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Assessing asthma self-management education among US children with current asthma, Asthma Call-back Survey (ACBS) 2015–2017

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Abstract

Objective: Asthma self-management education (AS-ME) is an effective strategy to help children with asthma achieve better asthma control and outcome. The objective of this study is to assess the association between the prevalence of receiving AS-ME curriculum components and sociodemographic characteristics among children with current asthma.

Methods: Behavioral Risk Factor Surveillance System, child Asthma Call-back Survey 2015–2017 aggregated data were used. Multivariable logistic regression models were used to assess associations of each AS-ME component question and sociodemographic characteristic, adjusting for sample weighting.

Results: Among 3,213 children with current asthma, 52% of children reported ever being given an asthma action plan by a doctor or other healthcare professional. After adjusting for other variables, boys and Non-Hispanic Black children were more likely to report being given an action plan (APR= 1.15[95% CI 1.00–1.32] and APR= 1.28[95% CI 1.07–1.54] respectively). Non-Hispanic Black (APR = 2.15 [95% CI 1.30–3.55]), non-Hispanic, other race (APR = 1.95 [95% CI1.04–3.66]), and Hispanic children (APR = 1.84 [95% CI 1.18–2.89]) were more likely to report taking a course to learn how to manage asthma than non-Hispanic White children. Hispanic children (40.8%) were more likely to report being advised to change home environment compared to non-Hispanic Whites (31.5%) (APR =1.28 [95% CI 1.01–1.63).

Conclusion: The prevalence of some elements of asthma-self management education was relatively low and there were differences observed in the prevalence of receiving AS-ME by race/ethnicity, parental education, and income. Targeted implementation of asthma self-management components and interventions may improve asthma control and reduce asthma morbidity.

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Disclosure statement

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

CDC disclaimer

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Keywords

Asthma; self-management; education; children; asthma attack

Introduction

Asthma self-management education (AS-ME) is an essential component of asthma disease management and has been shown to improve asthma outcomes (1). Asthma is one of the most prevalent chronic diseases among children, with approximately 7.8% of children diagnosed with asthma in the United States (2). Asthma exacerbations can lead to missed school days, hospitalization, and emergency department visits (3,4). Among children with asthma, non-Hispanic Black and Hispanic children experience worse asthma control and are at higher risk of poor asthma outcomes, including hospitalizations, emergency department (ED) visits, and mortality compared to white children (5–7). Also, the impact of asthma has been historically greater on children from low-income backgrounds, with these children having a higher prevalence of asthma and higher risk for poor asthma outcomes compared to children from higher-income backgrounds (2,8,9). Given these asthma health disparities, it is important to consider if and how access to and use of evidence-based asthma interventions varies across children with asthma by sociodemographic characteristics.

Asthma self-management education (AS-ME) is an effective strategy to help children with asthma achieve better asthma control and has been shown to reduce asthma-related ED visits and hospitalizations (10–13). AS-ME curriculum teaches how to effectively control asthma and includes instructions on medication adherence, how to recognize early signs and symptoms of asthma attacks or episodes, and how to recognize and avoid environmental triggers (7,11,14). In addition, the guidelines of the National Asthma Education and Prevention Program (NAEPP) recommend a written action plan for every patient, which can facilitate AS-ME. Effective AS-ME can be delivered to individuals, families, or groups in a variety of settings such as education in a clinic, school, pharmacy, or community and by a variety of providers (10–12).

Although previous studies have examined sociodemographic characteristics of children with current asthma, there has been limited research exploring the prevalence of asthma self-management education curriculum components by child's sociodemographic characteristics such as race/ethnicity and household income level. This is important for targeting interventions for health-education delivery to at-risk communities (15). The objective of this study is to assess the association between the prevalence of receiving asthma self-management education curriculum components and sociodemographic characteristics among children with current asthma using the 2015–2017 Behavioral Risk Factor Surveillance System (BRFSS), Asthma Call-back Survey (ACBS) data (16).

Methods

Survey data description

This analysis was conducted using the BRFSS, child ACBS 2015–2017 aggregated data. The ACBS collects information from BRFSS respondents who report an asthma diagnosis, including information on asthma symptoms, history, medication, healthcare utilization, asthma management and education, and exposure to asthma triggers. BRFSS survey respondents are eligible for the child ACBS if they report that the randomly selected child in the household has ever been diagnosed with asthma (lifetime asthma). The annual child ACBS weighting process is based on the BRFSS final child weight for the randomly selected child, adjusted for unequal probability of sample selection and differential non-response by demographic groups (16). More information on the background, design, data collection and processing, statistical, and analytical issues can be found at: https://www.cdc.gov/brfss/acbs/2017/pdf/Combined-2015-2017-ACBS-Child-Data-History-Analysis_final-508.pdf, 2022.

Variables

Respondents were considered to have current asthma if they answered “yes” to both questions, “Has a doctor, nurse or other health professional EVER said that the child has asthma?” and “Does the child still have asthma?” More information on BRFSS ACBS questions can be found at: https://www.cdc.gov/brfss/questionnaires/pdf-ques/2017_BRFSS_Pub_Ques_508_tagged.pdf. In this study, 6 ACBS questions related to asthma self-management education components were analyzed independently. ACBS questions on AS-ME included, Has a doctor or other health professional ever taught you or {child’s name} (Q1–Q4): (1) How to recognize early signs or symptoms of an asthma episode, (2) What to do during an asthma episode or attack, (3) How to use a peak flow meter to adjust his/her daily medications?, (4) Given an asthma action plan?; (Q5).Have you or {child’s name} ever taken a course or class on how to manage {his/her} asthma?, and (Q6) Have you ever been advised to change your home environment?” Child demographic variables included age, sex at birth, race/ethnicity, annual household income, and parental education.

Statistical analysis

We analyzed sociodemographic factors among children with current asthma including sex at birth (male or female), age group (0–4 years, 5–11 years, and 12–17 years), race/ethnicity (Non-Hispanic White, Non-Hispanic Black, Non-Hispanic Other race, and Hispanic), parent or guardian education level (did not graduate high school, graduated high school, attended college, graduated college), and household income (<$25 000; $25 000–$50 000; ≥$50 000; and missing). We calculated the frequencies and weighted percentages of children receiving each AS-ME component by these sociodemographic characteristics. We used the Rao-Scott Chi-square test to measure the bivariate association between each AS-ME variable and each sociodemographic factor. We used multivariable logistic regression models to assess associations of each AS-ME component question and each sociodemographic characteristic. The adjusted predicted risk ratio (APR) and 95% confidence intervals (CIs) were calculated, adjusting for sex at birth, age group, race/ethnicity, parental education, and household

income. Separate models were constructed for each of the asthma self-management education variables. All analyses were conducted using SAS (RTI International, NC). Statistical significance was set at the 0.05 level.

Results

Characteristics of children with current asthma

Among children with current asthma, 56.2% were male, 45% were non-Hispanic white, 28.1% were Hispanic, and 16.4% were non-Hispanic Black (Table 1). By age, 14.3% of children with current asthma were aged 0–4 years, 45.1% were aged 5–11 years and 40.6% were aged 12–17 years. Households with an income of $50 000 and above represented 44.6% of children with asthma, and 33.1% of the households had an income less than $25 000. 5.4% respondents had missing household income. An estimated 38.8% of children had a parent or guardian who had graduated college, while 25.2% had attended college but did not graduate (Table 1).

As-ME: Given an action plan

Overall, 52% of children with current asthma reported ever being given an asthma action plan by a doctor or other healthcare professional. The prevalence of participants who reported being given an action plan was associated with sex at birth ($p = 0.025$), age ($p = 0.031$) and race/ethnicity ($p = 0.049$) (Table 2). Receiving an action plan was more prevalent among males (55.7%) than females (47.2%) (Tables 2). After adjusting for other variables in the table, boys were still more likely to report being given an action plan (APR= 1.15[95% CI 1.00–1.32]) than girls (Table 3). By race/ethnicity, the prevalence of being given an asthma action plan was significantly higher for Non-Hispanic Black children (62.5%) compared to non-Hispanic White children (48.6%) (Table 2). This association remained after adjustment, with Non-Hispanic Black children more likely to report being given an asthma action plan compared to non-Hispanic White children (APR= 1.28[95% CI 1.07–1.54]) (Table 3). There were no significant differences in the percentages of children receiving an action plan by age group, household income or parent/guardian education attainment (Table 2).

As-ME: Taken a course to learn how to manage asthma

Only 12.7% of children with current asthma had taken a course to learn how to manage asthma. Race/ethnicity was significantly associated with taking a course to learn how to manage asthma ($p = 0.008$, Table 2). As seen in Table 2, the percentage taking a course among children with current asthma was significantly higher among non-Hispanic Black children (17.6%), non-Hispanic other race children (16.1%) and Hispanic children (15.9%) than non-Hispanic White children (8.4%). Non-Hispanic Black (APR = 2.15 [95% CI 1.30–3.55]), non-Hispanic, other race (APR = 1.95 [95% CI1.04–3.66]), and Hispanic children (APR = 1.84 [95% CI 1.18–2.89]) were more likely to report taking a course to learn how to manage asthma than non-Hispanic White children. No associations were observed between taking a course to learn how to manage asthma by gender, age group, household income or parent/guardian education attainment (Table 2).

As-ME: Taught to recognize early signs or symptoms of an asthma episode

Among the children with current asthma, 78.7% reported being taught to recognize early signs and symptoms of an asthma episode. (Table 2). Prevalence of being taught to recognize early signs and symptoms was lower for those with a household income less than $25 000 (72%) compared to those with a household income more than $50 000 (83.1%) (Table 2). Without adjusting for other sociodemographic characteristics, the children with a household income less than $25 000 were less likely to report being taught to recognize early signs and symptoms of an asthma episode than those with household income more than $50 000 (PR = 0.87 [95% CI 0.77–0.97]) (Supplementary Table 1); however, after adjusting for other variables in the model, this association was no longer statistically significant at $p < 0.05$ (PR = 0.89 [95% CI 0.80–1.00]) (Table 3).

As-ME: Taught to respond to an asthma episode

Among the children with current asthma, 84.5% reported being taught to respond to an asthma episode (Table 2). Prevalence of being taught to respond to an asthma episode was lower for those with a household income less than $25 000 (79.1%) compared to those with household income more than $50 000 (88.1%) (Table 2). Without adjusting for other sociodemographic characteristics, the children with a household income less than $25 000 were significantly less likely to report being taught to respond to an asthma episode than those with a household income more than $50 000 (PR = 0.90 [95% CI 0.82–0.98]); however, after adjusting for other variables in the model, this likelihood was no longer statistically significant (PR = 0.92 [95% CI 0.85–1.01]) (Table 3).

As-ME: Taught to use peak flow

Of the children with current asthma, 36.5% were taught to use a peak flow meter. Age group was associated with being taught to use peak flow (Table 2, $p < 0.001$). Prevalence of peak flow meter instruction was higher for children aged 12 –17 years (44.4%) than for children aged 0–4 years (25.3%) (Table 2). After adjustment for other variables, this association by age group remained, with children aged 12 –17 years more likely to report being taught to use a peak flow meter than those aged 0–4 years (APR = 1.88 [95% CI 1.32–2.70]) (Table 3). Children whose parents had attended college (but not graduated) were more likely to report being taught to use peak flow than those whose parents graduated college (PR =1.26 [95% CI 1.01–1.56) (Table 2). However, this association was no longer significant after adjusting for other variables in the model (PR =1.18 [95% CI 0.95–1.47) (Table 3).

As-ME: Advised to change home environment

Among the children with current asthma, 35.4% reported being advised to change their home environment. Hispanic children (40.8%) were more likely to report being advised to change home environment compared to non-Hispanic White children (31.5%) (APR =1.28 [95% CI 1.01–1.63) (Tables 2 and 3). In unadjusted analyses, children whose parents had attended, but not graduated (41.1%) were significantly more likely to report being advised to change their home environment compared to those who graduated college (32.7%) (PR =1.26 [95% CI 1.01–1.56]); however, this association was no longer significant when adjusted for other variables in the model (PR =1.12 [95% CI 0.89–1.40]) (Table 3).

Discussion

In this study, we assessed the prevalence of AS-ME among children with current asthma. We found that only 52% of children with current asthma had received an asthma action plan, indicating that almost half of them had never received an asthma action plan. Approximately 79% of the children with current asthma reported being taught to recognize early signs and symptoms of an asthma episode and 84.5% reported being taught to respond to an asthma attack. An estimated 36.5% of the children were taught to use a peak flow meter, 35.4% of parents were advised to change home environment, and only 12.7% had taken a course to learn how to manage asthma.

We found that non-Hispanic Black children were more likely to be given an asthma action plan after adjusting for all other variables. Since non-Hispanic Black children are at higher risk of asthma-related ED visits, hospitalizations, and mortality compared to White children with asthma (5–7,17), these results may indicate that receiving an asthma action plan may be related to disease severity. Although receiving an asthma action plan was higher among non-Hispanic Black children compared to non-Hispanic White children, approximately 37% of non-Hispanic Black children still did not receive such a plan. Providing an asthma action plan is an important component of asthma management. Research has suggested that asthma action plans promote better health outcomes for children at home and in their schools through improved collaboration and communication about asthma management, including proper medication use, learning to recognizing signs and symptoms of asthma attacks, and avoiding environmental triggers, (18,19). Our data indicate that children and their caregivers may benefit from receiving an asthma action plan. The National Asthma Education and Prevention Program guidelines recommend an asthma action plan for all individuals with asthma (20).

The overall prevalence of children and their caregivers who received a course on asthma in our study population was low (12.7%). Several studies have highlighted the benefits of asthma self-management courses for both parents as well as children that increase patient empowerment and better ability to control and manage their asthma (21–23). The low prevalence of receiving an asthma course in this population could be due to limited availability of these types of AS-ME components (11).

In unadjusted analyses, children with household income less than $25 000 were less likely to report being taught to recognize early signs and symptoms of asthma and less likely to report being taught to respond to an asthma episode compared to those with a household income greater than $50 000. As stated previously, some research indicates that children from low-income backgrounds may be at higher risk of poor asthma outcomes (2,8,9). Other studies have also indicated that low socioeconomic status can be a risk factor for less knowledge of asthma self-management. Lack of parent’s asthma self-management knowledge also has ramifications on children’s understanding of asthma, especially of younger children, as parents play a key role in their asthma management (15,24,25). In one study, despite receiving asthma education, in some cases, parents still identified a need for more information and education from healthcare professionals (26). Our analysis suggests

that a proportion of low-income families of children with current asthma are not currently receiving adequate educational intervention for asthma management (9,27,28).

The overall prevalence of receiving advice on changing the home environment was low (35%). Common asthma triggers include exposure to second-hand smoke, cockroaches, dust mites, pets, and mold (National Asthma Education and Prevention Program (20,29). AS-ME advice on reducing asthma triggers in the home environment could occur in healthcare encounters or other settings. Home visits to reduce environmental asthma triggers and provide asthma self-management education (AS-ME) has also shown to be an effective intervention for helping individuals or families decrease their exposure to asthma triggers and improve asthma control (30,31). We found that Hispanic parents and those with lower education levels were more likely to be advised to change home environment. Studies have shown that groups experiencing a high burden of asthma use indoor environmental control practices to avoid or prevent triggers, once they have knowledge of these asthma triggers (24,32). Our study has several strengths. We assessed AS-ME components using a sample of over 3,000 children with current asthma from 24 states participating in the ACBS. We included important sociodemographic variables to detect differences in AS-ME by race/ethnicity, household income, and parent education level, among others. Our results indicate some variation in AS-ME by these characteristics.

This study has some limitations. Data collected from the ACBS are cross-sectional, hence the observed associations do not imply causality and the temporal sequence of events are not known. Additional information such as when the AS-ME was received and the number of times it was received was unknown. Data, including asthma diagnosis, are based on self-reports from a phone survey. These self-reported findings may also be subject to social desirability bias. Additional information on individual and socioeconomic characteristics associated with AS-ME, not assessed in our analysis, could further our understanding of factors related to asthma self-management education among parents of children with asthma. Since this study did not include homeownership and rent as a variable, future studies could assess homeownership, as research suggests that renters may have more asthma triggers in their homes (32).

Conclusion

Since, asthma self-management education is a proven strategy for improving asthma outcomes and reducing asthma-related emergency department visits, hospitalizations, and healthcare costs, the findings of this study have important implications for reducing asthma morbidity and healthcare costs for children with asthma and their families. Our findings indicate that, despite national guidelines that recommend an asthma action plan for all individuals with asthma, only about half of children with asthma in our study indicated receiving an asthma action plan. The prevalence of some elements of asthma-self management education remained relatively low in our study population, with only 13% taking a course to learn how to manage asthma and less than 40% of children receiving advice on making changes to the home environment. Our results also show differences in the prevalence of receiving education on asthma self-management by race/ethnicity, parental education, and income. These findings highlight opportunities to improve asthma control

and reduce asthma morbidity through further implementation of asthma self-management components and interventions. Given current asthma health disparities, it is important to continue to assess differences in access to and receipt of asthma self-management education across affected groups.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Characteristics of children aged <18 years with current asthma[a]: Asthma Call-back Survey 2015–2017.

Characteristic	Unweighted N[b]	Weighted % (95% CI[c])
All	3,213	100.0
Sex at birth		
Female	1,354	43.8 (40.1–47.6)
Male	1,859	56.2 (52.4–59.9)
Age group		
0–4 years	315	14.3 (12.3–17.0)
5–11 years	1,239	45.1 (41.4–48.8)
12–17 years	1,659	40.6 (37.3–44.0)
Race/ethnicity		
Non-Hispanic White	1,981	45.0 (41.5–48.6)
Non-Hispanic Black	304	16.4 (13.7–19.4)
Non-Hispanic, Other	319	10.5 (8.3–13.1)
Race		
Hispanic	609	28.1 (24.8–31.6)
Household income		
<$25,000	783	33.1 (29.5–36.9)
$25,000-<$50,000	574	17.0 (14.5–19.7)
≥$50,000	1,669	44.6 (1.0–48.29)
Missing	187	5.4 (4.2–6.9)
Parent or guardian education attainment		
Did not graduate high school	223	12.2 (9.5–15.5)
Graduated high school	661	23.9 (20.9–27.3)
Attended college	880	25.2 (22.2–28.3)
Graduated college	1,447	38.8 (35.4–42.2)

[a]Respondents with a “yes” answer to both questions: (1) Has a doctor, nurse or other health professional ever told you that you had asthma? and (2) Do you still have asthma?

[b]unweighted number for Current asthma respondents.

[c]Confidence Interval.

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Table 2.

Prevalence of each asthma knowledge of self-management education curriculum component among children (aged <18 years) with current asthma[a] by sociodemographic characteristics: Asthma Call Back Survey 2015–2017.

	Given an action plan		Taken a course to learn how to manage asthma		Taught to recognize early signs or symptoms		Taught to respond to an asthma episode		Taught to use peak flow		Advised to change home environment	
Characteristic	**N[c]**	**% (95% CI)[d]**	**N[3]**	**% (95% CI)[d]**	**N[c]**	**% (95% CI)[d]**	**N[c]**	**% (95% CI)[d]**	**N[c]**	**% (95% CI)[d]**	**N[c]**	**% (95% CI)[d]**
All	1,725	52.0[e] (48.2–55.8)	396	12.7[f] (10.5–15.6)	2,606	78.7[g] (75.2–81.9)	2,769	84.5[h] (81.4–87.2)	1,278	36.5[i] (33.3–39.7)	1,105	35.4[j] (32.2–38.8)
Sex at birth		**P = 0.0254[b]**		P = 0.5448[b]		P = 0.2046[b]		P = 0.2106[b]		P = 0.5626[b]		P = 0.3158[b]
Female	700	47.2 (41.4–32.1)	176	13.6 (10.2–18.0)	1,084	76.0 (69.6–81.4)	1,149	82.3 (76.9–86.7)	524	35.3 (30.4–40.5)	445	33.4 (28.5–38.8)
Male	1,025	55.7 (50.8–60.4)	220	12.1 (9.4–15.6)	1,522	80.8 (76.4–84.6)	1,620	86.2(82.3–89.4)	754	37.3 (33.1–41.8)	660	37.0 (32.6–41.6)
Age group		**P = 0.0314[b]**		P = 0.4489[b]		P = 0.9999[b]		P = 0.3645[b]		**P = 0.0001[b]**		P = 0.7726[b]
0–4 years	151	47.1 (37.9–55.5)	33	10.1 (6.1–16.2)	243	78.7 (69.9–85.5)	256	82.6 (74.0–88.8)	68	25.3 (17.8–34.5)	102	36.3 (27.8–45.8)
5–11 years	710	57.5 (51.2–63.4)	153	14.2 (10.5–19.1)	998	78.7 (73.0–83.5)	1,066	86.8 (82.3–90.4)	436	33.0 (28.2–38.2)	421	34.1 (29.0–39.5)
12–17 years	864	47.5 (42.2–52.8)	210	12.1 (9.3–15.7)	1,365	78.8 (73.1–83.5)	1,447	82.6 (77.1–87.0)	774	44.4 (39.4–49.4)	582	36.6 (31.9–41.6)
Race/ethnicity		**P = 0.0499[b]**		**P = 0.0075[b]**		P = 0.2238[b]		P = 0.2472b		P = 0.6548[b]		P = 0.1153[b]
NH White	1,058	48.6 (44.1–53.0)	207	8.4 (6.6–10.5)	1,648	81.9 (77.7–84.5)	1,759	86.2 (82.1–89.5)	751	34.5 (30.6–38.7)	648	31.5 (27.8–35.6)
NH Black	189	62.5 (55.0–71.1)	52	17.6 (11.6–25.7)	242	81.4 (72.8–87.8)	264	88.5 (80.2–93.6)	147	40.4 (32.0–49.4)	109	39.8 (02.9–49.2)
NH, Other Race	152	55.7 (43.9–67.0)	48	16.1 (8.7–27.9)	239	77.2 (66.2–85.5)	265	85.1 (74.0–92.0)	123	35.4 (25.2–47.0)	97	31.1 (21.5–42.6)
Hispanic	326	49.9 (41.5–58.3)	89	15.9 (10.7–22.9)	477	72.6 (63.8–80.0)	481	79.3 (71.8–85.0)	257	37.6 (30.6–45.1)	251	40.8 (33.4–48.6)
Household income		P = 0.8776[b]		P = 0.6106[b]		**P = 0.0448[b]**		P = 0.1304[b]		P = 0.2249[b]		P = 0.1945[b]
<$25,000	417	52.1 (44.9–59.3)	117	15.1 (10.8–20.4)	596	72.0 (63.9–78.9)	621	79.1 (72.0–84.8)	350	40.7 (34.1–47.6)	296	38.1 (31.6–45.0)
$25,000–<$50,000	298	49.2 (40.9–57.5)	75	10.9 (7.1–16.4)	482	78.4 (69.1–85.5)	508	85.6 (78.2–90.8)	228	36.4 (29.6–43.8)	202	39.2 (31.4–47.6)
≥$50,000	921	53.1 (47.9–58.3)	185	12.0 (8.9–65.5)	1,380	83.1 (78.8–86.6)	1,485	88.1 (84.0–91.2)	625	32.7 (28.2–37.5)	548	31.4 (27.0–36.1)

Characteristic	Given an action plan		Taken a course to learn how to manage asthma		Taught to recognize early signs or symptoms		Taught to respond to an asthma episode		Taught to use peak flow		Advised to change home environment	
	N[c]	% (95% CI)[d]	N[3]	% (95% CI)[d]	N[c]	% (95% CI)[d]	N[c]	% (95% CI)[d]	N[c]	% (95% CI)[d]	N[c]	% (95% CI)[d]
Missing	89	50.8 (38.4–63.1)	19	11.1 (6.2–19.0)	148	85.6 (77.6–91.0)	155	85.3 (76.9–91.0)	75	42.0 (30.1–54.9)	59	40.9 (29.1–53.9)
Parent or guardian education attainment		P = 0.5286[b]		P = 0.6721[b]		P = 0.1191[b]		P = 0.1959[b]		P = 0.1430[b]		P = 0.2577[b]
Did not graduate high school	107	46.9 (32.8–61.5)	34	18.1 (9.5–31.6)	164	71.7 (57.2–82.7)	173	81.4 (69.1–89.5)	100	33.6 (23.7–45.2)	75	34.6 (23.6–47.6)
Graduated high school	333	48.6 (41.1–56.2)	78	12.4 (8.4–17.9)	519	73.4 (64.8–80.6)	549	79.0 (70.7–85.5)	268	39.6 (32.5–47.1)	215	34.1 (27.4–41.6)
Attended college	480	54.2 (47.3–61.0)	122	12.9 (9.2–17.7)	726	83.6 (77.3–88.4)	757	86.6 (81.5–90.5)	362	40.9 (34.5–47.6)	314	41.1 (34.6–48.0)
Graduated college	805	54.2 (48.8–59.4)	160	11.2 (8.2–15.2)	1196	81.1 (76.4–85.0)	1288	87.5 (83.1–90.9)	546	32.5 (28.1–37.3)	500	32.7 (28.2–37.6)

[a]Respondents with a "yes" answer to both questions: (1) Has a doctor, nurse or other health professional ever told you that you had asthma? and (2) Do you still have asthma?

[b]P-value for Wald χ^2 test of independence between education curriculum component and sociodemographic characteristics.

[c]unweighted number for current asthma respondents.

[d]CI = Confidence interval.

[e]Weighted percentage for this column Given an action plan calculated with numerator as those who answer "yes" for Given an action plan, denominator as "All".

[f]Weighted percentage for this column Taken a course to learn how to manage asthma calculated with numerator as those who answer "yes" for Taken a course to learn how to manage asthma, denominator as "All".

[g]Weighted percentage for this column Taught to recognize early signs or symptoms calculated with numerator as those who answer "yes" for Taught to recognize early signs or symptoms, denominator as "All".

[h]Weighted percentage for this column Taught to respond to an asthma episode calculated with numerator as those who answer "yes" for Taught to respond to an asthma episode, denominator as "All".

[i]Weighted percentage for this column Taught to use peak flow calculated with numerator as those who answer "yes" for Taught to use peak flow, denominator as "All".

[j]Weighted percentage for this column Advised to change home environment calculated with numerator as those who answer "yes" for Advised to change home environment, denominator as "All".

Bolded *p* values show significance.

Table 3.

Adjusted associations between each asthma knowledge of self-management education curriculum component and, gender, age-groups, race/ethnicity, household income and parental education level among children aged <18 years with current asthma[a]: Asthma Call Back Survey 2015–2017.

	Given an action plan	**Taken a course to learn how to manage asthma**	**Taught to recognize early signs or symptoms**	**Taught to respond to an asthma episode**	**Taught to use peak flow**	**Advised to change home environment**
Characteristic	Adjusted PR[b] (95% CI[c])	Adjusted PR[b] (95% CI[c])	Adjusted PR[b] (95% CI[c])	Adjusted PR[b] (95% CI[c])	Adjusted PR[b] (95% CI[c])	Adjusted PR[b] (95% CI[c])
Sex at birth						
Female	Referent	Referent	Referent	Referent	Referent	Referent
Male	**1.15 (1.00–1.32)**	0.90 (0.62–1.31)	1.05 (0.96–1.15)	1.03 (0.96–1.10)	1.09 (0.91–1.32)	1.12 (0.92–1.36)
Age group						
0–4 years	Referent	Referent	Referent	Referent	Referent	Referent
5–11 years	1.21 (0.97–1.50)	1.36 (0.77–2.41)	0.99 (0.88–1.10)	1.03 (0.94–1.14)	1.36 (0.93–1.97)	0.93 (0.69–1.25)
12–17 years	1.03 (0.82–1.30)	1.25 (0.71–2.20)	0.99 (0.88–1.11)	0.99 (0.89–1.09)	**1.88 (1.32–2.70)**	1.06 (0.79–1.41)
Race/ethnicity						
Non-Hispanic White	Referent	Referent	Referent	Referent	Referent	Referent
Non-Hispanic Black	**1.28 (1.07–1.54)**	**2.15 (1.30–3.55)**	1.02 (0.91–1.14)	1.04 (0.95–1.14)	1.16 (0.90–1.50)	1.24 (0.94–1.63)
Non-Hispanic, Other Race	1.12 (0.90–1.40)	**1.95 (1.04–3.66)**	0.95 (0.84–1.09)	0.99 (0.88–1.10)	1.09 (0.80–1.50)	1.00 (0.71–1.42)
Hispanic	1.05 (0.87–1.27)	**1.84 (1.18–2.89)**	0.94 (0.84–1.05)	0.95 (0.87–1.04)	1.07 (0.85–1.35)	**1.28 (1.01–1.63)**
Household income						
<$25,000	1.02 (0.85–1.23)	0.88 (0.53–1.45)	0.89 (0.80–1.00)	0.92 (0.85–1.01)	1.27 (0.99–1.63)	1.18 (0.89–1.56)
$25,000-<$50,000	0.92 (0.76–1.11)	0.72 (0.41–1.25)	0.94 (0.84–1.05)	0.98 (0.90–1.07)	1.07 (0.82–1.39)	1.17 (0.89–1.55)
≥$50,000	Referent	Referent	Referent	Referent	Referent	Referent
Missing	1.00 (0.77–1.30)	0.78 (0.39–1.59)	1.04 (0.95–1.14)	0.98 (0.90–1.08)	1.29 (0.90–1.84)	1.31 (0.90–1.91)
Parent or guardian education						
Did not graduate high school	0.86 (0.62–1.19)	1.42 (0.70–2.86)	1.00 (0.87–1.14)	1.01 (0.91–1.11)	0.84 (0.57–1.24)	0.85 (0.53–1.37)
Graduated high school	0.92 (0.76–1.11)	1.13 (0.65–1.95)	0.98 (0.88–1.08)	0.95 (0.87–1.04)	1.08 (0.85–1.38)	0.89 (0.67–1.18)
Attended college	1.00 (0.85–1.17)	1.18 (0.73–1.91)	1.08 (0.99–1.18)	1.02 (0.94–1.10)	1.18 (0.95–1.47)	1.12 (0.89–1.40)
Graduated college	Referent	Referent	Referent	Referent	Referent	Referent

[a]Respondents with a “yes” answer to both questions: (1) Has a doctor, nurse or other health professional ever told you that you had asthma? and (2) Do you still have asthma?

[b]APR, adjusted Prevalence Ratio, adjusted for the variables listed in this table.

[c] Confidence Interval.