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Pediatric emergency department visits and hospitalizations due to food-induced anaphylaxis in Illinois

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ABSTRACT

Background: Rates of food-induced anaphylaxis among children remain uncertain. In addition, little is known about the demographics of children who have experienced food-induced anaphylaxis resulting in emergency department (ED) visits and/or subsequent hospitalizations.
Objectives: To evaluate trends in ED visits and hospital admissions due to food-induced anaphylaxis among Illinois children and to identify socioeconomic variation in trend distribution.
Methods: Illinois hospital discharge data compiled by the Illinois Hospital Association were used to identify ED visits or hospitalizations for food-induced anaphylaxis in Illinois hospitals from 2008-2012. Data for children aged 0 to 19 years who were Illinois residents and received a diagnosis of food-induced anaphylaxis based on *International Classification of Diseases, Ninth Revision, Clinical Modification* codes (995.60 through 995.69) were included for analysis.
Results: There was a significant increase in the rate of ED visits and hospital admissions due to food-induced anaphylaxis among children in Illinois during the 5-year period, with an annual percent increase of 29.1% from 6.3 ED visits and hospital admissions per 100,000 children in 2008 to 17.2 in 2012 ($P < .001$). Increases in visit frequency were observed for all study variables, including age, sex, race/ethnicity, insurance type, metropolitan status, hospital type, and allergenic food. Visits were most frequent each year for Asian children and children with private insurance. However, the annual percent increase in visits was most pronounced among Hispanic children (44.3%, $P < .001$) and children with public insurance (30.2%, $P < .001$).
Conclusion: ED visits and hospital admissions for food-induced anaphylaxis have increased during a 5-year period among children in Illinois, regardless of race/ethnicity and socioeconomic status.

Introduction

Anaphylaxis is defined as a severe, IgE-mediated, potentially life-threatening reaction that is rapid in onset, and recent research suggests that rates are increasing.[1–5] Of the multiple triggers known to cause anaphylaxis, food allergens are the most common among the pediatric population.[5] Similarly, rates of childhood food allergy have increased to an estimated 8% of the US pediatric population with 40% of affected children having experienced a severe reaction, including anaphylaxis.[6]

Although investigation is warranted to better characterize disparities within the food allergic pediatric population, researchers are beginning to better understand potential variations by race/ethnicity and socioeconomic status. For example, in one population-based study[7] of more than 40,000 children, black and Asian children were significantly more likely to report a convincing food allergy compared with their white counterparts; however, these children reported lower rates of having physician-diagnosed asthma. These epidemiologic disparities suggested in the previous study were corroborated by studies reporting that black children confront higher odds of being sensitized to food allergens and to multiple foods.[8,9] To date, disparities describing differences in socioeconomic status suggest that children from families with lower incomes are both less likely to report a food allergy and less likely to have physician-diagnosed asthma.[6]

Although epidemiologic studies are beginning to better understand variations by demographics in food allergic children, little is known about the demographic profile for the subset of children who have experienced food-induced reactions resulting in emergency department (ED) visits and/or subsequent hospital

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admissions. However, studies specifically examining food-induced anaphylaxis in industrialized countries suggest increasing rates in the pediatric population.[1,5,10–12] For example, known demographic predictors of ED visits from a population-based study in Florida included younger age and female sex, whereas black patients were less likely to be treated in the ED.[13] Moreover, children receiving Medicaid are known to have lower odds of receiving epinephrine before arrival to the ED, which could place them at higher risk for hospitalization.[10]

Previous research estimating rates and predictors of ED visits and hospital admissions due to anaphylaxis have yielded mixed results and do not regularly stratify anaphylaxis trigger (eg, food) by demographic characteristics (eg, race/ethnicity). Thus, better characterizing who is affected by food-induced anaphylaxis remains critical to informing targeted public health interventions that ensure children's safety where they live, learn, and play. To this end, we sought to better understand the population of Illinois children experiencing anaphylaxis through a large database (COMPData) by (1) evaluating trends in annual ED visits and hospital admissions and (2) characterizing the distribution of ED visits and hospital admissions by race/ethnicity and socioeconomic status.

Methods

Institutional review board approval was not required for completion of this study per the policy of the institutional review board of Ann & Robert H. Lurie Children's Hospital of Chicago. Data reviewed were deidentified and not subject to written or verbal participant consent.

Study Design

Illinois hospital discharge data (COMPdata) compiled by the Illinois Hospital Association were used to identify ED visits or inpatient hospital admissions for food-induced anaphylaxis in Illinois hospitals between 2008 and 2012. This database, available to subscribing hospitals, includes all hospitals in Illinois with the exception of the 5 Veterans Affairs hospitals in the state. COMPdata include administrative data on ED visits and inpatient hospital admissions. Data elements include admission date, discharge date, hospital charges, diagnosis codes, procedure codes, age, sex, race/ethnicity, health insurance provider, and zip code. COMPdata uses rigorous standards to ensure that data are high quality and accurate. Data were included for Illinois residents aged 0 to 19 years at the time of ED visit or hospital admission who received a visit-related diagnosis of food-induced anaphylaxis based on the *International Classification of Diseases, Ninth Revision, Clinical Modification* codes (995.60 through 995.69).

Demographic data evaluated included age, sex, race/ethnicity, insurance type, and metropolitan status. Metropolitan status was based on zip code, which was further categorized into metropolitan areas using the rural urban commuting area codes. Clinical data evaluated included allergenic food, hospitalization status, hospital type, and length of stay. Allergenic foods were only analyzed individually if responsible for more than 10 cases each year; foods that did not meet this criteria were analyzed collectively as "other food." Cases in which the triggering food was not documented were analyzed as "unknown food." Hospital type was determined using pediatric intensive care unit (PICU) and children's hospital designations from the Illinois Department of Public Health.

Statistical Analysis

Rates per 100,000 children were calculated for ED visits and hospital admission by dividing the appropriate number of cases by Illinois population estimates per year. Population estimates for children residing in the state of Illinois were obtained from the US Census Bureau for the corresponding study period. The 95% CIs were calculated using the Mid-P Exact test. Joinpoint was used to calculate the average annual percent change (AAPC) and to test trends over time.[14] Analysis of variance was used to compare mean length of stay for hospitalizations between groups. Analyses were performed using SPSS statistical software, version 22 (SPSS Inc, Cary, North Carolina), and STATA statistical software, version 12 (Stata Corp, College Station, Texas). $P < .05$ was considered statistically significant.

Results

There were a total of 1,893 ED visits and hospital admissions due to food-induced anaphylaxis among children in Illinois during the 5-year study period, corresponding to an annual rate of 10.9 ED visits and hospitalizations per 100,000 children. Among children presenting to the ED, 203 (10.7%) were hospitalized, corresponding to an annual rate of 1.2 hospitalizations per 100,000 children (Fig 1 and Table 1). During the 5-year study period, there was one reported death due to food-induced anaphylaxis.

A significant increase in the rate of ED visits and hospitalizations due to food-induced anaphylaxis was observed from 2008 to 2012, with an annual percent increase of 29.3% from 6.3 ED visits and hospitalizations per 100,000 children in 2008 to 17.2 in 2012 ($P <$ .001). A similar trend was observed for the rate of hospital

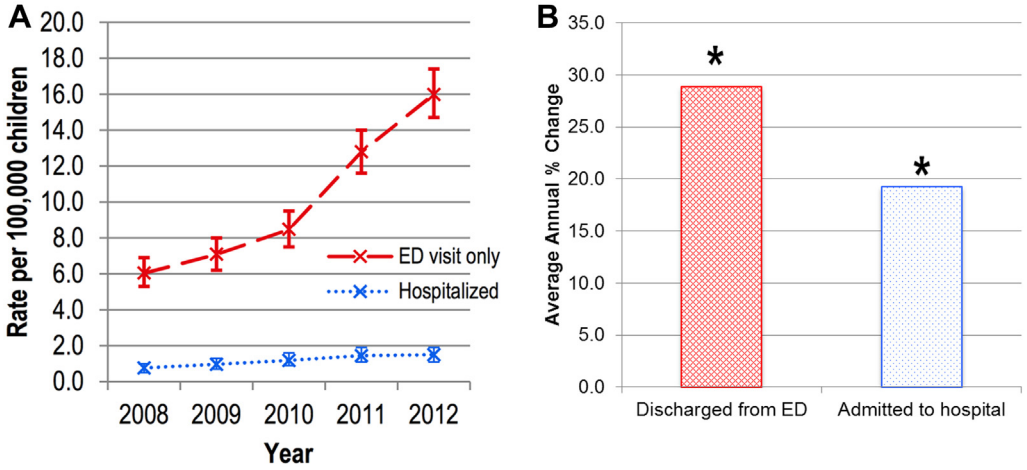

Figure 1. A, Rates of emergency department (ED) visits and hospital admissions due to food-induced anaphylaxis among children in Illinois. B, Annual percent increase in visits from 2008 to 2012. Asterisk indicates a statistically significant increase from 2008 to 2012 ($P < .005$).

Table 1
Rates of ED visits and hospital admissions for food-induced anaphylaxis among children in illinois by year, 2008-2012

Variable	Rate of ED visits and hospital admissions for food-induced anaphylaxis per 100,000 children (95% CI)				
	2008 (n = 226)	2009 (n = 279)	2010 (n = 319)	2011 (n = 481)	2012 (n = 590)
Overall	6.3 (5.5-7.2)	7.8 (6.9-8.8)	9.1 (8.2-10.2)	13.9 (12.7-15.2)	17.2 (15.9-18.7)
Age group, y					
0-4 (n = 840)	11.9 (9.7-14.4)	15.0 (12.6-17.8)	16.8 (14.1-19.8)	25.5 (22.1-29.2)	30.5 (26.9-34.5)
5-9 (n = 419)	4.6 (3.3-6.2)	6.5 (4.9-8.4)	7.2 (5.5-9.2)	12.8 (10.5-15.4)	17.7 (15.0-20.7)
10-14 (n = 284)	3.4 (2.3-4.9)	5.1 (3.7-6.9)	5.7 (4.2-7.5)	8.5 (6.7-10.7)	9.9 (8.0-12.2)
15-19 (n = 351)	5.3 (4.0-7.1)	4.8 (3.5-6.4)	7.3 (5.6-9.2)	9.4 (7.5-11.6)	11.8 (9.7-14.2)
Sex					
Male (n = 1117)	7.2 (6.1-8.6)	9.9 (8.5-11.5)	11.4 (9.9-13.1)	15.2 (13.5-17.2)	18.9 (17.0-21.1)
Female (n = 777)	5.4 (4.4-6.6)	5.6 (4.6-6.9)	6.7 (5.6-8.1)	12.5 (10.8-14.3)	15.5 (13.7-17.5)
Race/ethnicity					
Asian, non-Hispanic (n = 124)	12.9 (7.8-20.2)	11.6 (6.7-18.5)	15.2 (9.8-22.7)	22.4 (15.3-31.6)	24.1 (16.9-33.3)
Black, non-Hispanic (n = 369)	8.0 (5.9-10.6)	9.4 (7.1-12.2)	9.2 (6.9-12.0)	17.5 (14.2-21.3)	20.2 (16.8-24.4)
White, non-Hispanic (n = 1009)	6.0 (5.0-7.3)	7.6 (6.4-8.9)	10.1 (8.7-11.7)	14.2 (12.5-16.0)	16.8 (15.0-18.8)
Hispanic (n = 248)	2.8 (1.8-4.2)	3.8 (2.6-5.3)	4.5 (3.1-6.2)	7.4 (5.6-9.5)	12.5 (10.2-15.2)
Insurance type					
Private insurance (n = 1374)	7.7 (6.6-8.9)	8.3 (7.2-9.6)	11.0 (9.7-11.2)	16.9 (15.3-18.8)	18.8 (17.1-20.8)
Public insurance (n = (519)	3.9 (2.9-5.1)	7.0 (5.6-8.6)	6.0 (4.7-7.5)	9.2 (7.7-10.9)	14.8 (12.8-17.0)
Metropolitan status					
Chicago, urban (n = 639)	11.0 (8.7-13.8)	14.0 (11.4-17.1)	14.0 (11.4-17.8)	24.7 (21.2-28.7)	27.6 (23.9-31.7)
Chicago, not urban (n = 978)	7.4 (6.2-8.9)	8.5 (7.2-10.0)	10.4 (9.0-12.1)	13.5 (11.8-15.4)	17.8 (15.9-19.9)
Outside Chicago, urban (n = 125)	3.2 (1.8-5.9)	2.7 (1.3-4.9)	5.3 (3.2-8.2)	9.8 (6.9-13.5)	12.2 (9.1-16.2)
Outside Chicago, not urban (N = 142)	1.4 (0.7-2.5)	3.7 (2.5-5.4)	3.3 (2.1-4.9)	5.2 (3.7-7.2)	5.9 (4.3-7.9)
Hospitalization status					
Discharged from ED (n = 1753)	6.0 (5.3-6.9)	7.1 (6.2-8.0)	8.5 (7.5-9.5)	12.8 (11.6-14.0)	16.0 (14.7-17.4)
Admitted to hospital (n = 203)	0.8 (0.5-1.0)	1.0 (0.7-1.3)	1.2 (0.9-1.6)	1.4 (1.1-1.9)	1.5 (1.1-1.9)
Food allergen					
Peanut (n = 649)	2.2 (1.8-2.8)	2.2 (1.8-2.8)	3.7 (3.1-4.4)	4.8 (4.1-5.6)	5.6 (4.9-6.5)
Tree nut (n = 318)	0.9 (0.6-1.3)	1.5 (1.2-2.0)	1.5 (1.1-1.9)	2.3 (1.9-2.9)	2.9 (2.4-3.5)
Fin fish (n = 123)	0.4 (0.3-0.8)	0.7 (0.5-1.0)	0.4 (0.2-0.7)	0.9 (0.6-1.3)	1.1 (0.7-1.4)
Milk (n = 103)	0.4 (0.2-0.7)	0.4 (0.3-0.7)	0.3 (0.1-0.5)	0.8 (1.5-1.2)	1.0 (0.7-1.4)
Other food (n = 452)	1.8 (1.4-2.3)	2.0 (1.6-2.5)	2.0 (1.5-2.9)	3.1 (2.5-3.7)	4.1 (2.5-4.9)
Unknown food (n = 259)	0.6 (0.4-0.9)	1.0 (0.7-1.3)	1.3 (0.9-1.7)	2.0 (1.5-2.5)	2.6 (2.1-3.2)
Hospital type					
Dedicated pediatric hospital (n = 771)	2.6 (2.1-3.2)	3.5 (3.0-4.2)	3.4 (2.9-4.1)	5.7 (5.0-6.6)	6.8 (6.0-7.7)
Combined adult and pediatric hospital with PICU (n = 349)	1.5 (1.3-1.9)	1.2 (0.9-1.6)	1.9 (1.5-2.5)	2.3 (1.8-2.8)	3.1 (2.5-3.7)
Combined adult and pediatric hospital without PICU (n = 773)	2.2 (1.8-2.8)	3.1 (2.5-3.7)	3.7 (3.1-4.4)	5.8 (5.1-6.7)	7.4 (6.5-8.3)

Abbreviations: ED, emergency department; PICU, pediatric intensive care unit.

admissions, with an annual percent increase of 18.8% from 0.8 hospitalizations per 100,000 children in 2008 to 1.5 in 2012 ($P < .001$) (Fig 1 and Table 2).

Demographic Characteristics

Annual rates of ED visits and hospital admissions increased significantly from 2008 to 2012 for children of all ages, sexes, races/ethnicities, insurance types, and metropolitan statuses (Table 2). The annual percent increase was most pronounced among children aged 5 to 9 years (40.3%, $P < .001$), Hispanic children (44.3%, $P < .001$), children with public insurance (30.2%, $P < .001$), and children in urban neighborhoods outside Chicago (49.1%, $P < .001$). By demographic variable, visits were most frequent for children aged 0 to 4 years (Fig 2), Asian children (Fig 3), children with private insurance (Table 2), and children in urban Chicago neighborhoods (Fig 4). They were least frequent for children aged 15 to 19 years, Hispanic children, children with public insurance, and children in suburban neighborhoods outside Chicago. Interestingly, black children and white children had similar rates of ED visits and hospitalizations, as well as similar annual percent increases. Regarding geographic distribution, we also calculated the annual percent increase for geographic categories as follows: urban (AAPC, 27.3; 95% CI, 15.4-40.4; $P < .001$), suburban (AAPC, 28.8; 95% CI, 17.4-41.3; $P < .001$), and rural (AAPC, 39.4; 95% CI, −13.6 to 125.0; $P = .10$).

Clinical Characteristics

Anaphylaxis for any diagnosis increased between 2008 and 2012; however, the increase for all causes was substantially lower than the overall increase in food-induced anaphylaxis (9% compared with 29%). Annual rates of ED visits and hospital admissions increased significantly from 2008 to 2012 for all allergenic foods and hospital types (Table 2). Non–food-related anaphylaxis from 2008 to 2012 increased by 23.6%, which was lower than the overall percent increase of food-related anaphylaxis. The annual percent increase was most pronounced for children with tree nut–induced anaphylaxis (31.7%, $P < .001$) and for children presenting to a combined adult and pediatric hospital without a PICU (35.6%, $P < .001$). Visits were most frequent for children with peanut-induced anaphylaxis, followed by tree nut, fin fish, and milk allergy (Fig 5).

The proportion of children admitted to the hospital after presentation to the ED is listed in Table 3. By variable, hospitalizations were significantly more frequent for children with milk-induced anaphylaxis (23.3%, $P < .001$), children in suburban Chicago neighborhoods (12.7%, $P < .03$), and children presenting to a dedicated pediatric hospital or a combined adult and pediatric hospital with a PICU (12.3% for both, $P < .03$). Moreover, for infants, 42% were hospitalized as a result of their food-induced anaphylaxis compared with only 18% of children 1 year and older ($P = .02$).

Among children who were hospitalized, the mean (SD) length of stay was 1.5 (1.4) days, with a marginally shorter stay among children admitted to a dedicated pediatric hospital 1.2 (0.68) days versus 1.6 (1.5) days in a combined adult and pediatric hospital ($P = .16$). Length of stay did not vary significantly by age, sex, race/ethnicity, insurance type, metropolitan status, or food allergen.

Table 2
Annual percent increase in ED visits and hospital admissions for food-induced anaphylaxis among children in Illinois from 2008 to 2012

Variable	Average annual increase, %	*P* value
Overall	29.3	<.001
Age group, y		
0-4	27.3	<.001
5-9	40.3	<.001
10-14	30.1	<.001
15-19	25.6	<.001
Sex		
Male	26.7	<.001
Female	33.6	<.001
Race/ethnicity		
Asian, non-Hispanic	21.0	<.001
Black, non-Hispanic	28.1	<.001
White, non-Hispanic	30.6	<.001
Hispanic	44.3	<.001
Insurance type		
Private insurance	39.0	<.001
Public insurance	30.2	<.001
Metropolitan status		
Chicago, urban	27.2	<.001
Chicago, suburban	24.8	<.001
Outside Chicago, urban	49.1	<.001
Outside Chicago, suburban	38.5	<.001
Hospitalization status		
Discharged from ED	28.9	<.001
Admitted to hospital	19.3	<.001
Food allergen		
Peanut	30.2	<.001
Tree nut	31.7	<.001
Fin fish	21.8	.20
Milk	25.9	.200
Other food	23.4	<.001
Unknown food	43.5	<.001
Hospital type		
Dedicated pediatric hospital	27.1	<.001
Combined adult and pediatric hospital with PICU	22.9	<.001
Combined adult and pediatric hospital without PICU	35.6	<.001

Abbreviations: ED, emergency department; PICU, pediatric intensive care unit.

Discussion

Disparities

There was a significant increase in the annual rate of ED visits and hospitalizations due to food-induced anaphylaxis among children in Illinois from 2008 to 2012. Specifically, ED visits and hospital admissions increased on average 29.3% annually, whereas hospital admissions increased 18.8%. The upward trend in both ED visits and hospital admissions was observed, regardless of study variable analyzed. Moreover, although there was an upward trend in ED visits during the entire 5-year study period, there was a marked increase specifically between 2010 and 2012. ED visits and hospital admissions were most frequent for Asian children and children with private insurance. However, although Hispanic children and children with public insurance less frequently visited the hospital, these groups were among those with the largest annual percent increase in visits over time, suggesting trends in distribution may be in the process of change. Finally, black children and white children had similar rates of ED visits and hospital admissions, as well as similar increases in visits over the years.

The trends observed in this study are consistent with those reported in a Boston ED from 2001 to 2006, where the rate of ED visits due to food-induced anaphylaxis doubled with a similar increase in hospitalizations.[11] This finding may suggest, as our study does, that food allergy is increasing even in socioeconomically and demographically diverse populations. Understanding socioeconomic variation may help inform public health efforts and focus resources on children who are more likely to have an anaphylactic reaction or less likely to receive adequate health care.

Racial disparities are particularly important to detect, given that such disparities have been identified repeatedly for other atopic health conditions, including asthma and atopic dermatitis.[15–19] In the current study, Hispanic children less frequently visited the hospital for food-induced anaphylaxis compared with other racial groups/ethnicity. However, Hispanic children also experienced the greatest annual percent increase in ED visits and hospitalizations during the 5-year study period, suggesting that trends in racial distribution may change in the near future. This finding is consistent with the literature. It has been previously reported that Hispanic children have one of the lowest rates of ED visits due to food-induced anaphylaxis but are gradually accounting for a higher proportion of visits each year.[11] Similarly, it has been suggested that although food allergy prevalence is significantly lower among Hispanic children, this group accounts for a greater proportion of disease each year.[20] We further found that black children had rates of ED visits and hospitalizations similar to those of white children, as well as similar annual percent increases in visits.

Our finding is consistent with a study of predictors of hospital admissions for food-induced anaphylaxis, which found no differences in rates of ED visits between white and black patients.[21] In the study by Harduar-Morano et al,[13] black patients were 25% more likely to visit the ED for anaphylaxis due to food. Further work is

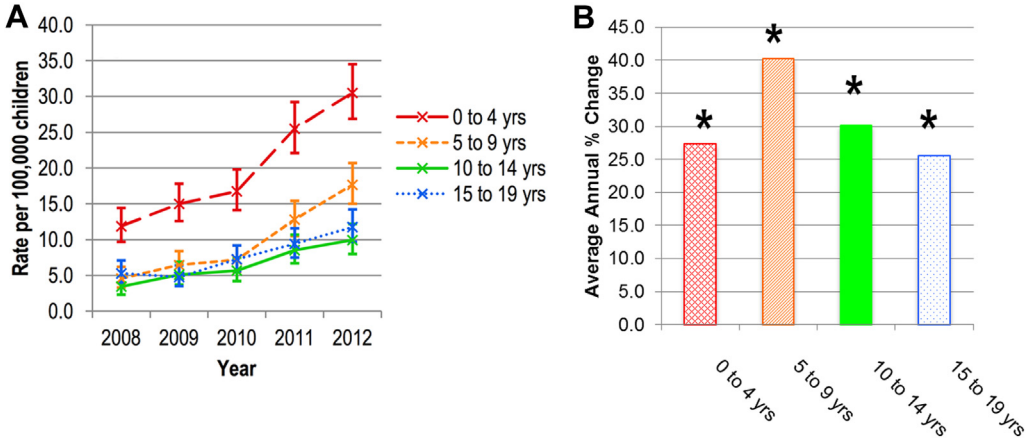

Figure 2. A, Distribution of rates of emergency department (ED) visits and hospital admissions due to food-induced anaphylaxis among children in Illinois by age. B, Annual percent increase in visits from 2008 to 2012. Asterisk indicates a statistically significant increase from 2008 to 2012 ($P < .005$).

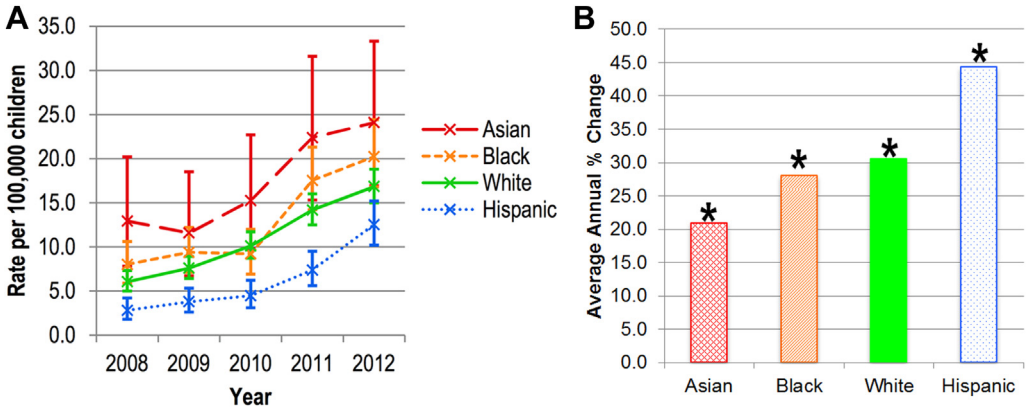

Figure 3. A, Rates of emergency department (ED) visits and hospital admissions due to food-induced anaphylaxis among children in Illinois by race/ethnicity. B, Annual percent increase in visits from 2008 to 2012. Asterisk indicates a statistically significant increase from 2008 to 2012 ($P < .005$).

warranted to better understand how race/ethnicity may predict the likelihood of food-induced anaphylaxis.

Similar trends were observed for children with public insurance as were seen among Hispanic children, namely, less frequent annual visits but a large percent increase over time. Studies of all causes of anaphylaxis have previously reported low rates among patients with public insurance.[10,22] Lower odds of food-induced anaphylaxis have also been estimated for patients with public insurance, and children from low-income households are reportedly less likely to have a food allergy.[6,13] However, our findings suggest that although food-induced anaphylaxis may be more commonly reported in higher socioeconomic groups, current trends are dynamic and have the potential to change.

Previous studies of all causes of anaphylaxis reported no association between allergy-related ED visits and metropolitan status.[23,24] However, we found that ED visits for food-induced anaphylaxis were most frequent for children from urban Chicago neighborhoods, which is consistent with our previous work revealing higher rates of food allergy with increasing population density.[7] Like the trends discussed above, this trend may also be fluid: although children from suburban neighborhoods outside Chicago less frequently visit the ED for food-induced anaphylaxis, they represent the greatest annual percent increase in visits. Given inconsistency in the literature, further research is warranted to better understand the association between metropolitan status and food-induced anaphylaxis. Currently, it is imperative that clinicians recognize the potential for food-induced anaphylaxis in children living in both urban and suburban environments and effectively educate families in the recognition and management of food-induced reactions.

Previous studies characterizing the severity of food allergy reactions report that more than half of peanut and tree nut allergic children experience a severe reaction.[6] For peanut allergies specifically, research has found that children experience severe reactions, including life-threatening anaphylaxis, at a higher rate when compared with other allergens.[25–29] Accordingly, our study found that ED visits for food-induced anaphylaxis were most frequent for children with peanut and tree nut allergies among known foods.

Several limitations to this study should be highlighted. COMPdata are administrative data, and the retrospective nature of our study design did not allow for verification of diagnosis codes with laboratory testing or oral food challenges or for validation of nonclinical data, such as insurance status. Sole reliance on diagnostic codes also increases the possibility of inaccurate coding or misclassification. There is a risk of underdetection of anaphylaxis because physicians often incorrectly assign a diagnosis of acute allergic reaction or other causes of respiratory failure or hypotension as opposed to selecting an *International Classification of Diseases, Ninth Revision* code consistent with anaphylaxis.[30] Likewise, there is a potential risk for overdiagnosis of anaphylaxis due to inaccurate coding or misclassification, particularly in younger children. Furthermore, an additional limitation of the COMPdata database is that the patients are deidentified, which does not allow

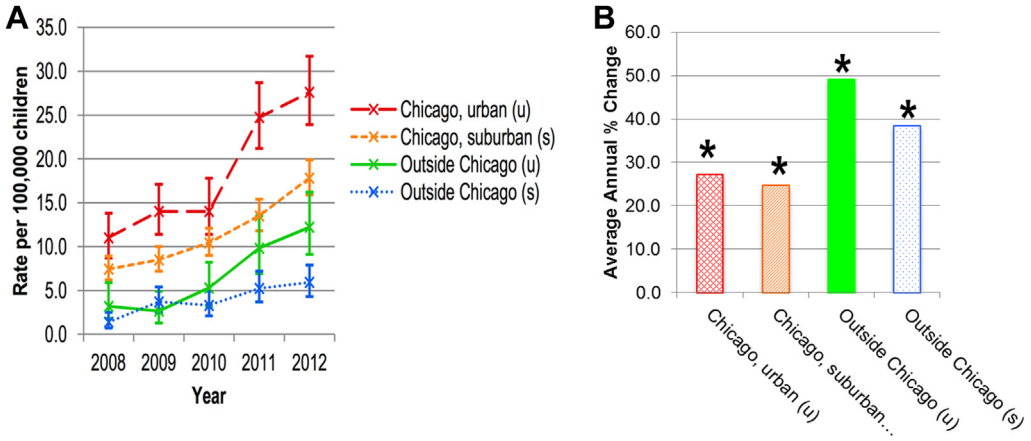

Figure 4. A, Rates of emergency department (ED) visits and hospital admissions due to food-induced anaphylaxis among children in Illinois by metropolitan status. B, Annual percent increase in visits from 2008 to 2012. Asterisk indicates a statistically significant increase from 2008 to 2012 ($P < .005$). U indicates urban; S, suburban.

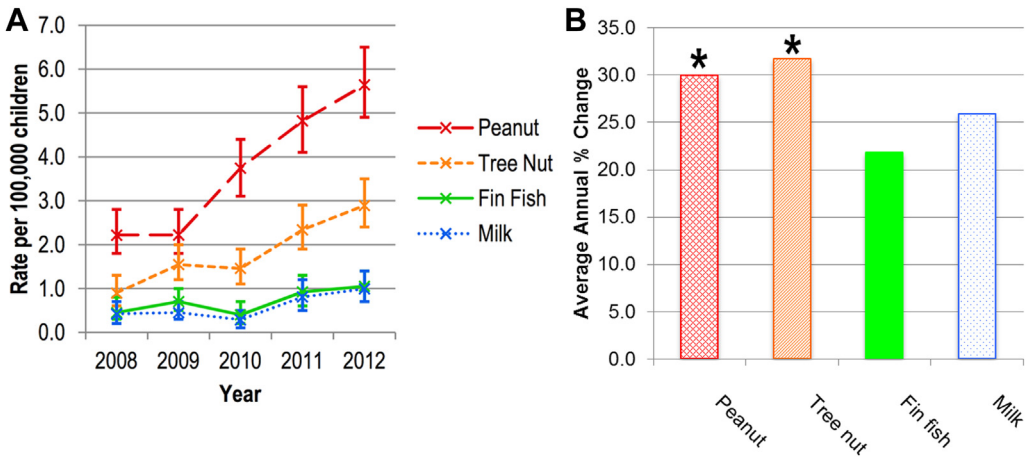

Figure 5. A, Rates of emergency department (ED) visits and hospital admissions due to food-induced anaphylaxis among children in Illinois by food allergen trigger. B, Annual percent increase in visits from 2008 to 2012. Asterisk indicates a statistically significant increase from 2008 to 2012 ($P < .005$).

for examination of patients who may have had more than one ED visit or hospitalization for food-induced anaphylaxis. In addition, a limitation of using claims data is that it is difficult to distinguish between a real change in rates in anaphylaxis vs a change in billing terms. Because the overall proportion of minorities in Illinois is increasing and we used the 2010 US Census estimates for race and ethnicity, it is possible that some of the changes related to race and ethnicity were due to demographic changes; however, we believe this is unlikely given the increase in rates in other racial and ethnic groups. Although we found an upward trend in the number of ED visits due to anaphylaxis (particularly between 2010 and 2012), our study was not population based and may not be powered to detect such change. Finally, our findings were limited to hospitals in Illinois and as such may not be generalizable to other areas of the country.

Our data suggest that the rate of food-induced anaphylaxis is increasing in Illinois. ED visits and hospitalizations increased on average 29.3% annually from 6.3 visits per 100,000 children in 2008 to 17.2 in 2012, whereas admissions increased 18.8% from 0.8 hospitalizations per 100,000 children in 2008 to 1.5 in 2012. Significant increases in ED visits and hospitalizations were observed for all study variables analyzed, including race/ethnicity, insurance type, and metropolitan status. Notably, although Hispanic children and children with public insurance less frequently visited the hospital, these groups were among the largest annual percent increase in visits over time. Furthermore, black children and white children had similar rates of ED visits and hospitalizations, as well as similar increases in visits. Such findings suggest that trends in distribution are dynamic and may change in the near future, warranting close monitoring to ensure proper resource allocation for children at higher risk. Currently, it is critical that physicians are vigilant in the timely diagnosis of food-induced anaphylaxis and able to adequately educate patient families about recognition and management of severe, potentially fatal reactions.

Table 3
Hospital admissions for food-induced anaphylaxis from 2008 to 2012

Variable	% hospitalized, (n)	*P* value
Age group, y		>.05
0-4	10.2 (86)	
5-9	9.1 (38)	
10-14	11.3 (32)	
15-19	13.4 (47)	
Sex		>.05
Male	11.5 (128)	
Female	9.7 (75)	
Race/ethnicity		>.05
Asian, non-Hispanic	11.3 (14)	
Black, non-Hispanic	11.9 (44)	
White, non-Hispanic	9.6 (97)	
Hispanic	9.7 (24)	
Insurance type		>.05
Private insurance	10.7 (147)	
Public insurance	10.8 (56)	
Metropolitan status		.03
Chicago, urban	8.5 (54)	
Chicago, suburban	12.7 (124)	
Outside Chicago, urban	7.3 (9)	
Outside Chicago, suburban	11.3 (16)	
Food allergen		<.001
Peanut	11.0 (71)	
Tree nut	11.6 (37)	
Fin fish	11.4 (14)	
Milk	23.3 (24)	
Other food	8.6 (39)	
Unknown	7.3 (19)	
Hospital type		.03
Dedicated pediatric hospital	12.3 (95)	
Combined adult and pediatric hospital with PICU	12.3 (43)	
Combined adult and pediatric hospital without PICU	8.4 (65)	

Abbreviations: ED, emergency department; PICU, pediatric intensive care unit.

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