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# Asthma Knowledge, Self-Efficacy, and Self-Management Among Rural Adolescents with Poorly Controlled Asthma

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## Abstract

Rural adolescents with asthma are a disparate group. Self-management is essential to asthma control. We describe asthma knowledge, self-efficacy, and self-management behaviors among 198 rural adolescents with poorly controlled asthma, exploring demographic differences; we also test the application of Social Cognitive Theory to asthma self-management examining if self-efficacy mediates associations between knowledge and self-management. Asthma knowledge and self-management were relatively poor in our sample, particularly among male and White adolescents; greater knowledge was significantly associated with better symptom prevention and management. Self-efficacy partially mediated the association between knowledge and symptom prevention, but not acute symptom management, suggesting that knowledge may not improve symptom prevention behaviors without confidence to implement such behaviors and that factors beyond knowledge and self-efficacy likely play a role in asthma self-management in this population. Addressing asthma knowledge and self-efficacy could improve self-management and, ultimately, enhance asthma control among rural adolescents with poorly controlled asthma.

### Keywords

adolescents; asthma; rural health; self-efficacy; self-management; adolescents; symptoms; prevention

## Introduction

Asthma is the most common pediatric chronic illness, with high prevalence and morbidity among adolescents (Akinbami et al., 2019; Miller et al., 2016; Zahran et al., 2018). Rural



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youth have significant asthma prevalence and morbidity (Estrada & Ownby, 2017; Lawson et al., 2017; Oluwole et al., 2020). While data are inconsistent regarding asthma prevalence in rural compared to urban settings, asthma is more likely to be uncontrolled among rural adolescents (Lawson et al., 2017; Oluwole et al., 2020; Pate et al., 2021) and is associated with increased emergency department visits compared to urban youth (Probst et al., 2018).

It is well established that adolescent asthma is associated with school absenteeism and poorer academic performance (Malika et al., 2021; Toyran et al., 2020; Tsakiris et al., 2013). Among adolescents with asthma, those who missed school because of their asthma are significantly more likely to have poorly controlled asthma (Hsu et al., 2016). Asthma-related emergency department visits, urgent care visits, and hospitalizations, all of which are markers of poor asthma control (Cloutier et al., 2020; Global Initiative for Asthma, 2020), are associated with poorer attendance and academic performance (Hsu et al., 2016; Mitchell et al., 2022). Asthma control, therefore, is key to academic success for adolescents with asthma.

Engagement in asthma self-management behaviors is one key factor contributing to asthma control (Cloutier et al., 2020; Global Initiative for Asthma, 2020). Adolescent asthma self-management is defined as behaviors adolescents can take to control their asthma outcomes, including through the prevention of symptoms and the management of acute symptoms (Mammen et al., 2018a). Despite the potential for asthma self-management to improve asthma control, adolescents with asthma tend to have poor treatment adherence (Dawson, 2019; Morton et al., 2014), and urban adolescents have been shown to have poor asthma self-management skills (Bruzzese et al., 2012; Netz et al., 2020; Sloand et al., 2021). Contextual factors, such as poverty, healthcare access, social norms and environmental factors, impact health (Probst et al., 2018), and may impact how rural adolescents manage their asthma. For example, relative to urban patients, rural patients are prescribed less anti-inflammatory medications (Diette et al., 2001; Lum et al., 2007; Ownby et al., 2014), and receive less asthma education (Lum et al., 2007). Additionally, limited access to specialist care in rural areas might exacerbate adolescent asthma and impede effective self-management (Probst et al., 2018). Despite this, most previous adolescent asthma self-management research has focused on urban adolescents (Bruzzese et al., 2012; Netz et al., 2020; Sloand et al., 2021), and little is known about asthma self-management in rural adolescents. This represents a critical gap in research. Thus, understanding how rural adolescents manage their asthma is an important first step in promoting better self-management and, in turn, improving asthma control.

Although adolescent asthma self-management has been shown to be poor, children's knowledge and cognitive skills tend to increase as they enter adolescence (Sherer & Radzik, 2016); this suggests a missing link between adolescent knowledge and self-management behavior. Bandura's Social Cognitive Theory (SCT) posits that in order to execute health behaviors, individuals must not only know about the behavior, but also have self-efficacy, or the belief that they can successfully complete the behavior (Bandura, 1977); while necessary, knowledge alone is not sufficient. Applied to adolescent asthma, SCT suggests that asthma-related self-efficacy would mediate associations between asthma knowledge and self-management behavior, determining whether adolescents act on their asthma

knowledge and implement self-management strategies. It is plausible that adolescents have the knowledge necessary for good self-management, but without self-efficacy, they may not take the necessary steps. However, to the best of our knowledge, the mediating role of self-efficacy in the relationship between asthma knowledge and self-management has not previously been tested in adolescents.

In this study we expand research on asthma self-management by describing asthma knowledge, self-efficacy, and self-management (i.e., symptom prevention and management) in a school-based sample of rural adolescents with poorly controlled asthma. We also test the hypotheses that, among rural adolescents with poorly controlled asthma, (1) there will be positive associations between asthma knowledge and asthma self-management behavior (i.e., prevention of symptom onset and acute symptom management) and (2) asthma-related self-efficacy will mediate the relationship between asthma knowledge and self-management behavior.

## Method

### Study Design and Participants

We conducted a cross-sectional analysis of baseline data from our team's larger school-based randomized trial testing the effectiveness of an asthma intervention in rural adolescents. In the larger trial, we recruited participants from eight high schools in rural areas of South Carolina. We used the Rural-Urban Commuting Area codes (WWAMI RUCA Rural Health Research Center, 2016) to determine if a school was in a rural area. The Institutional Review Boards of Columbia University and the Medical University of South Carolina approved the larger trial's study procedures.

To identify students for the larger trial, we obtained a waiver of caregiver consent. One week following distribution of an information letter to caregivers in participating schools, all adolescents in participating schools were asked to complete a screening survey during the school day. Adolescents eligible for the larger trial reported being diagnosed with asthma by a health care provider and having at least one sign of poorly controlled asthma. Given the larger trial was an effectiveness study, we broadly defined poorly controlled asthma as (1) in the last month: symptoms at least one day a week; activity limitations at least one day a week; night wakening at least two nights a month; or rescue inhaler use when symptomatic at least once a week, or (2) in the last 12 months: at least one asthma-related urgent visit to a medical provider, emergency room visit or hospitalization; use of systemic corticosteroids for asthma; or at least four asthma-related school absences. Trained research assistants explained the larger trial to eligible adolescents who were given a consent/assent package to take home; signed consent/assent packages were returned to the research assistants who visited the school several days a week.

### Data Collection

Following caregiver consent and adolescent assent, over one-month periods during Winter 2019 and 2020, adolescents completed baseline surveys during the school day, which were proctored by trained study personnel. All baseline surveys were completed prior to

declaration of the COVID-19 pandemic and related school closures beginning in March of 2020 (World Health Organization, 2020). Adolescents were compensated $15 for the time needed to complete the survey.

## Measures

In addition to demographic information and baseline asthma characteristics, adolescents completed the measures detailed below.

**Demographic and Asthma Characteristics.—**Adolescents self-reported their date of birth, sex, and race/ethnicity (race and ethnicity were assessed with one question). Date of birth was used to calculate age. The adolescents reported frequency of daytime symptoms, night wakening, and activity limitations over the previous two weeks. They also reported asthma-related acute care visits over the last three months. Additionally, adolescents reported their current asthma medications, which we classified as controller medication and quick-reliever medications.

**Asthma Knowledge.—**The *Asthma Knowledge Index* contains 41 true/false questions which assess understanding of asthma pathophysiology, triggers, consequences, and treatment. We calculated the total percent correct. This index has previously demonstrated acceptable internal consistency (Cronbach's $\alpha$ = .69) in youth with and without asthma (Hayes et al., 2013); however, in our sample it demonstrated low internal consistency (Cronbach's $\alpha$ = .41).

**Asthma Management Self-Efficacy.—**On the *Asthma Management Self-Efficacy Index*, adolescents rated their confidence to implement 14 asthma self-management behaviors using a seven-point scale (1 = not at all confident; 7 = completely confident). The index has previously demonstrated good internal consistency (Cronbach's $\alpha$ = .81) and treatment sensitivity in adolescents with poorly controlled asthma (Bruzzese et al., 2012). In our sample, it showed good internal consistency (Cronbach's $\alpha$ = .83).

**Asthma Symptom Prevention and Acute Symptom Management.—**The nine-item *Asthma Prevention Index* measures engagement in steps to prevent the onset of asthma symptoms (e.g., avoiding triggers, seeing a healthcare provider regularly), and the seven-item *Asthma Management Index* measures the steps adolescents take to manage acute symptoms once they begin (e.g., taking medication, monitoring symptoms). We summed the total number of steps taken for each index. The prevention index has been shown to have acceptable internal consistency (Cronbach's $\alpha$ = .70) and the management index has been shown to have low internal consistency (Cronbach's $\alpha$ = .53) in adolescents with poorly controlled asthma (Bruzzese et al., 2012). In our sample, the prevention index demonstrated good internal consistency (Cronbach's $\alpha$ = .77) while the management index demonstrated low internal consistency (Cronbach's $\alpha$ = .41).

## Data Analysis

We conducted analyses using SPSS 27. To characterize the study sample, we calculated descriptive statistics (i.e., counts and percentages). We used Poisson regressions to test

associations between variables when the outcomes were count, and linear regressions when the outcomes were continuous. For Poisson regressions, we exponentialized the regression coefficients (β) and reported them as relative risk (RR) to assess the strength and direction of the effect. We analyzed associations at the 5% significance level and calculated associated 95% confidence intervals (CIs). We controlled all models for school to account for potential between-subject correlations due to adolescents attending the same school.

To explore demographic differences in knowledge, self-efficacy, and self-management, we first modeled each outcome as a function of each demographic factor (i.e., age, sex, race/ethnicity) and then included all demographic factors in a final model for each outcome. Because results were consistent in models testing associations with each demographic factor separately and the final models with all the demographic factors, we only present the final models. In models testing associations between asthma knowledge, self-efficacy, and self-management, we controlled for sex because of known associations between sex and pediatric asthma outcomes (Netz et al., 2020; Shah & Newcomb, 2018). We additionally controlled for race/ethnicity as a proxy for the known negative effect of structural and interpersonal racism on pediatric asthma outcomes (Fanta et al., 2021; Landeo-Gutierrez & Celedon, 2020). Although race and ethnicity are distinct constructs (American Psychological Association, 2019), due to the structure of the survey question assessing them, we analyze them as one variable. Additionally, due to the small numbers of adolescents in racial/ethnic categories other than Black and White, we analyzed the remainder of adolescents as one category which we labeled as “another.”

As outlined by Baron and Kenny (1986), we used a set of three models to test whether self-efficacy mediates the relationship between knowledge and self-management, with separate sets of models for each type of self-management (prevention and management). First, Model 1 tested the association between knowledge (predictor) and self-management (outcome; i.e., prevention or management). The regression coefficient of knowledge in Model 1 is termed the “total effect.” Next, Model 2 tested the association between knowledge (predictor) and self-efficacy (proposed mediator). If the associations in Models 1 and 2 were significant, we then tested a third model which included knowledge (predictor) and self-management (outcome; i.e., prevention or management), adjusting for self-efficacy (proposed mediator). The regression coefficient of knowledge in Model 3 is termed the “direct effect.”

In Model 3, if the proposed mediator (self-efficacy) was significantly associated with the outcome (prevention or management), then we concluded that self-efficacy mediated the relationship between knowledge and self-management. Next, to determine if the mediation was full or partial, we examined the association between the predictor (knowledge) and the outcome (prevention or management) in Model 3. If this relationship remained significant after adjusting for the potential mediator (self-efficacy), then criteria for partial mediation was met; if knowledge was no longer significantly associated with self-management (prevention or management), then criteria for full mediation was met.

If self-efficacy met criteria to be a partial or full mediator, we used the “difference method” to calculate the mediated or indirect effect as the difference between the regression coefficients of knowledge to self-management (prevention or management) in Model 1 (the

total effect) and Model 3 (the direct effect). We gauged the proportion of the association explained by the mediator through the ratio of indirect effect to total effect (Jiang & VanderWeele, 2015).

## Results

### Participants

Participants were 198 adolescents with poorly controlled asthma. Ages ranged from 14 to 19 years (mean = 16.31), and 71% of participants reported being female. Most (69%) identified as Black, followed by White (22%), and the remainder as another race/ethnicity (10%; specific racial and ethnic identities included in this category are available in Table 1). About a third of our sample had an acute care visit to a medical provider or emergency department in the past three months and the majority (78%) reported having activity limitations at least one day in the past two weeks. Most (66%) reported taking a quick reliever medication. See Table 1 for additional sample characteristics.

### Asthma Knowledge

Adolescents' mean asthma knowledge score was 76.4% (SD = 7.9). Students incorrectly identified fevers (24%), frequent headaches (44%) and sore throats (45%) as asthma symptoms. While 91% knew asthma could be life threatening, only 27% understood that it is chronic, and 39% thought daily asthma medications were addictive. Nearly all participants (94%) knew exercise could trigger asthma, but only 62% knew that taking medicine before exercise can prevent symptoms; 30% erroneously thought those with asthma could never exercise like people without asthma. Some triggers were known to only a few adolescents: pesticides (41%); animals (35%); and strong emotions (32%). Some adolescents incorrectly identified non-triggers as triggers: touching dirty things (36%); not exercising (28%); and immunizations (20%).

### Asthma Self-Management

Table 2 details steps taken to prevent and manage symptoms. On average, adolescents reported taking 5.4 (SD = 2.6) out of 9 prevention steps; 39% took seven to nine steps, 34% took four to six, and 27% took three or fewer. Few reported regularly taking medication before trigger exposure (19%) or when getting a cold (18%); only 14% reported having regularly scheduled routine asthma-related medical visits. Adolescents reported taking on average 4.8 (SD = 1.5) out of seven steps to manage existing symptoms with 30% taking six or seven steps, 53% taking four or five steps, and 17% taking three or fewer. When symptomatic, adolescents reported staying calm (80%), avoiding triggers (78%), and taking medication (74%). However, only 37% saw a medical provider when symptomatic.

### Asthma Self-Efficacy

The mean self-efficacy score was 4.3 (SD = 0.8) out of seven: adolescents were slightly more confident than not in caring for their asthma. As detailed in Table 3, they were most confident about avoiding cigarette smoke and carrying medication with them, and least confident about keeping a checklist of symptoms and taking daily medication even when asymptomatic.

### Demographic Factors Associated with Asthma Outcomes

Table 4 presents the multiple regression model results. Sex was significantly associated with knowledge and self-efficacy. Relative to female adolescents, male adolescents had less asthma knowledge, took fewer prevention steps, and had lower self-efficacy. Race/ethnicity was significantly associated with prevention, such that, relative to Black adolescents, White adolescents took 36% fewer preventive steps.

### Mediation Models

**Symptom Prevention.—**As detailed in Figure 1A, results of Model 1 indicated that knowledge was significantly associated with prevention (β = .014; RR = 1.01 CI [1.01, 1.02]; $p$ = .001). Model 2 showed knowledge was also significantly associated with self-efficacy, the proposed mediator (β = .026 CI [.01, .04]; $p$ < .001). Finally, in Model 3, self-efficacy was significantly associated with prevention (β = .129; RR = 1.14 CI [1.04, 1.25]; $p$ = .006) and knowledge was significantly associated with prevention, but less strongly than in the Model 1 (β = .011; RR = 1.01 CI [1.00, 1.20]; $p$ = .015). This suggests self-efficacy was a partial mediator of the association between knowledge and prevention. The mediated or indirect effect was .003 (calculated by subtracting the direct effect, .011, from the total effect, .014) and about 21% of the total effect between knowledge and prevention was explained by the mediator, self-efficacy (calculated by dividing the indirect effect, .003, by the total effect, .014).

**Acute Symptom Management.—**As shown in Figure 1B, results of Model 1 showed knowledge was significantly associated with acute symptom management (β = .011; RR = 1.01 CI [1.00, 1.02]; $p$ = .016). As stated above, Model 2 indicated knowledge was also significantly associated with self-efficacy. Results of Model 3 showed that self-efficacy was not significantly associated with management (β = .088; RR = 1.09 CI [.99, 1.20]; $p$ = .069), suggesting self-efficacy does not mediate the relationship between knowledge and acute symptom management. Thus, we did not calculate direct and indirect effects.

## Discussion

In rural adolescents with poorly controlled asthma, levels of asthma knowledge and engagement in self-management behaviors were low, particularly for male and White adolescents. Consistent with our team's prior findings in urban adolescents (Bruzzese et al., 2012), most rural adolescents reported taking steps to prevent symptoms, but few did so regularly. Adolescents also tended to avoid triggers as a means of controlling asthma, a strategy that is imperfect; families often struggle to control exposure to environmental triggers (e.g., minimizing seasonal outdoor exposure) (Gautier & Charpin, 2017), and avoidance of other triggers, such as exercise, precludes adolescents from living an active lifestyle. Medical visits in our sample of rural adolescents were relatively uncommon. Few had regular, routine medical visits for asthma, and only about a third saw a healthcare provider or went to the hospital when symptomatic. These rates are lower than we found in our study of urban adolescents (Bruzzese et al., 2012), and consistent with known rural-urban differences in healthcare utilization (Oluwole et al., 2020; Probst et al., 2018).

Several demographic differences are noteworthy. Male adolescents' asthma knowledge and self-management was poorer than that of female adolescents, which is consistent with known sex-based differences in asthma perceptions and self-management (Mammen et al., 2018b; Zein & Erzurum, 2015). Although, relative to White youth, Black youth are impacted by a higher prevalence of asthma starting in childhood (Centers for Disease Control and Prevention, 2021), worse asthma outcomes (Zahran et al., 2018), and less frequent use of controllers medications (Sarpong & Miller, 2013), Black adolescents in our study reported taking more prevention steps than their peers. This unexpected finding may be explained by the fact that, due to health disparities attributable to the impact of systemic racism (Fanta et al., 2021; Landeo-Gutierrez & Celedon, 2020), Black youth may be forced to learn and implement prevention strategies earlier and more regularly. Alternatively, Black adolescents' caregivers may also remind them to take preventive actions. This explanation is supported in the parenting literature which finds Black adolescents perceive stronger parental control and family attachment (Clark et al., 2015; LeCuyer & Swanson, 2017).

To the best of our knowledge, this study is the first to examine the role of asthma-related self-efficacy in the relationship between asthma knowledge and self-management in adolescents. Asthma knowledge was significantly associated with both symptom prevention and acute symptom management, and self-efficacy partially mediated the relationship between knowledge and prevention, but not between knowledge and management. This suggests that self-efficacy may play a different role in symptom prevention compared to acute symptom management. Additionally, although statistically significant, the regression coefficients we calculated from the models in this study were relatively small, indicating that other factors we did not analyze likely also play a role in asthma self-management in this population.

A possible explanation for the different findings regarding the role of self-efficacy in symptom prevention compared to acute symptom management is the different contexts in which prevention and management actions are performed. Symptom prevention behaviors require forethought. Adolescents must plan courses of action and realize that steps taken now can avert the onset of symptoms. In this way, prevention efforts are goal-directed behaviors, which are influenced by the self-appraisal of one's capabilities (i.e., require self-efficacy) (Bandura, 1994). In contrast, acute symptom management behaviors occur when the adolescent is experiencing symptoms which necessitate immediate attention. There is evidence that when coping with acute asthma symptoms, adolescents utilize a reactive style rather than an anticipatory style (Bruzzese et al., 2012). As such, acute symptom management would rely less on self-efficacy than symptom prevention. Additionally, acute symptoms potentially increase adolescents' psychological and physical stress, both of which can decrease self-efficacy in the moment (Bandura, 1994).

Because the associations between variables in this study were relatively small, although still statistically significant, other variables may be playing potentially important roles in rural adolescent asthma self-management. Factors other than asthma knowledge and self-efficacy likely play a role in determining whether adolescents will engage in asthma self-management. For example, regardless of asthma knowledge, adolescents with strong versus weak social support might have significantly different self-management behaviors. It is also

possible that adolescents may have good asthma knowledge, including knowing what to do to prevent and manage symptoms, but may be unable to translate this knowledge into action if they have high levels of anxiety about their illness. This highlights the importance of considering factors in addition to knowledge and self-efficacy that may determine whether an adolescent with asthma is able and empowered to act to prevent and manage symptoms.

## Limitations

This study is not without limitations. These include that the study data are cross-sectional, meaning no causal inferences can be made, and that the study is a secondary data analysis, precluding measurement of other variables which might account for some of the relationship between asthma knowledge and self-management variables. Furthermore, all measures used in this study are self-report making them subject to recall bias. The knowledge and management scales also had low Cronbach's alphas in this sample (0.41 for both), suggesting that these constructs may not have been adequately measured. This could account for the small magnitude of regression coefficients addressed above. Additionally, our study lacked a matched comparison group with well-controlled asthma; thus, we cannot conclude whether asthma self-management is different among rural adolescents with well-controlled asthma. While a strength of this study is its focus on an underserved population, namely rural adolescents, this also limits its generalizability. Further research is needed to determine whether these findings apply to suburban or urban adolescents. Data collected for this study occurred prior to declaring the COVID-19 pandemic (World Health Organization, 2020). While this is a strength of the study because there were no potential confounds due to the pandemic, it did preclude us from exploring the impact of COVID-19 stay-at-home guidelines on asthma self-management; future research may want to systematically examine this.

## Implications for School Nursing

Despite these limitations, study findings have important clinical implications to help school nurses and other healthcare professionals improve asthma self-management in rural adolescents. Understanding rural adolescents' asthma self-management is an essential first step to intervening to improve their asthma outcomes and, relatedly, their school attendance and academic performance. Given the relatively low levels of asthma knowledge and self-management behaviors in our sample, there is a clear need for both individual- and school-level interventions. School nurses are ideally suited to provide education and support to adolescents who are struggling to manage their asthma, particularly in rural areas where adolescents with asthma might have poor access to specialist asthma treatment (Oluwole et al., 2020). Our findings indicate that they might want to consider emphasizing asthma's chronic nature and the importance of routine check-ups for asthma, as well as the need to use medication preventively.

In addition to providing education to improve asthma knowledge, school nurses and other healthcare professionals may also want to consider self-efficacy in the context of asthma self-management, particularly symptom prevention. They can assess not only whether adolescents have the knowledge to prevent symptoms, but also the belief that they can do so.

Intervening to improve the adolescents' confidence around preventive self-management has the potential to increase engagement in such behaviors. Furthermore, we suggest that school nurses and other healthcare professionals assess for and address other factors that might contribute to engagement in asthma self-management, taking care not to focus solely on asthma knowledge when intervening to improve asthma self-management. This is especially true when working with adolescents who have significant knowledge about asthma and yet consistently do not take recommended steps to prevent and manage symptoms.

## Conclusions

This study adds to the limited research on asthma self-management in rural adolescents. Findings suggest that rural adolescents with poorly controlled asthma have relatively poor asthma knowledge and self-management. The self-efficacy to care for one's asthma appears to play a role in allowing rural adolescents to translate asthma knowledge into symptom prevention efforts. Intervening to improve self-efficacy has the potential to improve asthma outcomes by increasing the efforts rural adolescents take to prevent the onset of asthma symptoms. School nurses can apply our findings by emphasizing the promotion of asthma knowledge and self-efficacy in their work to improve outcomes among adolescents with asthma.

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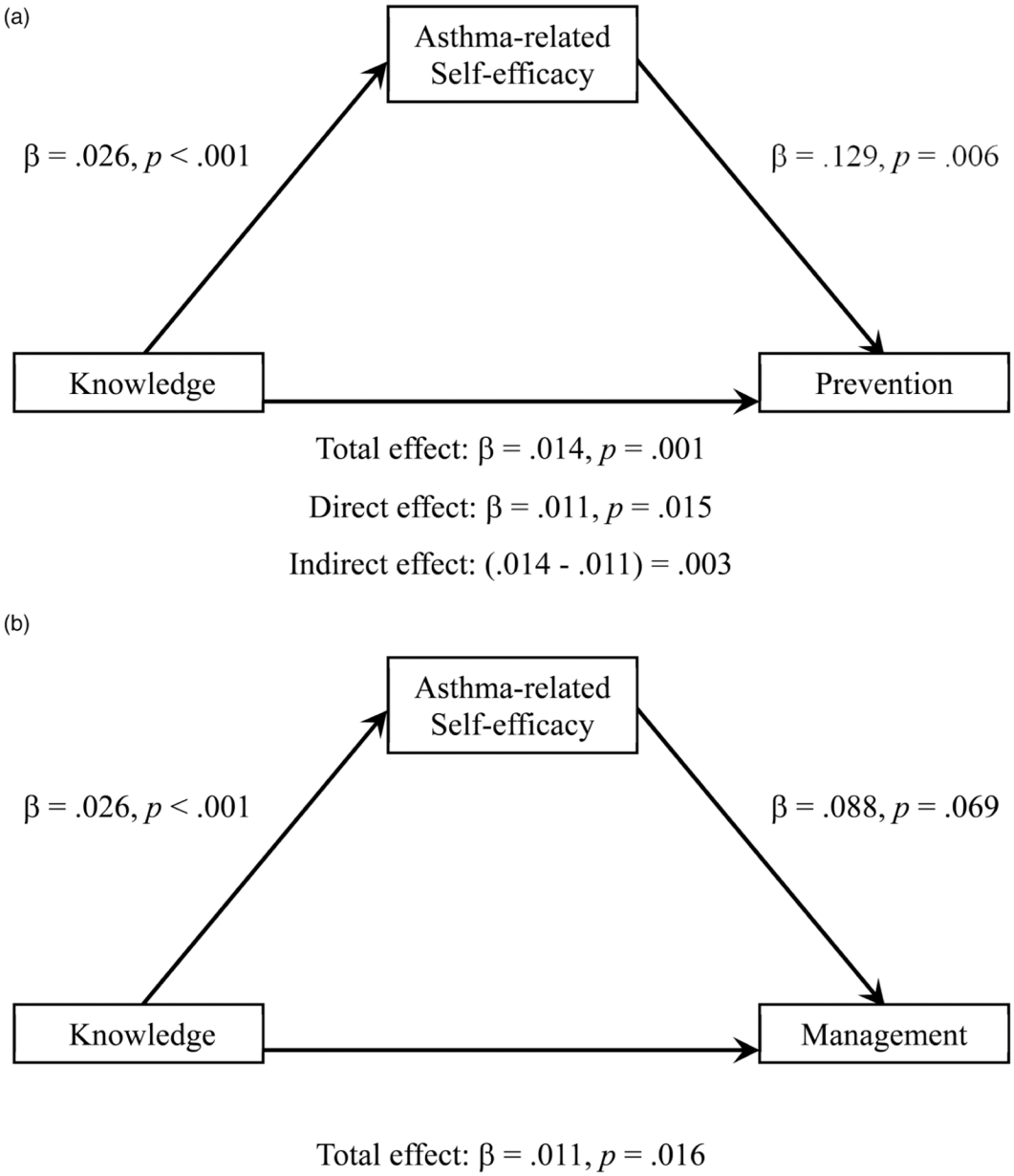


**Figure 1.**
Mediation models for outcomes (a) prevention and (b) management.

**Table 1.**

Participant Demographic and Clinical Characteristics.

| | Available N | N (%) |
|---|---|---|
| Demographic Characteristics | | |
| Age (mean (SD), years) | 197 | 16.31 (1.19) |
| Female | 190 | 135 (71.05) |
| Race/ethnicity | 181 | |
| Black | | 124 (68.51) |
| White | | 39 (21.55) |
| Another[a] | | 18 (9.94) |
| Clinical Characteristics | | |
| Symptoms in the past 2 weeks | 196 | |
| 3 or more days | | 96 (48.98) |
| 1 or 2 days | | 74 (37.75) |
| 0 days | | 26 (13.27) |
| Night Wakenings in the past 2 weeks | 198 | |
| 3 or more nights | | 37 (18.69) |
| 1 or 2 nights | | 70 (35.35) |
| 0 nights | | 91 (45.96) |
| Had at least one day of physical activities or usual after school or weekend activities limited in the past 2 weeks | 196 | 153 (78.06) |
| At least one urgent visit to a medical provider or ED visit in the past 3 months | 198 | 59 (29.80) |
| Takes controller medication | 198 | 67 (33.84) |
| Takes quick reliever medication | 196 | 129 (65.82) |

[a]Another race/ethnicity includes Hispanic/Latino (n = 8), Native American/American Indian (n = 2) and 2 or more races/ethnicities (n = 8).

**Table 2.**

Self-Management Steps Reported by Adolescents (N (%)).

| | Symptom Prevention | | |
|---|---|---|---|
| **Step taken** | **No** | **Yes, but not on a regular basis** | **Yes, on a regular basis** |
| Take daily medication | 120 (60.61) | 48 (24.24) | 30 (15.15) |
| Take medication when get a cold | 99 (50.00) | 64 (32.32) | 35 (17.68) |
| Take medication before trigger exposure | 92 (46.47) | 68 (34.34) | 38 (19.19) |
| Take medication in cold weather | 80 (40.41) | 70 (35.35) | 48 (24.24) |
| Stay away from triggers | 47 (23.74) | 59 (29.80) | 92 (46.46) |
| Clean room in a special way to get rid of triggers | 52 (26.26) | 63 (31.82) | 83 (41.92) |
| Pay attention to how you feel in situations where asthma may start | 30 (15.15) | 78 (39.39) | 90 (45.46) |
| Ask a doctor or the clinic for help | 96 (48.49) | 84 (42.42) | 18 (9.09) |
| See a doctor for asthma even when asymptomatic | 98 (49.49) | 73 (36.87) | 27 (13.64) |
| | **Management of Existing Symptoms** | | |
| | **No** | **Yes** | |
| Stay calm | 23 (11.62) | 175 (88.38) | |
| Rested | 40 (20.20) | 158 (79.80) | |
| Got away from trigger | 44 (22.22) | 154 (77.78) | |
| Take medication prescribed by doctor | 52 (26.26) | 146 (73.74) | |
| Observed if symptoms got better or worse | 65 (32.83) | 133 (67.17) | |
| Asked someone for help | 89 (44.95) | 109 (55.05) | |
| Went to a doctor or a hospital | 124 (62.63) | 74 (37.37) | |

**Table 3.**

Individual Self-Efficacy Items.

| Item | Mean (SD) |
|---|---|
| Take medicine to prevent symptoms when active | 4.54 (1.28) |
| Take medicine to avoid waking up when sleeping | 4.16 (1.32) |
| Take medicine when near a trigger | 4.46 (1.30) |
| Recognize early warning signs of asthma | 4.55 (1.33) |
| Stay away from cigarette smoke | 5.10 (1.39) |
| Keep checklist of symptoms | 3.75 (1.44) |
| Keep daily checklist of medicines being taken | 3.95 (1.47) |
| Have medicine next time asthma acts up | 4.71 (1.38) |
| Take prescribed medicine even when no symptoms | 3.83 (1.54) |
| Stay away from triggers | 4.49 (1.35) |
| Keep asthma from getting worse when symptoms start | 4.59 (1.20) |
| Control very bad symptoms yourself instead of going to emergency room | 4.18 (1.43) |
| Explain your asthma to friends | 4.22 (1.41) |
| Explain your asthma to teachers | 4.24 (1.49) |

**Table 4.**

Demographic Differences in Asthma Knowledge, Self-Management and Self-Efficacy: Multivariable Model.

| | **Knowledge**[a] | **Prevention**[b] | **Management**[b] | **Self-efficacy**[a] |
|---|---|---|---|---|
| **Predictor** | **β (95% CI)** | **RR (95% CI)** | **RR (95% CI)** | **β (95% CI)** |
| Age | −0.110 (−0.999, 0.778) | 0.976 (0.926, 1.028) | 0.969 (0.917, 1.025) | −0.051 (− 1.380, 0.036) |
| Sex (Ref=female) | **−3.628 (−6.029, −1.226)** ** | **0.850 (0.734, 0.984)** * | 0.915 (0.786, 1.066) | **−0.457 (−0.693, −0.222)** *** |
| Race/ethnicity (Ref=Black) White | 0.983 (− 1.907, 3.872) | **0.666 (0.550, 0.805)** *** | 0.895 (0.743, 1.079) | −0.179 (−0.462, 0.104) |
| Another | 2.726 (− 1.038, 6.490) | 0.950 (0.764, 1.182) | 1.038 (0.825, 1.307) | 0.084 (−0.285, 0.452) |

*Note*. CI = Confidence interval; RR = risk ratio.

[a]Linear regression controlling for school.

[b]Poisson regression controlling for school.

* $p < .05$;

** $p < .01$;

*** $p < .001$.