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Author manuscript

Ann Allergy Asthma Immunol. Author manuscript; available in PMC 2022 December 07.

Published in final edited form as:

Ann Allergy Asthma Immunol. 2022 October ; 129(4): 430–439. doi:10.1016/j.anai.2022.04.035.

Food Allergies in Inner-City Schools: Addressing Disparities and Improving Management

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Abstract

Objective: Food allergy (FA) affects approximately 8% of children in the United States. Management comprises both preventing and treating allergic reactions, which poses unique challenges in the inner-city school setting. In this article, we review the epidemiology of FA in school-aged children and management challenges and opportunities specific to the inner-city population.

Data sources: A literature search of the PubMed database was performed to identify published literature on FA epidemiology, FA management, school policies, disparities, inner-city, race, ethnicity, and socioeconomic status.

Study Selections: Relevant articles on FA management best practices and challenges in schools, with a particular emphasis on inner-city schools and populations and socioeconomic, racial, and ethnic disparities, were reviewed in detail.

Results: Disparities in FA prevalence, management, and treatment exist. Additional research is needed to better characterize these disparities and elucidate the mechanisms leading to them. There is a lack of evidence-based interventions for the prevention and treatment of food allergic reactions in schools and specifically in inner-city schools, in which a greater proportion of students may rely on school food.

Conclusion: There are opportunities for partnership among health care providers, schools, and communities to address unmet needs in FA management and disparities in the inner-city school setting.

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Dr Bartnikas and Ms Dupuis are co-first authors.

Disclosures: The authors have no conflicts of interest to report.

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Introduction

Food allergy (FA) affects nearly 8% of children in the United States and its prevalence is increasing.[1] Management relies on avoiding allergens and treating severe reactions with epinephrine. Allergen avoidance in school-aged children poses unique challenges. Children spend most of their time in school and during those hours are highly reliant on the school community for safety. FA is the most common cause of anaphylaxis in schools,[2] and 16% to 18% of children with FA experience reactions in school.[3] Epinephrine administration rates in school have increased, with a 23% increase per year for reactions to peanuts and tree nuts between 2006 and 2011 in Massachusetts.[4] Children with FA also experience increased psychosocial burden and are at increased risk of being bullied in school.[5,6]

Managing FA in schools is complex, controversial, and variable, and evidence-based guidance is minimal.[5] Effective strategies must address both safety and psychosocial considerations. Managing FA in inner-city schools has distinct challenges. Inner-city schools are typically found in older, densely-populated, urban neighborhoods. There is a higher proportion of racial and ethnic minority students, and many students are from families with low income or limited English proficiency. Many inner-city schools struggle with limited funding and resources, increased student-teacher ratios, lack of access to full-time school nurses, and bureaucratic challenges. Whereas there is a critical need to identify and implement evidence-based FA policies that can be easily adopted by all schools, it is important to have a flexible and tailored approach on the basis of understanding the unique needs and challenges of different school settings.

In this article, we review the literature on the epidemiology, risk factors, and comorbidities of FA in inner-city schoolchildren. In many cases, publications on inner-city populations are lacking, so discussion is extrapolated from studies on racial and ethnic minority and socioeconomically disadvantaged children. We also evaluate FA reactions and management in schools and discuss unmet needs and opportunities for partnership among health care providers, schools, and communities to address FA management and disparities in the inner-city population.

Epidemiology of Food Allergy in School-Aged Children

There are disparities in FA prevalence by race, ethnicity, and socioeconomic status (SES).[7] In a US Medicaid-enrolled population, FA prevalence was higher among Asian, Black, and Pacific Islander and lower in Hispanic and Native American vs White children.[8] In a nationally representative sample of US households, the odds of having FA were highest among Black compared with White children, whereas the odds of having multiple vs a single FA were highest among Black and Asian compared with White children.[1] The highest rate of increase in FA prevalence over recent decades was seen in Black children.[9] It is unclear whether increased prevalence is because of increased sensitization or improved recognition and diagnosis.[10,11]

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Racial and Ethnic Disparities in Specific Food Allergens

There are racial and ethnic differences in FA prevalence for specific foods (Table 1).[12-15] The reasons for these differences are unclear and may be related to timing or type of food introduction, SES, environmental exposures, or barriers to health care. For example, higher cockroach exposure in inner cities may lead to increased sensitization and prevalence of shellfish and fish allergy in inner-city children through cross-reactive tropomyosins.[16,17]

Risk Factors for Food Allergy Prevalence and Severity

Children living in inner cities may have risk factors for increased FA prevalence and severity (Fig 1). Risk factors for FA are likely multifactorial and may be related to poverty, poor air quality and pollution, aeroallergen exposures, vitamin D deficiency, microbiome, poorquality housing, suboptimal patient or family education, psychosocial stress, and reduced health care access and quality resulting from structural and systemic racism.[7,18,19]

Atopic Dermatitis

Atopic Dermatitis (AD) has been found in multiple studies to be a major risk factor for developing FA, with patients with severe AD at the highest risk.[20] Living in an inner city is associated with increased odds of AD diagnosis.[21] Racial and ethnic disparities exist in AD, with increased AD prevalence, severity, and persistence in Black and Hispanic compared with White children in the United States.[19] Early-life sensitization to indoor allergens prevalent in inner cities, specifically mouse and cockroach, was associated with increased odds of AD in an inner-city birth cohort.[22]

Asthma

Asthma prevalence and severity are increased and control is decreased in inner-city and underserved populations.[23] Fatal food anaphylaxis is associated with having an asthma diagnosis,[24] and severe allergic reactions are more common in patients with uncontrolled asthma.[25] Several groups have found high rates of food allergen sensitization, clinical FA, and multiple food triggers in inner-city children with asthma.[26-28] A study of inner-city school children with asthma found high FA prevalence (24%), and those with FA had decreased asthma control.[26]

Vitamin D Deficiency

Vitamin D modulates immune responses and deficiency has been associated with atopic conditions including FA, anaphylaxis, asthma, AD, and allergic rhinitis. The primary source of vitamin D is skin synthesis after sun exposure. Higher concentrations of melanin in skin of color absorb solar ultraviolet B radiation, reducing skin vitamin D synthesis.[29] Inner-city children have several risk factors for vitamin D deficiency, including darker skin color, and spending less time outdoors. These risk factors, mediated by vitamin D deficiency, may lead to increased FA prevalence and severity in inner-city children.

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Food Allergy Management, Anaphylaxis, and Access to Quality Care

The major risk factor for fatal food anaphylaxis is delayed epinephrine administration. Unfortunately, there are disparities in FA management and access to quality care among minority and low-income children.

A retrospective study from an urban minority hospital-based pediatric clinic found that, whereas most (79.9%) patients with FA were prescribed epinephrine autoinjectors (EAIs), only 67% were referred to allergists and 45% were seen by allergists.[27] Only 38.2% of patients had Emergency Action Plan (EAPs) documented in the medical record. Patients evaluated by allergists were more likely to be prescribed EAIs and have EAPs compared with those not seen by allergists. Rates of referral, EAI prescriptions, and EAP documentation did not differ by race.[27] A study of children with FA from 2 urban tertiary care centers found that, whereas age at the first visit to an allergist did not differ by race, ethnicity, or insurance status, the duration of allergist follow-up was shorter in Black and Hispanic vs White children, and children insured through Medicaid vs private insurance.[12] These factors could lead to underdiagnosis of FA and delayed recognition and treatment of allergic reactions in inner-city children. In the same cohort, there were higher rates of FA-related anaphylaxis and emergency department (ED) visits in Black and Hispanic vs White children. There was no difference in FA-related anaphylaxis and ED visits by insurance type (Medicaid vs private insurance).[12] In another study, the rates of pediatric ED visits for food-induced anaphylaxis were highest among Black vs White children and children living in urban vs rural areas.[30]

It has been observed that fatal anaphylaxis may be more common in Black and South Asian patients, and also in cases in which there is a lack of urticaria during allergic reactions.[24] A study of medical students found a disparity in the visual diagnosis of urticaria in skin of color vs light skin (57.5% vs 82.2% diagnosed correctly).[31] Many US health care providers report inadequate training in skin conditions in patients of diverse skin colors, particularly among Black patients. This lack of training persists in didactics, textbooks, and peerreviewed literature, which often underrepresent images of patients with skin of color.[32] This disparity in accurate recognition of urticaria, a common warning sign of allergic reactions, could lead to delayed diagnosis and treatment of anaphylaxis in patients with skin of color, possibly accounting for an increased risk of fatal reactions.

Strategies to Manage Food Allergies in Schools

School-based FA management requires the involvement of individuals across multiple levels within the school environment.[33] The lack of evidence-based interventions to prevent and treat allergic reactions in schools,[34] and variation in implementation across schools, may contribute to limited preparedness to treat anaphylaxis in schools and added psychosocial burden on families with FA.[35,36] Guidelines for school-based FA management developed by the Centers for Disease Control and Prevention are voluntary in nature.[34] Recent practice guidelines for FA management in schools offer recommendations, though some may be difficult to implement in underresourced settings, such as inner-city schools (Table 2).[5]

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Restricting Food Allergens in Schools

One of the most common preventive strategies in schools is restricting allergens, though there is limited evidence for effectiveness in preventing allergic reactions. Policies range from banning specific allergens brought in from home or sold in the cafeteria, to restricting where allergens can be eaten (eg, peanut-free tables or classrooms). Specially designated areas are one of the most common policies.[4,37]

In a study of Massachusetts schools, those with peanut-free tables had lower rates of epinephrine administration vs schools without peanut-free tables; no other food allergen restriction policy was effective at reducing epinephrine administration rates.[4] Schools with more restrictive policies had higher proportions of low-income and minority students vs schools without such policies.[38] The impetus for implementing more restrictive policies in these schools is unclear, though it could be because of higher FA prevalence among specific students or lack of school resources, such as financial constraints, diminished epinephrine availability, shortage of school nurses, or lack of training. The presence of peanut-free classrooms does not consistently reduce environmental peanut exposure. In a study of inner-city elementary schools, food allergens were detected on tables and floors in all schools, albeit at low levels, and milk and peanut were detected in all table wipe samples.[39]

In underresourced settings such as inner-city schools, in which there may be limited staff supervision during mealtimes, instituting allergen-restricted zones such as peanut-free tables may promote the safety of students with FA. However, these policies should consider the potential psychosocial impact on children, further discussed below. Providing allergen-restricted zones as an option but not a mandate for children may allow FA management to be personalized to balance the safety and psychosocial needs of individual students.

Stock Epinephrine

The passage of the 2013 School Access to Emergency Epinephrine Act, which incentivizes states to authorize or require that public schools stock undesignated EAIs be used for any student or staff in the event of an allergic reaction, marked an important milestone for treating FA reactions in schools. Before this, Houston elementary schools with high SES were 6 times more likely to have epinephrine injectors compared with lower SES schools.[40] Such disparities likely reflect access to care differences by income. All but 1 state now allows stock epinephrine in schools, though only 12 mandate it, and the mandate often depends on the availability of funds.[41] This has the potential to further accentuate disparities given the inequitable distribution of resources for stock epinephrine across schools.

A cost-effectiveness analysis of stock epinephrine for the treatment of anaphylactic reactions to peanuts in Chicago public schools found the intervention was cost-effective if the device cost no more than USD 338 annually per school.[42] A model in which individual schoolchildren did not provide their own EAI but instead relied on school stock epinephrine led to cost savings. Such a model may also be life-saving for inner-city children with FA, given reduced access to EAIs in this population.[43]

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Emergency Action Plans

A study of school EAPs among students in Chicago public schools found that, in adjusted models, the odds of having an EAP were significantly lower for Black vs White children and for students who received free school lunch vs those who did not.[44] The results speak to the racial, ethnic, and socioeconomic segregation of the city given that EAPs require physician verification and minority and low-income families may have lower access to health care.[44]

Staff Education and Training

Multiple studies have assessed the effectiveness of training school staff to prevent and manage FA reactions.[45,46] One study in Houston elementary schools found that, compared with nurses in schools without a FA training program, nurses in schools with a 1-hour training session improved their knowledge of FA reaction treatment.[47] There is great variation in who is trained and allowed to administer epinephrine in schools. Among schools participating in a stock epinephrine program, 31% reported that all school staff was trained to administer epinephrine but only 22% of schools reported that all staff was allowed to administer epinephrine.[48] The need to have all staff trained and authorized to administer epinephrine is highlighted in a study that found the odds of having unlicensed staff administering epinephrine for a FA reaction was doubled for schools with higher vs lower building-to-nurse ratios.[49] This may be particularly salient in inner-city schools in which nurses may oversee multiple schools and in which there is often a shortage of nurses, particularly during the coronavirus disease 2019 (COVID-19) pandemic.[50]

Psychosocial Impact of Food Allergies and School Policies

Children and families living in inner cities face psychosocial challenges including housing and food insecurity, poverty, reduced access to health care, neighborhood safety concerns, segregation, and structural and systemic racism. These burdens and others can lead to reduced quality of life (QOL) and increased anxiety, worry, and depression.[51] For children and families with FA, the chronic and unpredictable nature of FA can further adversely impact psychosocial functioning.[52]

In school-aged children, caregivers are tasked with developing FA management plans to enable the child's safe participation in activities outside of the home. Parents and children may have considerable concerns about FA reactions in schools and the ability of school staff to manage anaphylaxis. A survey of primarily White, non-Hispanic, higher-income families of children with FA found that, whereas most reported schools having at least 1 food allergy policy in place, 27.4% of parents had concerns regarding their child's safety at school and many felt additional policies were necessary to improve the safety of the school environment for their child, particularly regarding epinephrine access, food labeling, and FA education and training.[37]

Up to half of the children with FA report experiencing bullying, most commonly at school, and children with FA are twice as likely to be bullied compared with children without FA.[6,53-56] Bullying is perpetrated most commonly by classmates and other students, but also by teachers and school staff.[6,54,56] Common reasons for being bullied included having

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a FA, being secluded in special groups (eg, sitting at special lunch tables), receiving special treatment, or carrying or wearing allergy medications (eg, EAIs).[6,56] Bullying is associated with decreased QOL and increased distress in children and their parents.[6] Table 3 summarizes the studies to date evaluating FA-related bullying.[6,53-56] Few studies have evaluated the impact of sociodemographic factors on FA-related bullying and none have evaluated rates in inner-city schools.[6,53-55] Racial and ethnic differences may exist in FA-related bullying, though most studies were done in primarily White, non-Hispanic, and higher SES cohorts.

School FA policies could have a substantial psychosocial impact on children. Bullying related to FA was less frequently reported by students with FA in schools banning peanuts.[57] It is possible that schools with policies restricting allergens may have lower rates of allergic reactions; students with FA and their parents may have decreased stress, worry, and anxiety related to FA; and students with FA may experience less FA-related bullying simply owing to the decreased presence of their allergens. However, in schools with allergen-restricted areas such as “peanut-free” lunch tables, it is also possible that students with FA could feel singled out because of their FA and become targets for bullying. In fact, ethnic minority children with low SES recruited from an urban pediatric clinic had high levels of social anxiety because of their FA.[58] One potential explanation offered was that, in underresourced schools that may opt to use designated allergen-free tables, children with FA sitting at those tables may feel isolated from peers.[58]

Food Allergy, Food Insecurity, and School Meals

Food insecurity (FI) is defined as inadequate access to affordable and nutritious food.[59] One in 5 children with FA lives in food-insecure households, compared with 1 in 6 children without FA.[60] Families at risk of FI perceive the risk that their child with FA will accidentally consume unsafe food to be higher compared with their food-secure counterparts.[61] Low-income households of children with FA spend more on FA emergency management (eg, ED visits) compared with their higher-income counterparts, but less on preventive steps (eg, specialty foods).[62] FI is associated with higher caregiver stress and worse QOL compared with food-secure households. Among patients with FA, overall QOL is worse in FI compared with food-secure groups.[63] Low-income families with FA face a dual burden in ensuring access to safe, allergen-free foods for their children.[64] Factors that may contribute to or exacerbate FI for inner-city families are low SES and living in food deserts in which there is limited access to affordable, healthy, and allergen-safe food options.

Families with FI are more likely to obtain food from food banks,[61] in which there is added concern over the availability of safe foods.[65] Low-income families with FA may struggle with the purchase of safe foods during the monthly Supplemental Nutrition Assistance Program cycle because such foods are often cost-prohibitive and may deplete funds before the renewal of benefits.[66] Programs meant to alleviate challenges related to the provision of safe food (Table 4), such as the National School Lunch Program, may play an important role for these families. A recent survey of families with children with FA revealed that 4.7% were at risk of FI and 10.8% were eligible to receive free or reduced-price school meals. Notably, 70% of families eligible to receive free or reduced-price school meals opted out of receiving

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them; the primary reason being concerns regarding FA (89%).[67] The study population was primarily higher income and likely underestimated the burden of FI among families with FA.

Among inner-city schoolchildren, free or reduced-price school meals are often the default thanks to the *Community Eligibility Provision*, which was authorized as part of the 2010 Healthy, Hunger-Free Kids Act, allowing schools and local educational agencies located in low-income areas to provide free breakfast and lunch to all students.[68] A study of caregivers of children with FA in Chicago, Illinois, Cincinnati, Ohio, and Washington, District of Columbia, found the odds of eating food prepared at school were 2.5 times higher in Black vs White children, though it is unclear what is driving this difference.[69]

Special Case: The Coronavirus Disease 2019 Pandemic

The ongoing COVID-19 pandemic led to widespread school closures. For families with FA at risk of FI and relying on school meals, the pandemic may be an additional source of strain.[51,59] Compared with households without dietary restrictions, households with FA were more likely to experience FI in the year before the pandemic and more likely to experience incident or worsening FI during the pandemic.[70] Multiple school districts developed innovative ways to ensure that children kept receiving school meals while school was conducted remotely, including by creating pick-up sites at school and dropping off meals along bus routes.[71] This may further exacerbate disparities if schools with more resources are better able to adapt and innovate.

Opportunities to Address Food Allergy Management and Disparities

Opportunities exist at many levels for patients, health care providers including allergists and primary care providers, schools, and communities to partner to identify and address disparities in FA management in inner-city schools (Fig 2).

Individual Level

For children with FA and their parents, increased awareness of FA risk factors, signs, and symptoms can lead to earlier diagnosis of FA and treatment of anaphylaxis, leading to improved health outcomes. Allergists and other health care providers can identify patients that may be at risk of underdiagnosis or undertreatment of FA and increase outreach across levels of the socioecological model to raise awareness and provide access to high-quality care. Health care providers can ensure their patients have written EAPs that are updated annually and EAI prescriptions to bring to schools and reduce the financial burden on families by prescribing low-cost alternatives to EAIs and connecting families with financial assistance programs.[72]

Interpersonal Level

The interpersonal level comprises interconnections among patients, families, peers, school staff, and health care providers. Providing school nurses, teachers, and staff with high-quality FA education may lead to better recognition of allergic reactions, higher quality FA management, and raise awareness of bullying. In managing children with long-term health conditions such as FA, school nurses perceive a lack of parental support and knowledge of

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health conditions.[73] Parents perceive limited communication and lack of collaboration with school staff, and concern about their children's relationships with their peers because of their medical conditions.[74]

Parents, school staff, and classmates can overcome these barriers by collaborating and communicating to develop FA management and education plans. Educating and training school staff and peers can demystify and correct misconceptions regarding FA. This may lead to improved awareness and management, increased understanding of challenges children with FA face, and decreased FA-related teasing and bullying. Allergists can play a critical role in facilitating these interpersonal discussions and bridging communication gaps.

School Level

Many school-level barriers to providing optimal FA management are exacerbated by conditions inherent to inner-city schools. School nurses cite insufficient staffing, lack of school programs for stock epinephrine and providing education and training, lack of evidence-based school guidelines, lack of time, and poor institutional support.[73] Parents of children with FA have concerns regarding lack of school nurses, inconsistencies in school staff carrying or trained to use EAIs, limited availability of EAIs, limited allergen-free environments, and concerns that allergen information on school lunch menus is often unavailable.[37,74] Nurses and parents both cite concerns for limited FA education materials.[73,74]

Providing sufficient nurse staffing and education is critical to addressing these needs. Although many schools may not have a full-time school nurse, providing FA education and training to all school staff and students is important, and allergists can provide this education through outreach and partnership with schools. FA training among the school staff is associated with improvements in their ability to recognize symptoms and identify the appropriate treatment of allergic reactions and may improve school-level FA management preparedness.[45] Key stakeholders including parents, school staff, and allergists can partner to develop school FA management guidelines that are sensitive to the safety and needs of students with FA and the larger school community.[45,72,75] Students should be provided access to safe snacks and meals at school, with clear allergen labeling. For families with young children, menus must be provided in advance so parents can review ingredients and make plans for alternative choices if needed. For low-income families who rely on free or reduced-price school meals, providing subsidized allergen-free meal options is important to minimize financial strain. Finally, schools should have robust antibullying policies to promote the safety and well-being of students with FA.

Community and Policy Level

At the community and policy level, there is a lack of evidence-based FA management guidelines and a lack of coordination between school and health care systems. Further research is needed into the impact of school FA policies on allergic reactions, particularly from schools representing diverse students and regions. Allergists can work with communities and local and national governments to standardize and implement evidence-based policies to promote the safety and well-being of children with FA. Efforts to promote

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equitable access to high-quality schools and health care are critically needed to provide inner-city children with the necessary resources.

Conclusion

The goal of the schools' FA management includes minimizing the risk of allergic reactions while maximizing the emotional well-being of students. All children with FA, regardless of zip code, SES, race, or ethnicity, deserve to attend school in a physically and emotionally secure environment fostering education, safety, and social inclusion. The impact of the multiple facets of social determinants of health on FA is not well understood and many unanswered questions remain, as summarized in Table 5. Challenges in addressing FA in inner-city children include the paucity of research in underrepresented and underserved populations, and the historical focus on race and ethnicity in the scientific literature, which can fail to acknowledge the underlying structural racism and health inequities that may better account for observed disparities in FA outcomes. Allergists play an important role in the FA community by providing care to patients, outreach to communities, and advancing research. By understanding the unique challenges in caring for patients with FA from diverse backgrounds, we can develop strategies to ensure that all children with FA receive the care they deserve.

Funding:

This research is supported by the National Institutes of Health K23 AI143962 (Dr Bartnikas), K24 AI106822 (Dr Phipatanakul), and The Allergy and Asthma Awareness Initiative, Inc (Dr Phipatanakul).

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Key Messages

- Food allergy management consists of both preventing and treating allergic reactions, which poses unique challenges in the inner-city school setting.
- Managing food allergy in schools is complex, controversial, and highly variable, and evidence-based guidance is minimal.
- Disparities in food allergy prevalence, management, and treatment exist.
- Further research is needed to better characterize and address these disparities and understand the mechanisms leading to them.
- There are opportunities for partnership among health care providers, schools, and communities to address unmet needs in food allergy management and disparities in the inner-city school setting.

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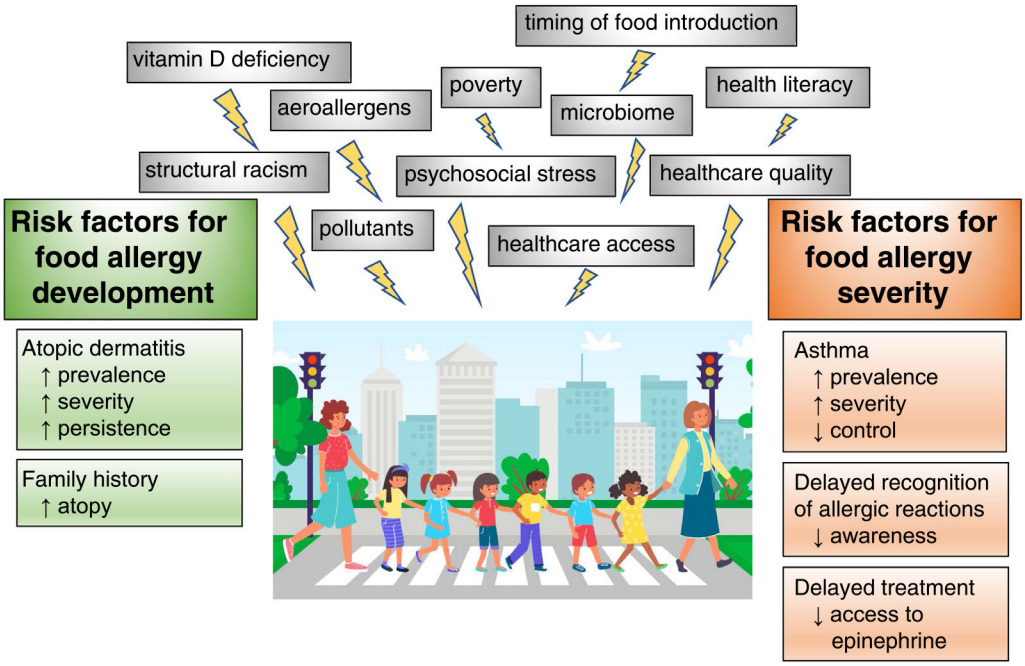

Figure 1.

Risk factors for food allergy in inner-city children. Risk factors for food allergy development and severity, and the possible interaction with social determinants of health and other social and environmental factors, are summarized.

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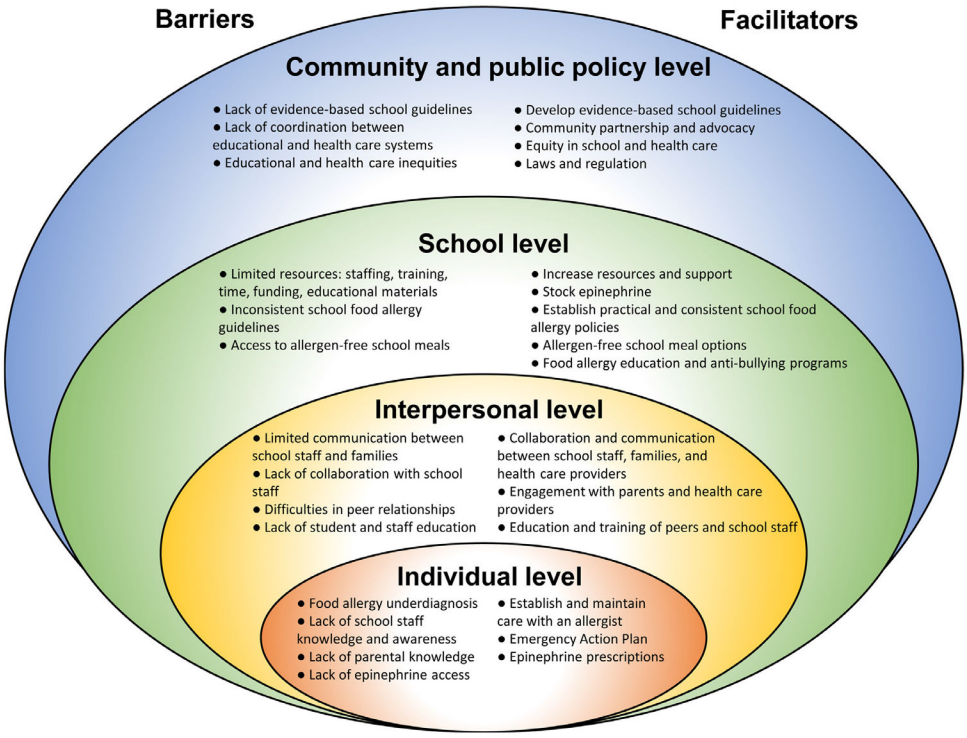

Figure 2.

Socioecological model of barriers to and facilitators for inner-city school food allergy management. Individual-level comprises children with food allergies and their parents. Interpersonal level comprises relationships among patients, families, peers, school staff, and health care providers. School-level comprises school nurses, teachers, and other school staff. Community and public policy level comprises relationships among institutions, laws, and policies.

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Table 1

Specific Food Allergens in US Children by Race and Ethnicity

Reference	Study population	Race/ ethnicity	Statistic	Reported prevalence and odds ratios by food allergen									
				Peanuts	Tree nuts	Milk	Egg	Wheat	Soy	Sesame	Fish	Shellfish	Corn
Mahdavinia et al,[12] 2017	Children 0-17 y old with food allergies seen in allergy/immunology clinics in Chicago, Illinois and Cincinnati, Ohio	White	Prevalence (%)	65.1	45.5	24.9	38.3	7.4	7.4	—	3.5	7.39	2.1
			Odds ratio	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	—	(ref)	(ref)	(ref)
		Black	Prevalence (%)	65.6	18.6	29.5	44.6	23.2	27.0	—	34.39	23.5	15.1
			Odds ratio	1.12	0.31[a]	0.98	1.27	2.95[a]	3.43[a]	—	11.66[a]	3.34[a]	6.6[a]
		Hispanic	Prevalence (%)	52.5	25.3	25.3	45.5	11.1	12.1	—	16.2	15.2	7.1
			Odds ratio	0.65	0.49[a]	0.82	1.19	1.31	1.40	—	4.82[a]	2.26[a]	3.28[a]
Mahdavinia et al,[13] 2021	Children 0-12 y old with food allergies seen in allergy/immunology clinics in Chicago, Illinois, Cincinnati, Ohio, and Washington, District of Columbia	White	Prevalence (%)	62.6	51.3	25.2	42.1	5.2	5.4	20.5	8.2	8.0	—
			Odds ratio	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	—
		Black	Prevalence (%)	64.9	56.5	21.3	35.2	12.6	10.0	10.5	23.9	31.8	—
			Odds ratio	0.87	1.27	0.81	0.81	2.10	0.97	0.52	2.54[a]	3.11[a]	—
Coulson et al,[14] 2020	Adolescents 11-16 y old whose mothers were recruited in Eastern Massachusetts during pregnancy	White	Odds ratio	(ref)	—	(ref)	(ref)	(ref)	—	—	—	—	—
		Black	Odds ratio	2.41[a]	—	1.41	2.66	0.72	—	—	—	—	—
		Hispanic	Odds ratio	1.44	—	NA	NA	NA	—	—	—	—	—
		Mixed race, Asian or Pacific Islander, American Indian or Alaskan Native, or other	Odds ratio	4.14[a]	—	1.52	1.35	2.29	—	—	—	—	—
Wang et al,[15] 2020	Children 0-17 y old from a nationally representative panel	White	Odds ratio	—	—	—	—	—	—	—	—	(ref)	—
		Black	Odds ratio	—	—	—	—	—	—	—	—	2.3[a]	—
		Hispanic	Odds ratio	—	—	—	—	—	—	—	—	1.4	—
		Asian	Odds ratio	—	—	—	—	—	—	—	—	1.7	—

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Reference	Study population	Race/ ethnicity	Statistic	Reported prevalence and odds ratios by food allergen									
				Peanuts	Tree nuts	Milk	Egg	Wheat	Soy	Sesame	Fish	Shellfish	Corn
		Mixed race or other	Odds ratio	—	—	—	—	—	—	—	—	0.9	—

Abbreviations: NA, not applicable; ref, reference interval.

NOTE. Findings from selected studies are detailed above. Selected studies were not conducted specifically in inner-city populations. White is the reference group for calculating odds ratios. "—" indicates statistic not evaluated in a given study.

[a]Statistically significant differences in odds ratios.

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Table 2

Summary of Recommendations for Managing Food Allergic Reactions in Schools

Recommendation	Strength of recommendation	Certainty of evidence	Specific considerations for inner-city schools
Food allergy training, allergy action plans, and site-wide protocols			
1. Suggest that schools implement training for teachers and other personnel in the prevention, recognition, and treatment of food allergic reactions.	Conditional	Very low	• Requires budget and resources for training. • Requires access to quality educational materials.
2. Suggest that schools require all parents of students with diagnosed food allergy to submit an up-to-date Emergency Action Plan.	Conditional	Very low	• Requires communication between schools and parents. • Consider barriers to referrals to and follow-up with an Allergist.
3. Suggest that schools implement site-wide protocols for management of suspected food allergic reactions in individuals with no Emergency Action Plan on file.	Conditional	Very low	• Important for inner-city schools, in which food allergy may be underdiagnosed by health care providers or underreported by families. • Requires budget, resources, training, and bureaucratic support to develop and implement protocols.
Epinephrine vs other treatments for allergic reactions			
4. Suggest that school personnel use epinephrine only when they suspect someone is experiencing anaphylaxis, rather than use epinephrine as the first universal treatment for all suspected allergic reactions.	Conditional	Very low	• Requires budget, resources, training, and bureaucratic support to develop and implement protocols.
5. Suggest that school personnel do not preemptively administer epinephrine in cases when no signs or symptoms of an allergic reaction have developed, even if a student has eaten a food to which they have a known allergy or history of anaphylaxis.	Conditional	Very low	• Requires budget and resources for training.
Stocking unassigned epinephrine autoinjectors			
6. Suggest that schools stock unassigned epinephrine autoinjectors on site, instead of requiring students with allergy to submit personal autoinjectors to be stored on site.	Conditional	Very low	• Requires access to unassigned epinephrine autoinjectors. • Overcomes barriers by increasing access to epinephrine.
Site-wide food prohibitions and allergen-restricted zones			
7. Suggest that schools do not prohibit specific foods site-wide (eg, nut-free schools).	Conditional	Very low	• Requires budget, resources, and bureaucratic support to change existing policies. • Requires education of students and school personnel to promote the safety of students with food allergy. • Important to ensure access to allergen-free school meals.
8. Suggest that schools do not establish allergen-restricted zones (eg, peanut-free classrooms, milk-free tables), except in limited special circumstances.	Conditional	Very low	• Requires budget, resources, and bureaucratic support to change existing policies.

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Recommendation	Strength of recommendation	Certainty of evidence	Specific considerations for inner-city schools
			• Requires education of students and school personnel to promote the safety of students with food allergy.

NOTE. Modified from practice guidelines developed by Waserman et al.[5]

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Table 3

Food Allergy-Related Bullying in US Schoolchildren

Reference	Study design	Number of participants	Instrument to measure bullying	Questionnaire completed by	Child population	Rate of food allergy-related bullying
Annunziato et al,[55] 2014	Longitudinal, single center	127	EMPOWER Program Survey	Children	Mainly White (89.5%), non-Hispanic (91.9%), and higher socioeconomic status (65.4% annual household income ≥ $100,000).	• Overall: 30.7%-32.5% • Did not stratify results by race, ethnicity, or household income.
Brown et al,[57] 2021	Longitudinal, multicenter	252	Self-generated questionnaire	Parents	All non-Hispanic. White (73.4%) and Black (26.6%). Annual household income ≥ $100,000 in 74.1% of White families vs < $50,000 in 60.7% of Black (P < .001).	• Overall: 18.7% • No significant racial differences overall (White 20.0% vs Black 15.6%, P = .50). • In children >11 yo, White children are more likely to be bullied compared with Black (44.8% vs 18.2%, P = .046). • Household income is not a predictor of bullying.
Cooke et al,[56] 2021	Cross-sectional, multicenter	121	EMPOWER Program Survey	Parents and children	Racial/ethnic breakdown was comparable to study clinic populations and household income comparable to the region's US Census Bureau data. Black (37.0%), White (30.0%), Multiracial (12.0%), Other (8.0%); Hispanic (12.0%). Annual household income ≥ $100,000 in 41.0% of families.	• Overall: 34% • No significant differences by race or ethnicity. • Did not stratify results by household income.
Lieberman et al,[54] 2010	Cross-sectional, multicenter	353	Self-generated questionnaire	Mainly parents	Mainly White (95.1%), non-Hispanic (97.4%).	• Overall: 35.2% • Did not stratify results by race or ethnicity. • Socioeconomic status not evaluated.
Shemesh et al,[6] 2013	Cross-sectional, single center	251	EMPOWER Program Survey	Parents and children	Mainly White (85.7%), non-Hispanic (90.4%), and higher socioeconomic status (65.3% annual household income ≥ $100,000).	• Overall: 31.5% • Hispanic children are more likely to be bullied than non-Hispanic (64.3% vs 29.5%, P < .01). • Black children are more likely to be bullied (80.0%), and all other races less likely to be bullied (White 29.6%, Asian 32.3%, Indian 33.3%). Statistical comparisons not presented as participants could select > 1 race. • No significant difference by household income.

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Table 4

Federal Food Assistance Programs in the United States

Legislation, Policy, or Program	Description	Website for further information
Farm Bill	Legislation package that authorizes or reauthorizes the USDA programs across the US food system, including nutrition assistance programs such as the Supplemental Nutrition Assistance Program.	https://www.usda.gov/farmbill
SNAP	Nutrition benefits program for low-income families, formerly known as Food Stamps. Benefits are dispersed once per month by means of the Electronic Benefits Transfer program in accordance with the Thrifty Food Plan for specific family sizes.	https://www.fns.usda.gov/snap/supplemental-nutrition-assistance-program
EBT	An electronic system that allows SNAP participants to use their benefits to pay for food.	https://www.fns.usda.gov/snap/ebt
Thrifty Food Plan	A food plan was developed by the USDA to estimate the lowest cost of a healthy diet for a family of 4.	https://www.fns.usda.gov/snap/thriftyfoodplan
Healthy, Hunger-Free Kids Act	Legislation that authorizes funding for the USDA's child nutrition programs, including the National School Lunch Program. Provides standards for healthy school meals.	https://www.fns.usda.gov/cn/healthy-hunger-free-kids-act
NSLP	Federally assisted meal program that provides free or reduced-price lunches to children at school.	https://www.fns.usda.gov/nslp
Community Eligibility Provision	Nonpricing meal service option allows schools and school districts in low-income areas to serve free school meals to all students without having to apply.	https://www.fns.usda.gov/cn/community-eligibility-provision
Pandemic-EBT	Established by the Families First Coronavirus Response Act to provide benefits to children that would have received free or reduced-price school meals if schools had not been closed because of the COVID-19 pandemic.	https://www.fns.usda.gov/snap/ebt

Abbreviations: COVID-19, coronavirus disease 2019; EBT, Electronic Benefits Transfer; NSLP, National School Lunch Program; SNAP, Supplemental Nutrition Assistance Program; USDA, US Department of Agriculture.

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Table 5

Assessment of Unmet Needs in Food Allergy Among Inner-City Schoolchildren

Food allergy epidemiology
Determine food allergy prevalence across diverse populations
Understand the role of social determinants of health in food allergy prevalence
Access to health care
Identify barriers to food allergy diagnosis
Identify barriers to medical care
Improve access to written Emergency Action Plans
Improve access to epinephrine autoinjectors
Improve screening for food insecurity in primary care and allergy clinics
Food allergy management in schools
Develop evidence-based school food allergy policies
Implement food allergy management policies in schools
Identify barriers to a successful implementation of food allergy management strategies in schools
Implement food allergy education for students and staff
Identify barriers to communication between school staffand families
Increase access to stock epinephrine
Psychosocial impact
Identify risk factors for impaired psychosocial functioning in inner-city children and families
Increase psychosocial support for children and families
Increase awareness of food allergy–related bullying
Implement anti-bullying programs in schools
Economic impact
Increase access to low-cost allergen-free foods for families at risk of food insecurity
Increase availability of allergen-free school meals

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