

(5 hours), it is unlikely that AD was involved in triggering the reaction in this case.⁷

Although there is no strict recommended observation period for anaphylaxis cases, it is reasonable to establish an 8-hour monitoring period. However, patients with a history of risk factors (eg, asthma, previous biphasic reactions, unknown inciting trigger, hypotension at presentation, or protracted anaphylaxis) should be observed for a longer period, perhaps at least 24 hours after the first symptoms.^{5,10} Prognosis is good once the acute phase has been overcome, and patients generally undergo immunotherapy to prevent future episodes, as in the present case.

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Comparison of asthma prevalence and morbidity among rural and nonrural youth



Characterizing the experience of pediatric asthma in rural communities is in a nascent stage. Rural youth can encounter barriers that place them at risk for asthma-related health disparities.¹ They are also equally^{2,3} or more likely⁴ to be diagnosed as having asthma than youth in urban areas and can experience significant asthma morbidity.^{3–7} Previous studies have compared rural and urban youth residing in separate states,² focused on a predominantly minority and low-income sample from a rural south delta region,^{5–7} or analyzed a Medicaid-only cohort of young rural children.⁴ The current study further characterized rural asthma by comparing the prevalence and morbidity of asthma in rural and nonrural counties using a broad, statewide survey administered to a wide range of public middle and high school students in Florida. Given known pediatric asthma disparities,⁸ we also examined differences in the prevalence of asthma and morbidity among African American, Hispanic, and non-Hispanic white youth residing in rural counties.

Data from the 2014 Florida Youth Tobacco Survey (FYTS), an annual, cross-sectional, anonymous school survey, were used. The survey involved a 2-stage cluster probability sample design: a random sample of public middle and high schools was selected, and then a random sample of classrooms was selected within each school. In even-numbered years, the sample is drawn at the county level to allow estimates for each county. The combined student and school participation rates for the 2014 FYTS were 81% for middle schools and 78% for high schools. Imputation was

used in instances of missing data. Institutional review board approval was obtained.

Students reported on sex, grade, and race/ethnicity. Asthma status was determined by the following questions: (1) “Has a doctor or nurse ever told you that you have asthma?” and (2) “Do you still have asthma?” Students who answered yes to both questions were categorized as having asthma. Asthma-related morbidity was determined by the following questions: (1) “During the past 12 months, did you have an asthma attack?” and (2) “During the past 12 months, how many times did you go to an emergency department (ED) or urgent care center because of your asthma?” Students were dichotomized based on whether they did or did not report having an asthma attack or an ED or urgent care visit in the past 12 months. Florida statute defines rural areas as those with a population density of less than 100 persons per square mile. On the basis of population density estimates from the 2010 US Census, 30 counties were considered rural and 37 were nonrural.

Data were statistically weighted to be representative of all Florida public middle and high school students. SAS survey procedures (SAS Institute Inc, Cary, North Carolina) accounted for the complex sample design. To assess significance for prevalence, 95% confidence intervals (CIs) were calculated. Two groups whose CIs did not overlap were interpreted as having a statistically significant difference at $P < .05$. Logistic regression modeling was used to estimate the odds of having asthma, experiencing an asthma attack, or visiting an ED or urgent care center for students living in rural counties for each racial/ethnic group after controlling for sex.

Table 1
Odds of Sex and Race Differences for Asthma and Morbidity Within Rural Counties

Variable	OR (95% CI)		
	Asthma diagnosis	Asthma attacks	ED visits
Middle school students			
Step 1			
Sex (male comparison)			
Female	1.1 (0.9–1.2)	1.2 (0.9–1.6)	2.0 (1.4–2.7) ^a
Step 2			
Sex (male comparison)			
Female	1.1 (0.9–1.2)	1.2 (0.9–1.7)	1.9 (1.3–2.6) ^a
Race (non-Hispanic white comparison group)			
African American	1.7 (1.5–2.1) ^a	0.7 (0.5–1.1)	2.3 (1.6–3.3) ^a
Hispanic	0.8 (0.7–1.0)	0.8 (0.5–1.2)	1.1 (0.7–1.7)
High school students			
Step 1			
Sex (male comparison)			
Female	1.4 (1.2–1.7) ^a	1.4 (1.0–2.0)	1.2 (0.8–1.8)
Step 2			
Sex (male comparison)			
Female	1.4 (1.2–1.7) ^a	1.4 (1.0–1.9)	1.3 (0.8–1.9)
Race (non-Hispanic white comparison group)			
African American	1.5 (1.2–1.9) ^a	0.7 (0.5–1.1)	1.9 (1.2–3.0) ^a
Hispanic	0.7 (0.6–1.0)	1.0 (0.6–1.6)	1.7 (0.9–3.0)

Abbreviations: CI, confidence interval; ED, emergency department; OR, odds ratio.

^a $P < .05$.

Among middle school students, 51.4% were male, and 37.0% identified as non-Hispanic white, 23.3% as African American, 29.6% as Hispanic, and 10.1% as other race. Among high school students, 51.3% were male. There was a similar distribution of racial/ethnic background: 39.1% self-identified as non-Latino white, 22.3% as African American, 30.6% as Latino, and 8.0% as other race (eTable 1).

Asthma prevalence did not differ between students in rural and nonrural counties among middle (rural, 12.9%; nonrural, 12.1%) and high school students (rural, 11.2%; nonrural, 10.7%). No differences were found among middle or high school students between rural and nonrural counties with regard to the percentage of students reporting an asthma attack or visiting an ED or urgent care center in the past 12 months. African American middle and high school students were more likely to report having asthma than their non-Hispanic white peers. African American middle and high school students were more likely to report an ED or urgent care visit for their asthma in the past 12 months compared to non-Hispanic white students. No differences were reported in asthma prevalence or morbidity between Hispanic and non-Hispanic white students (Table 1).

Consistent with previous research,² the prevalence of asthma in our statewide sample was similar in middle and high school students from rural and nonrural counties. Rates of asthma attacks and ED or urgent care center visits in the past 12 months were also similar between rural and nonrural youth; this finding is consistent with previous research conducted at a statewide level with a Medicaid cohort of children 6 years or younger.⁴ African American students in rural communities were more likely to report a diagnosis of asthma and experience higher rates of ED or urgent care use compared with their non-Hispanic white peers. Our findings suggest that racial/ethnic disparities exist within rural communities.

Our study leveraged a statewide sample with a broad age range to build on previous research by demonstrating that asthma prevalence and morbidity is common among rural youth in Florida. Additional research is needed in this area¹ that consistently defines and measures rurality across samples to

allow for greater generalizability of results. Research is also needed that focuses on determinants of racial/ethnic disparities in rural communities.⁹

Study limitations include that the FYTS is cross-sectional, contains few asthma morbidity questions, and is administered in public schools, precluding examination of temporal associations and limiting generalizability to other students. The FYTS assesses asthma-related variables at the county level, which limited our ability to assess potential differences in urban and suburban areas. Finally, the FYTS questions limited our ability to assess potential differences between racial/ethnic subgroups and non-Hispanic white youth residing in rural communities.

Our study highlights the need to focus on rural youth, an overlooked area in pediatric asthma literature. Next steps for inquiry include determining what factors (eg, health care access) contribute to rates of asthma morbidity among rural youth. Larger systematic changes in the quality of health care in rural settings are needed to elicit change in asthma morbidity. We suggest incorporating a community needs assessment before intervention because this will ensure that researchers address community needs and involve interested stakeholders.

Supplementary Data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.jana.2016.05.019>.

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eTable 1

Prevalence of Asthma Status and Morbidity by Sex, Race/Ethnicity, and County Type

Variable	Prevalence (95% CI), %	
	Middle school	High school
Asthma diagnosis	12.1 (11.5–12.6)	10.8 (10.2–11.3)
Sex		
Male	11.5 (10.7–12.3)	9.3 (8.6–10.0)
Female	12.6 (11.8–13.4)	12.2 (11.5–12.9)
Race/ethnicity		
Non-Hispanic white	10.6 (9.9–11.2)	9.8 (9.2–10.4)
African American	15.0 (13.6–16.5)	12.9 (11.5–14.2)
Hispanic	12.1 (10.9–13.2)	10.4 (9.4–11.5)
Other	11.6 (10.0–13.2)	10.9 (9.4–12.5)
County type		
Rural	12.9 (12.0–13.7)	11.2 (10.4–12.0)
Nonrural	12.1 (11.5–12.6)	10.7 (10.2–11.3)
Asthma attack	30.6 (28.4–32.8)	28.6 (26.4–30.8)
Sex		
Male	27.1 (24.1–30.1)	20.4 (17.2–23.7)
Female	33.8 (30.5–37.1)	34.7 (31.8–37.6)
Race/ethnicity		
Non-Hispanic white	33.1 (30.0–36.2)	31.0 (28.2–33.9)
African American	28.4 (23.3–33.5)	25.3 (20.5–30.1)
Hispanic	28.8 (24.4–33.2)	27.2 (22.9–31.5)
Other	33.1 (26.7–39.5)	33.7 (26.2–41.3)
County type		
Rural	26.7 (23.9–29.5)	28.5 (25.2–31.8)
Nonrural	30.8 (28.5–33.2)	28.6 (26.3–30.8)
Asthma ED or urgent care visit	29.4 (27.2–31.7)	23.6 (21.5–25.8)
Sex		
Male	25.3 (22.1–28.5)	19.3 (16.1–22.5)
Female	32.6 (29.4–35.9)	26.9 (24.0–29.8)
Race/ethnicity		
Non-Hispanic white	23.3 (20.5–26.0)	16.0 (13.6–18.3)
African American	36.2 (31.0–41.3)	31.1 (25.9–36.2)
Hispanic	28.9 (24.3–33.4)	25.6 (21.2–29.9)
Other	32.5 (25.8–39.2)	27.9 (20.6–35.3)
County type		
Rural	26.7 (23.5–30.0)	23.9 (20.5–27.2)
Nonrural	29.6 (27.2–32.0)	23.6 (21.4–25.9)

Abbreviations: CI, confidence interval; ED, emergency department.