce the correct weighted population sizes that reflect an average annual population rather than a cumulated or duplicated period population size, as outlined in the methodology guide to multi-year analysis from the NSCH.[37] All analyses account for the complex survey design weights with robust SEs to account for clustering by state. We conducted univariate analyses and assessment of missingness of the variables of interest. Then we conducted bivariate analyses using Pearson's chi-squared tests to examine the independence of various covariates by nativity status.

We adopted a DD design to estimate the effect of removal of the 5-year waiting period by comparing the change in health indicators among low-income, as determined by the state of residence federal poverty level eligibility for Medicaid and CHIP, foreign-born children in low-income households in states that removed the 5-year waiting period (i.e. treatment group)

compared to foreign-born children with low-income households in states that did not remove the waiting period (i.e. control group).

The following logistic regression equation was used to estimate the effects of the 5-year waiting period policy removal on health indicators between the treatment and control groups:

$$logit\,[P(H_{ist})] = \alpha_0 + \beta WP_{st} + L_{ist} + \lambda_s + \tau_t + \epsilon_{ist},$$

where H_{ist} represents a health indicator of individual *i;* WP_{st} is an indicator variable for the state-level policy removal; λ_s is a set of fixed effects for the child's state of residence; and τ_t is a set of fixed effects for the survey year. We include year- and state-fixed effects to account for any changes over time common to all states that occurred at the national level as well as any time invariant differences between states. All models were estimated in the Stata 17 software.[50] We used marginal standardization to estimate the model-predicted difference in difference estimate, or the average treatment effect of the treated, with confidence intervals calculated using the delta method in the 'margins' command.[51]

The DD design relies on an identifying assumption that trends in states that did not remove the waiting period serve as a valid counterfactual for the trends in states that did remove the waiting period (known as parallel trends assumption). However, the parallel trends assumption could be violated if state-specific changes in other factors related to our outcomes occur contemporaneously with removal of the waiting period. We relax this assumption by controlling for immigrant-specific and general characteristics, indicated by a vector L_{ist} in equation above, such as family structure, household primary language, child's age, child's sex, highest education level attained by caregiver in household, state unemployment rate, state poverty rate, and political party of state's governor. As the political party of the state's governor was not measured for DC, we adjusted for the political party of state's governor separately to estimate change in the difference in difference estimate.

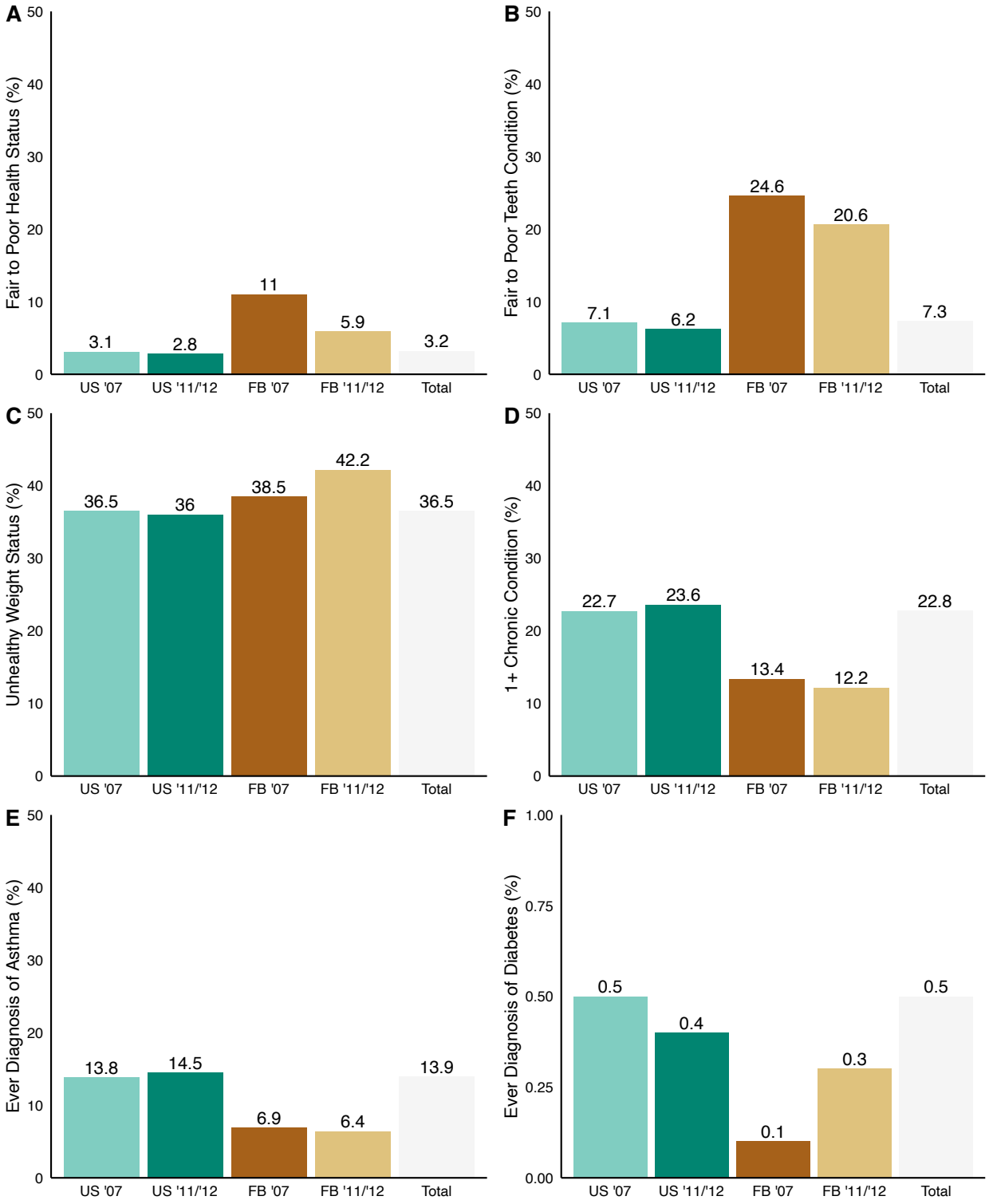
Additionally, to enhance our ability to draw a causal inference from the described models, we performed placebo tests checking for potential violations of the parallel trends

assumption. Specifically, we conducted the DD analyses among US-born children or children in household of FPL greater than 300%, who are unlikely to be affected by the state restrictions to federally funded programs (*n* = 171,746).

Results

Demographics

Sample characteristics by nativity status and by survey year are provided in Table 2 and Figure 1. The NSCH data included 174,427 children from the combined 2007 (*N* = 88,902) and 2011/12 (*N* = 85,525). For our main analyses, we restricted the sample to foreign-born children with a household FPL below 300%. We excluded those with incomplete covariates (n = 85 from 2007 survey and n = 178 from 2011/12 survey). From the 2007 survey, our analytic sample included 1,649 children. From the 2011/12 survey, we included 1,032 children. In both survey years, foreign-born children were older than US born children ($mean_{FB}$ = 11.5 vs. $mean_{US}$ = 8.4 years). Majority of the foreign-born children identified as Hispanic whereas majority of the US-born children identified as White, non-Hispanic. Overall, foreign-born children had worse health status, condition of teeth, and unhealthy weight status. However, foreign-born children had lower prevalence of chronic conditions, asthma, and diabetes than US born children (Figure 1). Greater proportion of foreign-born children were uninsured and used less healthcare services than US born children (Table 2).



Note: X–axes represent child nativity staus by NSCH survey year; Y–axes represent proportion of health indicator;
Sample sizes by survey year and nativity status of each health indicator are listed in Table 1; The range of y–axis in F is scaled from 0 to 1%
Abbreviations: FB = foreign born, US = US born

Figure 1. Distribution of health indicators by National Survey of Children's Health year and child nativity.

Table 2. Weighted sample characteristics of families in NSCH 2007 & 2011/12 by survey year and nativity

	Total	2007		2011/12	
		US born	Foreign born	US born	Foreign born
Sample size, weighted N	174,427	86,428	2,474	84,025	1,500
Child characteristics					
Age (years), Mean (SD)	8.6 (5.2)	8.4 (5.2)	11.5 (4.2)	8.5 (5.2)	11.5 (4.1)
Female	48.8%	48.9%	49.6%	48.9%	44.4%
Race/Ethnicity					
Hispanic	21.4%	18.8%	57.7%	21.3%	58.4%
Black, non-Hispanic	13.4%	14.2%	11.5%	12.8%	8.1%
Multi-racial/Other, non-Hispanic	9.6%	8.7%	16.3%	9.7%	24.4%
White, non-Hispanic	55.7%	58.2%	14.5%	56.2%	9.1%
Child health status					
Excellent or very good	85.0%	85.5%	63.0%	86.0%	68.9%
Good	11.8%	11.4%	25.9%	11.2%	25.2%
Fair or poor	3.2%	3.1%	11.0%	2.8%	5.9%
Weight status, age 10-17 years only†					
Healthy	63.5%	63.5%	61.5%	64.0%	57.8%
Overweight	5.6%	5.0%	8.4%	5.9%	7.4%
Obese	15.3%	15.2%	14.9%	15.4%	17.0%
Underweight	15.6%	16.3%	15.2%	14.7%	17.8%
Overall condition of teeth‡					
Excellent or very good	67.8%	67.9%	44.6%	69.3%	49.6%
Good	19.1%	19.0%	30.4%	18.4%	29.1%
Fair or poor	7.3%	7.1%	24.6%	6.2%	20.6%
Asthma, ever*	13.9%	13.8%	6.9%	14.5%	6.4%
Diabetes, ever*	0.5%	0.5%	0.1%	0.4%	0.3%
1+ Chronic condition(s)*	22.8%	22.7%	13.4%	23.6%	12.2%
Insurance type					
Uninsured	7.3%	7.8%	40.2%	4.6%	27.0%
Public only	31.4%	29.3%	21.2%	34.1%	34.3%
Private only	61.3%	62.9%	38.6%	61.3%	38.7%
Healthcare services utilization in past 12 months					
No medical care					
Preventive care	86.9%	88.9%	77.9%	85.7%	66.4%
Preventive dental care	78.1%	79.2%	61.7%	78.2%	64.3%

Usual source of care	92.8%	93.9%	76.8%	92.9%	75.5%
Parent and household characteristics					
Family structure					
2 parents: Biological or adopted	68.2%	68.0%	69.1%	68.1%	74.4%
2 parents: Step family	8.3%	7.5%	9.5%	9.1%	10.0%
Single mother	18.7%	18.6%	17.2%	19.1%	12.7%
Other	4.8%	5.9%	4.1%	3.7%	2.9%
Below 300% FPL	57.4%	56.1%	77.4%	57.1%	76.8%
Non-English primary language	13.6%	10.8%	64.0%	12.2%	77.7%
Highest education of adult in household					
Less than HS	14.3%	8.5%	25.1%	19.0%	52.2%
12 yrs or HS graduate	27.6%	23.5%	20.2%	32.7%	18.9%
More than HS	58.1%	68.0%	54.6%	48.3%	28.9%
State level context					
Residence in state with Democrat governor	48.1%	52.7%	42.3%	43.2%	52.2%
State level poverty rate	13.7%	12.5%	12.8%	15.0%	15.2%
State level unemployment rate	6.7%	4.6%	4.6%	9.0%	9.4%

Abbreviations: NSCH, National Survey of Children's Health; N, sample size; SD, standard deviation; FPL, federal poverty level; yrs, years; HS, high school

† NSCH do not report BMI for children of ages less than 10 years. Therefore, children of ages 0-9 years are excluded from the BMI prevalence estimates (n = 92,138). Sample sizes by survey year and nativity status are as follows: 2007 US born = 41,615; 2007 foreign-born = 1,339; 2011/12 US born = 38,507; 2011/12 foreign-born = 828.

‡ 9,436 are children less than 1 year of age and are excluded from the overall teeth condition prevalence estimates. Sample sizes by survey year and nativity status are as follows: 2007 US born = 81,730; 2007 foreign-born = 2,461; 2011/12 US born = 79,314; 2011/12 foreign-born = 1,486.

* 391 are missing parent-report of ever diagnosis of asthma; 82 are missing parent-report of ever diagnosis of diabetes; and 6 are missing parent-report of more than 1 chronic conditions.

Family structure and state level context were similar between foreign born and US born children, though the poverty and unemployment rates overall were higher in 2011/12 than 2007. Higher proportion of foreign-born children lived in households below 300% FPL. Foreign-born children lived in a greater proportion of households where the highest education obtained by adult was less than high school than US born children. In more than 60% of the households of foreign-born children, the primary language in their homes was non-English.

CHIPRA effects on health indicators on immigrant children

Among foreign-born children in households with FPL below 300%, the marginal predicted difference in difference estimates were small and near the null across all health indicators. All marginal predicted estimates are presented in Table 3. We estimated an increase in risk of poor health status (DD estimate, 95% CI = 0.06 [0.01, 0.12]), an increase in risk of poor teeth condition (DD estimate, 95% CI = 0.06 [-0.02, 0.14]), and a decrease in risk of asthma (DD estimate, 95% CI = -0.04 [-0.07, -0.01]) among low-income, foreign-born children from the removal of the 5-year waiting period (Table 3, Adjusted A models). Additionally adjusting for political party of the state's governor did not change the impact of the 5-year waiting period policy removal meaningfully on any of the health outcomes (Table 3, Adjusted B models).

Policy effects on US born children

To check the validity of our DD design assumption, we conducted placebo tests among US born children or children in households of FPL greater than 300%. The removal of the 5-year waiting period had no impact on all health indicators in this group. This indicated no violation of the parallel trend assumption, essential for validity of the DD analyses. The marginal predicted estimates are presented in Table 4.

Table 3. Effects of removal of 5-year waiting period on health indicators among foreign-born* children

	Crude Risk Difference (95% CI)	Adjusted A† Risk Difference (95% CI)	Adjusted B‡ Risk Difference (95% CI)
Poor Health Status	0.07 (0.02, 0.13)	0.06 (0.01, 0.12)	0.06 (0.01, 0.11)
Poor Teeth Condition	0.06 (-0.01, 0.14)	0.06 (-0.02, 0.14)	0.06 (-0.01, 0.14)
Unhealthy Weight Status	-0.01 (-0.12, 0.11)	0.00 (-0.12, 0.11)	0.00 (-0.12, 0.11)
Chronic Condition	-0.03 (-0.08, 0.02)	-0.03 (-0.08, 0.02)	-0.03 (-0.08, 0.02)
Asthma	-0.04 (-0.08, -0.01)	-0.04 (-0.07, -0.01)	-0.04 (-0.07, 0.00)
Diabetes	0.00 (-0.01, 0.00)	0.00 (-0.01, 0.00)	0.00 (0.00, 0.00)

* Defined as children who are foreign-born with a household of poverty level below 300%
† Adjusted for state unemployment rate, state poverty rate, child age, child sex, child race/ethnicity, household family structure, and caregiver highest education level
‡ Further adjusted for political party of state's governor

Table 4. Placebo analyses of effects of removal of 5-year waiting period on health indicators among non-affected* children

	Crude Risk Difference (95% CI)	Adjusted A† Risk Difference (95% CI)	Adjusted B‡ Risk Difference (95% CI)
Poor Health Status	0.01 (0.00, 0.01)	0.00 (0.00, 0.01)	0.00 (0.00, 0.01)
Poor Teeth Condition	0.02 (0.01, 0.02)	0.00 (0.00, 0.01)	0.01 (0.00, 0.01)
Unhealthy Weight Status	-0.01 (-0.03, 0.00)	-0.01 (-0.02, 0.00)	-0.01 (-0.02, 0.00)
Chronic Condition	-0.02 (-0.03, -0.01)	-0.01 (-0.02, 0.00)	-0.01 (-0.02, 0.00)
Asthma	0.00 (-0.01, 0.01)	0.00 (-0.01, 0.01)	0.00 (-0.01, 0.01)
Diabetes	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)

* Defined as children who are US-born or with household poverty level of at least 300%
† Adjusted for state unemployment rate, state poverty rate, child age, child sex, child race/ethnicity, household family structure, and caregiver highest education level
‡ Further adjusted for political party of state's governor

Discussion

In this study, we found minimal impact of the removal of the 5-year bar on health indicators among foreign-born children of low-income households, accounting for state-specific and individual-level confounding. These results vary from a previous study where the 5-year bar of public benefits programs improved the health status of children in immigrant families, including asthma attacks and overall health status.[11] Those findings suggested that the 2009 CHIPRA legislation, in addition to the welfare reform, had an immediate impact, as they examined 2009 health estimates. In comparison, in this current study, our findings suggest that long-term effects of the 5-year bar alone may be limited on the health of immigrant families.

We found unexpected increases in the prevalence of poor overall health status. One explanation for the worse health due to the removal of the 5-year bar could be through the enhanced detection of existent, poor health conditions among foreign-born children in households of low-income. In other words, by removing the 5-year eligibility bar for legal permanent resident within their five years of residence, these children may use health care services more. With greater use, we hypothesize that caregivers are more aware of their children's poor health conditions and are captured in the parent-reports of health in the NSCH. Our study highlights the persistent disparity of health among foreign-born children in low-income households despite state-level changes to broaden public program eligibilities.

We expanded on the prior knowledge of the impact of the 5-year bar on immigrant children's health by including health indicators beyond infant health outcomes, health services use, and health outcomes few years post the policy change. Our findings of health impacts of the removal of the 5-year bar are suggestive and should be explored further. For example, documentation status plays a critical role in defining the target population for the removal of the 5-year bar – its eligibility restrictions specifically hold for legal permanent residents. Our sample likely included ineligible, immigrant children (i.e., undocumented, documented but not yet permanent resident, naturalized) by including all foreign-born children in our analyses. Due to

the data limitations, we included foreign-born children with low-income in our sample with the recognition that they may experience spillover health consequences and perceived stigma based on immigration statuses, such as being perceived as holding undocumented status.[52,53]

To estimate the specific impact of public benefit programs eligibility expansion on the health of legal permanent residents within their five years of residence, future studies should restrict the sample to permanent residents. It should also be noted though, for full comparison, studies should examine health effects of the policy by documentation status and as group-level effects to better understand spillover effects among racial/ethnic groups who may be misrecognized as holding undocumented status and consequently subject to discrimination in the US.

Another explanation of the near null findings could be related to the design of the NSCH dataset and may limit inferences from our study findings. First, the current study uses parent-report of health indicators. Due to interviewer or memory bias, there may be misclassification of health status which the caregiver underreported the children's poor health status (i.e., greater false positives of good health). Parent-proxy reports have been indicated as poor to okay substitutes to children's self-reports of health status.[54] Thus, objective measurements of clinician's diagnoses of health in accordance with the recommendations of preventive pediatric health,[55] such as blood pressure, dyslipidemia, oral health, depression, would be a useful area for future research. Second, while NSCH survey design accounted for non-response, survey response rates could be lower than expected among immigrants living in states who abstained to remove the 5-year bar. Higher non-response among affected population is also likely to yield estimates biased toward null, leading to an underestimation of the actual policy effects. Third, examining the diversity within racial and ethnic groups and policy impacts within groups may also be worthwhile, future research. The majority of the NSCH sample of foreign-born children are Hispanic and sample sizes of other racial or ethnic groups are too small to validly compare estimates.

Health indicators represent only temporary status of health, whereas obtaining eligibility for public benefits may benefit the well-being and health of the child through multiple mechanisms. For example, beyond improvement in access to healthcare services utilization and insurance coverage, immigrant families may be able to decrease out-of-pocket costs on healthcare and allocate increased spending on other areas that impact development and health of children (i.e., housing, diet, after-school activities). Despite our study findings of minimal impact of the policy removal on health indicators, there exists benefits in immigrant children's overall development and health beyond its direct, intended consequence.

Finally, and perhaps most importantly, the 5-year bar is only one policy among many, relevant policies that contribute to the health among immigrant children in the US. For these children, a complex system of federal, state, and local policies influences their ability to interact socially and economically with the society. Both healthcare policies, such as the 5-year waiting period examined in this study, and non-healthcare policies (e.g., in-state tuition for undocumented immigrants, identification for employment) impacts not only the children's development and health but also their family's financial wellbeing over time. In a recent review, restrictive policies were generally associated with worse health outcomes and inclusive policies were associated with better health outcomes among children.[56] Thus, there exists likely a mix of both inclusive and exclusive policies that co-occur to create hostile, neutral, or welcoming experiences and environments across the lifetime that impact children's health over time.

Additionally, the US political context between 2007 and 2012 was still heavily concerned in responding to terrorism and unauthorized immigration. For example, Arizona Senate Bill 1070, commonly known as the "show me your papers" law, was enacted in 2010 and generated immense fear of deportation among the immigrant population. Due to ineffective training and implementation of the policy, Latino communities were targeted for racial discrimination by law-enforcement officers.[57] In addition, the Secure Fence Act of 2006 was an act funded to construct a double-layered fence and increase staffing and technology at the Southwest border.

Such policies during this period emphasized border control and tightening of the US admissions eligibility. It is likely that such a hostile context for immigrant populations at the border and in select states generated heightened stressful environments for families across the country and affected the health and wellbeing of immigrant children. Thus, the current study findings of increased poor health status due to the removal of the 5-year eligibility bar for public benefits should be interpreted with this larger sociopolitical context in mind.

By taking advantage of a publicly available and nationally representative data and linking it with information on state policy of the 5-year waiting period for CHIP, we examined the effects of removal of restrictive 5-year bars of public benefits on health indicators among immigrant children. The results of this study suggest that the potential impact of removal of the 5-year bar of public benefits alone may not be the only factor contributing to the health of immigrant children in the US. Improving the health of immigrant children and their families, instead, may require larger sociopolitical and structural changes that ultimately dismantles disparities across racial and ethnic groups. An example may be implementing a specified set of healthcare services with universal coverage regardless of legal status of children. Future research with objectively measured health indicators and documentation status may elicit evidence to entirely remove arbitrary restrictions on public health program benefits at the federal and state levels for the health and well-being of immigrant children.

Supplement

Supplementary Table of Sample Sizes

Health Outcome	FB Crude	FB Adj A*	FB Adj B†	US Crude	US Adj A*	US Adj B†
Poor Health Status	2,681	2,662	2,600	171,746	171,214	167,989
Poor Teeth Condition	2,664	2,645	2,583	162,327	161,832	158,883
Unhealthy Weight Status	1,397	1,386	1,356	80,892	80,695	79,469
Chronic Condition	2,681	2,662	2,600	171,740	171,208	167,983
Asthma	2,674	2,655	2,593	171,362	170,831	167,617
Diabetes	2,679	2,660	2,598	171,666	171,136	167,913

Abbreviations: FB, foreign-born; Adj, adjusted; US, US-born

* Adjusted for state unemployment rate, state poverty rate, child age, child sex, child race/ethnicity, household family structure, and caregiver highest education level

† Further adjusted for political party of state's governor

Aim 3. Ethnic Structure of Residence and Health Services Use of US Immigrant Children

Background

The social context of arrival in the US among immigrant children and their families shapes their incorporation into the American society. The spatial assimilation theory describes that an important outcome of assimilation and upward mobility in socioeconomic status is residential integration.[15,16] It has been suggested that individuals are healthier when they reside in neighborhoods with higher concentration of their own racial and ethnic group, also known as the ethnic density effect.[17,18] Such neighborhoods with high concentrations of a certain race and ethnicity provide buffering effects to enhance social cohesion and sense of belonging. This protective effect of ethnic density may be especially true for immigrant populations in which it creates a community in the US society upon arrival.

Ethnic communities are traditionally described as ethnic enclaves, or geographical areas where an ethnic group is spatially clustered and socioeconomically distinct from another race and ethnicity. Residence in ethnic enclaves and its relationship to health are mixed due to differences in analytic samples by race and ethnicity. Harmful associations have been found between residence in ethnic enclaves and health, particularly among US Black populations.[58–63] For other ethnic minority groups, residing in ethnic enclaves is rarely harmful[62,63] and some studies report null relationships.[64,65] A recent systematic review additionally attribute the mixed findings in the literature largely due to limitations in previous studies of inadequate adjustment of area deprivation and population density.[66]

Expanding on this body of research on ethnic enclaves, ethnoburb was first, distinctly identified in a study of Chinese coethnic community in Los Angeles County, California.[67] Generally, ethnoburb is defined as a suburban geographical area with a high presence of an ethnic group yet with greater ethnic heterogeneity and higher income than ethnic enclaves. With the heterogeneity of neighborhoods that recent immigrant families settle in, it is important to

examine how the types of residential ethnic structures differ in the relationship with health services use.

Despite this variation in neighborhoods of arrival, majority of newer immigrant families are still settling in poor, inner-city neighborhoods.[68–70] Such neighborhoods are often historically marked by discrimination in which allocation of health resources by the state may be limited. Prior work have found the mechanism of ethnic density and health to be based upon the direct and indirect consequences of discrimination.[71,72] More specifically, residence in coethnic communities can reduce exposure to discrimination, which it's relationship with greater stress and health problems are well established.[73–77] Thus operationalizing ethnoburbs distinct from ethnic enclaves provides an opportunity to understand the potential heterogeneity of coethnic neighborhood effects on health services use among immigrant children.

Finally, ethnic enclaves and ethnoburbs may serve as a vehicle for access to health information and resources for healthy behaviors (i.e., use of preventive healthcare services) among immigrant families. Understanding the relationship of the macrostructural environment of ethnic enclaves and ethnoburbs among immigrant children highlight areas for resource allocation of health services to all public needs, including those of foreign-born children. To our knowledge, there is no study to date that examines the relationship of ethnic structure of residence and immigrant children's health services use.

Drawing from prior works on ethnic enclaves and ethnoburbs,[62,78] our overall objective of this study is to understand the role of ethnic structure of neighborhoods on health services use among immigrant children. We use a longitudinal, electronic health record-based dataset of community health centers (CHC) between 2012 and 2020. In this study, we estimate the association between ethnic structure of residence with the odds of annual preventive health services use over time among immigrant children.

Method

We used electronic health record (EHR)-based, longitudinal data from the Foreign-Born Latinos Cardiovascular Screening (FOCUS) study at Oregon Health and Sciences University (OHSU). The FOCUS study population includes individuals between the ages 9 and 79, seen at the safety net clinics from 2012 to present. Community health centers are safety net clinics that provide primary care to individuals regardless of insurance and immigration status. They serve as a critical site for health services for patients with low income and who are immigrants, including those who are undocumented. Studies demonstrated that CHCs are perceived to be safe places to disclose information by this population.[79,80] Services are often more culturally and linguistically appropriate, with providers who are acutely aware of the unique barriers to access of their patients.

We restricted our study sample to foreign-born children between the ages 9 and 18 with at least one visit to the study clinics between January 1, 2012, and December 31, 2020. Children had on average per year, 3 healthcare visits with a range of 1 to 72 visits. For well-child visits, on average children had one visit with a range of 0 to 6 well-child visits total per year. The data was linked with community markers of social determinants of health from the American Community Survey (ACS) by the patient's census tract. Foreign-born children were identified using their place of birth listed on the health record. The Emory Institutional Review Board (IRB) approved this study.

Ethnic structure of residence

Using ACS data at the patient's census tracts and following prior works,[78,81] we defined ethnic enclaves and ethnoburbs using three neighborhood typologies: percent ethnicity, population density, and median household income. All ACS data represented 5-year average estimates of the years 2012 through 2016.

An ethnic enclave was defined as a geographic area with high coethnic density (percent any one ethnicity at the tract greater than one standard deviation above the corresponding

ethnicity's state average), medium to high population density (tract population density greater than the top two terciles of state density), and high poverty (tract median household income was lower than the state's average). An ethnoburb was defined as a geographic area with high coethnic density and low population density. We further specified ethnoburb by high and low poverty. All other typologies of neighborhoods were categorized as other, which was used as our referent group. Table 1 below displays the categorization of the ethnic structure of residence.

In our analyses, we only included the neighborhood of longest duration per child. As the smallest geographic unit of analyses was at the census tract, a move during the study period within the same census tract was not considered as a move. On average, children did not move, with a range of 0 to 4 moves in the analytic sample. To understand potential influence of mobility into and out of ethnic enclaves as a process of assimilation and ethnoburbs on health services use, we conducted sensitivity analyses additionally adjusting for the number of moves in the study period.

Table 1. Classification of ethnic structure of residence in current study of foreign-born children in FOCUS 2012-2020

Ethnic Structure Description	High Ethnic Concentration†	High Poverty†	Low Population Density†
Ethnic Enclave	1	1	0
High Income Ethnoburb	1	0	1
Low Income Ethnoburb	1	1	1
Other*	-	-	-

† High ethnic concentration was categorized as if the tract percent concentration of any one ethnicity was greater than the corresponding ethnicity's state average; high poverty was categorized as tracts with the median household income greater than the state's average; low population density was categorized as tract density less than the state density's lowest tercile cutoff
* Tracts with all other combinations of ethnic concentration, poverty, and population density was categorized as other and used as the reference group in the analyses

Health services use

We defined healthcare services use as repeated, binary measurement of annual use (versus no use) of three main markers of preventive health services. The markers of preventive

service markers are informed by the American Academy of Pediatrics recommendations for preventive pediatric health care.[55] We included body mass index, blood pressure, and well-child visits per year for all children. We dichotomized our outcome as whether the patient had at least one of preventive service markers on an annual basis. Since well-child visits are required for all children every year, we also examined well-child visits alone with residence in ethnic enclaves and ethnoburbs. Our outcome was measured for each annual year starting 1/1/2012 or at start of patient's EHR initiation date, repeated each year through 12/31/2020. We estimated the odds of receiving annual preventive care over the study period.

Demographic information and state-level covariates

We included characteristics associated with health services use from the FOCUS data including child's nativity, sex, age at first encounter, race/ethnicity, insurance type, and preferred language at the clinic visit. We also adjusted for characteristics at the census tract using ACS data including unemployment rate and the Gini index. We examined potential differences in the relationship between residence in ethnic enclaves/ethnoburbs and health services use by insurance type.

Data analyses

For this study, in the main analyses, we restricted the sample to children who are foreign-born to understand the relationship of neighborhood ethnic structure of residence and immigrant children's health services use. We conducted univariate analyses and assessment of missingness of the variables of interest. Then we conducted bivariate analyses using chi-squared tests and correlation matrix to determine the association between various covariates and health services use. Lastly, we used generalized linear mixed models to estimate the association between ethnic enclave/ethnoburb residence and odds of preventive healthcare services use between 2012-2020. We tested for multiplicative interaction in the relationship between ethnic structure of residence and odds of healthcare services use by insurance type and by child's race/ethnicity. All models were estimated using PROC GLIMMIX in SAS V.9.4.

The models included a random intercept at the neighborhood level (i.e. census tract). Example model is as follows:

$$logit\left[P\left(Health\ services\ use_{ij}\right)\right]$$
$$= \pi_{0j} + \pi_{1j}(Race, ethnicity) + \pi_{2j}(Sex) + \pi_{3j}(Age) + \pi_{4j}(Preferred\ language)$$
$$+ \ \pi_{5j}(Type\ of\ insurance) + \pi_{6j}(FPL) \ + \ \varepsilon_{ij}$$
$$\pi_{oj} = \beta_{00} + \beta_{01}(unemployment\ rate) + \beta_{02}(Gini\ income\ inequality\ index)$$
$$+ \beta_{03}(Ethnic\ structure\ of\ residence) + u_{0j}$$

We fitted models sequentially to assess the variance in healthcare services use at the neighborhood (i.e. census tract) level. The first model was an "empty" model with a global intercept only, which describes clustering of health services use, if any. Subsequent models included additional set of predictors (while retaining previous predictors): 1) individual characteristics; 2) neighborhood characteristics; and 3) ethnic structure of residence.

To quantify the between cluster (i.e. clustering of the ethnic structure) variation we calculated the median odds ratio (MOR).[59-61] To estimate the precision of this estimate, 95% credible interval (CrI) was calculated for the MOR using the posterior distribution of the neighborhood level variance and computing the 2.5th and 97.5th percentiles of the resulting distribution. The MOR quantifies the variation between clusters by comparing the odds ratio of two persons from two randomly chosen different clusters (one of higher propensity and one of lower propensity). The MOR is calculated using the following equation:

$$MOR = \exp\left(\sqrt{2 * \sigma^2} * \phi^{-1}(0.75)\right),$$

where $\phi(\cdot)$ is the cumulative distribution function of the normal distribution with mean 0 and variance 1, $\phi^{-1}(0.75)$ is the 75th percentile and $exp(\cdot)$ is the exponential function. A theoretical derivation of the formula is provided in other works.[59] The measure is always greater than or equal to 1, in which a value of 1 indicates there is no variation between clusters and a large MOR indicates considerable between-cluster variation. The MOR is not statistically dependent

on the prevalence of the outcome and thus allows for direct comparison with the fixed-effects odds ratios.

Results

Demographics

Our analytic sample included 6,524 of foreign-born patients, ages 9-18 years old with at least one encounter at a clinic in the FOCUS study. Patients had one to eight observations. We excluded 15 patients with missing foreign language preference at the clinic visit and five additional patients with missing ethnic structure of residence. Sample characteristics by ethnic structure of residence are provided in Table 2.

Majority of our study sample resided in ethnic enclaves (62%). The study included 1,474 distinct tracts with a range of one to 236 patients per tract. Less than 16% lived in ethnoburbs and within this group, close to two-thirds lived in high income ethnoburbs. Ethnic enclaves, on average, had the highest unemployment rate (mean (SD) = 11.1 (4.8), while low-income ethnoburb had the worst income inequality (Gini index mean (SD) = 0.47 (0.06; Table 2).

The proportion of Hispanics compared to other race and ethnicities was highest among those who resided in ethnic enclaves or ethnoburbs. In other neighborhoods, the race and ethnicities of its residents were more diverse – including Asians, Blacks and Hispanics. Ethnic enclaves and ethnoburb residents were more likely to be in poverty than those who lived in other neighborhoods. Across all health services use markers, those who lived in ethnic enclaves had the highest prevalence of services use.

Table 2. Sample characteristics of foreign-born children in FOCUS by ethnic structure of residence, 2012-2020†

		Ethnic Structure of Residence			
	Total	Ethnic Enclave	High Income Ethnoburb	Low Income Ethnoburb	Other
Sample size	6,524	4,046	663	345	1,470
Individual level characteristics					
Age at first encounter (years), Mean (SD)	14.1 (2.8)	14.1 (2.8)	14.2 (2.8)	14.1 (2.9)	14.1 (2.9)
Female	50.8%	49.8%	52.9%	54.8%	51.9%
Race/Ethnicity					
Hispanic	47.5%	49.8%	53.1%	53.0%	37.3%
Black or African American, NH	34.8%	35.5%	36.5%	38.8%	31.0%
Asian, NH	15.9%	13.4%	6.9%	6.7%	28.7%
Hawaiian or Other Pacific Islander, NH	0.4%	0.4%	0.5%	0.3%	0.6%
White, NH	1.5%	0.9%	3.0%	1.2%	2.4%
Foreign language preference at clinic visit	82.5%	76.2%	83.2%	76.0%	85.7%
Insurance type					
Never Insured	10.6%	8.8%	16.1%	14.5%	12.4%
Some Public	70.6%	70.9%	63.3%	68.7%	73.3%
Some Private and Public	9.2%	8.5%	12.5%	11.6%	9.0%
Some Private	9.6%	11.8%	8.0%	5.2%	5.3%
Federal Poverty Level					
Never Documented	13.9%	13.4%	15.1%	9.9%	15.7%
Maximum always FPL < 100	75.2%	77.8%	73.6%	82.9%	66.8%
Maximum always between FPL 100–200	7.6%	6.3%	8.6%	5.5%	11.2%
Always over FPL 200	3.3%	2.5%	2.7%	1.7%	6.3%
Annual healthcare services indicators					
Any one preventive services	86.7%	87.7%	84.9%	82.0%	85.9%
Well-child visits	56.0%	58.4%	48.1%	47.5%	55.1%
BMI measurement	77.4%	78.7%	73.0%	71.0%	77.4%
Blood pressure measurement	85.2%	86.0%	84.2%	81.2%	84.6%
Neighborhood level characteristics					
Unemployment rate	9.7 (4.7)	11.1 (4.8)	6.7 (3.3)	8.6 (4.7)	7.8 (3.5)
Gini Index	0.45 (0.07)	0.45 (0.07)	0.42 (0.05)	0.47 (0.06)	0.43 (0.05)

Abbreviations: FOCUS, Foreign Born Latinos Cardiovascular Screening Study; SD, standard deviation; NH, Non-Hispanic; FPL, federal poverty level; HS, high school

† Participants on average had 1.9 encounters, with a range of 1 to 8 visits

Ethnic structures of residence and health services use

Preventive health services use

Estimates and standard errors from analyses of annual preventive health services use among foreign-born children are listed in Table 3. In model 1, we first estimated an "empty" model which only includes a random intercept and allowed us to detect the existence of a possible contextual, neighborhood effect. Models 2 and 3 sequentially added individual and neighborhood covariates of interest, respectively, with a random neighborhood effect. Model 4 was an extension of model 3 that additionally included the ethnic structure of residence.

In these analyses, we estimated no differences in estimates of the relationship between ethnic structure of residence and preventive health care services use by insurance type or by race/ethnicity. Older children were less likely to use preventive health services annually than younger children and girls were less likely to use preventive health services than boys. The parameter estimates were transformed into odds ratios, which are shown in Table 4.

The individual-specific fixed effects are conditional on the random effects and should be interpreted as odds ratios for within-cluster comparisons. The MOR represents the median of odds ratios between two randomly chosen persons, one with a higher propensity to use preventive health services use and another with a lower propensity. For Model 1, an empty model, estimated an MOR of 2.65 (95% CrI: 2.30, 3.01), a relatively high OR. In other words, heterogeneity of foreign-born children using preventive health services between neighborhoods is substantial. In model 2, for two persons with same individual-level covariates, the MOR between the person living in a neighborhood with the higher propensity to use preventive health services annually and the person living in the neighborhood with the lower propensity is 3.01 (95% CrI: 2.31, 3.16).

When adding neighborhood covariates (model 3) and then ethnic structure of residence (model 4), the unexplained cluster heterogeneity reduced, yielding an MOR of 2.86 (Model 3 95% CrI: 2.48, 3.30; Model 4 95% CrI: 2.36, 3.15). The decrease in MOR between Model 2 and

Model 3 occurs when we account for neighborhood unemployment rate and income inequality. This reduction of cluster heterogeneity suggests that a fairly large proportion of the variation between neighborhoods in the propensity to use health services use may be explained by neighborhood covariates. However, an MOR of 2.86 is still a high OR – indicating there remains high variation between neighborhoods in the propensity for annual preventive health services use after accounting for neighborhood covariates and ethnic structure of residence. In our sensitivity analyses, there were no major differences in the estimates and in the MOR when we additionally adjusted for the number of moves during the study period (results not shown in tables).

Well-child visits

Estimates and standard errors from analyses of annual well-child visits among foreign-born children are listed in Table 5 and corresponding odds ratios are shown in Table 6. Results were similar as in models examining preventive health services use. There were no differences in estimates by insurance type or by race/ethnicity. The MOR for the empty model was 1.82 (95% CrI: 1.76, 1.99), detecting some existence of a contextual, neighborhood effect. Accounting for individual level covariates, neighborhood covariates, then ethnic structure of residence increased the MOR to 1.91 (95% CrI: 1.86, 2.11). In the model including ethnic structure of residence (model 4), the MOR was equal to 1.91. In other words, in the median case, the residual heterogeneity between areas increased by 1.9 times the individual odds of having annual well-child visits when randomly picking out two individuals in different areas. Similar as in the preventive health services use model, there were no differences in the estimates and MOR after adjustment for the number of moves.

Table 3. Estimates and standard errors from analyses of annual preventive health services use among foreign-born children of ages 9-18, 2012 – 2020

	Model 1		Model 2		Model 3		Model 4	
	Estimate	SE*	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	2.37	0.06	7.16	0.37	5.94	0.60	5.94	0.60
Age at first encounter	—†		-0.40	0.02	-0.40	0.02	-0.40	0.02
Race/ethnicity	—		0.22	0.07	0.21	0.07	0.21	0.07
Sex	—		-0.19	0.09	-0.19	0.09	-0.19	0.09
Foreign language preference	—		0.52	0.11	0.50	0.11	0.50	0.11
Insurance status	—		0.40	0.07	0.39	0.07	0.39	0.07
FPL	—		0.24	0.08	0.28	0.08	0.28	0.08
Gini Index	—		—		1.33	1.13	1.30	1.14
Unemployment rate	—		—		0.07	0.01	0.07	0.02
Ethnic structure of residence	—		—		—		0.01	0.05

* SE, Standard error
† Not included

Back to page 71, Results.

Table 4. Odds ratio for using annual preventive health services among foreign-born children of ages 9-18, 2012 – 2020

		Model 1			Model 2			Model 3			Model 4		
		Odds Ratio (95% CI)											
Fixed effects variables	Intercept (not exponentiated)	2.37	2.26	2.48	7.16	6.43	7.89	5.94	4.75	7.12	5.94	4.75	7.12
Age at first encounter	18 vs. 9 yo	—†			0.03	0.02	0.04	0.03	0.02	0.04	0.03	0.02	0.04
Race/ethnicity	Hispanic vs. NHW	—			1.25	1.09	1.42	1.23	1.08	1.40	1.23	1.08	1.40
	Black vs. NHW	—			1.55	1.19	2.02	1.51	1.16	1.96	1.51	1.16	1.96
	Asian vs. NHW	—			1.93	1.30	2.87	1.86	1.26	2.75	1.86	1.26	2.75
	Hawaiian & other PI vs. NHW	—			2.41	1.42	4.07	2.28	1.35	3.85	2.28	1.35	3.85
Sex	Female vs. Male	—			0.83	0.69	0.98	0.82	0.69	0.98	0.82	0.69	0.98
Foreign language preference	Foreign language vs. English	—			1.68	1.36	2.08	1.65	1.34	2.04	1.65	1.33	2.04
Insurance status	Some Public vs. Never insured	—			1.49	1.29	1.72	1.48	1.28	1.70	1.48	1.28	1.70
	Some public + private vs. Never insured	—			2.22	1.67	2.96	2.18	1.64	2.91	2.18	1.64	2.91
	Some private vs. Never insured	—			3.31	2.15	5.09	3.22	2.10	4.95	3.23	2.10	4.95
Federal poverty level	FPL always over 200 vs. Never documented	—			2.07	1.27	3.38	2.31	1.41	3.79	2.31	1.41	3.79
	FPL between 200-100 vs. Never documented	—			1.63	1.17	2.25	1.75	1.26	2.43	1.75	1.26	2.43
	FPL always below 100 vs. Never documented	—			1.27	1.08	1.50	1.32	1.12	1.56	1.32	1.12	1.56
Gini Index	10% Index increase	—			—			1.14	0.91	1.43	1.14	0.91	1.43
Unemployment rate	10% increase	—			—			2.11	1.57	2.83	2.10	1.57	2.83
Ethnic structure of residence	Ethnic enclave vs. Other	—			—			—			1.02	0.76	1.38
	High income ethnoburb vs Other	—			—			—			1.02	0.83	1.24
	Low income ethnoburb vs. Other	—			—			—			1.01	0.91	1.11
Random effects		*Median Odds Ratio (95% CrI)*											
Neighborhood		2.65	2.30	3.01	3.01	2.31	3.16	2.86	2.48	3.30	2.86	2.36	3.15

† Not included

Abbreviations: CI, confidence intervals; yo, years old; NHW, Non-Hispanic White; FPL, federal poverty level; CrI, credible intervals

Back to page 71, Results.

Table 5. Estimates and standard errors from analyses of annual well-child visits among foreign-born children of ages 9-18, 2012 – 2020

	Model 1		Model 2		Model 3		Model 4	
	Estimate	SE*	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	-0.02	0.03	2.63	0.15	2.22	0.29	2.22	0.29
Age at first encounter	—†		-0.19	0.01	-0.19	0.01	-0.19	0.01
Race/ethnicity	—		-0.10	0.03	-0.10	0.03	-0.11	0.03
Sex	—		-0.15	0.04	-0.15	0.04	-0.15	0.04
Foreign language preference	—		0.24	0.05	0.23	0.05	0.23	0.05
Insurance status	—		0.08	0.04	0.07	0.04	0.07	0.04
FPL	—		0.09	0.04	0.10	0.04	0.10	0.04
Gini Index	—		—		0.42	0.60	0.46	0.60
Unemployment rate	—		—		0.02	0.01	0.03	0.01
Ethnic structure of residence	—		—		—		-0.01	0.03

* SE, Standard error
† Not included

Back to page 71, Results.

Table 6. Odds ratio for having annual well-child visit among foreign-born children of ages 9-18, 2012 – 2020

		Model 1			Model 2			Model 3			Model 4		
		Odds Ratio (95% CI)											
Fixed effects	Intercept (not exponentiated)	-0.02	-0.08	0.04	2.63	2.33	2.93	2.22	1.64	2.80	2.22	1.64	2.80
Age at first encounter	18 vs. 9 yo	—†			0.18	0.15	0.20	0.18	0.15	0.20	0.18	0.15	0.20
Race/ethnicity	Hispanic vs. NHW	—			0.90	0.85	0.96	0.90	0.85	0.96	0.90	0.84	0.96
	Black vs. NHW	—			0.82	0.72	0.93	0.81	0.71	0.92	0.81	0.71	0.92
	Asian vs. NHW	—			0.74	0.61	0.89	0.73	0.60	0.88	0.73	0.60	0.88
	Hawaiian and other PI vs. NHW	—			0.67	0.52	0.86	0.66	0.51	0.85	0.65	0.51	0.85
Sex	Female vs. Male	—			0.86	0.79	0.93	0.86	0.79	0.93	0.86	0.79	0.93
Foreign language preference	Foreign language vs. English	—			1.27	1.14	1.41	1.26	1.13	1.40	1.26	1.13	1.40
Insurance status	Some Public vs. Never insured	—			1.08	1.00	1.16	1.08	1.00	1.16	1.08	1.00	1.16
	Some public + private vs. Never insured	—			1.16	1.01	1.34	1.16	1.01	1.34	1.16	1.01	1.34
	Some private vs. Never insured	—			1.25	1.01	1.55	1.25	1.01	1.54	1.25	1.01	1.54
Federal poverty level	FPL always over 200 vs. Never documented	—			1.33	1.07	1.64	1.37	1.10	1.70	1.37	1.10	1.70
	FPL between 200-100 vs. Never documented	—			1.21	1.05	1.39	1.23	1.07	1.42	1.23	1.07	1.42
	FPL always below 100 vs. Never documented	—			1.10	1.02	1.18	1.11	1.03	1.19	1.11	1.03	1.19
Gini Index	10% Index increase	—			—			1.04	0.93	1.17	1.05	0.93	1.18
Unemployment rate	10% increase	—			—			1.28	1.11	1.48	1.30	1.11	1.51
Ethnic structure of residence	Ethnic enclave vs. Other	—			—			—			0.97	0.83	1.13
	High income ethnoburb vs Other	—			—			—			0.98	0.88	1.08
	Low income ethnoburb vs. Other	—			—			—			0.99	0.94	1.04
Random effects		*Median Odds Ratio (95% CrI)*											
Neighborhood		1.82	1.76	1.99	1.92	1.82	2.07	1.91	1.77	2.03	1.91	1.86	2.11

† Not included

Abbreviations: CI, confidence intervals; yo, years old; NHW, Non-Hispanic White; FPL, federal poverty level; CrI, credible intervals

Back to page 71, Results.

Discussion

Ethnic structures of residence are well recognized as an important indicator of incorporation into American society. While ethnic communities and its characteristics have been defined, distinctions to define heterogeneity within these communities are limited. In addition, no studies to date, to our knowledge, have examined the relationship between the type of ethnic structure of residence with immigrant children's health services use. We expand upon the current literature to address both gaps. First, we defined immigrant children's residential neighborhood into four types: ethnic enclave, high income ethnoburb, low income ethnoburb, and other. This study incorporated both population density and neighborhood level deprivation, factors critical yet attributed to mixed findings in prior studies,[66] to understand ethnic density effects on health among immigrant children. Majority in our study sample of foreign-born children lived in ethnic enclaves. Second, there was no evidence of an association between the ethnic structure of residence and use of preventive health services. No differences in these relationships were found across insurance types. However, neighborhood level income inequality and unemployment rates explained much of the variance in children's use of preventive services between neighborhoods.

Our study findings of null relationships between ethnic structure of residence and use of preventive health services are consistent when compared to the mixed findings in the literature. Ethnic minority groups, in particular Hispanic and Latino populations, have reported rarely harmful and null relationships between ethnic enclaves and health.[62,63] For Hispanic persons in the US, protective density effects were more salient for infant mortality,[82] birth weight,[83] and smoking during pregnancy.[84] With our study sample of foreign-born children being largely Hispanic, our findings contribute to the lack of evidence of an ethnic density effect for the use of preventive health services.

We contribute to findings of prior literature by examining area level deprivation and population density. Further, we uniquely define ethnoburbs into high and low income ethnoburbs

with the recognition of the potential variation of economic contexts of these environments. With these unique distinctions and variations explained by neighborhood level economic contexts, we provide further evidence that the ethnic structure of residence should not be used as a marker of area deprivation.

To our knowledge, this study is the first to examine the relationship between ethnic structure of residence and immigrant children's use of preventive services. Considerable amount of the variation in use of preventive health services across neighborhoods were explained after adjustment for neighborhood income inequality and unemployment rate. This variation did not change after including ethnic structure of residence, suggesting that area level deprivation may play a key role in understanding the differences in the use of annual preventive health services. Neighborhoods with high unemployment rates and unequal distribution of income are likely marked also by the long history of segregation and discrimination in the US. Many of these neighborhoods that immigrant families reside in may lack the quality and places to receive primary care due to systemic discrimination of allocation of services and coverage of public benefits. Thus, the protective ethnic density effects beyond the neighborhood level deprivation may be minimal in comparison.

With the use of electronic health records, we link estimates of tract level neighborhood typologies to understand ethnic density effects and preventive health services use among foreign-born children. The advantage of this long term, expansive study of neighborhood ethnic characteristics is contrasted by a potential for selection bias. The FOCUS data, by design, excludes children that never sought care at the safety net clinics in the OCHIN network and selection bias may be present. For instance, it is hypothesized that ethnic enclaves may have greater number of clinics; whereas ethnoburbs may have sparse number of clinics to receive care. This affects children's initial participation in the FOCUS study and may overreport children's use of services if they reside in ethnic enclaves and vice versa if they reside in ethnoburbs. We hypothesize though that the effects of this selection bias are small due to the

FOCUS study clinics encompassing community health centers beyond public and private hospitals. CHCs often are the main source of health care services for immigrants and families of low-income. With the Affordable Care Act, health centers in Medicaid expansion states were located evenly in rural and urban areas; in non-expansions states, they were more likely to be located in rural areas.[85] While effects of selection bias may be small, we urge future studies of ethnic structures of residents and use of services with non-administrative data to strengthen the evidence of our findings.

We note that there may be potential for spillover effects, in which US born children of racial and ethnic groups may also experience ethnic density effects. For the purposes of defining the unique mechanism of immigrant children, we restricted our analyses to foreign born children. However, identifying relationships between ethnic structures of residence and preventive health services use may be useful area for future research. Such examination would allow for understanding of neighborhood typologies and access to preventive services in the general population regardless of nativity status. Finally, due to restrictions on number of foreign-born individuals, our study sample was inadequate and underpowered to understand racial and ethnic differences. We strongly suggest future work that are well-powered to consider race and ethnicity as a dimension of salient stratification for economic and social resources in the US.

The findings from this study of electronic health records of foreign-born children between 2012 through 2020 in the US support the need to understand neighborhood level, social determinants of health. Key indicators of annual preventive health services use among immigrant children may be shaped heavily by the neighborhood level area deprivation. Future efforts to reach health equity and reduce disparities in access to health services may benefit from reducing income inequality at the general population.

Conclusion and Future Directions

This dissertation contributes to the growing body of work demonstrating the need for insurance coverage and understanding of political and neighborhood context among immigrant children. In aim 1, we found that insurance coverage is critical to improve the use of health services among foreign-born children and especially those in households of low-income. In aim 2, disparities in the health among children from immigrant families persisted despite state-level changes to broaden public program eligibilities. Work in this area should explore longer term effects of the 5-year bar on clinically diagnosed health conditions. In aim 3, while ethnic density effects may be minimal, area level deprivation of residential neighborhoods of immigrant families was important to explain the differences in use of annual preventive services. Overall, a useful area for expansion of knowledge of immigrant children's health is an assessment of differences across sociopolitical factors by documentation status.

With the projected growth in immigrant populations of diverse race and ethnicities in the US, it is critical that we establish valid and precise examinations of their health and unique experiences of migration and health access. Beyond this dissertation, I note below several areas for future research of social epidemiologists in immigrant health.

First, documentation status places yet another barrier to access care. Immigrants with undocumented status have an increased risk for uninsured status.[6] Social epidemiologists conducting research with immigrant populations need to measure documentation status to holistically capture the heterogeneity between groups within this subpopulation. Immigrant populations experiences transform over time in the US as their legal residency and citizenship status changes if they decide to naturalize. This would better inform how policy and neighborhood contexts influences their health and access to health.

Second, contextualizing individual experiences is key in any epidemiology study. Individual level factors alone simply cannot encompass the complex experiences of our lives and emphasis on an ecosocial approach[86] is needed in immigrant health research. For example,

this dissertation findings suggest that area level deprivation and policies of public benefits define a critical part of immigrant children's access to healthcare services and subsequently their health.

When contextualizing and defining experiences of immigrant children and children of mixed status families, social epidemiologists must critically define the comparison or referent group of analyses. Explicitly choosing comparison groups helps clarify our understanding of health disparities. For example, for undocumented immigrants, an appropriate comparison group may be naturalized citizens or US born individuals of the same race and ethnicity. With clear *a priori* considerations of our comparison group, we move away from (over)generalizing our experiences to the non-Hispanic Whites in the US. This group, while historically the majority, is a single group in our society like all other racial and ethnic groups and should not be differentiated as the ideal experience.

Finally, population level data sources that capture the unique experiences of immigrants and especially immigrant children are limited so far. One suggestion for social epidemiologists in this area of research includes use of simulation-based methods to allow for data pooling across data sources, particularly in the presence of privacy restrictions (i.e., documentation status and tract level information).[87] Such a rigorous approach for creating complex, synthetic datasets allows for creation of a nationally representative samples based on data from less representative samples.

This dissertation is unavoidably influenced by my interpretations and experiences as a social epidemiologist and an immigrant in the US. I believe that we as scientists have a responsibility to document and provide evidence to change policies that will establish health equity for all individuals in the US. Epidemiologic methods of causal inference and methods in interdisciplinary fields of sociology, anthropology, and law are all critical in building this evidence and subsequently, shaping the future of immigrant's health. The continued health disparities and

inequitable access to healthcare services among immigrant children and their families in the US must change.

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