Pollution, Poverty, and Potentially Preventable Childhood Morbidity in Central California

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Objective To measure ecological relationships between neighborhood pollution burden, poverty, race/ethnicity, and pediatric preventable disease hospitalization rates.

Study design Preventable disease hospitalization rates were obtained from the 2012 California Office of Statewide Health Planning and Development database, for 8 Central Valley counties. US Census Data was used to incorporate zip code level factors including racial diversity and poverty rates. The pollution burden score was calculated by the California Office of Environmental Health Hazard Assessment using 11 indicators. Poisson-based negative binomial regression was used for final analysis. Stratification of sample by age, race/ethnicity, and insurance coverage was also incorporated.

Results Children experiencing potentially preventable hospitalizations are disproportionately low income and under the age of 4 years. With every unit increase in pollution burden, preventable disease hospitalizations rates increase between 21% and 32%, depending on racial and age subgroups. Although living in a poor neighborhood was not associated with potentially avoidable hospitalizations, children enrolled in Medi-Cal who live in neighborhoods with lower pollution burden and lower levels of poverty, face 32% lower risk for ambulatory care sensitive condition hospitalization. Children living in primary care shortage areas are at increased risk of preventable hospitalizations. Preventable disease hospitalizations increase for all subgroups, except white/non-Hispanic children, as neighborhoods became more racially diverse.

Conclusions Understanding the geographic distribution of disease and impact of individual and community level factors is essential to expanding access to care and preventive resources to improve the health of children in California's most polluted and underserved region. *(J Pediatr 2016;168:198-204)*.

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Ambulatory care sensitive conditions (ACSCs) are diagnoses for which timely and effective outpatient, or ambulatory, treatment can help reduce the likelihood of hospitalizations through prevention and/or management of a health condition.[1] Examples of ACSC diagnoses in pediatric hospitalizations include asthma, pneumonia, and conditions for which immunizations are available.[2] Prior research highlights the effects of insurance status and access to primary care as key determinants of ACSCs.[3-5]

Inequalities in ACSC hospitalizations point toward the larger issue of social inequalities in health. Understanding the characteristics of communities disproportionately shouldering ACSC hospitalizations is an important step in identifying associated causes. Research demonstrates an overall pattern suggesting that the clustering of social, economic, and environmental health risks in low income and racially segregated neighborhoods limits opportunities for people in these communities to live healthy lives.[6,7] The combined ecological/neighborhood exposures are also known as "multiple risk exposure" and "cumulative risk" and appear to be particularly detrimental for children.[8] A prominent theory is that the burden of cumulative exposure over the life course increases the vulnerability of individuals, usually members of traditionally excluded racial/ethnic groups in lower socioeconomic communities, and increases the likelihood that elevated environmental exposures will impair their health.[9]

California's San Joaquin Valley (SJV) is an important region, responsible for a substantial portion of the nation's agricultural production. Its residents suffer from high rates of poverty and cumulative exposure to environmental hazards, as indicated in the Figure. Recent studies in the SJV demonstrated that residents of its 8 counties experience worse overall health and shorter life expectancies than other California regions. The variability of life expectancy by zip code is among the highest in the nation. In zip codes with the lowest life expectancy, people can

ACSC	Ambulatory care sensitive condition
CES	CalEnviroScreen
FPL	Federal poverty line
ICD-9	*International Classification of Diseases, Ninth Revision*
SJV	San Joaquin Valley

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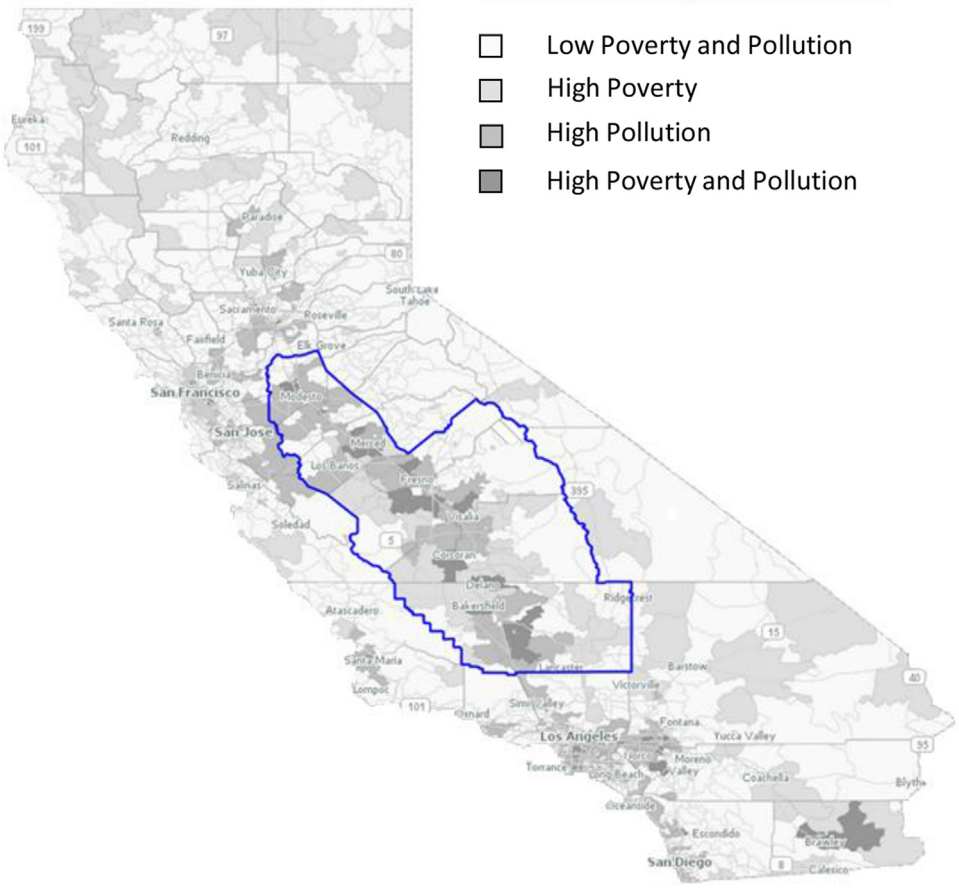

Figure. Top quintile of poverty and pollution in California's SJV. Pollution Burden Score, California Office of Environmental Health Hazard Assessment (OEHHA) CalEnviroScreen version 1.0 and Individuals Living in Poverty, American Community Survey, 2012.

expect to live approximately 69 years or less, and people can expect to live to 90 years or more in zip codes with the highest life expectancy. Many of the zip codes with low life expectancy have been highlighted in recent reports describing how historic redlining policies and current development models have concentrated African American, and more recently Latino and Asian immigrant families in relatively diverse urban core and rural slum neighborhoods.[5,10]

This study seeks to analyze ACSC events in the context of race, poverty, pollution, and neighborhood composition, a cumulative approach not previously explored with ACSC diagnoses.

Methods

This is a retrospective analysis of ACSC hospitalizations. Inpatient healthcare facilities licensed by the state of California are required to submit data to the California Office of Statewide Planning and Development semi-annually regarding all patient hospitalizations.[11] The data are de-identified and made publicly available within 2 years of admission. Each ACSC hospitalization record includes information on the patient's race/ethnicity, age, sex, county, and zip code of residence, expected source of payment, hospital charges, and facility type. There may be repeat preventable disease hospitalizations for the same individual, but unfortunately, the de-identification process did not allow for preventable disease hospitalizations to be grouped by patient. A primary *International Classification of Diseases, Ninth Revision* (ICD-9) diagnosis and up to 24 additional diagnoses are also included. For this analysis, 2012 California Office of Statewide Planning and Development patient discharge data were used from admissions of individuals residing within the 8 SJV counties: San Joaquin; Stanislaus; Merced; Madera; Fresno; Kings; Tulare; and Kern.

Measures

ACSC hospitalizations in the SJV were assessed using ICD-9 codes classified as prevention quality indicators by the Agency for Healthcare Research and Quality. The Agency for Healthcare Research and Quality prevention quality indicators consist of ACSCs for which appropriate outpatient care can prevent the need for hospitalizations or for which early intervention can prevent complications or more severe disease. These