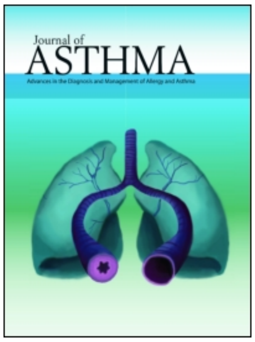

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Health care access, concentrated poverty, and pediatric asthma hospital care use in California's San Joaquin Valley: A multilevel approach

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ABSTRACT

Background: California's San Joaquin Valley is a region with a history of poverty, low health care access, and high rates of pediatric asthma. It is important to understand the potential barriers to care that challenge vulnerable populations. *Objective*: The objective was to describe pediatric asthma-related utilization patterns in the emergency department (ED) and hospital by insurance coverage as well as to identify contributing individual-level indicators (age, sex, race/ethnicity, and insurance coverage) and neighborhood-level indicators of health care access. *Methods*: This was a retrospective study based on secondary data from California hospital and ED records 2007–2012. Children who used services for asthma-related conditions, were aged 0–14 years, Hispanic or non-Hispanic white, and resided in the San Joaquin Valley were included in the analysis. Poisson multilevel modeling was used to control for individual- and neighborhood-level factors. *Results*: The effect of insurance coverage on asthma ED visits and hospitalizations was modified by the neighborhood-level percentage of concentrated poverty (RR = 1.01, 95% CI = 1.01–1.02; RR = 1.03, 95% CI = 1.02–1.04, respectively). The effect of insurance coverage on asthma hospitalizations was completely explained by the neighborhood-level percentage of concentrated poverty. *Conclusions*: Observed effects of insurance coverage on hospital care use were significantly modified by neighborhood-level measures of health care access and concentrated poverty. This suggests not only an overall greater risk for poor children on Medi-Cal, but also a greater vulnerability or response to neighborhood social factors such as socioeconomic status, community cohesiveness, crime, and racial/ethnic segregation.

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Emergency department; insurance coverage; multilevel model; pediatric asthma; race/ethnicity; San Joaquin Valley

Introduction

Asthma is a leading chronic condition for children which causes severe life disruption that can be prevented with appropriate care and services (1,2). For families of low-income, the services provided by the emergency department (ED) and hospital are usually the primary sources of health care to combat asthmatic exacerbations (3). The services that are provided to publicly funded families are usually of poorer quality in comparison to those who are privately insured (4). Similarly, inequities in prevalence, treatment, and outcomes of asthma have also been found by race/ethnicity (5). However, little is known about how place-based indicators, such as concentrated poverty and related social factors, affect asthma morbidity or how they may influence the relationship between insurance coverage and asthma morbidity. This exploratory analysis is an attempt to understand the place-based indicators that may moderate individual-level risk factors known to contribute to pediatric asthma inequities.

Epidemiologists have identified multiple pathways that contribute to asthma exacerbations including poor housing conditions, low socioeconomic status, air pollution, cigarette smoke, occupational exposures, genetics, and diet, among other factors (6–12). However, these studies have been unclear in identifying the level at which social factors manifest themselves to produce health inequities. Social vulnerability such as low-socioeconomic status, poverty, inadequate access to care, and insurance type are typically conceptualized to impact health at the person-level as opposed to the group-level. In general, these studies rely on an individualistic theoretical framework for disease causation that does not account for all sources of variability in asthma morbidity. Because of the complicated relationship between exposures and chronic disease, recent studies are demonstrating that particular low-income populations demonstrate a greater health response to environmental exposures, due to social factors (13–15). For example, a recent study demonstrated that the association between fine particulate matter and

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spina bifida was modified by neighborhood poverty, income, and education (16).

Asthma morbidity has been shown to vary greatly by geography and has been implicated as a population indicator of social and environmental vulnerability (17,18). Researchers have proposed implementing a multilevel approach to better discern the complex interaction between individuals and the environments they live in. The current study aims to improve the literature on the social determinants of asthma by analyzing health care access at the individual- and neighborhood-level and by investigating the health care access barriers that may increase a population's vulnerability to social and neighborhood circumstances. First, we describe hospital utilization rates and estimate the population-level utilization rates stratified by insurance coverage. Then, we examine associations between concentrated poverty, access to care with asthma-related events. Finally, we explore cross-level interactions to understand how neighborhood factors modify the impacts of individual level determinants of asthma-related acute care utilization.

California's San Joaquin Valley (SJV) is a region where cumulative risk factors have been shown to contribute to poor health (19–21). The SJV has pediatric asthma rates greater than the rest of the state. According to the California Health Interview Survey (CHIS), 17.2% of children younger than 14 years of age living in the SJV have ever been diagnosed with asthma compared to 12.7% in the rest of California (22). In terms of ED use, CHIS finds that 30.6% of these children have visited the ED or urgent care for asthma compared to 12.6% for the rest of California (23). Identifying the contextual determinants of poor health in the SJV could elucidate how demographic and macro-individual factors shape these findings.

Methods

Data sources

Patient discharge data (hospital discharge) and ED records, from 2007 to 2012, were obtained from California's Office of Statewide Health Planning and Development (OSHPD). Zip code-level measures were obtained from a variety of sources including the American Community Survey (ACS), OSHPD for identifying primary care-shortage areas, and ArcGIS was used to compute the distance to the nearest ED. These files were linked by the patients' zip code of residence. Approval from California State University-Fresno's institutional review board (IRB) and the Committee for the Protection of Human Subjects for the California Health and Human Services Agency was obtained prior to the commencement of this study.

Study population

Patient records included individuals who reside in the eight SJV counties, specifically, Fresno, Kern, Kings, Merced, Madera, San Joaquin, Stanislaus, and Tulare. All records were de-identified; however, patient records included zip code of residence that was used to attribute geographic communities. The sample population included in analyses was children aged 0 to 14, identified as white or Hispanic (Latino), expected source of payment was Medi-Cal (Medicaid in California) or private insurance, and resided in one of the eight SJV counties. Children aged older than 14 years of age were omitted from analyses because asthma made up less than 1% of the hospitalized population.

Outcome variable

Population rates of potentially preventable asthma-related hospitalization and emergency department (ED) visits were the health outcomes of interest throughout this study. Prevention quality indicators (PQI) from the Agency of Healthcare Research and Quality (AHRQ) were used as criteria in identifying asthma-related primary diagnoses. International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes were used to identify potentially preventable asthma events and included: 49300, 49301, 49302, 49311, 49312, 49320, 49321, 49322, 49382, 49390, 49391, and 49392. These ICD-9-CM codes are consistent with Lu who adapted these codes for use in a pediatric population (24). In order to model population rates of asthma, 24 cells per zip code were used as population categories, each cell had an event rate estimated. The cells were categories by age (0–4, 5–9, and 10–14), sex (female and male), race/ethnicity (non-Hispanic white and Latino), and insurance coverage (Medi-Cal and private) that had 3, 2, 2, and 2 levels, respectively. The numerator in each cell was the count of asthma events in a specific age, sex, racial/ethnic, and insurance category, and the denominator was the estimated count of the target population (exposed group). The target population was estimated by using ordinary least square (OLS) regression to predict the number of children eligible for Medi-Cal in California at the zip code-level by age, sex, and race/ethnicity. The Medi-Cal population was estimated by the proportion of individuals living two times below 138% of the poverty level, controlling for demographic covariates: % white-male-0 to 4, % white-male-5 to 9, % white-male-10 to 14, % white-female-0 to 4, % white-female-5 to 9, % white-female-10 to 14, % Latino-male-0 to 4, % Latino-male-5 to 9, % Latino-male-10 to 14, % Latino-female-0 to 4, % Latino-female-5 to 9, and % Latino-female-10 to 14,

$F(13, 1376) = 93.9$, $p < .001$, $R^2 = .47$. The same regression model was used to predict the population that is eligible for private insurance coverage, $F(13, 1376) = 70.7$, $p < .001$, $R^2 = .40$. We then multiplied the predicted proportions of eligibility by the number of children living in a zip code to compute a denominator for each target population.

Individual-level predictors

Individual-level predictors included age, sex, race/ethnicity, and insurance coverage. These variables were dichotomously coded. Age was coded to include children younger than 5; 5 to 9; and 10 to 14 (reference group). Sex was coded for boys and girls (reference group). The two racial/ethnic groups were Latino/Hispanic and non-Hispanic white (reference group). Insurance coverage was dichotomized into Medi-Cal and private (reference group) where all other types of coverage were omitted from the analysis.

Neighborhood-level predictors

The zip code (neighborhood) was the geographical unit that could be used to link individual-level data to ecological data. After extensive internal discussion and statistical testing, we included primary care-shortage areas (PCSA), the number of community clinics, the distance in miles to the nearest ED, and the percentage of childhood concentrated poverty (percentage eligible for Medi-Cal) as neighborhood-level measures. We investigated other measures of health care access from OSHPD's publically available data sources including PCSA score, primary care physician ratio, and primary care civilian population to physician ratio. These measures of health care access all performed similarly to PCSA in model development; therefore, we only included PCSA in our final models. Only predictors that were found to be independently associated with mean asthma rates were included in multivariate models with the exception of PCSA that was added for theoretical purposes. PCSA was coded dichotomously, where 1 = a PCSA and 0 = not a PCSA. The number of community clinics in a zip code was measured continuously. The distance to the nearest ED was computed in ArcGIS. ArcGIS 10.3.1 software is a geographic information system that may be used to analyze spatial data. We used a zip code-level layer and geocoded ED sites for the state of California in order to measure the distance to the nearest ED from each zip code. Distance to the nearest ED was the miles from a zip code's centroid to the nearest hospital with an ED. Concentrated poverty was measured as the percentage of children living below 138% of the poverty level who were eligible for Medi-Cal and was treated continuously in analyses.

Table 1. Summary statistics of individual- and neighborhood-level indicators for asthma ED visits and hospitalizations, San Joaquin Valley, CA, 2007–2012.

Indicator	ED visits ($n = 37{,}455$)	Hospital discharge ($n = 7329$)	San Joaquin Valley[a]
Individual-level characteristics			
Girls	35.20%	34.10%	51.00%
Boys	64.80%	65.90%	49.00%
White	28.90%	33.30%	27.10%
Latino	71.10%	66.70%	72.90%
0–4 years	49.30%	64.30%	33.90%
5–9 years	31.80%	26.30%	33.00%
10–14 years	18.90%	9.40%	33.10%
Private coverage	31.70%	32.40%	39.30%
Medi-Cal coverage	68.30%	67.60%	60.70%
Neighborhood-level characteristics ($n = 213$)			Mean (SD)
PCSA[b]			0.38 (0.49)
Distance			9.45 (7.86)
Concentrated poverty			34.17 (15.79)
Community clinics			1.01 (1.20)

[a]Individual level data source: AskCHIS 2012.
[b]dichotomous variable.

Statistical analysis

We conducted summary statistics for the sample population and compared it to the general pediatric population of the SJV by gender, race/ethnicity, age, and insurance coverage. Means and standard deviations for the neighborhood-level variables are provided in Table 1 to illustrate the context in which these asthmatic events take place. We stratified the sample population by insurance coverage and estimated utilization rates in the population (Table 2). These analyses were conducted in IBM SPSS Statistics 24.

Due to the nested nature of these data, children living within zip codes, hierarchical generalized non-linear modeling was used for the multivariate feature of our analyses found in Table 3. It was appropriate to use Poisson-based models for parameter estimation and we used the general pediatric population as the exposure variable. Three models with varying-slopes are presented

Table 2. Rates for asthma-related ED visits and hospitalizations by insurance coverage, San Joaquin Valley, CA, 2007–2012.

	ED[a]		Hospital[b]	
Indicator	Medi-Cal[c]	Private[d]	Medi-Cal[c]	Private[d]
Girls	13.86	3.49	23.48	8.59
Boys	23.37	6.23	23.43	7.81
White	16.73	5.91	22.01	12.02
Latino	19.31	4.38	23.90	6.29
0–4 years of age	28.68	5.86	36.60	12.34
5–9 years of age	17.38	5.28	24.52	8.80
10–14 years of age	9.65	3.54	8.69	3.46

[a]ED rates per 1000.
[b]Hospital rates per 10,000 in estimated population.
[c]Medi-Cal coverage eligibility were all children below the Federal Poverty Level.
[d]Private coverage eligibility were all children above the Federal Poverty Level.

Table 3. Results of multilevel models, rate ratios and 95% confidence intervals for risk of asthma ED visit and hospitalization, San Joaquin Valley, CA, 2007–2012.

	ED			Hospital		
Indicator	Model 1 Rate ratio (95% CI)	Model 2 Rate ratio (95% CI)	Model 3 Rate ratio (95% CI)	Model 1 Rate ratio (95% CI)	Model 2 Rate ratio (95% CI)	Model 3 Rate ratio (95% CI)
Individual-level characteristics						
Male[a]	1.76*** (1.70–1.82)	1.76*** (1.70–1.82)	1.77*** (1.71–1.83)	1.86*** (1.74–1.99)	1.86*** (1.74–1.99)	1.86*** (1.74–1.99)
Latino[c]	0.75*** (0.68–0.83)	0.75*** (0.67–0.83)	0.75*** (0.67–0.83)	0.59*** (0.52–0.68)	0.58*** (0.51–0.67)	0.58*** (0.50–0.67)
0–4[b] years	2.47*** (2.28–2.68)	2.47*** (2.29–2.67)	1.98*** (1.69–2.34)	6.62*** (5.95–7.37)	6.61*** (5.94–7.35)	6.06*** (5.35–6.87)
5–9[b] years	1.68*** (1.58–1.78)	1.68*** (1.58–1.77)	1.68*** (1.59–1.79)	2.87*** (2.57–3.21)	2.87*** (2.57–3.2)	2.87*** (2.57–3.21)
Medi-Cal	3.48*** (3.01–4.01)	3.47*** (3.01–3.99)	2.16*** (1.52–3.07)	3.53*** (3.13–3.98)	3.49*** (3.09–3.93)	1.25 (0.97–1.63)
Neighborhood-level characteristics						
PCSA		0.95 (0.80–1.13)	0.97 (0.81–1.16)		1.12 (0.94–1.34)	1.03 (0.85–1.26)
Distance to nearest ED		0.98*** (0.97–0.99)	0.97*** (0.80–1.13)		0.99** (0.98–0.99)	0.98** (0.97–0.99)
Concentrated poverty		1.01*** (1.01–1.02)	1.00 (0.99–1.01)		1.01*** (1.01–1.02)	1.000 (0.99–1.00)
Community clinics		1.01 (0.95–1.08)	1.02 (0.95–1.09)		0.98 (0.91–1.05)	0.99 (0.92–1.05)
Interaction effect on 0–4 years of age						
Distance to nearest ED			1.02** (1.01–1.03)			—
Concentrated poverty			2.09*** (1.45–3.01)			—
PCSA			—			1.19*** (1.04–1.37)
Interaction effect on Medi-Cal						
Concentrated poverty			1.01** (1.01–1.02)			1.03*** (1.02–1.04)
Variance component	0.18***	0.15***	0.16***	0.23***	0.19***	0.21***

***$p < .001$.
**$p < .01$.
[a]female = reference group.
[b]10–14 year olds = reference group.
[c]non-Latino white = reference group.

in increasing complexity. Model 1 presents an individual-level analysis. Model 2 introduces neighborhood-level predictors, controlling for individual-level predictors. Model 3 includes individual and neighborhood-level predictors as well as cross-level interactions between level 1 and level 2 beyond the main effect predictors. We tested for significant cross-level interactions on individual-level age and insurance type by all neighborhood-level variables that demonstrated a significant main effect on the outcome. Only significant interactions are presented in Model 3. Multilevel analysis provided several advantages including: allowed for investigation of naturally clustered data within neighborhoods, controlled effects at multiple levels and across zip codes, allowed for cross-level interactions, and provided output in rate ratios. Multilevel analyses were conducted in HLM 7.

Results

There were a total of 37,455 ED visits and 7329 hospitalizations attributed to asthma for children younger than 15 years of age from 2007–2012. Asthma (ICD-9 49390) and acute asthma exacerbations (ICD-9 49392) together comprised 74.3% of sampled asthma cases in the ED. Extrinsic asthma with acute exacerbations (ICD-9 49302) and acute asthma exacerbations (ICD-9 49392) together comprised 72.5% of the asthmatic events in the hospital. Table 1 provides summary statistics for individual- and neighborhood-level population characteristics. In the ED and hospital, boys, Latinos, the youngest age group, and those on Medi-Cal used the greatest proportion of services. These groups used ED and hospital services in greater proportion than their overall representation in the general population, with the exception of Latinos who used hospital services at a lower proportion. Of the zip codes in the SJV, 38% were designated as primary care-shortage areas. The mean value for the distance to nearest hospital was 9.45 (SD = 7.86), percentage of concentrated poverty was 34.17 (SD = 15.79), and the number of community clinics was 1.01 (SD = 1.20).

Table 2 displays population rates for asthma-related ED visits and hospitalizations stratified by insurance coverage where the denominator in each rate was estimated using OLS. Across all indicators, children on Medi-Cal were estimated to use ED and hospital services at least at two times the rate when compared to those who were privately insured. Children younger than five years of age were five times more likely to visit the ED than their privately insured counterparts and three times more likely to be hospitalized.

Table 3 summarizes multilevel associations between asthma-related mean rates and predictors. Preliminary null models suggested that mean rates of asthma ED visits (variance component = 0.264, $p < .001$) and hospitalizations (variance component = 0.294, $p < .001$) varied by zip code and were significant. For brevity, we present only findings for the final model, Model 3.

Model 3 presents the final fit including individual-, neighborhood-, and cross-level interactions. The main effects for children on Medi-Cal and for children younger than five were large; thus, we tested for cross-level interactions that might explain the large effect sizes observed. We saturated the significant neighborhood-level variables onto the individual-level measures and removed the predictors that did not interact. With respect to ED visits, the risk increased for the youngest children (RR = 1.98, 95% CI = 1.69–2.34) who lived in neighborhoods with high levels of concentrated poverty and who lived in neighborhoods furthest from the ED (RR = 2.09, 95% CI = 1.45–3.01; RR = 1.02, 95% CI = 1.01–1.03, respectively). Further, the risk for children on Medi-Cal (RR = 2.16, 95% CI = 1.52–3.07) was increased in neighborhoods with a greater proportion of concentrated poverty (RR = 1.01, 95% CI = 1.01–1.02). In terms of hospitalizations, the youngest children (RR = 6.06, 95% CI = 5.35–6.87) had an increased rate ratio of 19% when living in a primary care-shortage area compared to those who were not (RR = 1.19, 95% CI = 1.04–1.37). The effect of Medi-Cal insurance coverage on rates of asthma hospitalizations (RR = 1.25, 95% CI = 0.97–1.63) was completely explained by the neighborhood-level percentage of concentrated poverty (RR = 1.03, 95% CI = 1.02–1.04). In summary, Model 3 suggests asthmatic health care utilization events for the youngest children (0–4) and children on Medi-Cal are modified by the distance to the nearest ED, primary care-shortage areas, and by concentrated poverty.

Discussion

The current study adds to the literature on the determinants of asthma morbidity by demonstrating that neighborhood concentrated childhood poverty exerts itself through insurance coverage to produce differential health outcomes at the individual-level. Although prior studies have shown that poverty is associated with poor health and that health disparities exist between insurance coverage, this paper suggests that concentrated poverty interacts with a person's insurance coverage to contribute to health disparities. The effects of individual-level poverty are different for those living in neighborhoods of concentrated poverty than in more affluent settings. In route to the ED, neighborhood-level concentrated poverty, a proxy for Medi-Cal eligibility, increases the risk difference between Medi-Cal covered children and privately insured children. In terms of hospital admissions, neighborhood-level concentrated poverty completely explains the risk difference between Medi-Cal children and those who are privately insured. Therefore, addressing the poverty-linked factors that exacerbate asthma morbidity risk in these neighborhoods may reduce insurance coverage disparities.

Consistent with the literature on asthma disparities, we found that boys are at greater risk than girls, whites are at greater risk compared to Latinos, and the youngest children are at greatest risk when compared to older youth (25,26). Medi-Cal recipients use a greater proportion of services than their privately-insured counterparts do. The population rate for ED visits and hospitalizations was three times greater for children eligible for Medi-Cal compared to children eligible for private insurance (3). The youngest children (age 0–4) and those on Medi-Cal were most vulnerable to the social and health care context and were at greatest risk for ED visitation and hospitalization. The youngest children and the Medicaid population were at greatest risk for hospital care use (27–29). White children use hospital services at greater rates than their Latino counterparts do for respiratory complications, including asthma. One explanation of this phenomenon is that foreign-born Latinos have a health advantage only when living in a neighborhood with high rates of immigrants that provide group cohesiveness and a sense of collective efficacy (30,31). Latinos in the SJV are largely from Mexican decent which may explain our finding that Latinos are at lower risk than whites are. There are large disparities within Latino subpopulation where Puerto Ricans are at greatest risk for asthma prevalence and severity and Mexicans are the lowest risk subgroup, often at lower risk than non-Hispanic whites (32–34). In addition, there are barriers to care that depend on documentation status. Undocumented Mexican families employed in the SJV tend to not use hospital care because they are afraid of deportation or because there is a language barrier (35). Future research should investigate asthma disparities within the Latino/Hispanic subgroups and test if geographic indicators help to explain these differences.

These data suggest that the percentage of concentrated poverty in a neighborhood and the distance to the nearest hospital are significant predictors of ED visits. In addition, these factors were found to interact with the individual-level effect of insurance coverage on asthmatic ED visits to produce increased risk for children on Medi-Cal compared to their privately insured counterparts. This finding is similar to recent research that suggests that contextual, compositional, and environmental factors interact to contribute to asthma inequities between neighborhoods (36). Our finding supports the social determinants of health framework hypothesizing that individuals have interactive relationships with their neighborhood environment (8,9,19,37).

Concentrated poverty at the neighborhood-level interacted with a person's insurance coverage to attenuate the individual-level effect on asthma ED visits and completely eliminated the insurance effect on hospitalizations at the individual-level. For example, the rate of hospitalization was relatively similar between privately-insured children and publicly-insured children in neighborhoods of low concentrated poverty; however, the rate of hospitalization among publicly-insured children was much greater compared to the rate for privately-insured children was in neighborhoods with high concentrated poverty. In other words, for privately-insured children, concentrated poverty did not make a difference in the rate of hospital admission and for publicly-insured children the level of concentrated poverty increased the risk substantially. Although the neighborhood-level interaction effect size of concentrated poverty on Medi-Cal status is small, we hold that a RR of 1.03 (95% CI 1.02–1.0) has major implications at the neighborhood-level because the population at risk is substantial. For example, one could say that among Medi-Cal children, the rate of hospitalization increases by 3% with every 1% increase in neighborhood-level concentrated poverty. In the 213 SJV zip codes analyzed in this study, the mean rate of concentrated poverty was 34% with a standard deviation of 16% suggesting large amounts of variability in the rate of hospitalizations by concentrated poverty.

Prior studies have focused on the relationship between neighborhood disadvantage and individual-level access to care assuming that Medicaid status should be operationalized at the individual-level. For example, Kirby and Kaneda found that neighborhood disadvantage is associated with decreased likelihood of having a usual source of care, increased likelihood of experiencing unmet need, and decreased likelihood of obtaining preventive care, after controlling for individual-level covariates (38). Although Kirby and Kaneda control for neighborhood-level rates of general practitioners, hospital beds, and metropolitan statistical areas, similar to previous research they do not focus in on the potential effects of neighborhoods with high concentrations of childhood poverty. Browning and Cagney surveyed adults and tested the effects of social context beyond poverty in Chicago neighborhoods by measuring insurance, poverty, affluence, and residential stability, among other factors (39). They found that the effect of poverty was explained by measures of affluence, residential stability, community collectiveness, and insurance type. In preparation of the current study, our preliminary analyses suggest that low income neighborhoods in the SJV have worse food access, less green space, fewer jobs, lower quality jobs, and less educational access; each of these may reduce the capacity of families to make indoor improvements to reduce impacts of asthma (40,41). Concentrated poverty at the neighborhood level has been demonstrated to be associated with the presence of mice and cockroaches beyond individual race/ethnicity, socioeconomic status, and other social characteristics, and home-based asthma interventions can be effective in reducing the number of emergency department visits and school absenteeism when targeting the indoor and outdoor environmental burden (42,43). Poor families living in low-income neighborhoods are exposed to an array of social and environmental asthma triggers, and these neighborhood conditions present a multitude of potential causal pathways that have been theorized to impact asthma including psychosocial stressors associated with increases in allostatic load, immunological pathways, and epigenetic changes (44–47). The wide range of social and environmental burden can be reduced with effective home-based, multi-trigger, multicomponent interventions and can have economic value beyond positive health outcomes (48).

In the current study, we included asthma-related ED visits and hospitalizations for children younger than five years of age. The accuracy of asthma diagnosis in this young age group is frequently called into question mainly due to other common conditions that produce asthma-like symptoms and because of the difficulty in establishing chronicity in the very young. Additionally, lung function is difficult to measure in very young children (49). However, there are studies that suggest a shift in asthma diagnosis toward earlier life stages and the increasing reliability of asthma diagnoses in early childhood (25,50–52). A recent study demonstrated in a longitudinal design that more recent birth cohorts have earlier asthma onset in comparison to past birth cohorts, indicating that younger generations are at greater risk for asthma onset between one and four years of age (53). This study suggests that diagnostic change cannot account for the dramatic increase in asthma prevalence in this young age group. The study puts forth that unknown factors may contribute to asthma onset only in the youngest children or that the population of older children is "saturated" in their exposures. It is worth investigating if the increase in childhood concentrated poverty serves as an explanation for the increase in asthma diagnoses at early stages of life.

Limitations

The data available limit our ability to test all of the pathways that contribute to asthmatic events. For example, these data do not have information on parental cigarette smoking, long-term controller medications, asthma severity, health behaviors, psychological factors, genes, allergens, or other environmental exposures. Another limitation of the data set was that we were not able to link individuals to each visitation record; therefore, we could not measure the number of repeated visits by a child.

There is potential for effects of bias in our estimation of the Medi-Cal and private pay populations in the SJV. In estimating the Medi-Cal eligible population, we could not take into account immigration status, family mobility, and other barriers to enrollment. On one hand, if we overestimated the overall Medi-Cal population this would lead to lower rates of observed hospital care use. Alternatively, if we underestimated this population, the rates of observed hospital use would exaggerate the difference in use between Medi-Cal and privately-insured children. Potentially the estimated privately-insured population could be underestimated due to middle class individuals not getting insurance at work, not buying privately, or being priced-out and unable to afford coverage. This would work to decrease the estimated rate among privately insured and would increase payer effect observed. We compared our insurance coverage estimates to self-reported coverage type from UCLA's AskCHIS survey tool and concluded that there were almost no children above 300% of poverty who were uninsured and of those who were below 200% of poverty about 4–6% were reported being uninsured. Although children may enroll in Medi-Cal at the time of service, especially when considering hospital presumptive eligibility guidelines by the Centers for Medicare and Medicaid Services and the Children's Health Insurance Plan (CHIP) services (54), these data suggest that any bias in our insurance coverage estimation may underestimate the rate difference by insurance type. California provides continuous eligibility for Medi-Cal and CHIP coverage promoting ongoing preventive primary care as well as treatment for health issues (55).

Conclusions

We found that pediatric populations using Medi-Cal are at increased risk for ED visitation when living in a neighborhood with concentrated poverty compared to children using Medi-Cal who reside in communities that are more affluent. Our findings extends accounts of inner city asthma to more rural communities; it shows the effect of neighborhood segregation on low-income Latinos, and that neighborhood influences vary by payer status as well as race/ethnicity and age. To the best of our knowledge, there are no studies demonstrating the interaction between individuals' payer status and communities' health care access. This study suggests that a social mechanism exists on the pathway of poverty to pediatric asthma hospital care and that in-home asthma intervention programs may have further reaching effects if they include reducing environmental burdens both in-home and outdoor as well as social interventions that increase pediatric and familial access to the health care services.

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Declaration of interest

The authors report no potential conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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