

Social Determinants of Emergency Department Visits in Mild Compared To Moderate and Severe Asthma

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Research Article

Keywords: Social determinants, emergency department, asthma

Posted Date: December 15th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-1157040/v1>

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Version of Record: A version of this preprint was published at Lung on March 23rd, 2022. See the published version at <https://doi.org/10.1007/s00408-022-00524-3>.

Abstract

Social determinants of health (SDH) influence emergency department (ED) use among children with asthma. We aimed to examine if SDH were more strongly associated with ED use among children with moderate/severe compared to mild asthma. This study utilized the 2016-2019 data from the National Survey of Children's Health. Children with asthma ages 0-17 years (N=9,937) were included in the analysis. Asthma severity and all-cause ED use in the past year were reported by caregivers. The association between patient factors and ED visits was evaluated using ordinal logistic regression. Based on the study sample, 29% of children with asthma had moderate/severe asthma. In the mild group, 30% visited the ED at least once in the past 12 months, compared to 49% in the moderate/severe group. SDH associated with ED visits included race/ethnicity, insurance coverage, and parental educational attainment, but the strength of these associations did not vary according to asthma severity. In a nationally-representative data set, SDH were equally predictive of ED use regardless of children's asthma severity. Interventions to reduce ED use among children with asthma should be considered for children with any severity of asthma, especially children in socially disadvantaged groups at higher risk of ED utilization.

Introduction

Asthma is the most common chronic lung disease among children, affecting nearly 9% of children in the United States.¹ As a multifactorial disease, asthma is influenced by biologic, social, and environmental exposures throughout the life course. The lack of access to preventive measures like medications, primary care visits, and good quality environmental conditions can lead to poorer outcomes for children with asthma, including emergency department (ED) visits for asthma exacerbation. In 2013-2015 there were 129.6 ED visits for asthma per 10,000 children under 5 years of age.¹ The burden of ED visits for asthma exacerbation is higher among children with social determinants of health signifying socioeconomic disadvantage. For example, ED utilization is higher among children with asthma who have public insurance or gaps in insurance coverage, lower parental education, lower income, environmental exposures, and lack of access to medical care.²⁻⁴

Although prior studies have documented several socioeconomic disparities in ED use among children with asthma, these studies do not consider the possibility that social determinants of health (SDH) could matter more for children with moderate/severe asthma opposed to children with mild asthma. For children with moderate/severe asthma, challenges to disease control associated with socioeconomic disadvantage could be more likely to result in asthma exacerbation requiring treatment in the ED, whereas for children with mild asthma, differences in disease control according to socioeconomic characteristics may be less likely to result in ED visits. A stronger association of SDH with ED visits in children who have moderate/severe asthma could imply a need to prioritize efforts to address SDH in these groups to improve health outcomes. Therefore, in this study, we used nationally representative data to test whether associations between SDH and ED use were stronger among children with moderate/severe asthma, as compared to children with mild asthma. Our hypothesis was that each SDH would be correlated with ED

visits more strongly among children with moderate or severe asthma, than among children with mild asthma.

Methods

We used data from the 2016-2019 National Survey of Children's Health (NSCH), a nationally representative cross-sectional survey collecting data on the physical and emotional health of US children age 0-17 years.⁵ Analysis of these data was deemed not human subjects research by the local Institutional Review Board. One child per household was randomly sampled for collection of detailed data by a knowledgeable caregiver, using a self-administered paper or web questionnaire.⁵ For our study, we limited the analysis to children who had been diagnosed with asthma and still had asthma at the time of the survey. Following prior research, we stratified this sample by caregiver rating of asthma severity (mild vs. moderate or severe),⁶ and excluded cases with unknown asthma severity. Lastly, we excluded cases with missing data on the study outcome (ED visits) or study covariates.

The primary outcome was the number of all-cause ED visits in the past 12 months, classified as none, one, or two or more.² The primary independent variable was caregiver-reported asthma severity (mild vs. moderate or severe). Measures of SDH included parental educational attainment (highest of either parent) and type of insurance (any private, public only, or none). Covariates included the child's age, sex, race/ethnicity, exposure to tobacco smoke, and whether the child has a usual source of health care that was not the ED.

Data were summarized using weighted means or proportions and compared by categories of asthma severity using Wald test. The association between patient factors and ED visits was evaluated using an ordinal logistic regression. We initially fit unadjusted models where the number of ED visits was regressed on each patient factor and its interaction with asthma severity.⁷ As none of the interaction terms reached statistical significance, the final multivariable model included asthma severity and the patient factors, but no interactions between patient characteristics and asthma severity. All analyses accounted for survey weights and the complex sampling design. Data analysis was conducted using Stata/SE 16.1 (College Station, TX: StataCorp, LP). $P < 0.05$ was considered statistically significant.

Results

The 2016-2019 NSCH included 10,394 children with asthma, of whom 53 were excluded due to unknown asthma severity, and 404 were excluded due to missing data on study variables. Based on the 9,937 children in the analytic sample, we estimated that 35% of children with asthma had moderate or severe asthma as rated by their caregivers (95% confidence interval [CI]: 33%, 37%). We estimated that 64% of children with asthma did not visit the ED in the last 12 months (95% CI: 62%, 66%), 23% visited the ED once (95% CI: 21%, 25%), and 13% visited the ED more than once (95% CI: 12–15%).

ED visit frequency and patient characteristics are compared by asthma severity in Table 1. Children with moderate or severe asthma were more likely to visit the ED than children with mild asthma. Children identified as non-Hispanic white or non-Hispanic other were significantly more likely to have mild asthma compared to Hispanic and non-Hispanic black children who were more likely to have moderate or severe asthma. Children of parents with a maximum education level of high school or less were significantly more likely to have moderate/severe asthma, while parents of children with more than a bachelor's degree were significantly more likely to have mild asthma. Children with any private insurance were significantly more likely to have mild asthma, while children with only public insurance were significantly more likely to have moderate or severe asthma.

Table 1

Emergency department visits and patient characteristics by caregiver-rated asthma severity (N=9,937).

Variable	Children with mild asthma (N=7041)	Children with moderate/severe asthma (N=2896)	P
	Weighted mean or proportion (95% CI)	Weighted mean or proportion (95% CI)	
ED visits in last 12 months			
0	0.70 (0.68, 0.73)	0.52 (0.47, 0.56)	<0.001
1	0.21 (0.19, 0.23)	0.26 (0.22, 0.31)	0.022
2 or more	0.09 (0.07, 0.10)	0.22 (0.18, 0.26)	<0.001
Age (years)	10.4 (10.2, 10.6)	10.2 (9.8, 10.5)	0.301
Sex			
Male	0.57 (0.55, 0.60)	0.54 (0.50, 0.58)	0.219
Female	0.43 (0.40, 0.45)	0.46 (0.42, 0.50)	0.219
Race/ethnicity			
Non-Hispanic White	0.47 (0.45, 0.50)	0.37 (0.33, 0.40)	<0.001
Non-Hispanic Black	0.19 (0.17, 0.21)	0.27 (0.24, 0.31)	<0.001
Hispanic/Latino	0.22 (0.20, 0.25)	0.29 (0.24, 0.34)	0.014
Other	0.11 (0.10, 0.13)	0.07 (0.06, 0.09)	<0.001
Insurance type			
Private	0.61 (0.59, 0.64)	0.44 (0.40, 0.48)	<0.001
Public only	0.34 (0.32, 0.37)	0.50 (0.46, 0.55)	<0.001
None	0.04 (0.03, 0.06)	0.06 (0.04, 0.07)	0.202
Parental educational attainment			
High school or less	0.23 (0.20, 0.25)	0.30 (0.27, 0.35)	0.001
Some college	0.32 (0.30, 0.34)	0.35 (0.31, 0.39)	0.258
Bachelor's degree	0.22 (0.21, 0.24)	0.19 (0.17, 0.22)	0.059
Graduate/professional degree	0.23 (0.21, 0.25)	0.15 (0.13, 0.18)	<0.001

CI, confidence interval; ED, emergency department

Variable	Children with mild asthma (N=7041)	Children with moderate/severe asthma (N=2896)	P
	Weighted mean or proportion (95% CI)	Weighted mean or proportion (95% CI)	
Tobacco exposure	0.19 (0.17, 0.21)	0.20 (0.17, 0.23)	0.628
Has usual source of care	0.80 (0.78, 0.82)	0.20 (0.17, 0.23)	0.067
CI, confidence interval; ED, emergency department			

On unadjusted ordinal logistic regression, none of the SDH or other patient factors were differentially associated with the number of ED visits (**Appendix** Table 1). Therefore, the final multivariable model included no interaction coefficients (Table 2). In this model, factors associated with more ED visits included moderate/severe asthma, having only public insurance, and identifying as non-Hispanic Black. Factors associated with fewer ED visits included high parental educational attainment (bachelor's or graduate/professional degree).

Table 2
Multivariable ordinal logistic regression of emergency department visits (N=9,937).

Variable	OR	95% CI	P
Asthma severity			
Mild	Ref.		
Moderate/severe	2.13	1.73, 2.63	<0.001
Age (years)	0.91	0.89, 0.93	<0.001
Sex			
Male	Ref.		
Female	0.91	0.74, 1.11	0.35
Race/ethnicity			
Non-Hispanic White	Ref.		
Non-Hispanic Black	1.49	1.17, 1.90	0.001
Hispanic/Latino	1.09	0.81, 1.46	0.59
Other	1.14	0.86, 1.50	0.36
Insurance type			
Private	Ref.		
Public only	1.60	1.25, 2.05	<0.001
None	1.60	1.04, 2.47	0.034
Parental educational attainment			
High school or less	Ref.		
Some college	0.80	0.60, 1.07	0.14
Bachelor's degree	0.58	0.42, 0.79	0.001
Graduate/professional degree	0.59	0.41, 0.85	0.004
Tobacco exposure	1.20	0.94, 1.54	0.14
Has usual source of care	0.77	0.59, 1.00	0.054
CI, confidence interval; OR, odds ratio; Ref. reference			

Discussion

Our study examined whether social determinants of ED utilization among children with asthma differed in their association with this outcome based on the severity of asthma. Using data from a large nationally representative survey, we confirmed that children with public insurance, children whose parents had a maximum education level of high school or less, and children who were Hispanic or African American were more likely to have ED visits in the past 12 months. We found no support for our primary hypothesis, insofar as these social determinants had equally strong associations with ED visits among children with mild asthma, and among children with moderate/severe asthma. Therefore, efforts to address social determinants of ED visits among children with asthma should include not only children with moderate-to-severe asthma, but also children with mild or currently well-controlled asthma.

Previous studies analyzed how SDH such as neighborhood disorder, stress, socioeconomic status, parental mental health problems, country of origin, and food insecurity affect the prevalence of asthma and its clinical outcomes.⁸⁻¹⁴ However, these studies did not analyze how severity of asthma might modify the relationship between SDH and ED use. We hypothesized that children with moderate or severe asthma would experience stronger associations between SDH and ED use, owing to worse asthma control in this group and potentially stronger links between SDH and risk of exacerbations requiring treatment in the ED. However, we found that SDH (e.g., race/ethnicity, insurance coverage, parental educational attainment) were equally predictive of ED use regardless of children's asthma severity. We speculate that this may reflect different mechanisms connecting SDH and ED visits in children with mild as compared to moderate/severe asthma. While SDH might influence ED visits in children with moderate/severe asthma due to increasing the risk of exacerbations, the same SDH factors might influence (all-cause) ED visits in children with mild asthma due to their association with barriers to receiving health care in other settings, such as lack of a consistent healthcare provider, transportation issues, and financial hardship.

The importance of SDH as a risk factor for ED visits among all children with asthma raises the question of how these social factors can be best addressed in clinical and community settings. Previous work has described addressing social needs in this population within an outpatient asthma clinic, leading to sustainable reduction in ED utilization in a high-risk asthma population,¹⁵ or conducting screening for SDH using community health workers once children have been hospitalized for asthma exacerbation.¹⁶ Importantly, these initiatives have disproportionately targeted children with moderate or severe asthma (e.g. children who have already been hospitalized, or children identified as high-risk in an outpatient clinic). However, our study suggests that addressing SDH among children with asthma regardless of its severity could help reduce ED visits. Therefore, screening interventions to identify SDH related to food insecurity, housing, medication, transportation, and health literacy could be implemented for children with asthma seen in a wide range of settings,¹⁷⁻²⁰ whether inpatient, outpatient primary care, outpatient subspecialty, or school-based clinics.

Even though our study utilized the largest available nationally representative survey data on US child health, our conclusions are subject to several limitations. We utilized cross-sectional survey data, relying on caregivers to answer questions about their children's health, which could subject the data to recall and

non-response bias. An additional limitation was the lack of data on asthma-specific ED visits (which were not assessed in the NSCH), as opposed to all-cause ED visits. However, previous analyses have demonstrated similar patterns of health disparities in all-cause and asthma-specific ED use among children with asthma.² The dataset used in this study did not include environmental exposures, which may have provided further information on the causal pathway linking SDH and ED use among children with asthma.²¹ Lastly, we were unable to ascertain whether children had been screened for SDH in a clinical setting, or if they had participated in asthma-specific initiatives aimed at improving asthma control and reducing ED use.

In conclusion, our study found that SDH were equally predictive of ED use among children with asthma regardless of caregiver-reported asthma severity. Addressing SDH among all children with asthma may reduce ED utilization, health care costs and asthma exacerbations in this population, although the underlying mechanisms are likely different between children with mild and those with moderate or severe asthma. Based on our findings, we suggest that healthcare professionals screen for SDH early on to help families connect with appropriate community resources to improve pediatric asthma outcomes.

Declarations

"Conflict of Interest: None"

"The authors declare that no funds, grants, or other support were received during the preparation of this manuscript."

"The authors have no relevant financial or non-financial interests to disclose."

"All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by [Kamel Alachraf], [Caroline Currie], [Dr. Dmitry Tumin] and [Dr. William Wooten]. The first draft of the manuscript was written by [Kamel Alachraf] and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript."

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Supplementary Files

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- [AppendixTable1.docx](#)