

The Impact of Social Determinants of Health on Children with Asthma



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SzAsthma is the most common chronic disease of childhood. Disparities in asthma outcomes have led to international attention on the biologic, social, economic, and other factors that impact the health of children with asthma. Studies indicate that social determinants of health such as housing, neighborhood safety, and access to care significantly impact the health of children with asthma. However, screening for socioeconomic and environmental factors that impact asthma can be difficult to integrate into clinical practice. In addition, it is not yet clear which interventions to address these factors are most effective. This article will review recent studies of determinants and social determinants of health and propose a framework for identifying and addressing them in the care of children with asthma in a clinical setting. © 2020 Published by Elsevier Inc. on behalf of the American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2020;8:1808-14)

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INTRODUCTION

Asthma is the most common chronic disease of childhood in the United States. From 2001 to 2013, asthma prevalence in the United States increased and then plateaued at 8.3%.^{1,2} Across the globe, asthma prevalence is increasing according to the

Global Burden of Disease study published in 2016, and cited and reported in the 2018 Global Asthma Report.³ The morbidity of asthma in the United States is high and is higher in children than in adults. Children missed more than 13.8 million days of school in 2013.^{2,4} The projected costs of poorly controlled asthma leading to outpatient, emergency department (ED) visits, hospitalizations, and other direct and indirect costs over the next 20 years are more than 50 billion dollars per year.^{5,6}

Asthma prevalence and asthma outcomes vary across populations. Asthma is more prevalent globally in adults and children with low socioeconomic status and in other overburdened and underresourced populations.^{2,3} In the United States, asthma prevalence varies by race and ethnicity.¹ In 2016, the prevalence of asthma according to the National Health Interview Survey was 15.7% in blacks, twice that in the white population.² Disparities in asthma morbidity, as defined by asthma exacerbations (hospitalizations or ED visits or requiring oral steroids), asthma control, and exercise limitation, are also evident in the United States even after controlling for the increased prevalence seen in black and Puerto Rican populations.⁷

The mechanism of poor asthma outcomes in black children is not clear. Previous studies suggest that disparities in asthma may be due in part to a differential response to asthma therapy or genetic difference in response to inflammation.⁸ New data from the Severe Asthma Research Program supports data published previously by Beck et al,⁹ suggesting that the racial differences in asthma outcomes may be explained by environmental, socioeconomic, and other social determinants (SDs) of health.¹⁰ These results highlight the urgency of identifying SDs of health to address the disparities in asthma outcomes seen across populations. These studies also suggest that interventions to eliminate disparity should be directed at social, economic, and environmental inequities.¹¹

The World Health Organization defines SDs of health as “conditions in which people are born, grow up, live, work and age. These conditions influence a person’s opportunity to be healthy, his/her risk of illness and life expectancy. Social inequities in health—the unfair and avoidable differences in health status across groups in society—are those that result from the uneven distribution of social determinants.”¹² In various studies and reports, SDs of health are said to account for up to 50% of the variation in health. Studies of severe asthma in the United States, the United Kingdom, and elsewhere suggest that SDs of health impact health and health care in at least half if not more of the children with asthma.^{10,13} Factors associated with increased asthma morbidity can include poverty,^{2,3} poor housing,¹⁴ high levels of environmental pollution, second-hand smoke (SHS), allergen exposure, poor access to specialty care or high-quality primary care,¹⁵ exposure to high levels of stress or family

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Abbreviations used

ED- Emergency department

OR- Odds ratio

SD- Social determinant

SHS- Second-hand smoke

chaos,^{16,17} and lack of community/social support.¹⁸⁻²⁰ Matsui et al¹¹ suggest that to understand causal pathways in asthma, investigators need to integrate an evaluation of environmental, socioeconomic, and psychosocial pathways into any study of the biologic factors impacting asthma.

This Rostrum will address the impact of SDs of health on asthma morbidity in children in the United States and around the world. We will propose a framework for thinking about and discussing SDs of health and a basic outline for addressing SDs of health in asthma care in practice. The approach to addressing SDs of health is similar to those proposed by the National Academy of Health, the American Academy of Pediatrics, and others.^{21,22} We will not address the disparities in asthma prevalence. There is evidence that SDs of health such as poverty and race impact the prevalence of wheeze and asthma. The biologic mechanism may include epigenetic change related to stress and hardship. However, the root cause of asthma is likely multifactorial and there is much left to learn about the complicated impact of SDs of health on asthma prevalence in the United States and other populations and therefore beyond the scope of this article.

A FRAMEWORK FOR SDs OF HEALTH OF ASTHMA OUTCOMES

Maslow's Hierarchy of Needs is a well-known, theoretical construct that is used in many sectors to describe what motivates or allows humans to achieve goals and address barriers.²³ Academic studies have used Maslow's hierarchy to better categorize barriers to care.²⁴ Others have evaluated the retention of vulnerable families in longitudinal research using this framework.²⁵ In 2015, Henize et al²⁴ in the Pediatric Primary Care Center in Cincinnati used Maslow's Hierarchy of Needs to create a common framework for discussing the SDs of health with the community as they built a partnership to improve child health.

Maslow's hierarchy has been recreated in Figure 1. It includes a tiered set of needs that must be satisfied before a person can reach self-actualization or "full potential."²⁵ The categories in Figure 1 are taken from Maslow's original article. They include (1) physiologic needs (food and shelter); (2) safety (safe homes and neighborhoods); (3) belonging (community support and loving relationships); (4) self-esteem (independence and confidence); and (5) full potential (the child and family's ideal state of health).

There are factors that affect families and children at several levels of this hierarchy and are therefore difficult to put in the hierarchy that we will address separately, before reviewing the data behind the SDs of health in each tier of Figure 1. The first is poverty. Children with asthma and their families who live just above, at, or below the poverty line are more likely to have increased asthma morbidity.¹ As with all determinants of health, this relationship may be mediated by differences in physical environment, neighborhood characteristics, family relationships, education, and access to health services.^{14,26-30} It has been

suggested that the relationship between poverty and asthma is higher in the United States than in other high-income countries, and that this relationship may be related to surrogates of poverty, in particular urban living—housing and aeroallergen exposure—that is worsening asthma in inner cities in the United States more so than in other parts of the world.³¹ Socioeconomic status as a SD of health is therefore difficult to put into a framework such as Maslow's Hierarchy of Needs. For a provider who is working with the family or even a health system that is working with the community, it may be easier to approach patient care and interventions by breaking down many of the aspects of poverty into limited resources and the psychosocial impact of having limited access to resources. Using Maslow's hierarchy, those might include barriers to meeting physiologic needs (food and shelter), safety (safe neighborhoods), and self-esteem.

The second overarching factor is race/ethnicity. In the United States, Hispanic and black Puerto Rican populations have worse asthma outcomes than the white population.⁷ The mechanism for that association is unclear. Although we understand that race/ethnicity are social constructs, there may be a biological mechanism that is not yet delineated. Race/ethnicity are also often inextricably connected to many other determinants. Experiences of racism and discrimination are often unnamed SDs of health that can both confound and mediate the relationship between race/ethnicity and asthma.^{11,32} In separate studies, Beck et al⁹ and Fitzpatrick et al¹⁰ showed that 80% of asthma outcome differences seen in the black and white patients in the study could be explained by SDs of health such as socioeconomic status, neighborhood characteristics, and hardship. In an elegantly written editorial, Matsui et al¹¹ suggested that providers consider biologic factors in tandem with economic, environment, psychosocial, life hardship, and other disparities when evaluating the relationship between race/ethnicity and asthma outcomes. Stempel et al³³ further explored how to apply a biopsychosocial model to pediatric asthma care.

Below, we will provide the data that explain factors that can be separated into Maslow's tiers. It is worth noting that although the framework has clear categories, the barriers to satisfying needs in each tier are complicated as many of the SDs of health coexist and interact.

Physiologic

Food. The need for food, water, and shelter must be met before any others according to Maslow's hierarchy. Studies in child health show that children who live with caregivers who feel insecure about the amount of food they have or who experience housing instability have worse chronic health care outcomes.^{34,35} In 2019, Drennen et al³⁶ reported that the incidence of food insecurity, for example, was 27% in a survey of caregivers of more than 28,000 children in 5 cities. There have been few studies looking at the relationship between food insecurity and asthma outcomes. A recent study of children with asthma and Supplemental Nutritional Assistance Program participation found that an increase in monthly food stamp benefits led to a decrease in asthma-related ED visits, suggesting that decreased concern about feeding the family may allow parents to prioritize asthma care.³⁷

Shelter. The association between asthma outcomes and housing is likely multifactorial. However, poor asthma control and exposure to allergens and indoor allergens such as pests and



FIGURE 1. Maslow's hierarchy of needs (developed from Maslow et al²²). It has been used in a health care setting to categorize barriers to care, and SDs of health.

molds has been extensively reported in the literature. Mouse and cockroach exposure in inner-city homes has been described as endemic.³⁸ Beck et al¹⁴ analyzed publicly available housing code violation data in a large urban area and adjusted the violation reports by the number of living units. Examples of asthma-relevant housing code violations include cockroaches, rodents, mold, water damage, and so forth.¹⁴ ED visits and hospitalizations for asthma were 22% higher in children with asthma living in census tracts with a high density of asthma-relevant housing code violations after adjusting for poverty. Children in those areas were also more likely to be readmitted for asthma. In a study of 150 urban children with asthma, every 10-fold increase in bed mouse allergen level was associated with an 87% increase in the odds of any asthma-related health care use among mouse-sensitized (odds ratio [OR], 1.87; 95% CI, 1.21-2.88) but not non—mouse-sensitized children.³⁹

Unfortunately, allergen exposure in the home is not the only risk to children with asthma.⁴⁰ Allergen exposure in school was found to be higher than in many homes with mouse, cat, and dog allergens found in more than 90% of schools, with only cockroach more commonly in homes.⁴¹ Further analysis indicated that mouse allergen exposure is associated with increased asthma symptoms and decreased lung function.⁴¹

Air quality. Studies have suggested that urban living, exposure to fuel combustion, and other vehicle emission may worsen asthma morbidity.⁴² However, urban living is also associated with SHS exposure and increased aeroallergen exposure. Therefore, the association between air quality and asthma health is difficult to separate out from other SDs of health.^{29,43}

Inner-city living. The association between inner-city living and asthma outcomes is similarly difficult to discern. When looking specifically at inner-city urban living, a study of 23,065 children noted no significant difference in the prevalence of current asthma or asthma morbidity between inner-city and non—inner-city areas after adjusting for race/ethnicity, region, age, and sex, whereas lower household income, black race, and Puerto Rican ethnicity were all independent risk factors.⁴³ This study concluded that “although the prevalence of asthma is high in some inner-city areas, this is largely explained by demographic factors and not by living in an urban neighborhood,” leading to a call to “rethink” the asthma epidemic in inner cities. As noted in a recent review, “Re-examining these paradigms of asthma risk factors and performing rigorous analyses to uncover complexities among associations of neighborhood and asthma are important. It is not solely one's neighborhood but the segregation within the neighborhood that contribute to disease and health disparities.”⁴⁴

SHS exposure. Consistent associations have been noted between SHS exposure and measures of asthma morbidity in children including increased risk of ED visits, health care utilization, asthma severity, persistence of asthma, poorer pulmonary function, risk of hospitalization, and exacerbation severity (requiring intravenous steroids).⁴⁵⁻⁴⁸ A systematic review and meta-analysis of 25 studies notes that children with asthma and SHS exposure were twice as likely to be hospitalized for asthma (OR, 1.85; 95% CI, 1.20-2.86) than children with asthma but without SHS exposure.⁴⁷ Children with SHS exposure and asthma were also significantly more likely to have ED visits (OR, 1.66; 95% CI, 1.02-2.69), wheeze symptoms (OR, 1.33;

95% CI, 1.24-1.41), and lower ratio of FEV₁ to forced vital capacity (OR, -3.35; 95% CI, -5.35 to -1.33). However, as always, confounders exist. Children and families who report SHS exposure in studies have been shown to have less access to care, and lower rates of influenza vaccination.⁴⁹

Safety

Children exposed to violence and stress. Neighborhood violence has been associated with biologic change, including cortisol levels, mental health, and stress in children.^{50,51} Several studies show that exposure to stress may increase a child's risk for poor asthma outcomes. For example, Beck et al³⁰ showed that children living in census tracts with high level of violent crime reports were more likely to be admitted to the ED or hospital even after controlling for income, housing, and traffic exposure.^{30,52}

Family relationships and chaos. Several studies show that good relationships in the home can protect children from the impact of neighborhood violence. Research by Chen et al^{20,53,54} over several studies shows that good family relationships may protect children with asthma from poor asthma control and poor asthma outcomes despite living in poor neighborhood social conditions. Alternatively, "family chaos," which has been defined in validated tools as trouble accomplishing goals, finding things, or establishing a routine, has been associated with disruptions in the caregivers' ability to prioritize medications and symptom monitoring.^{17,55}

Access to health services. As with many determinants of health, the effect of poor access to health services is difficult to separate from other SDs of health. Broad racial and ethnic disparities have been noted to impact access to medical care across the United States, beyond the realm of asthma.¹⁵ In a study of 648 urban minority children, seeing a specialist was significantly associated with a reduction in asthma exacerbations. However, a multivariate analysis showed that poor children were 4 times less likely to be seen by an asthma specialist than nonpoor children with asthma.⁵⁶ Access to specialist care is not only related to increased likelihood to have a written asthma action plan and to be on a daily controlled medication, but also it is possible that access to biologics in asthma care for children with severe, treatment-resistant asthma will be less when followed over time.

Belonging

Social isolation and community support. Parents and children, especially adolescents with asthma and allergies, describe social isolation as result of the asthma, the medications, or anxiety related to the disease and its possible outcomes. These factors may impact mental health, health beliefs, and adherence to asthma medications, which leads to poor asthma outcomes.^{57,58}

One study of perceived social support showed that adolescents who report poor social support are significantly less likely to take their medications.¹⁹ In a separate study, family support was linked to improved adherence to medications, asthma control, and asthma quality of life.¹⁸ Studies show that school programs are an effective way to improve asthma control and outcomes. However, many parents do not feel that the schools understand asthma or are willing to partner with them in the care of asthma.⁵⁹

Esteem

In Maslow's Hierarchy, esteem refers to self-confidence, respect, and prestige.

Education and health literacy. Education and occupation are linked to prestige and esteem in many countries and societies. In the care of children with chronic disease, self-confidence and self-efficacy are linked to improved asthma control and outcomes. The confidence to manage chronic disease is inextricably linked to the ability to understand and use health information to make health-related decisions. This ability is central to the definition of health literacy.⁶⁰ As with all categories of determinants of health, health literacy is difficult to separate from other SDs of health including socioeconomic status, race/ethnicity, and education. Health literacy also is not fixed; it may change over time with increasing interaction with health-related services. Finally, health literacy is complicated by differences in expectations of health and chronic disease, which may vary by culture and family experiences.⁶¹ Unsurprisingly, study results of the direct relationship between health literacy and asthma outcomes are variable.^{62,63} An upcoming systematic review on how to improve health literacy with asthma may help inform research moving forward.⁶⁴

What is clear is that all patients, regardless of education and health literacy, benefit from a better understanding of the disease and treatment plans. Thus, consistent messaging, clear, simplified education and educational tools, and involving patients and families in discussions of asthma care to improve patients' and families' understanding of asthma may be the best way to impact self-confidence and self-management skills. For example, studies showing improved parent understanding of asthma when using asthma action plans with pictures indicate that all patients benefit from clear and simple educational tools.⁶⁵ Studies of shared decision making, where providers work to understand the patient and families' understanding of the disease and treatments and work together to create treatment plans and goals, are also encouraging. In a study of 756 children in North Carolina, patients and families whose providers implemented shared decision making were followed for more than 3 years and then compared with matched controls. Those receiving usual care were twice as likely to require oral steroids.⁶⁶ A study of an electronic portal to encourage shared decision making showed improved understanding of asthma and improved patients' and parents' satisfaction with care.⁶⁷

Self-actualization

The top of Maslow's pyramid, self-actualization, is reaching one's "full potential." In a child with asthma, "full potential" may be that a kid can be a kid and participate in almost any activity they choose, go to school, and never feel limited. The parents may reach their potential when they can to consider their own goals without constant worry about the health of their child with asthma.

ADDRESSING SDs OF HEALTH IN ASTHMA

A task force to address disparities in child health was convened in 2016 by the Environmental Protection Agency and the Director of Health and Human Services. Renewing the Federal Commitment to Advance Children's Health: The President's Task Force on Environmental Health Risks and Safety Risks to Children calls for "new policies, community programs, and

TABLE I. Pragmatic steps to addressing SDs of health in clinic

Working with patients	1. Use shared decision making in creating shared asthma goals and treatment plans 2. Use clear and simple educational tools with consistent messaging at a low literacy level such as low literacy asthma action plans to reinforce asthma education⁷³ 3. Work to connect families to their schools and school nurses 4. Work with office to screen for modifiable environmental, socioeconomic, behavioral, safety, and other SDs of health
Adjusting the health system	1. Collaborate with patients and the community to build partnerships and build a multipronged support system for patients with asthma and their families 2. Take data from those programs to other sectors and to payers to advocate for a population health approach that includes support for services to address disparities in care and SDs of health
Local and federal advocacy	1. Collaborate with providers, caregivers, and families to advocate for change to housing, transportation, education, and other areas that impact health. Examples might include tobacco and e-cigarette legislation and housing laws that require landlords to address housing violations and asthma triggers 2. Work with health systems to advocate for change and support and educate providers who are willing to speak

research to reduce the burden of asthma among minority children and those with family incomes below or near the poverty level.”⁶⁸ Despite this call to action, many providers are hesitant to ask about SDs of health because they feel that they do not have the expertise, the resources, or time to address the answers.⁶⁹ In addition, limited data exist on the best way to screen for and the effectiveness of interventions to address SDs of health.^{21,70,71}

To address these concerns, guides to practice change and community collaborations have been published along with curricula to implement change by content experts and national and international associations including the National Academy of Medicine.^{21,24,33,72} For providers caring for patients and families with asthma, some of the first steps might include the steps outlined in [Table I](#) and detailed below:

1. *Addressing SDs of health in clinic: Start simple.* Addressing SDs of health at the point of care with patients can be as simple as adjusting practice to understand SDs of health through shared decision making or as complicated as implementing a comprehensive psychosocial screener. Clinical practices should consider workflow adjustments that may be needed and the resources available for patients before implementation. Specialists might consider how to collaborate with primary care to address identified barriers to care.
 - a. Shared decision making: Involving patients and caregivers in the discussion of goals for therapy and the treatment plan will help providers understand their perception of asthma, control, and the medications. Addressing these concerns may make families feel less isolated and better understood and improve their self-confidence around managing the disease at home and advocating for their children with asthma.^{59,74} Allowing the family and patient to participate in the creation of goals and a treatment plan and asking the family to “teach” the plan back to the provider may also improve health literacy directly.⁷⁵
 - b. Provide access to consistent care with clear educational tools.
 - c. Engage schools: Children often spend more awake time at school than at home. Several studies show that school asthma programs have a positive impact on asthma control and outcomes.⁷⁶ Engaging the school by sending a school

action plan and involving the school nurse in achieving the patient’s asthma goals may address family concerns about the safety of a child with asthma at school and increase their feeling of community support and belonging.⁵⁹

- d. Consider screening for modifiable SDs of health in the office to identify needs such as food insecurity or housing. Social work, navigators, or community health workers may not be available in every setting. However, if available, they help prioritize and address concerns and provide resources. Community resource guides and information may also be available. Follow-up to assess the impact of any referrals made to address barriers to health will not only be appreciated by the family but also help the practice identify reliable resources.
2. *Addressing asthma as a component of addressing population health: Identify the root causes of poor health.* Improving the health of populations by identifying and addressing the root cause of health problems and disparities is a central premise of population health. Practices, hospitals, and health systems that identify and address SDs of health in populations they see can use that data to inform programs that address barriers to health faced in the population and the community they serve.⁶⁹ Cook et al¹³ apply a multidisciplinary approach to refractory asthma to identify modifiable factors before the patients ever see a specialist. At Cincinnati Children’s Hospital, asthma program leaders used systematically applied quality improvement methodology to implement, expand, and evaluate an asthma program. The program began with hospital-based care and screens for SDs of health, then added care coordination to address clinical care and SD of health, and built in community collaboration to support the asthma care. The result was an impressive decline in asthma-related visits to the ED and the hospital across the population over time.⁷⁷
- Through work with families and communities, community-based clinics, hospitals, and integrated health systems and accountable care organizations are uniquely positioned to study the impact of programs such as the Cincinnati asthma program and others. Health systems and accountable care collaboratives can also take this data to community partners to help build collaboration across sectors.

They also use the information to negotiate financial support for addressing SDs of health from payers as they shift to value-based care models and begin to incentivize decreases in avoidable costs.⁷⁸

3. *Advocacy*: Providers and staff are already well equipped with stories of factors that impact health. Those stories combined with their expertise can make providers powerful advocates for changes in social and economic policies that impact health. Asthma collaborations to address barriers to care such as housing, education and schools, and other health-related SDs of health that impact the families can bring multiple stakeholders to the table including providers, patients, and community and governmental agencies. Recent examples include the following:

- a. School-based education and management guideline and policies created by the School-based Asthma Management Program workforce, which included the Environmental Protection Agency, the American Academy of Allergy, Asthma & Immunology, the American Academy of Family Practice, Hospitals, Departments of Public Health, Associations of School Administrators and School Nurses, and others.⁷⁹
- b. Legislation for stock albuterol in schools that has been brought forward by schools, school nurses, providers, and families in several states.⁸⁰

CONCLUSIONS

Asthma is one of the most common chronic diseases seen in children in many EDs, hospitals, and outpatient clinic visits. Asthma affects all populations of children but, in many under-resourced and overburdened populations, the socioeconomic, environmental, and behavioral determinants are the root cause of poorly controlled asthma. In those families, priorities such as finding shelter free from asthma triggers, a safe neighborhood, and a supportive community compete with their ability to manage the child's asthma. Providers have an opportunity to help caregivers and patients identify barriers and work with families to address them or connect them to resources that can help.

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