

Asthma: School-based Self-Management Interventions for Children and Adolescents with Asthma

Community Preventive Services Task Force Finding and Rationale Statement Ratified July 2019

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CPSTF Finding and Rationale Statement

Context

Asthma is the most common chronic lung disease among children in the United States, affecting approximately 6 million children, or one out of every 12 (Zahran et al. 2018). The burden of childhood asthma in the United States is disproportionate, with higher rates in urban settings and low-income and minority communities (Woods et al. 2016; Sullivan et al. 2019).

Children with asthma may experience limitations in daily activities, missed school days, hospitalizations, or urgent primary care and emergency department visits.

Schools provide a unique opportunity for asthma control activities. Students, parents, and staff can be educated about asthma prevention and control, steps can be taken to remove or reduce asthma triggers, and healthcare services can be offered to students. School-based interventions are an important component of a comprehensive community and health system approach to asthma control.

Intervention Definition

School-based self-management interventions for asthma control provide education or counseling to help children and adolescents with asthma learn to do one or more of the following:

- Recognize and manage asthma symptoms
- Use medications and inhalers properly
- Avoid asthma triggers

Interventions may also provide instruction on the following:

- Monitoring asthma signs and symptoms
- Stress management
- Implementing an asthma action plan

Interventions may be delivered to students with asthma in group or individual sessions. Trained facilitators may include nurses, teachers, health educators, or peers, and sessions may be provided at school during or outside of regular school hours. Self-management interventions may be combined with additional asthma control activities directed at school staff, parents, or healthcare providers.

CPSTF Finding (July 2019)

The Community Preventive Services Task Force (CPSTF) recommends school-based self-management interventions for asthma control based on strong evidence of effectiveness in reducing hospitalizations and emergency room visits among children and adolescents with asthma. Interventions were effective when delivered by trained school staff, nurses, and health educators in elementary, middle, and high schools serving diverse populations.

When implemented in schools in low-income or minority communities, interventions are likely to reduce asthma morbidity, improve asthma-related quality of life, and promote health equity.

Rationale

Basis of Finding

The Community Preventive Services Task Force (CPSTF) uses recently published systematic reviews to conduct accelerated assessments of interventions that could provide program planners and decision makers with effective options for improving the health of their communities. The following published review was selected and evaluated by a team of specialists in systematic review methods, and in research, practice, and policy related to asthma prevention and control:

Harris KM, Kneale D, Lasserson TJ, McDonald VM, Grigg J, Thomas J. School-based self-management interventions for asthma in children and adolescents: a mixed methods systematic review. *Cochrane Database of Systematic Reviews* 2019, Issue 1. Art. No.: CD011651. DOI: 10.1002/14651858.CD011651.pub2

The team reviewed the evidence summarized in the publication and examined the included studies to obtain additional data on study, intervention, and population characteristics. The CPSTF assessment considered the findings of the published review, the additional data from the included studies, and expert input from team members and the CPSTF.

The published systematic review included 33 randomized controlled trials (search period through August 28, 2017).

The CPSTF considered outcomes from the 30 studies that examined effectiveness for one or more outcomes related to morbidity, quality of life, or asthma control. Three of these studies did not measure any of the outcomes of interest to the CPSTF and were excluded from this analysis. Included studies compared effectiveness of asthma self-management interventions with no intervention or self-management interventions targeting health issues other than asthma. Nineteen of the 30 studies provided measures that were included in the published meta-analysis. Estimates of change for asthma-related outcomes are summarized in the table below.

Findings on Asthma-related Outcomes

Body of Evidence	Studies and Participants	Summary Effect Estimate from Harris et al. 2019 Meta-Analyses (95% CI)	Direction of Effect
Asthma-related emergency department visits	13 studies 3883 participants	OR 0.70 (0.53, 0.92)	Favors the intervention
Asthma-related hospitalizations	6 studies 1873 participants	SMD: -0.19 (-0.35, -0.04)	Favors the intervention
Unplanned visits to medical provider (general practitioner/emergency department)	5 studies 3490 participants	OR: 0.74 (0.60, 0.90)	Favors the intervention
School absences (all causes)	10 studies 4609 participants	SMD: -0.07 (-0.22, 0.08)	Inconsistent effects
Self-reported asthma-related quality of life	7 studies 2587 participants	SMD: 0.27 (0.18, 0.36)	Favors the intervention

CI: Confidence Interval; OR: Odds Ratio; SMD: Standardized Mean Difference

Fifteen studies reported evidence on one or more of the asthma-related outcomes that could not be included in meta-analyses. Two studies measured differences in emergency department visits (1 favorable, 1 no change). Three studies reported differences in hospitalizations (1 favorable, 1 mixed, 1 no change), and one study measured change in unplanned visits to medical providers (favorable). Seven studies reported changes in school absences with mixed results (4 favorable, 1 mixed, 2 no change). Finally, nine studies reported on differences in asthma-related quality of life and showed generally favorable results (6 favorable, 3 no change).

Twenty of the included studies measured intervention effects on one or more asthma control outcomes. Compared to controls, students in self-management intervention groups reported less need for the use of asthma reliever medications (6 studies) and fewer activity limitations (6 studies), but little or no change in self-reported day-time or night-time symptoms (12 studies) or measures of lung function (6 studies).

Studies provided self-management instruction alone (15 studies) or in combination with additional asthma control activities (15 studies). Reported effects were similar across both groups of studies. Additional activities included asthma-related training and workshops for teachers and staff (10 studies), education or asthma awareness events for parents and caregivers (9 studies), additional interventions for students (e.g., visits with healthcare providers, asthma awareness education; 9 studies), environmental or policy assessments or changes (4 studies), and strategies targeting healthcare providers (e.g., academic detailing and efforts to promote asthma action plans; 6 studies).

Across the included studies, the median study duration was 12 months (interquartile interval [IQI]: 10 to 30 months) with a median loss to follow-up of 14.0% (IQI: 7.0% to 19.0%). Intervention sessions were delivered to groups (22 studies), groups and individuals (3 studies), or individuals (2 studies); 2 studies did not report this information. Interventions provided a median of six sessions (IQI: 3 to 6 sessions) that ranged from 15 to 90 minutes each. More than half of the studies provided self-management instruction encouraging the proper use of asthma medication inhalers, but only 25% of the studies reported providing inhaler demonstration or assessment of proper use as part of follow-up.

Applicability and Generalizability Issues

Most of the included studies were conducted in the United States (19 studies). The remaining studies were conducted in Canada (4 studies), Australia (2 studies), the United Kingdom (2 studies), China (1 study), Jordan (1 study), and Spain (1 study).

Most of the nineteen U.S. studies evaluated programs implemented in higher risk communities (e.g., low income) and reported information about students' race, ethnicity, and socioeconomic status. These studies showed interventions were effective among minority and low-income populations. Sixteen studies included African American students, with a median proportion of 67.5% (IQI: 33% to 95%). Eleven studies reported on Hispanic ethnicity, with a median proportion of 41% (IQI: 3% to 48%). Five of the ten studies that reported family income described student populations in which more than 50% were in the low-income category.

Studies included students aged 5 to 10 years (20 studies), 11 to 15 years (14 studies), and 16 years and older (1 study). Most studies were conducted in elementary schools and/or middle schools (21 studies). Most of the U.S. interventions were set in urban areas (16 studies); only three studies were set in rural settings.

Studies included a median of 259 participants (IQI: 114 to 663 participants). Information on students' asthma severity was inconsistently reported; some studies did not report severity at all, and those that did used different scales or measures of severity. Eleven studies described students' asthma severity using a classification of intermittent or

persistent, with persistent ranging from mild to severe. Most students were classified as having intermittent (median: 42% [range: 22 to 71]; 4 studies), or mild (median: 28% [IQR: 20 to 46]; 11 studies) to moderate (median: 29% [IQR: 14 to 59]; 9 studies) persistent asthma.

Studies most often recruited students by using surveys or announcements (50%), or health records (27%). Interventions were delivered by nurses (27%), teachers (17%), and health educators (13%). More than half of the studies reported training their facilitators (17 studies).

Data Quality Issues

The published systematic review included randomized controlled trials (33 studies) with either individual (student) or group (school) assignment. The authors evaluated study quality using the Cochrane risk of bias assessment tool (Higgins 2011). Summary risk of bias was assessed as low (2 studies), unclear (27 studies), and high (1 study). Important potential limitations included unclear or high risk of bias for selective reporting (17 studies) and unclear or high risk of bias due to incomplete outcome data (18 studies).

Other Benefits and Harms

The published review did not report or postulate on additional benefits of school-based self-management interventions for asthma. The CPSTF postulates that interventions encouraging asthma action plans could increase the number of students with asthma who develop plans with their parents and providers and have them filed with the school.

No harms of these interventions were described or evaluated in the published review or included intervention studies.

Economic Evidence

There was not enough economic evidence to determine cost-effectiveness or cost-benefit for school-based asthma self-management interventions. The economic review included 8 studies (search period 1995 through May 2020). Studies were from the United States (6 studies), Australia (1 study), and the United Kingdom (1 study). Seven studies reported intervention cost, three included the averted cost of healthcare, and two reported return on investment or provided sufficient information for the economic review team to compute it. All monetary values are reported in 2019 U.S. dollars.

Studies included students from elementary or middle schools (3 studies; 37%), middle or high schools (2 studies; 25%), high school (2 studies; 25%), or a combination of these (1 study; 12.5%). Studies were conducted in urban areas (5 studies; 62.5%), rural areas (2 studies; 25%), or mixed settings (1 study; 12.5%). A median of 162 children with asthma participated in the studies (IQR: 141 to 252). Among the 6 studies that reported race and ethnicity, participating students were Black or African American (55.1%), Hispanic or Latino (22%), or other (22.9%). Seven studies that reported socioeconomic status indicated students were drawn from populations with low (71.4%) or mixed (28.6%) socioeconomic status (defined by household or community income levels).

Interventions were delivered in group (3 studies), individual (2 study), or group and individual (2 studies) sessions; one study did not report on delivery format. The median study duration was 12 months and interventions included a median of four sessions (IQR: 3 to 4 sessions). Intervention content included asthma education (8 studies), knowledge checks on asthma and self-management (5 studies), instruction on the proper use of inhalers (7 studies), and knowledge checks on inhaler use (5 studies). Personnel that delivered the sessions were nurses (3 studies), asthma educators (3 studies), teachers (2 studies), and peer educators (1 study), or a combination of these (2 studies).

Components considered to be drivers of intervention cost included the labor cost associated with session delivery and the cost of inhalers and spacers. Components considered to be drivers of healthcare cost included inpatient stays, outpatient visits, emergency department visits, and medications.

The economic review team assessed the quality of cost and benefit estimates based on the capture of drivers and the appropriateness of measurement and methods used to compute them. Of the eight intervention cost estimates, six were of good quality and two were fair. The component of intervention cost most often missing was the cost of identifying students with asthma. One study did not account for the wages of some staff who delivered sessions as part of a team. Of the three healthcare cost estimates, two were of good quality and one was fair. Noted limitations for healthcare cost estimates were as follows: missing inpatient stays or emergency department visits, lack of a control group, and reliance on student or parent self-report.

Intervention Cost

- The median cost per person was \$44 (IQI: \$40 to \$131), based on eight estimates from seven studies.

Economic Benefit

- The changes in healthcare cost per person were -\$208, \$0, and \$62, based on estimates from three studies.

Return on Investment

- The return on investment was -1 and -2.5, based on two studies that reported both intervention cost and change in healthcare cost. The negative values indicate intervention cost exceeded the healthcare cost averted.

The variation in intervention cost per person is partly explained by differences in the size of intervention groups, with smaller intervention costs associated with larger groups. One study that reported an unusually small intervention cost of \$9 per person delivered the intervention to individuals through an interactive website and hired a coordinator to work with parents of students who needed professional health care. Intervention cost did not vary by type of staff delivering the intervention or by delivery format (i.e., group or individual).

The review team could not assess a comprehensive return on investment from the societal perspective because none of the included studies considered benefits to parents from avoided loss of workdays or benefits to school districts from averted loss of revenues associated with school absences.

Considerations for Implementation

Findings of this review support the use of asthma self-management interventions delivered in school settings to children and adolescents with asthma. The CPSTF also recommends [school-based health centers](https://www.thecommunityguide.org/findings/promoting-health-equity-through-education-programs-and-policies-school-based-health-centers) [https://www.thecommunityguide.org/findings/promoting-health-equity-through-education-programs-and-policies-school-based-health-centers] based on evidence of effectiveness for a range of student education and health outcomes, including reduced asthma-related emergency department visits and hospitalizations. School-based health centers can provide a useful location for asthma self-management instruction and may be used to identify students with asthma.

The following considerations for implementation are drawn from studies included in the existing evidence review, the broader literature, and expert opinion.

Guidance is available to inform implementation of school-based asthma self-management interventions and help schools select from a range of strategies.

- The Centers for Disease Control and Prevention (CDC), [National Asthma Control Program \(NACP\)](https://www.cdc.gov/asthma/nacp.htm) [https://www.cdc.gov/asthma/nacp.htm] provides resources and tools to foster [asthma-friendly schools](https://www.cdc.gov/asthma/schools.html) [https://www.cdc.gov/asthma/schools.html].
 - [Strategies for Addressing Asthma in Schools](https://www.cdc.gov/asthma/pdfs/Strategies_for_Addressing_Asthma_in_Schools_508.pdf) [https://www.cdc.gov/asthma/pdfs/Strategies_for_Addressing_Asthma_in_Schools_508.pdf] promotes school action to identify barriers and address environmental triggers.
 - [Success stories](https://www.cdc.gov/asthma/controlling_asthma_factsheet.html) [https://www.cdc.gov/asthma/controlling_asthma_factsheet.html] feature ways schools have worked to prevent and control asthma
 - The [EXHALE technical package](https://www.cdc.gov/asthma/pdfs/EXHALE_technical_package-508.pdf) [https://www.cdc.gov/asthma/pdfs/EXHALE_technical_package-508.pdf] provides an evidence-based group of strategies to help improve asthma control and inform decision-making in communities, organizations, and states.
- [CDC Healthy Schools](https://www.cdc.gov/healthyschools/index.htm) [https://www.cdc.gov/healthyschools/index.htm] provides information specific to managing [asthma](https://www.cdc.gov/healthyschools/asthma/index.htm) [https://www.cdc.gov/healthyschools/asthma/index.htm] at school.
- The American Lung Association provides resources based on real-life activities that have been used in U.S. schools, including step-by-step instructions for a long-term asthma management plan in the [Asthma-Friendly Schools Initiative Toolkit](https://www.lung.org/lung-health-and-diseases/lung-disease-lookup/asthma/asthma-education-advocacy/asthma-friendly-schools-initiative/toolkit/) [https://www.lung.org/lung-health-and-diseases/lung-disease-lookup/asthma/asthma-education-advocacy/asthma-friendly-schools-initiative/toolkit/].
- Examples of school-based asthma self-management programs include [Open Airways for Schools \(OAS\)](https://www.lung.org/lung-health-and-diseases/lung-disease-lookup/asthma/asthma-education-advocacy/open-airways-for-schools/) [https://www.lung.org/lung-health-and-diseases/lung-disease-lookup/asthma/asthma-education-advocacy/open-airways-for-schools/] and the [Roaring Adventures of Puff](https://www.cdc.gov/asthma/interventions/childhood_asthma.htm) [https://www.cdc.gov/asthma/interventions/childhood_asthma.htm]. These programs provide educational and interactive approaches (e.g., group discussion guides, stories, games) to promote and improve asthma control.
- The American Academy of Allergy Asthma & Immunology offers guidance on components for a [comprehensive school-based asthma management program](https://www.aaaai.org/conditions-and-treatments/school-tools/SAMPRO) [https://www.aaaai.org/conditions-and-treatments/school-tools/SAMPRO].
- The National Asthma Education and Prevention Program offers [Managing Asthma: A Guide For Schools](https://www.nhlbi.nih.gov/files/docs/resources/lung/asth_sch.pdf) [https://www.nhlbi.nih.gov/files/docs/resources/lung/asth_sch.pdf]

Implementing a personalized asthma action plan involves the student, family, and asthma care provider. Encouraging students to work with their healthcare providers to develop an asthma action plan is a common element of self-management instruction. Schools may want to establish policies or practices that encourage or require students with asthma to submit an asthma action plan. Following are example plans that can be personalized.

- [Asthma Action Plan](https://www.cdc.gov/asthma/actionplan.html) [https://www.cdc.gov/asthma/actionplan.html] resources from CDC include guidelines and forms that can be printed and completed for immediate use
- [Asthma Action Plan for Home & School](https://www.aaaai.org/Aaaai/media/MediaLibrary/PDF/Documents/Libraries/16-asthma-action-plan-v10_hires.pdf) [https://www.aaaai.org/Aaaai/media/MediaLibrary/PDF/Documents/Libraries/16-asthma-action-plan-v10_hires.pdf] from the American Academy of Allergy, Asthma, and Immunology
- [Asthma Action Plan](https://www.nhlbi.nih.gov/files/docs/public/lung/asthma_actplan.pdf) [https://www.nhlbi.nih.gov/files/docs/public/lung/asthma_actplan.pdf] from the National Institutes of Health, National Heart, Blood, and Lung Institute

School resources and staff time will likely be required to recruit students with asthma to participate. Notices may be sent to parents or students (e.g., email, fliers), students may be recruited through school-based health centers, or schools may start with student-filed asthma action plans.

Parental consent and provider prescription requirements for self-management training, asthma action plans, and rescue medications vary by school district and can be barriers to full participation.

Evidence Gaps

Based on the evidence and findings of the Harris et al. systematic review, the CPSTF identified several research questions for future study.

- How effective are these interventions with high school students who have asthma?
- How does effectiveness vary between programs set in urban and rural schools? Future studies could inform and provide additional evidence on programs and program components in rural settings.
- Does teaching students how to use inhalers and following up with them to ensure proper use have an effect on asthma-related outcomes?
- Do additional school policies (e.g. child inhaler possession and use policies, requirements for asthma action plans) improve student self-management practices and overall asthma control?
- How does effectiveness of self-management interventions vary by asthma severity?
- What is the effect of the intervention on parents' work productivity?
- What is the effect of the intervention on school district revenues associated with asthma-related school absences?
- What is the effect of the intervention on the cost of emergency department visits and inpatient stays?
- What is the return on investment when an intervention is implemented with funding from the local school district, public health agency, or area hospitals?
- What is the economic merit of the intervention in terms of societal cost-benefit and cost-effectiveness?

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provide information and options for decision makers and stakeholders to consider when determining which programs, services, and policies best meet the needs, preferences, available resources, and constraints of their constituents.

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