Characteristics of Existing Asthma Self-Management Education Packages

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Key Messages

Purpose

To identify the components that comprise asthma self-management education (AS-ME) packages used in the United States, and examine, compare, and organize their key characteristics and available research to enable a better understanding of current practice and future needs.

Key Messages

- Many AS-ME packages are currently available in English and Spanish for different populations and settings
- Most packages rely on in-person instruction with paper-based materials
- Packages are often tailored to local settings, but little is known about how they are modified
- Numerous studies found that packages are associated with improved asthma control, reduced symptom frequency, increased asthma knowledge, and fewer school absences; results are mixed for outcomes such as hospitalizations, emergency department visits, and quality of life

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None of the investigators have any affiliations or financial involvement that conflicts with the material presented in this report.

The information in this report is intended to help healthcare decision makers—patients and clinicians, health system leaders, and policymakers, among others—make well-informed decisions and thereby improve the quality of healthcare services. This report is not intended to be a substitute for the application of clinical judgment. Anyone who makes decisions concerning the provision of clinical care should consider this report in the same way as any medical reference and in conjunction with all other pertinent information, i.e., in the context of available resources and circumstances presented by individual patients.

This report may periodically be assessed for the currency of conclusions. If an assessment is done, the resulting surveillance report describing the methodology and findings will be found on the Effective Health Care Program website at www.effectivehealthcare.ahrq.gov. Search on the title of the report.

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Preface

The Agency for Healthcare Research and Quality (AHRQ), through its Evidence-based Practice Centers (EPCs), sponsors the development of evidence reports and technology assessments to assist public- and private-sector organizations in their efforts to improve the quality of healthcare in the United States. The reports and assessments provide organizations with comprehensive, science-based information on common, costly medical conditions and new healthcare technologies and strategies. The EPCs systematically review the relevant scientific literature on topics assigned to them by AHRQ and conduct additional analyses when appropriate prior to developing their reports and assessments.

This EPC evidence report is a Technical Brief. A Technical Brief is a rapid report, typically on an emerging medical technology, strategy or intervention. It provides an overview of key issues related to the intervention—for example, current indications, relevant patient populations and subgroups of interest, outcomes measured, and contextual factors that may affect decisions regarding the intervention. Although Technical Briefs generally focus on interventions for which there are limited published data and too few completed protocol-driven studies to support definitive conclusions, the decision to request a Technical Brief is not solely based on the availability of clinical studies. The goals of the Technical Brief are to provide an early objective description of the state of the science, a potential framework for assessing the applications and implications of the intervention, a summary of ongoing research, and information on future research needs. In particular, through the Technical Brief, AHRQ hopes to gain insight on the appropriate conceptual framework and critical issues that will inform future research.

AHRQ expects that the EPC evidence reports and technology assessments will inform individual health plans, providers, and purchasers as well as the healthcare system as a whole by providing important information to help improve healthcare quality.

If you have comments on this Technical Brief, they may be sent by mail to the Task Order Officer named below at: Agency for Healthcare Research and Quality, 5600 Fishers Lane, Rockville, MD 20857, or by email to epc@ahrq.hhs.gov.

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In designing the study questions, the EPC consulted a panel of Key Informants who represent subject experts and end-users of research. Key Informant input can inform key issues related to the topic of the Technical Brief. Key Informants are not involved in the analysis of the evidence or the writing of the report. Therefore, in the end, study questions, design, methodological approaches and/or conclusions do not necessarily represent the views of individual Key Informants.

Key Informants must disclose any financial conflicts of interest greater than $5,000 and any other relevant business or professional conflicts of interest. Because of their role as end-users, individuals with potential conflicts may be retained. The TOO and the EPC work to balance, manage, or mitigate any conflicts of interest.

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Prior to publication of the final evidence report, EPCs sought input from independent Peer
reviewers without financial conflicts of interest. However, the conclusions and synthesis of the
scientific literature presented in this report does not necessarily represent the views of individual
reviewers.

Peer Reviewers must disclose any financial conflicts of interest greater than $5,000 and any
other relevant business or professional conflicts of interest. Because of their unique clinical or
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Characteristics of Existing Asthma Self-Management Education Packages

Structured Abstract

Background. As the prevalence and burden of asthma continues to grow, so does the need to identify and invest resources in effective interventions. Asthma self-management education (AS-ME) packages facilitate knowledge and self-care for asthma patients and families. Many AS-ME interventions are widely studied, but uncertainty remains about optimal design, characteristics, and implementation. Heterogeneity in format, delivery mechanisms, target audiences, and other features complicates efforts to identify best practices in designing AS-ME packages.

Purpose. To identify components of AS-ME packages, and examine, compare, and organize key characteristics and available research to improve understanding of current practice and future needs.

Methods. Existing AS-ME packages were identified, acquired, and reviewed. Major characteristics were evaluated, including population, audience, setting, delivery mechanism, and content. Key Informants were interviewed to identify contextual factors affecting development and implementation of AS-ME packages. A systematic literature review was conducted to identify and synthesize current research.

Findings. We reviewed 14 AS-ME packages for adults, adolescents, children, and parents, designed for use in schools, community-based sites, healthcare facilities, or patient homes. Most packages facilitate education in-person with an instructor, while a few are self-directed. Learning materials are typically paper based, and few packages incorporate audiovisual or online content. Most packages are available in English and Spanish, and most are free. Packages address asthma knowledge, medication and device use, symptom management, and asthma triggers. Most packages are generally up to date.

Implementation of AS-ME packages varies widely. Most packages were developed or disseminated by a few professional or patient advocacy organizations. Instructors often tailor packages to local settings and many homegrown packages also exist.

We reviewed 7 systematic reviews and 33 primary studies published since 2007. Half evaluated school-based packages, while the others examined home or community settings. Most studies were conducted in children or adolescents. Frequently reported outcomes include asthma control, asthma knowledge, symptoms, quality of life, hospitalizations, and emergency department use. AS-ME packages were generally associated with improved asthma control, reduced symptom frequency, increased asthma knowledge, and fewer school absences. Results were mixed when examining hospitalizations, emergency department visits, and quality of life.

Conclusions. A robust choice of branded AS-ME packages exists for many patient populations and settings, although these vary in structure, delivery, and accessibility. Homegrown packages are also common but not widely shared. Further research on home-based and adult-focused packages is needed.

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Introduction

Background

Asthma is a chronic respiratory syndrome characterized by airway inflammation and a variety of symptoms including coughing, wheezing, and shortness of breath. More than 8 percent of both adults and children in the United States have asthma, and in 2016 asthma accounted for 1.7 million emergency department visits and more than 3,500 deaths.[1] Asthma can significantly reduce patients' and families' quality of life and affects attendance at school, work, and participation in recreational activities. Half of adults and nearly 40 percent of children report poorly controlled or uncontrolled asthma, although a wide variety of pharmacological and other interventions are available to improve asthma control and reduce the frequency and burden of symptoms.[2]

Patients and families can play a substantial role in minimizing the burden of asthma through careful medication management, reducing exposure to environmental triggers, and responding rapidly to exacerbations.[3] However, understanding the complex interaction between respiratory physiology, asthma triggers, short- and long-term medications, and rescue therapies requires significant education and training that may be challenging for patients and caregivers. Clinical practice guidelines developed by the National Heart, Lung and Blood Institute therefore emphasize formal and comprehensive asthma self-management education (AS-ME) as a key component of optimal asthma care.[4] National standards for AS-ME have been published,[5] and the Centers for Disease Control and Prevention (CDC) recently introduced a new technical package aimed at improving asthma control, EXHALE, that highlights AS-ME as a vital strategy within a continuum of approaches to improve asthma care. EXHALE describes AS-ME as a strategy to teach

> "…basic facts about asthma, roles of medications, how to use medications correctly, what to do when asthma symptoms worsen, and how to reduce exposure to asthma triggers…Effective AS-ME can be delivered in a variety of settings (e.g., individual, family, or group education in a clinic, school, pharmacy, or community) by a variety of providers (e.g., nurses, respiratory therapists, certified asthma educators, or community health workers) …[and] requires repetition and reinforcement."[6]

Dozens of AS-ME packages have been developed and disseminated by various organizations and agencies, and many packages or their components have been examined in controlled studies. A recent review of reviews[3] synthesized the findings of 27 systematic reviews encompassing 270 randomized controlled trials of AS-ME approaches. The authors found that AS-ME improves asthma control and reduces healthcare utilization, and can be implemented for diverse populations in varying settings. Other recent reviews have also suggested the value of AS-ME for improving asthma outcomes[7] and quality of life.[8]

Despite the widespread use and evaluation of AS-ME packages, there remains uncertainty about their optimal design, characteristics, and implementation. Heterogeneity in content, format, delivery mechanisms, targeted populations, and other features complicates efforts to identify best practices in designing packages. Additionally, different populations and types of learners may need different educational approaches and strategies. As the prevalence and burden of asthma remain high,[1,2] there is increasing interest by clinical experts, patient advocates, public health leadership, and policymakers to identify and invest resources in effective interventions. Future packages would benefit from a structured framework delineating the current state of AS-ME practice, knowledge, and research.

This Technical Brief mapped the ecosystem of current AS-ME packages. We identified the different components that comprised selected AS-ME packages that are used in the United States, and examined, compared, and organized their key characteristics to enable a better understanding of current practice. We summarized important elements of their scope, design, content, and target audience, and included evidence, when available, addressing their effectiveness, feasibility, and user satisfaction. Our analysis also highlighted factors affecting implementation, including public availability and cost, user literacy, mode of delivery, and ease of use. Finally, we identified key gaps in knowledge about optimal AS-ME packages, and illuminated the practical challenges to future work in this field.

Guiding Questions

GQ 1: What are the characteristics of AS-ME packages, and how do they vary?

Audience
- Who is included in the intended audience?
- Are packages focused on, or limited to, specific patient characteristics?
- What level of literacy is required? Are packages offered in multiple languages?

Delivery and use of AS-ME packages
- What is the setting for delivery of education?
- Is education self-directed, or delivered by an instructor (if so, whom)?
- What aspects of the package are interactive?
- What mediums are used to deliver education and facilitate communication?
- What is the timeframe?
- How are packages initially accessed? Is there a clinical gatekeeper (e.g., referral or login permission needed)?

Educational content
- What key content areas are addressed?
- How do packages address cognitive, psychological, and/or emotional components of asthma and asthma self-management?
- What tools are provided to recipients as components of the packages?
- What evidence supports the validity of the content? Does the content align with national asthma guidelines?
- When were the packages designed/updated?
- Are explicit educational goals identified? How is individual learning/progress evaluated?

GQ 2: What is the context and implementation of AS-ME packages?
- Who develops the packages?
- Are packages publicly available? Is there a fee? Are they protected by copyright?
- How much does it cost to develop, produce, promote, disseminate, and use packages?
- Who pays for educational packages?
- Do recipients earn a certification of completion?
- Is there a process to sustain/support retention of learning over time?
- What factors are important facilitators and barriers to implementation of AS-ME?
- How is technology used to support implementation?

- If education is guided by an instructor, how are instructors identified and trained?
- Are current/future workforce resources adequate to provide instruction?
- How is implementation evaluated?

GQ 3: What is the current evidence addressing AS-ME packages?
- What asthma outcomes are measured? Are packages associated with good outcomes?
- What patient-centered outcomes are measured? Are packages associated with good outcomes?
- What implementation outcomes are measured? Are packages associated with good outcomes?
- How applicable is current evidence to various populations and settings?

GQ 4: What future research is needed to close evidence gaps regarding AS-ME packages?
- What additional evaluation is needed on existing AS-ME packages?
- Are different evaluation approaches needed to assess AS-ME?
- What new types of packages, or components and features of packages, may be needed?
- Is further evaluation needed focusing on specific patient populations? Are some populations not adequately addressed by current packages?

Methods

The Centers for Disease Control and Prevention (CDC) nominated this topic to inform current and future efforts to expand the dissemination, use, and value of asthma self-management education (AS-ME). We generated a protocol that included preliminary Guiding Questions (GQs) and inclusion/exclusion criteria in the form of PICOTS (populations, interventions, comparators, outcomes, timing, and settings). We interviewed Key Informants (KIs) representing a broad range of stakeholders and incorporated their feedback into a final protocol that was posted on the Effective Care website on April 16, 2019. The protocol is available online (https://effectivehealthcare.ahrq.gov/topics/asthma-education/protocol) and is registered in PROSPERO (https://www.crd.york.ac.uk/prospero/).

1. **Data Collection**

A. **Discussions With KIs**

We selected KIs with expertise in one or more of the following areas: AS-ME; adult and pediatric asthma; environmental allergens and irritants; community-based interventions; and populations at high risk for significant asthma morbidity and poor outcomes. We interviewed either individually or collectively seven KIs located in the United States. We asked KIs about the content of AS-ME packages, ways design features of educational materials could be improved, challenges encountered when implementing AS-ME packages, and ways to facilitate the delivery of education. KIs also provided insight into how AS-ME should be evaluated, and how education interacts with other types of asthma interventions.

KI input helped inform GQs 1, 2, and 4. We also used KI input to refine the systematic literature search, identify grey literature resources, provide information about ongoing research, confirm evidence limitations, and recommend approaches to help fill these gaps. Table 1 presents the questions asked of the KIs.

Table 1. Questions for key informants

Number	Question
1.	What do you see as the most important features of AS-ME packages?
2.	What types of educational content are best delivered through AS-ME? Are certain content areas less conducive to AS-ME?
3.	What are the relative advantages and disadvantages of self-directed AS-ME compared with instructor-delivered education?
4.	What types of professionals (e.g., physicians, nurses, community health workers, social workers) are best trained to provide instruction in AS-ME? Should other groups of professionals play a greater or different role in delivering AS-ME? How does this vary by patient population?
5.	How should packages be accessed by patients? How might online/mobile technology be incorporated into design/delivery of AS-ME?
6.	What are the most important clinical and psychosocial goals for patients who engage in AS-ME? How should outcomes be assessed?
7.	How can/should packages address population differences such as age, literacy, social/cultural/economic factors, and high-risk patients?
8.	What operational factors (e.g., ease of use, availability, timeframe) are important to consider when delivering AS-ME? Which factors are the biggest barriers?
9.	What confounding factors pose a challenge to interpreting research and evaluation studies on the design, implementation, use, and assessment of AS-ME, and how can future research/evaluation be designed to minimize these confounders?
10.	Where do you think are the most important gaps in current knowledge, and can you recommend approaches to help fill these gaps?
11.	In addition to published literature, what unpublished resources could help inform our analysis?
12.	Can you suggest strategies we might use to organize, present, and disseminate our findings?

B. Grey Literature Search

Grey literature was critical for identifying AS-ME packages (GQ 1 and GQ 2), and finding descriptions and evaluations of AS-ME packages implemented by individual hospitals, health systems, provider groups, community organizations, or public health agencies. ECRI-Penn Evidence-based Practice Center (EPC) Information Center searched multiple gray literature sources such as: Centers for Disease Control and Prevention (CDC), ClinicalTrials.gov, ECRI Guidelines Trust, Medscape, National Academy of Medicine, and the websites of organizations and agencies. We also searched for patient apps and other online AS-ME tools. Finally, input from the KIs helped to identify other grey literature sources. Complete lists of the resources searched and search concepts and strategies are available in Appendix A.

C. Published Literature Search

Evidence from the published literature search helped inform GQ 3. Medical librarians at ECRI-Penn EPC Information Center searched bibliographic databases including MEDLINE, PubMed (unprocessed records only), EMBASE, CINAHL, and the Cochrane Library using controlled vocabulary and text words. Searches covered the literature published from January 1, 2007, through December 15, 2019. Complete lists of the resources searched and search concepts and strategies are available in Appendix A. Reference lists from systematic reviews were reviewed and compared against our retrieved articles. If a systematic review contained references that appeared to meet our inclusion criteria but had not been captured by our initial search results, we reviewed the search strategy to determine if refinement of the search strategy was needed to include these articles.

Literature screening was performed in duplicate using the database Distiller SR (Evidence Partners, Ottawa, Canada). Literature search results were initially screened for relevancy based on predetermined eligibility criteria (Table 2). Full-text of relevant abstracts were requested and screened. All disagreements were resolved by consensus discussion among the two original screeners.

D. Inclusion of AS-ME Packages and Published Literature

Specific AS-ME packages were included if they contained an interactive component, described a methodology for use or implementation, and were available for use in the United States. Packages were excluded if they consisted only of paper materials, slides, checklists, or other materials without any interactive element, did not include guidance for how they should be used, or were used exclusively outside of the United States. Table 2 describes the inclusion and exclusion criteria.

Published studies were included if they presented postintervention data on asthma patients in the United States who used an AS-ME package, and were full-length English language publications. We did not require that studies have control groups. Studies were excluded if they were available only as abstracts or only examined patients outside the United States. If a study contained an AS-ME intervention used in multiple countries including the United States, we included it if at least 50 percent of patients were in the United States, or if patient data was stratified by country.

Table 2. PICOTS

PICOTS	Criteria
Population	Asthma Any age ≥ 50% U.S. patients
Intervention	Asthma self-management education (AS-ME) packages with: • interactive component • description of methodology for use or implementation • available in the United States
Comparator	No intervention Control Standard of care Other AS-ME package(s)
Outcomes	Reports at least one outcome of interest listed under Guiding Question 3: • Asthma control • Asthma-related healthcare utilization • Asthma-related medication adherence • Asthma-related quality of life • Ease of use • Acceptability • Patient/family/instructor satisfaction • Feasibility • Adoption • Fidelity • Applicability
Timing	Any
Setting	Any

2. Data Organization and Presentation

A. Information Management

We abstracted and tabled descriptive characteristics from AS-ME packages and published studies. Factors abstracted from AS-ME packages included, but were not limited to, the characteristics described in GQs 1 and 2. Factors abstracted from published studies included PICOTS categories (population, intervention, comparator, outcomes, timing, setting). We highlighted outcome measures that were used in these studies, and the applicability of the results to various populations. KI interviews helped refine which data points should be abstracted, and how they might be organized. KI interviews were documented during each call by a designated member of the project team.

B. Data Presentation

We designed an analytic framework that visually communicates the integration of AS-ME into patient care. This framework includes the roles and relationships of those who design, implement, use, and assess AS-ME packages, and the interaction of AS-ME with short- and long-term clinical and evaluative outcomes.

Characteristics of AS-ME packages and outcomes of published studies are presented in searchable evidence tables. We also developed figures and tables that synthesize the current state of knowledge regarding AS-ME evaluation and research and highlight evidence gaps that require further study and assessment. Finally, we narratively summarized significant perspectives and insights gathered from KIs.

Findings

We identified 25 potentially relevant asthma self-management education (AS-ME) packages through our searches of published and grey literature sources, Key Informant (KI) interviews, and discussion with the Centers for Disease Control and Prevention (CDC). We included and evaluated 14 packages in this Technical Brief. We were unable to acquire six packages, usually because we could not identify a source with direct access to the materials, or our requests for access received no replies, and we excluded five because they did not meet our inclusion criteria. Appendix B has a description of packages we did not review and the reasons for exclusion.

Our search of the published literature identified 293 potentially relevant studies. We excluded 189 studies during title and abstract screening because they were not relevant to the Guiding Questions (GQs) or did not include patients in the United States. This resulted in full-text screening of 104 articles. We excluded 64 studies at the full-text level. Appendix C has a list of excluded studies organized by reason for exclusion.

We included 40 articles in our review. Seven were systematic reviews, 16 were randomized controlled trials (RCTs), 16 were observational studies, and we included one descriptive study. Figure 1 presents a PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram of our study screening.

A search of ClinicalTrials.gov identified 10 trials of AS-ME interventions currently underway in the United States. Seven trials are categorized as "Recruiting," two trials are "Active, not recruiting," and one trial is "Not yet recruiting." These ongoing studies suggest substantial interest and investment in developing additional AS-ME interventions.

Figure 1. Study attrition diagram
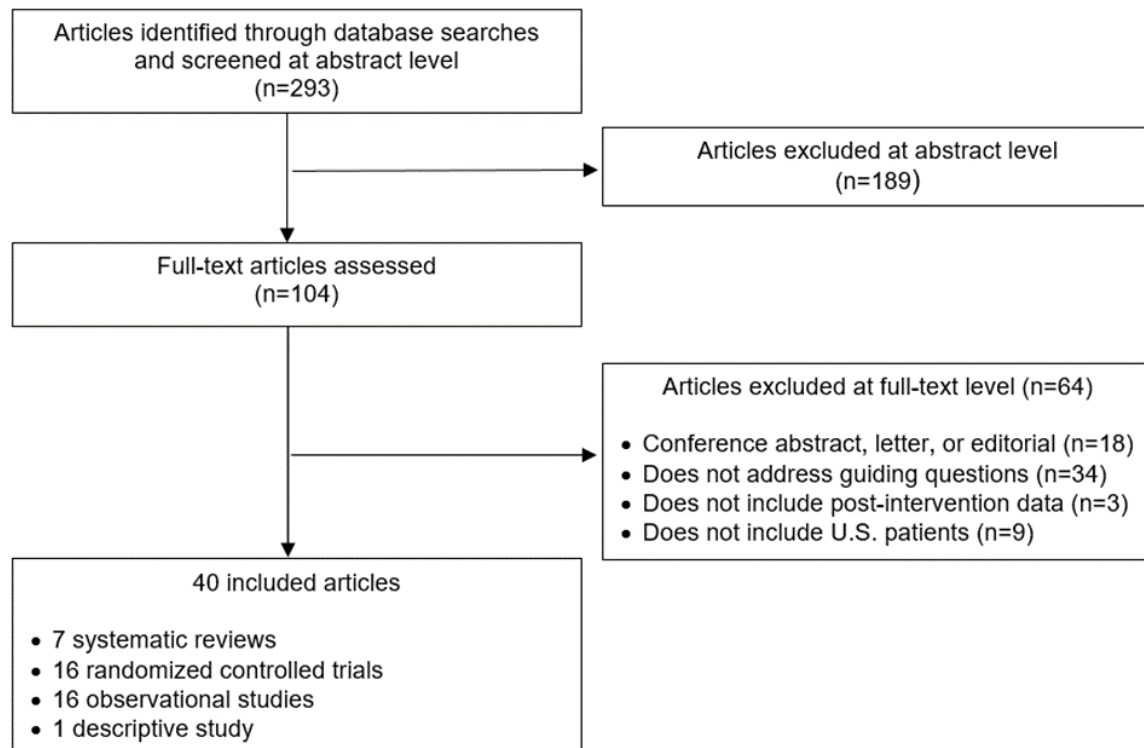
Organization of This Report

In the first section we address GQ 1 by describing and summarizing key structural characteristics of the 14 AS-ME packages we reviewed, focusing on who uses them, how they are designed, and their content. Table 3 describes the intended audience, patient population, setting, and available languages for each package. Table 4 describes how each package is accessed and delivered to end-users. Tables 5 and 6 describe the packages' components, including curriculum and other key features such as asthma action plans.

In GQ 2 we discuss the implementation of AS-ME packages. This section addresses how packages were developed, disseminated, and funded, and how educators can be trained to deliver AS-ME. We also address barriers to implementation. Our findings are informed by KI feedback as well as our own review of the 14 AS-ME packages. Table 7 summarizes important aspects of implementation for each package. Figure 2 provides an overview of the characteristics of existing AS-ME packages and relevant implementation factors.

GQ 3 examines evidence for the effectiveness of AS-ME packages. We reviewed and synthesized 40 published articles that met our inclusion criteria. Figures 3 through 6 summarize the study design, setting, population, and outcomes addressed in the evidence base. Table 8 lists the packages that were evaluated in these studies, and Table 9 summarizes study findings by key outcome.

In GQ 4 we highlight future needs for AS-ME development, implementation, and research, which are summarized in Table 10.

Additional details about the AS-ME packages and published literature that we reviewed are available in Appendix D.

Characteristics of AS-ME Packages (GQ 1)

Audience

AS-ME packages can be designed to educate asthma patients or their families directly, or they can be intended for training healthcare professionals such as health educators, school nurses, or clinicians who engage patients in self-management activities. Five of 14 packages we reviewed were designed to teach self-management skills to adults with asthma, while five other packages provide education to children or adolescents and/or their families and caregivers. (Throughout this Technical Brief, "children" are defined as less than 10 years old and "adolescents" are defined as 10 to 17 years old.) Additionally, two packages are intended to train healthcare professionals, specifically school nurses and clinical pediatricians, respectively, in strategies for teaching patients. Finally, two packages can serve multiple audiences. *A Breath of Life* is used to train health educators who then teach children and families in their local communities. It was also designed to directly educate parents of children and adolescents with asthma. *Asthma 101* has been used to teach adult patients directly, and also to train nursing students, school personnel, childcare providers, and coaches. (Note: *Asthma 101* is no longer available as a training program. For those who are interested in the content, the workbook is available to download for free from the American Lung Association (ALA) website. ALA suggests that stakeholders review its *Asthma Basics* program as an alternative.)

Patient Population

Several packages were designed for use in specific patient populations. *A Breath of Life* is intended to serve Latino communities, while *Women Breathe Free* is tailored to adult women with asthma. Packages produced by the Asthma and Allergy Foundation of America (AAFA), including *Asthma Care for Adults*, *Wee Breathers*, and *You Can Control Asthma*, emphasize their content is appropriate for multicultural, minority, and/or low-income communities. The packages we reviewed do not indicate whether their materials are suited to clinical subgroups at higher risk for poor outcomes, such as patients with obesity or other significant comorbidity. Only three packages indicate they are designed for patients with "mild to severe" or "moderate to severe" asthma, while the remaining packages do not explicitly address asthma severity.

Setting

AS-ME can be delivered in schools, patient homes, community sites, and healthcare facilities. The appropriate setting for each package depends on the intended audience and the location and role of the educator or facilitator. Most packages can be implemented in multiple types of settings; for example, *You Can Control Asthma* can be implemented in school, home, community, and healthcare settings. As noted above, *A Breath of Life* is intended for both community health educators and the subsequent education of parents in community settings. Six other packages were designed for various combinations of home, school, community, and healthcare environments. Finally, we identified two packages designed only for home use and two developed specifically for use in schools.

Language and Literacy

Language and literacy are important components of any program to improve patient self-management. All the packages we reviewed were designed in English; Spanish-language versions were available for 8 of 12 packages that include a patient-facing component (i.e., were not designed exclusively for professional training). We identified no package providing materials in any language other than English or Spanish. However, our KI interviews indicated that efforts are underway to produce AS-ME packages in additional languages, although details were not provided.

While identifying multilingual availability of the packages is easy, it is more challenging to determine if they are written at an appropriate literacy level for users. *Asthma Care for Adults* is described by the AAFA as "easy reading in plain language," while *Wee Breathers'* parent materials are written at a sixth-grade reading level. The parent materials for *You Can Control Asthma* are at a sixth-grade level as well, and the student component is written at a third-grade level. Other packages we reviewed did not self-identify literacy levels of potential users.

Table 3. Asthma self-management education packages: audience, patient population, setting, and language

Package	Audience: Asthma Patients	Audience: Parents, Caregivers	Audience: Nurses, Clinicians	Audience: Promotoras	Audience: Teachers	Patient Population: Adults	Patient Population: Children, Adolescents	Patient Population: Preschool-Age Children	Setting: Home	Setting: School	Setting: Community	Setting: Healthcare facility	Language: English	Language: Spanish
A Breath of Life NHLBI (2014)		✓		✓			✓				✓	✓	✓	✓
Asthma 101 ALA (Year NR)	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓
Asthma Basics for Children AAFA (2010)		✓			✓			✓	✓	✓			✓	✓
Asthma Care for Adults AAFA (2018)	✓	✓				✓			✓		✓	✓	✓	
Asthma Workbook University of Michigan (2018)	✓					✓			✓		✓	✓	✓	
Breathe Well, Live Well ALA (2019)	✓					✓			✓		✓	✓	✓	✓
Creating Asthma-Friendly Environments and Promoting Access to Guidelines-Based Care for Children with Asthma NEEF & NASN (2018)			✓				✓		✓	✓	✓		✓	
Kickin' Asthma ALA (2015)	✓						✓			✓			✓	✓
Open Airways for Schools ALA (2018)	✓						✓			✓			✓	✓
Pediatric Asthma Initiative NEEF (Year NR)			✓				✓		✓		✓	✓	✓	
Severe Asthma Care for Adults AAFA (2019)	✓	✓				✓			✓				✓	
Wee Breathers AAFA (2013)		✓					✓	✓	✓				✓	✓
Women Breathe Free University of Michigan (2010)	✓					✓			✓		✓		✓	
You Can Control Asthma* AAFA (2005)	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓
Total (N=14)	9	7	3	1	2	6	8	3	11	6	9	7	14	8

AAFA=Asthma and Allergy Foundation of America; ALA=American Lung Association; NASN=National Association of School Nurses; NEEF=National Environmental Educational Foundation; NHLBI=National Heart, Lung, and Blood Institute; NR=Not reported

Note: Children defined as under age 10; Adolescents defined as ages 10 to 17.

*Program has been implemented in daycare centers and asthma camp.

Delivery of Education

Nearly every package includes a potential face-to-face educational element. Packages intended for in-school use necessarily rely on in-person learning, but packages for parents or adult patients usually include in-person teaching as well. Three packages incorporate face-to-face teaching in community settings or the patient's home. Two packages include a combination of in-person learning and scheduled phone calls between educators and patients. Two packages can be implemented through in-person education or self-directed learning without face-to-face interaction.

When learning is delivered in person to adult patients or parents, education is facilitated by a nurse, a respiratory therapist, or a nonclinical professional trained specifically in asthma education, such as a community health worker or other health educator. School-based programs are typically led by school nurses, or teachers who receive specialized training in health education. The packages are generally designed to be taught successfully by any of these categories of healthcare or educational professionals, and do not indicate specific limits on who can facilitate their use. Seven of the nine packages that include in-person teaching in school, home, community, or healthcare settings provide an instructor's manual to guide facilitation.

The timeframe recommended for implementing in-person learning varies widely. School-based packages are designed to be delivered in four, five, or six sessions with each session lasting 40 to 60 minutes, depending on the package. Most in-person AS-ME packages for adult patients or parents range from four to seven sessions of approximately 1 hour each. Sessions can be scheduled on consecutive weeks or spaced out over a longer period of time, and packages are generally designed to be flexible and amenable to adaptation, to enable use in different settings with varying resources. The *Breathe Well, Live Well* package offers multiple alternatives, including one-day, two-day, three-day, and self-directed frameworks.

Interactivity and Technology

The reliance on in-person and phone-based teaching for most packages creates substantial opportunity for interactive learning including questions, feedback, and demonstrations of how to use devices such as inhalers and peak flow meters. School-based packages feature significant interactive opportunities such as games, skits, and role playing. Home-based packages lacking those elements provide patients or parents with tools or activities that expand the educational experience beyond a simple reading of didactic material. These tools or activities take numerous forms, such as self-evaluation activities that measure understanding of the material, structured assessments of the home environment to identify asthma triggers and reduce exposure, and asthma action plans and symptom logs that patients and families are encouraged to complete at home and share with their healthcare provider for review and discussion.

Few packages incorporate audiovisual elements, and only one includes a web-based component. All packages use paper-based materials, and five packages designed for patients or parents also include videos or audiovisual elements. We identified no apps meeting our inclusion criteria for packages, but several ongoing trials described in ClinicalTrials.gov examine apps or web-based educational interventions. Our KIs shared their experience that AS-ME developers and researchers have found, that patient engagement with asthma-oriented apps is difficult to sustain, with users frequently abandoning mobile-based interventions, while nonusers may have limited access to technology-based tools. Nevertheless, efforts to develop technology-based tools for asthma management remain an important focus of research and development.

Accessibility

Many AS-ME packages are readily available on the Internet for free, while access to several others include a fee and require the requestor to belong to or submit a formal request to the organization that developed the package. Nine of the packages we evaluated were freely available for downloading from the website of the sponsoring organization. These include the packages developed by the National Heart, Lung, and Blood Institute (NHLBI) (https://www.nhlbi.nih.gov/health-topics/all-publications-and-resources/breath-life-asthma-control-my-child), the National Environmental Education Foundation (NEEF) (https://www.neefusa.org/health/asthma and https://www.pathlms.com/nasn/courses/9421), and the University of Michigan (http://www.med.umich.edu/1libr/Asthma/AsthmaWorkbook.pdf), and some but not all of the packages from ALA (https://www.lung.org/lung-health-and-diseases/lung-disease-lookup/asthma/asthma-education-advocacy/) and AAFA (https://www.aafa.org/programs-for-patients-and-caregivers/). Conversely, three ALA packages require that requestors contact their local ALA chapter to arrange access to the materials; fees are required but are often waived due to grants or sponsorships. AAFA's *You Can Control Asthma* materials can be purchased for a fee ranging from $8 for an individual patient workbook to $50 for a full set of materials (including child and family workbooks and the implementation guide); AAFA's *Asthma Care for Adults* package can be downloaded for free (https://www.pathlms.com/aafa/courses/8092) or printed versions are provided at no cost for those who qualify, such as Federally Qualified Health Centers (FQHCs). For those who do not qualify, printed and bound editions can be purchased for $90. Of packages that we did not review, *Asthma Education for the Community Health Care Worker*, developed by the Association of Asthma Educators (AAE), can be ordered from the AAE after completion of a signed agreement and payment of $50 per manual, while *Peak Performance USA*, developed by the American Association for Respiratory Care, is described online as a free package, but we were unable to access the materials because a published URL link did not function properly and we could not identify any individuals who have direct knowledge of and access to the program.

Eleven packages are formally copyrighted, while one package is protected by a Creative Commons license. Several of these packages, though copyrighted, openly indicate that their materials can be reproduced with attribution. Additionally, our KIs indicated that they are aware of routine collaboration between several professional organizations to share AS-ME resources and avoid duplication of effort. However, developers generally expect that the content of their materials will not be altered, which may present challenges for organizations or end-users interested in modifying a package for a specific setting or population.

Table 4. Asthma self-management education packages: delivery and accessibility

Package	In-Person Education	Self-Directed Learning	Phone-Based Component	Paper-based Materials	Audiovisual Component	Downloadable	Available Only Upon Request	Requires Membership	No Fee Required	Fee for Some Components	Fee for all Components	Copyrighted or Licensed
A Breath of Life NHLBI (2014)	✓			✓	✓	✓			✓			
Asthma 101 ALA (Year NR)	✓	✓		✓		✓			✓			✓
Asthma Basics for Children AAFA (2010)	✓	✓		✓		✓			✓			✓
Asthma Care for Adults AAFA (2018)	✓	✓		✓	✓	✓				✓ *		✓
Asthma Workbook University of Michigan (2018)	✓		✓	✓		✓			✓			✓
Breathe Well, Live Well ALA (2019)	✓	✓		✓	✓		✓				✓	✓
Creating Asthma-Friendly Environments and Promoting Access to Guidelines-Based Care for Children with Asthma NEEF & NASN (2018)	✓				✓	✓			✓			✓
Kickin' Asthma ALA (2015)	✓			✓			✓				✓	
Open Airways for Schools ALA (2018)	✓			✓			✓				✓	✓
Pediatric Asthma Initiative NEEF (Year NR)	✓				✓	✓			✓			✓
Severe Asthma Care for Adults AAFA (2019)		✓		✓	✓	✓			✓			✓
Wee Breathers AAFA (2013)	✓			✓		✓			✓			✓
Women Breathe Free University of Michigan (2010)	✓		✓	✓		✓			✓			✓
You Can Control Asthma AAFA (2005)	✓			✓	✓		✓				✓	✓
Total (N=14)	13	5	2	12	7	10	4	0	9	1	4	12

AAFA=Asthma and Allergy Foundation of America; ALA=American Lung Association; NASN=National Association of School Nurses; NEEF=National Environmental Educational Foundation; NHLBI=National Heart, Lung, and Blood Institute; NR=Not reported

* For Asthma Care for Adults, printed materials can be purchased, or are available at no cost for those who qualify, such as Federally Qualified Health Centers.

Educational Content

We evaluated each AS-ME package to identify the broad categories of educational content that comprise their curriculum. The broad areas we focused on were lung physiology, medication and device use, symptom management and asthma triggers. We found that content is generally homogenous across packages, with variations that primarily reflect differences in the intended audience and setting. Table 5 summarizes the content areas for each package.

Lung Physiology

Every package except one includes an overview of lung physiology with an emphasis on asthma-related inflammation. The packages differ primarily in the level of detail and the clinical sophistication of the language used. Packages designed for healthcare professionals include more clinical detail and jargon than packages for adult patients and parents, while packages for children present basic information in age-appropriate terms.

Medications and Devices

Nearly every package discusses controller and rescue medications, with content generally focused on each medication's role in asthma care and the importance of using them optimally. Some packages go into greater detail about specific medication categories, such as the distinction between corticosteroids and long-acting beta agonists, but most packages focus on a high-level overview of medication use. Our KIs felt strongly that information about medication dosing is critical for asthma patients and must be presented in clear, straightforward language.

Device use is also featured in the curriculum. All but one package addresses inhaler use, often with diagrams or illustrations to assist patients. Six packages include information on using spacers, eight packages instruct patients about how to use peak flow meters, and three describe nebulizer use. We did not conduct a detailed comparison of specific device instructions or techniques across every package, but we note that our KIs identified variation in these approaches as a potential limitation of using AS-ME materials. For example, there are multiple techniques for inhaler use, and the instructions patients receive from their clinical team should be consistent with any AS-ME package they are provided, to avoid confusion.

Packages intended for adult patients are just as likely as packages for children and parents to include information about spacers, peak flow meters, or nebulizers. Most of the information addressing medications and devices is descriptive, but two also include recommendations for improving adherence. *You Can Control Asthma*, for example, provides parents with suggestions for encouraging children to become self-reliant regarding medication use.

Symptom Management

Nearly every package provides education on monitoring asthma symptoms, while seven also focus on preventing symptom onset or exacerbation. Six packages have a symptom log or symptom diary that patients can use to regularly track their asthma morbidity and share that information with their clinician. Eleven packages include an asthma action plan template that provides a framework for self-management. Our KIs emphasized that action plans are widely considered vital for successful asthma management, and they recommended that an individual patient's plan should be shared with all of their caregivers and providers, including specialists and emergency department physicians.

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Asthma Triggers

Thirteen packages include detailed information about common environmental (e.g., dust mites, pests) and behavioral (e.g., exercise, stress) triggers, and describes strategies for reducing or avoiding triggers at home or in school. Seven packages include checklists to help patients and their families identify and remediate triggers at home.

Additional Curriculum Elements

Several packages address the cognitive, psychological, or emotional challenges associated with asthma and asthma self-management, which our KIs identified as critical for successful asthma care. The *Asthma Workbook* and *Women Breathe Free* emphasize individual goal setting to address asthma symptoms, triggers, and overall health, and provide tools and guided activities to promote goal-oriented self-care. *Asthma Basics for Children* and *Breathe Well, Live Well* discuss stress management, relaxation strategies, and behavioral approaches to improve well-being. *You Can Control Asthma* and *A Breath of Life* address children's feelings about their asthma and strategies for managing those challenges.

We also evaluated whether AS-ME packages include scientifically valid and up-to-date content, and are feasible to implement. Most packages were developed or updated in recent years, including six packages from 2019 or 2018 and three packages introduced or revised between 2013 and 2015. Two packages date from 2010, one is from 2005, and we were unable to determine the timeframe for the remaining two packages. Five packages are explicitly based on and are consistent with current clinical practice guidelines. Our KIs emphasized packages require regular review to ensure their currency, especially when national clinical practice guidelines are updated, and revised periodically to include new therapeutic interventions. Controlled clinical trials evaluating five packages have been published in peer-reviewed journals. Finally, five of the packages report undergoing pilot testing to assess their feasibility in practice. Additional information about the evidence base addressing AS-ME effectiveness and feasibility is described under GQ 3.

A final and critical part of a complex educational curriculum is assessing whether participants have learned the material and implemented new asthma management strategies in response to that learning. The packages we reviewed measure their impact in a variety of ways. Five packages include a set of knowledge-based questions that are administered before and after completion of the program, or upon completion of individual units/chapters/sessions, to determine the extent to which information was understood and retained. In a variation on this approach, *Open Airways for Schools* uses verbal questions embedded throughout the curriculum to assess student learning. Two packages rely on patient self-testing and assessment to evaluate their progress. Two other packages do not assess knowledge but instead measure each patient's asthma morbidity before and after the program to evaluate clinical improvement.

Recognition of accomplishment is also important for patients and their families. Seven packages provide a formal certificate upon completion of their curriculum. Two of these are school-based, two are home or community-based packages for parents, and three are home-based packages for adults with asthma.

Table 5. Asthma self-management education packages: curriculum

Package*	Lung or Asthma Physiology	Controller or Rescue Medications	Alternative Medications	Adherence Strategies	Inhaler Use	Spacer Use	Nebulizer Use	Peak Flow Meter Use	Symptom Control	Triggers	Psychosocial Elements
A Breath of Life NHLBI (2014)	✓	✓		✓	✓			✓	✓	✓	✓
Asthma 101 ALA (Year NR)	✓	✓			✓	✓		✓	✓	✓	
Asthma Basics for Children AAFA (2010)	✓	✓	✓						✓	✓	✓
Asthma Care for Adults AAFA (2018)	✓	✓			✓	✓	✓	✓	✓	✓	✓
Asthma Workbook University of Michigan (2018)	✓				✓	✓		✓	✓	✓	✓
Breathe Well, Live Well ALA (2019)	✓	✓			✓		✓	✓	✓	✓	✓
Kickin' Asthma ALA (2015)	✓	✓			✓	✓		✓	✓	✓	
Open Airways for Schools ALA (2018)	✓	✓			✓				✓	✓	
Severe Asthma Care for Adults AAFA (2019)	✓	✓							✓	✓	✓
Wee Breathers AAFA (2013)	✓	✓			✓	✓	✓	✓	✓	✓	
Women Breathe Free University of Michigan (2010)		✓			✓				✓	✓	✓
You Can Control Asthma AAFA (2005)	✓	✓		✓	✓	✓		✓	✓	✓	✓
Total (N=12*)	11	11	1	2	10	6	3	8	12	12	8

AAFA=Asthma and Allergy Foundation of America; ALA=American Lung Association; NASN=National Association of School Nurses; NEEF=National Environmental Educational Foundation; NHLBI=National Heart, Lung, and Blood Institute; NR=Not reported

*Creating Asthma-Friendly Environments and Promoting Access to Guidelines-Based Care for Children with Asthma and Pediatric Asthma Initiative not included because they do not have a patient-facing component.

Table 6. Asthma self-management education packages: content features

Package*	Workbook	Handouts	Activities or Games	Asthma Action Plan	Symptom log or Diary	Medication List	Trigger Checklist	Participant Assessment	Certificate of Participation	Pilot Testing or Validation Studies
A Breath of Life NHLBI (2014)		✓	✓	✓			✓	✓	✓	✓
Asthma 101 ALA (Year NR)				✓		✓	✓		✓	✓
Asthma Basics for Children AAFA (2010)		✓	✓	✓	✓		✓			✓
Asthma Care for Adults AAFA (2018)		✓		✓	✓	✓	✓	✓	✓	

Package*	Workbook	Handouts	Activities or Games	Asthma Action Plan	Symptom log or Diary	Medication List	Trigger Checklist	Participant Assessment	Certificate of Participation	Pilot Testing or Validation Studies
Asthma Workbook University of Michigan (2018)	✓			✓	✓			✓		
Breathe Well, Live Well ALA (2019)	✓			✓			✓	✓		✓
Kickin' Asthma ALA (2015)	✓		✓	✓				✓	✓	✓
Open Airways for Schools ALA (2018)		✓	✓	✓				✓	✓	✓
Severe Asthma Care for Adults AAFA (2019)		✓		✓	✓		✓	✓	✓	
Wee Breathers AAFA (2013)		✓		✓			✓	✓		✓
Women Breathe Free University of Michigan (2010)	✓	✓		✓	✓			✓		
You Can Control Asthma AAFA (2005)	✓				✓			✓	✓	✓
Total (N=12*)	5	7	4	11	6	2	7	10	7	8

AAFA=Asthma and Allergy Foundation of America; ALA=American Lung Association; NASN=National Association of School Nurses; NEEF=National Environmental Educational Foundation; NHLBI=National Heart, Lung, and Blood Institute; NR=Not reported

*Creating Asthma-Friendly Environments and Promoting Access to Guidelines-Based Care for Children with Asthma and Pediatric Asthma Initiative are not included because they do not have a patient-facing component.

Implementation of AS-ME Packages (GQ 2)

The context in which AS-ME is implemented is critically important for success. We explored several major facets of implementation, including the development, dissemination, and availability of AS-ME packages, and the resources used to deliver, support, and sustain them. The packages are summarized in Table 7.

Development and Dissemination

The packages we reviewed were developed and/or are disseminated by nonprofit associations, academic institutions, or the federal government. Two leading organizations in promoting asthma care—ALA and AAFA —accounted for 9 of the 14 packages. NEEF has two packages, including one in collaboration with the National Association for School Nurses. Two packages come from the University of Michigan, and the remaining package is a project of NHLBI. The packages that we could not acquire or review fit a similar pattern, coming from institutions such as the Association of Asthma Educators, the American Association for Respiratory Care, Vanderbilt University, and Rush University Medical Center. We did not identify any AS-ME packages developed by for-profit commercial interests.

We found little information about how AS-ME packages are developed when we reviewed the materials contained in each package and the websites of the organizations that developed or promote them. Two packages disseminated by ALA and one package promoted by AAFA were

initially designed and tested by independent groups of clinicians and researchers, whose work was later adopted and branded by those organizations. Other packages appear to have been developed in-house by the groups that currently disseminate them, but details are generally scarce. Several packages acknowledge individuals involved in their development but lack discussion about how they conducted their work. A few packages briefly describe field testing and review by clinical experts but do not provide additional context. Some packages do not include any details about the processes used in their development.

Based on their experiences, our KIs also provided insight, into some of the roles professional organizations serve in the development of AS-ME packages. For example, clinicians and other asthma educators often contact content developers to request additional content or tools that address challenges that may be specific to a patient population or a geographic region, and this can lead to development of new materials. Developers also partner directly with organizations representing specific populations, such as African-American or Hispanic patients, to tailor AS-ME packages to the needs of those communities. One recent effort has focused on collaboration with faith-based organizations to better reach their constituents. However, some developers do not have a direct relationship with patients and rely instead on providers and other stakeholders to inform their work and help shape their AS-ME efforts.

Costs and Resources

Data on the cost or resources associated with developing, producing, or disseminating AS-ME packages are also lacking. We found no publicly available information about such factors, and we identified no studies of specific packages that addressed the costs of development or implementation. Our KIs, including representatives from organizations that develop or promote AS-ME packages, did not address issues of cost or other resources.

Reporting of external grant funding is the one important exception to the paucity of information on resource use and cost. Nine of 14 packages report funding support from CDC, while one package was developed and funded by NHLBI. Three packages that received CDC funding also received funding from other Federal agencies, State health departments, and/or foundations. The packages do not disclose the amount of support received or how those resources were used.

Training

As nearly all packages we reviewed were designed to include in-person teaching, we examined how facilitators might be recruited, selected, trained, and evaluated.

For three packages disseminated by the ALA, the organization provides online training courses for nurses, teachers, and others who intend to administer their packages. Trainees are self-selected and complete training at their own pace. When training is complete, instruction manuals are available to guide their work. We could not determine if ALA evaluates or reviews the performance of asthma educators in the field, or if any mechanism for communicating updated materials or providing periodic retraining exists.

AAFA also provides training in asthma education, with programs that are open broadly to interested participants and not linked directly to specific AS-ME packages. However, AAFA packages include extensive training manuals, and advise program planners to enlist support from teachers, school nurses, respiratory therapists, community health workers, or others who are or could become proficient in facilitating asthma education.

Aside from ALA and AAFA, we were unable to gain substantial insight into educator training. NHLBI's *A Breath of Life* is designed to prepare *promotoras* who then educate families in the community. The package offers extensive information on the curriculum provided to the promotoras, but we could not identify who actually administers their training. Similarly, the other packages refer generally to asthma educators, nurse educators, or peers as responsible for administering the respective packages, but additional details were not available and we did not identify any instructor manuals for those packages.

AAE offers numerous online training courses for professionals involved with asthma education. Some courses address broad themes in asthma care while others focus on specific interventions, skills, or patient populations. Most courses offer continuing medical education credits and involve a fee, although some resources are available free to AAE members. These programs are not tailored to specific AS-ME packages, but they are likely to provide knowledge and skills that could prepare asthma educators to implement AS-ME interventions.

Our KIs suggested that many types of health professionals, including (but not limited to) nurses, respiratory therapists, and community health workers, can facilitate AS-ME with appropriate training. However, they cautioned that educators are most effective when trained in the specific skills and tools included in a given package (such as a particular technique for inhaler use or a patient self-assessment instrument) and that skills and tools may vary by package. They also acknowledged that little funding is available for AS-ME training.

Adaptability

One of the most important aspects of AS-ME implementation is the frequent need to adapt a program to a local setting, specific population, or even an individual patient. AS-ME packages often include a broad and complex set of elements, including lesson plans, assessment instruments, patient and parent handouts, and supplemental audiovisual material. When a clinician, asthma educator, or school nurse implements a package, they may consider whether every facet of the curriculum or each supporting tool useful for their target audience. Since patients, settings, and resources vary widely, it is common for local sites to modify a branded program to better suit the patients they serve.

Adaptation may be minor (such as omitting part of a lesson that is less relevant for a certain population or replacing a given handout with another from a different source) or a major departure in which substantive components of several different packages are combined with local resources to form a new set of materials. Many providers have developed homegrown packages that may build on or mirror valuable elements of existing packages, but include new elements or creative approaches to implementation. Our KIs emphasized that flexibility of AS-ME materials is vitally important to clinicians and asthma educators. Packages containing elements that can be used independently and do not require a fixed, step-by-step approach to complete, offer greater opportunities for users to adapt them as needed.

Our review of the published literature, described below in response to GQ 3, identified several studies that examined modified versions of popular branded packages. Unfortunately, it was difficult to determine—from our analysis of existing packages, our review of the literature, or our KI discussions—how frequently AS-ME packages are modified in practice, or whether similarities or patterns in how packages are adapted by different users exist.

Additional Barriers to Implementation

In addition to emphasizing the importance of adaptability, our KIs identified several other potential challenges to successful AS-ME implementation. First, patient beliefs and values sometimes conflict with recommended practices. For example, some patients have misconceptions about asthma medications, or prefer alternative treatments that are not evidence based. Clinicians and educators must be able to recognize these concerns, and need strategies and tools that foster productive conversations with patients. A second challenge stems from the need for patients to navigate across many different settings on a daily basis, from home to work, from school to playground. Optimal self-management requires awareness of how different places or activities can affect asthma, and how to adapt. Education should address these challenges directly and offer clear strategies that can be remembered and internalized. Finally, patients with asthma face a major challenge that is all too common across healthcare: disjointed coordination and communication among providers, patients, families, teachers, coaches, and other caregivers. AS-ME packages should strive to include curriculum and strategies that facilitate communication and coordination among the many professional and personal stakeholders that are crucial to patients with asthma.

Table 7. Asthma self-management education packages: sponsorship, development, funding, and training

Package	Sponsor: Patient/Health Advocacy Organization	Sponsor: Educational Foundation	Sponsor: Professional Association	Sponsor: University	Sponsor: Governmental Agency	Developed In-house	Adapted From Previous Research	Funding: CDC	Funding: Other Federal / State Agencies	Funding: Foundation Grants	Training Provided By Sponsor	Instructional Manual Included
A Breath of Life NHLBI (2014)					✓	✓			✓			✓
Asthma 101 ALA (Year NR)	✓					✓						
Asthma Basics for Children AAFA (2010)	✓						✓	✓	✓	✓		
Asthma Care for Adults AAFA (2018)	✓					✓		✓				✓
Asthma Workbook University of Michigan (2018)				✓		✓						
Breathe Well, Live Well ALA (2019)	✓						✓	✓			✓	✓
Creating Asthma-Friendly Environments and Promoting Access to Guidelines-Based Care for Children with Asthma NEEF & NASN (2018)		✓	✓			✓		✓				
Kickin' Asthma ALA (2015)	✓					✓		✓		✓	✓	✓
Open Airways for Schools ALA (2018)	✓						✓	✓	✓		✓	✓
Pediatric Asthma Initiative NEEF (Year NR)		✓				✓		✓				
Severe Asthma Care for Adults AAFA (2019)	✓					✓						
Wee Breathers AAFA (2013)	✓					✓		✓				✓
Women Breathe Free University of Michigan (2010)				✓								
You Can Control Asthma AAFA (2005)	✓					✓		✓				✓
Total (N=14)	9	2	1	2	1	10	3	9	3	2	3	7

AAFA=Asthma and Allergy Foundation of America; ALA=American Lung Association; CDC=Centers for Disease Control and Prevention; NASN=National Association of School Nurses; NEEF=National Environmental Educational Foundation; NHLBI=National Heart, Lung, and Blood Institute; NR=Not reported

Overview of Existing AS-ME Packages

Figure 2 summarizes the main components of AS-ME implementation identified in the packages we reviewed, and demonstrates the steps needed to implement AS-ME, and the variation across packages on key factors such as educator training, audience and patient populations and settings, access to materials, and methods for delivering and evaluating learning.

Figure 2. Map of AS-ME characteristics and implementation
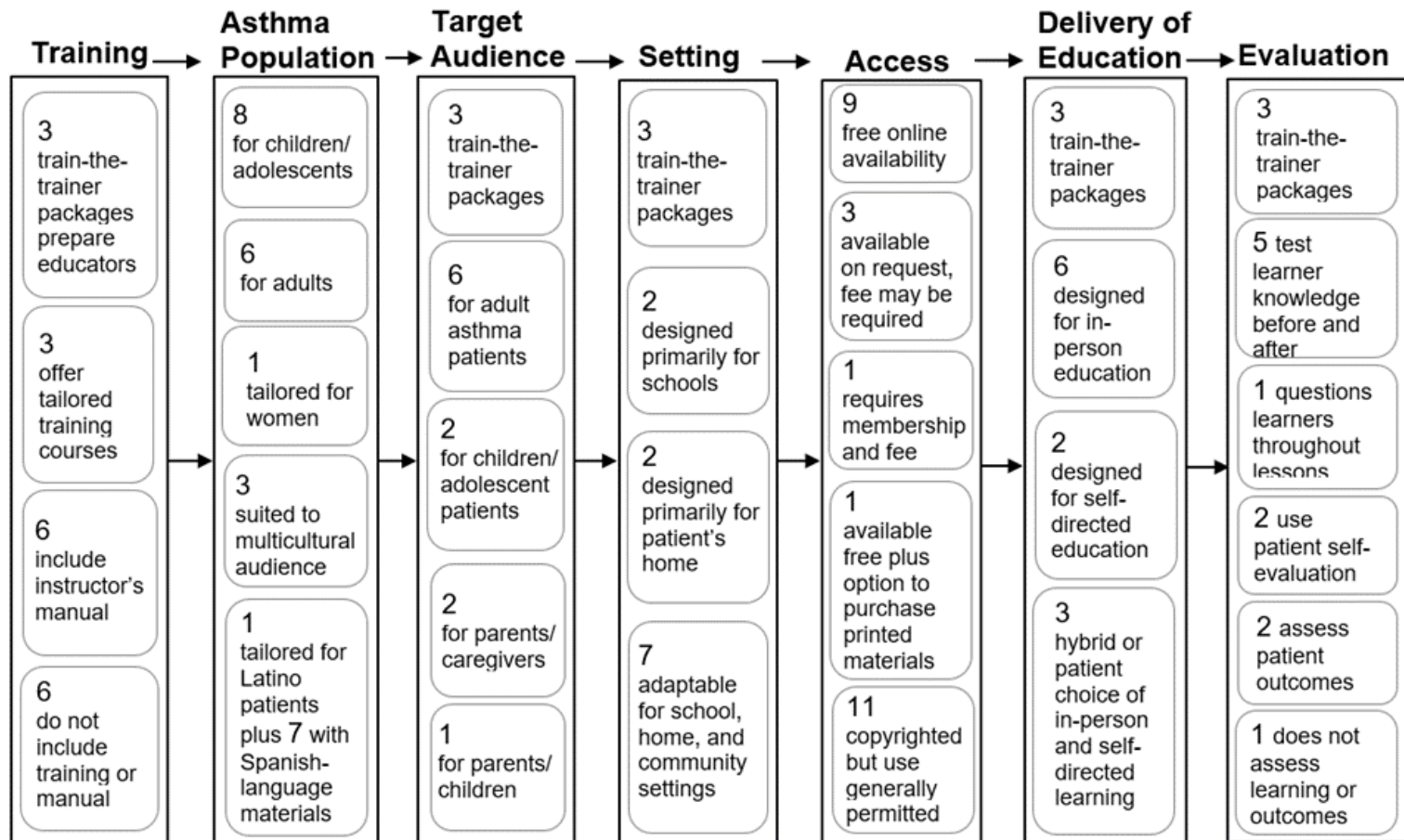
Effectiveness of AS-ME Packages (GQ 3)

To evaluate the effectiveness of AS-ME packages, we conducted structured literature searches for published studies as described in the Methods chapter. Our searches identified 7 systematic reviews, 16 RCTs, 16 observational studies, and 1 descriptive study of AS-ME packages published since 2007. All of the systematic reviews included RCTs, and five of the seven incorporated other study designs as well. Figure 3 summarizes the study designs included in the evidence base. Evidence tables summarizing each systematic review and primary study are in Appendix D.

Figure 3. Study designs of included articles
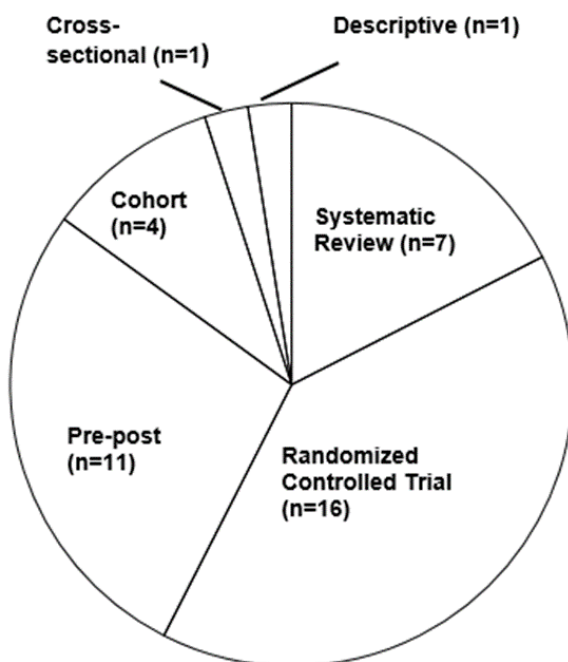
Specific AS-ME Packages

In GQs 1 and 2 we evaluated 14 AS-ME packages. Four of those packages were examined in eight primary studies identified in our searches: *Asthma 101, Asthma Basics for Children, Kickin' Asthma,* and *Open Airways for Schools*. We identified no studies assessing the other nine packages.

In addition to these 8 studies, we identified 10 primary studies that examined 9 other packages with unique names or brands. We also included 15 primary studies of homegrown AS-ME packages that were developed for use in a local community or clinical setting, but not sponsored or disseminated by a national organization or branded in some way. Table 8 lists the packages included in the primary studies and Table 9 highlights key findings for each package.

Table 8. Asthma Self-Management Education Packages in Primary Studies

Named Packages from Grey Literature Search With Published Studies on Effectiveness	Other Named Packages Assessed in Primary Studies	Homegrown Packages Assessed in Primary Studies
Asthma 101: pre-post[9] **Asthma Basics for Children**: pre-post[10] **Kickin' Asthma**: pre-post[11] and cohort[12] **Open Airways for Schools**: 3 RCTs[13-15] and 1 cohort[16]	**ASMA: Asthma Self-Management for Adolescents**: RCT[17] **Asthma Blues**: pre-post[18] **Asthma: It's a Family Affair!**: RCT[19] **Fight Asthma Now**: RCT[20] **Green Means Go**: pre-post[21] **Healthy Homes**: pre-post[22] **I Can Cope**: RCT[13] **Partners in School Asthma Management**: RCT[23] **Puff City**: RCT[24] **SHARP: Staying Healthy-Asthma Responsible & Prepared**: 2 RCTs[25,26]	**6 RCTs**[27-32] **5 pre-post**[33-37] **2 cohort**[38,39] **1 cross-sectional**[40] **1 descriptive**[41]

Setting

Nearly half the primary studies (17 of 33) examined packages implemented in schools, while 6 studies[18,27,36,38,39,41] took place in hospitals, and 6[28,30,31,34,35,37] in community settings. Only 3 studies[22,29,33] evaluated AS-ME initiatives in a patient's home, and the remaining study[9] used *Asthma 101* as a training module for nursing students.

Similarly, the systematic reviews consisted mainly of school-based primary studies. Three reviews[42-44] focused exclusively on school-based interventions, while one[45] examined AS-ME conducted by school nurses or community-based nurses. Another review[8] evaluated peer-led programs in schools or camps, and one[46] assessed programs implemented in school, community, and healthcare settings. Finally, one review[7] examined interventions designed to train healthcare professionals to provide AS-ME. Figure 4 summarizes study setting according to study design.

This evidence base indicates strong interest in school settings and a paucity of studies of home-based interventions. Notably, this diverges from the packages we summarized in GQs 1 and 2, where home-based interventions were more common than any other setting.

Figure 4. Setting of published studies
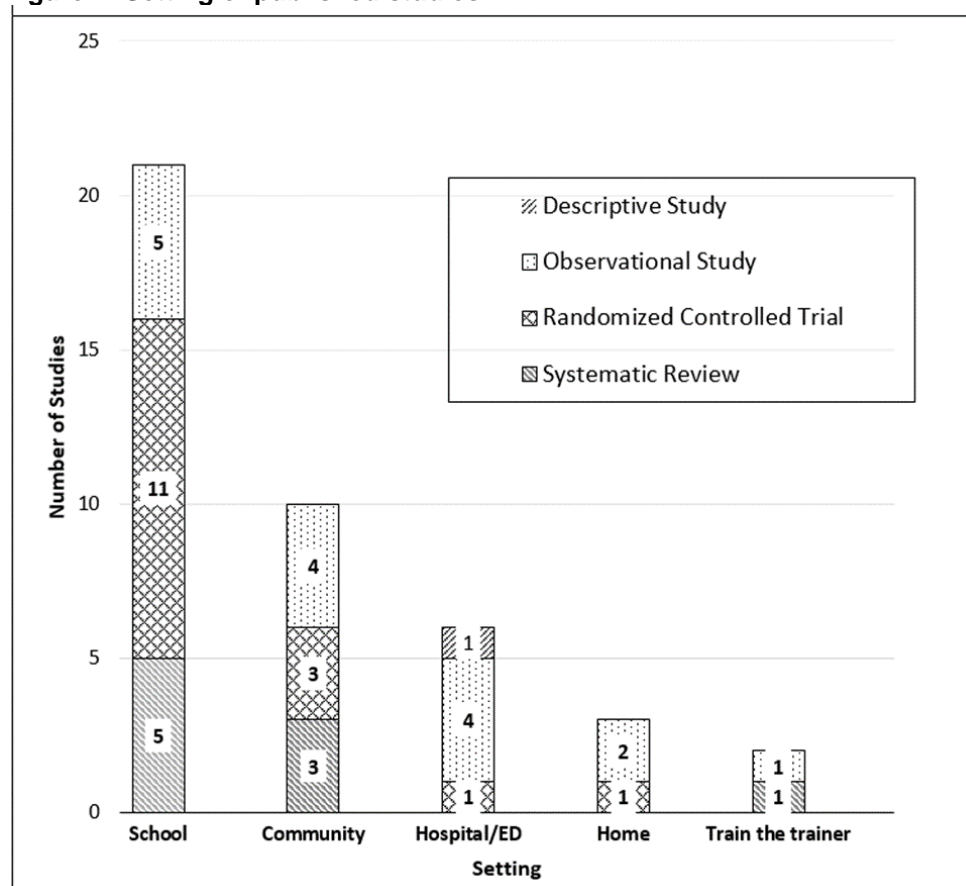
Population

Given the predominance of school-based interventions, it is not surprising that 24[10-17,19-26,32-34,36,38-41] of 33 primary studies evaluated children or adolescents, while only 8[18,27-31,35,37] focused on adults with asthma. Additionally, all 7 systematic reviews focused on children or adolescents. Figure 5 summarizes the age distribution of included studies by study design. All primary studies we evaluated were conducted in the United States, per our inclusion criteria. Every systematic review included both U.S.- and non-U.S.-based studies.

Most primary studies focused on communities with large minority populations and indicators of low socioeconomic status. Twenty-one studies (12 RCTs[13-15,17,19,20,23-27,32] and 9 observational studies[10,18,21,22,33,34,36,38,39]) were conducted in populations comprising more than 50 percent Black (including African-American, Caribbean, and/or African), and/or Hispanic or mixed race/ethnicity patients. Five other studies did not describe patient race or ethnicity.[11,16,28,35,41] Seven RCTs[13-15,17,20,23,24] and seven observational studies[16,21,22,33,34,38,39] primarily enrolled patients likely living close to the poverty line, as indicated by income, insurance coverage, or eligibility for public programs. However, almost none of the remaining studies reported data addressing socioeconomic status.

Asthma severity was reported in about half of primary studies.[13-15,17,19,24-27,29,30,33,34,39,40] Patients in those studies were more likely to have mild or moderate asthma, while severe asthma was generally less common. Few studies reported on other health measures such as patient comorbidity or body mass index.

Figure 5. Population of published studies
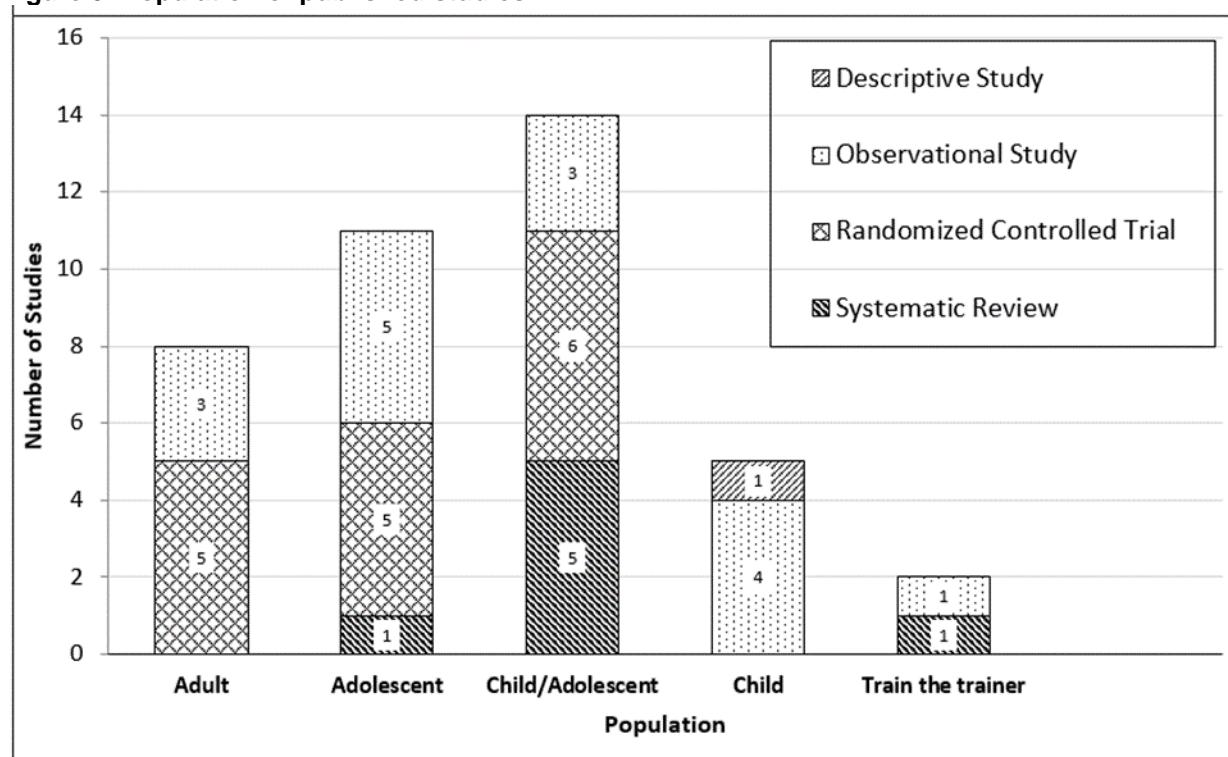
Outcomes

Important asthma outcomes include asthma control, symptom frequency, emergency department (ED) visits, hospitalizations, and medication use. We found that studies examined a variety of these key outcomes as described below. Figure 6 summarizes the outcomes reported across studies. Table 9 shows how outcomes were distributed across studies of specific AS-ME packages.

Two systematic reviews performed meta-analysis,[8,42] while the remainder synthesized studies narratively. Most reviews did not synthesize the key characteristics of interventions used in the individual studies. One review,[46] however, identified eight factors associated with successful approaches, including structured curricula, reinforcement, active participation, collaboration, autonomy, feedback, multiple exposure, and problem solving.

We did not assess study quality for individual primary studies per our protocol and the standard procedures for Technical Briefs, but we note that six of seven systematic reviews[7,8,42,44-46] assessed study quality using standardized evaluation tools and found that most primary studies were at high or unclear risk of bias.

Clinical Measures

Eight primary studies[13,14,27,31,33-35,40] measured asthma control, usually through standardized instruments such as the Asthma Control Test or Asthma Control Questionnaire. Six [13,27,33-35,40] found that AS-ME interventions significantly improved asthma control, while two[14,31] found no difference.

Symptom frequency was reported in 11 primary studies and 2 systematic reviews, using data collected through diaries, logs, phone calls, and in-person visits; seven[10,11,15,22,24,30,33] of these

studies found that symptoms were reduced, while four primary studies[17,19,23,31] and both systematic reviews[8,44] found no difference.

Ten primary studies[10,11,17,22,24,29,33,34,38,39] examined the effect of AS-ME on ED visits and nine primary studies[10,17,22-24,29,33,34,39] measured the effect on hospitalizations, while two systematic reviews[42,43] evaluated both outcomes. Results were mixed, with a little more than half of primary studies and one review reporting significant reductions in use, while the remaining studies found no difference—and one study[38] found that ED visits increased after implementation. Three primary studies[25,28,31] collected data on medication use and all of them found that AS-ME did not significantly affect patients' use of maintenance or rescue medications.

Patient-Centered Measures

Several patient-centered outcomes often associated with asthma were also measured. Knowledge and understanding of asthma by patients and/or parents was evaluated in 12 primary studies[9,16,18-21,26,32,35-37,41] and 2 systematic reviews,[44,45] using a variety of pre and post-test tools to identify learning. All of these studies found that knowledge improved, which is encouraging but may also indicate publication bias.

Asthma-related quality of life (QoL) was assessed in 12 primary studies and 2 systematic reviews[8,44] as well, usually through standardized surveys such as the Asthma Quality of Life Questionnaire or the Pediatric Asthma Quality of Life Questionnaire. Six[13,17,28,33,35,37] of 12 primary studies found QoL improved, while six primary studies[14,15,24,27,29,30] and both reviews found no difference.

Six primary studies and three systematic reviews measured school absences, with five primary studies[10,11,17,22,34] and one review[43] reporting fewer absences associated with AS-ME and one primary study[24] finding no difference. The other two reviews[42,44] reported mixed results.

Finally, two primary studies[23,28] found that patients who participated in AS-ME were more likely to avoid exposure to asthma triggers, while one study[12] found no effect on patient behavior regarding trigger avoidance.

AS-ME Packages Evaluated In GQs 1 and 2

Four studies (three RCTs[13-15] and one cohort study[16]) evaluated *Open Airways for Schools*. Three studies identified improvement in asthma control,[13] symptom frequency,[15] QoL,[13] or asthma knowledge,[16] while one study[14] reported no difference in asthma control or QoL. *Kickin' Asthma* was assessed in one pre-post[11] and one cohort[12] study. One study[11] found the intervention was associated with significantly reduced risk for ED visits, asthma symptoms, and school absences; the other study[12] reported that patients who completed the program used peak flow meters and spacers more frequently but there was no change in use of rescue medications or avoidance of asthma triggers. A pre-post study[10] found that *Asthma Basics for Children* was associated with fewer ED visits, hospitalizations, symptoms, and daycare absences, and increased parent knowledge. A pre-post study[9] using *Asthma 101* to train nursing students found that the package was effective at improving students' knowledge.

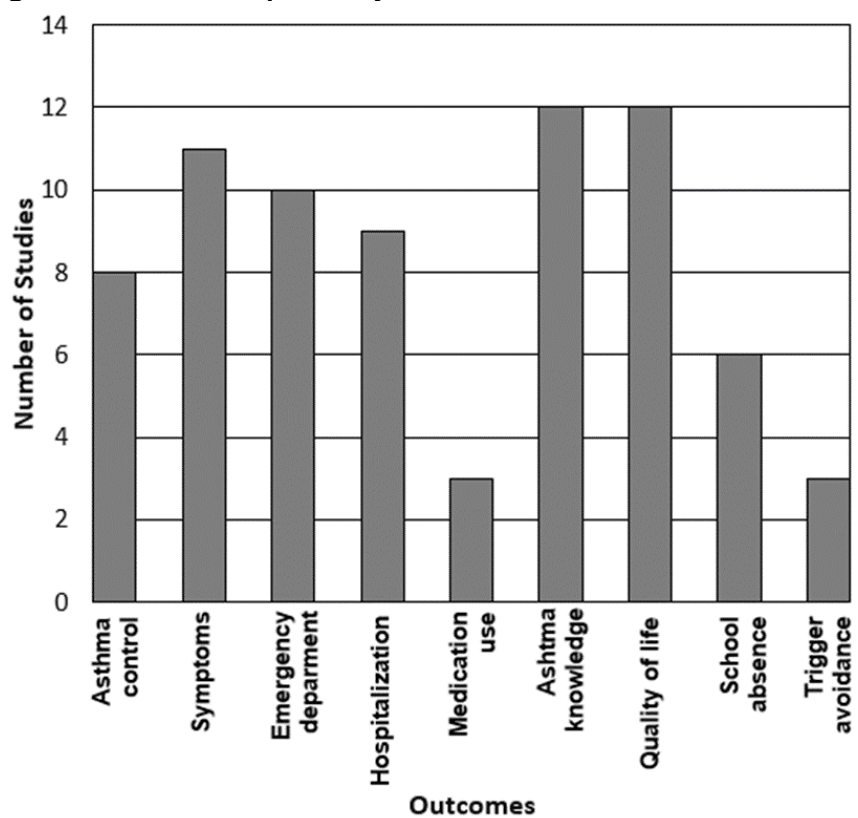**Figure 6. Outcomes reported by included studies**

Table 9. Summary of primary study outcomes by AS-ME package

Asthma Self-Management Education Package	Setting	Population	Asthma Control	Symptom Frequency	Hospitalization / ED Visits	Device/ Medication Use	Asthma Knowledge	Quality of Life
ASMA: Asthma Self-Management for Adolescents 1 RCT[17] (N=345)	School	Adolescents		No effect	Reduced			Improved
Asthma 101 1 Pre-post[9] (N=158)	Training	Nursing students					Improved	
Asthma Basics for Children 1 Pre-post[10] (N=874)	Child care center	Children		Reduced	Reduced			
Asthma Blues 1 Pre-post[18] (N=10)	Hospital	Adults				Improved	Improved	
Asthma: It's a Family Affair! 1 RCT[19] (N=24)	School	Adolescents		No effect			Improved	
Fight Asthma Now 1 RCT[20] (N=536)	School	Children/ Adolescents				Improved	Improved	
Green Means Go 1 Pre-post[21] (N=103)	School	Children					Improved	
Healthy Homes 1 Pre-post[22] (N=115)	Home	Children		Reduced	Reduced ED visits No effect on hospitalizations			
I Can Cope 1 RCT[13] (N=104)	School	Children/ Adolescents	Improved					Improved
Kickin' Asthma 1 Pre-post[11] (N=513); 1 Cohort[12] (N=87)	School	Adolescents		Reduced in pre-post study[11]	Reduced in pre-post study[11]	No effect in cohort study[12]		
Open Airways for Schools 3 RCTs[13-15] (N=1493); 1 Cohort[16] (N=65)	School	Children/ Adolescents	Improved in 1 RCT[13] No effect in 1 RCT[14]	Reduced in 1 RCT[15]			Improved in cohort study[16]	Improved in 1 RCT[13] No effect in 2 RCTs[14,15]
Partners in School Asthma Management 1 RCT[23] (N=835)	School	Children/ Adolescents		No effect	No effect			

Asthma Self-Management Education Package	Setting	Population	Asthma Control	Symptom Frequency	Hospitalization / ED Visits	Device/ Medication Use	Asthma Knowledge	Quality of Life
Puff City 1 RCT[24] (N=314)	School	Adolescents		Reduced	No effect on ED visits Reduced hospitalizations			No effect
SHARP: Staying Healthy-Asthma Responsible & Prepared 2 RCTs[25,26] (N=270)	School	Children/ Adolescents				No effect in 1 RCT[25]		
Homegrown (N=15) • 6 RCTs[27-32] (N=876) • 5 Pre-post[33-37] (N=388) • 2 Cohort[38,39] (N=1696) • 1 Cross-sectional[40] (N=456) • Descriptive[41] (N=156)	All settings	All populations	Improved in 2 RCTs,[27,30] 3 pre-post studies,[33-35] 1 cross-sectional study[40] No effect in 1 RCT[31]	Reduced in 1 RCT[30] and 1 pre-post study[33] No effect in 1 RCT[31]	Reduced in 2 pre-post studies[33,34] No effect in 1 RCT[29], 1 cohort study[39] Increased in 1 cohort study[38]	Improved in 1 RCT[32] and 2 pre-post studies[35,37] No effect in 2 RCTs[28,31]	Improved in 1 RCT,[32] 3 pre-post studies,[35-37] 1 descriptive study[41]	Improved in 1 RCT[28], 3 pre-post studies [33,35,37] No effect in 3 RCTs[27,29,30]

ED=emergency department; QoL=quality of life; RCT=randomized controlled trial
Note:
Blank cells indicate the outcome was not reported.
*Children defined as under age 10; Adolescents defined as ages 10 to 17

Evidence Gaps and Challenges (Guiding Question 4)

Table 10 highlights areas where current and future AS-ME packages could better serve patient needs, and identifies knowledge gaps that could be addressed by further research.

Table 10. Future needs in AS-ME development, implementation, and research

Development of AS-ME	Implementation of AS-ME	Research on AS-ME
Language and Literacy • Packages in languages other than English and Spanish would benefit many growing and underserved patient populations • Packages designed for varying learning styles would be beneficial • Translation of audio and visual components – not just text – is also important • Many packages do not indicate the level of general literacy or health literacy needed for comprehension **Asthma Severity** • Most packages do not identify if they are appropriate for patients with mild, moderate, or severe asthma **Updating and Revision** • Some of the most popular and widely studied packages were the earliest ones developed, and may require updating to cover emerging issues in asthma care and new standards of practice **Costs and Resources** • Few details are publicly known about the costs and resources needed to develop and disseminate AS-ME packages; sharing information could benefit future developers and innovators and encourage funding support	**Accessibility** • Several packages require fees or are limited to organizational members • Many packages are homegrown and are not known or available to others **Technology Platforms** • Uptake of technological tools including asthma apps and online delivery of AS-ME is slow and poorly sustained **Adaptability** • Little is known about the prevalence of modified packages, or the types of adaptations that most commonly occur **Training** • Resources and payment models for educator training are scarce • Many packages do not indicate whether a facilitator would need specific skills or knowledge – beyond general training in asthma education – to address any unique aspects of a given curriculum • Assessment of trainers and training programs would be informative **Coordination** • More resources are needed to guide patients on achieving self-management across different settings such as school, home, and recreational activities • Coordination between patients, caregivers, providers, and educators is often inadequate	**Population** • More research in adult populations are needed • Studies do not adequately report asthma severity or comorbidity • Studies do not adequately report socioeconomic factors, including housing status and income, that interact with many asthma interventions **Settings** • Studies of home-based interventions are lacking • More studies of AS-ME in healthcare facilities and community settings are also needed • Few studies address the implementation or effectiveness of self-directed AS-ME packages **Outcomes** • Studies reporting standard measures of asthma control are needed • Studies that evaluate school and work absenteeism, medication use, and trigger avoidance are also lacking **Effectiveness** • For many existing packages there are no published studies of their effectiveness • Almost no controlled trials compare packages to each other or to other substantive asthma interventions • Research is lacking on how patients and families perceive the value and sustainability of AS-ME

Summary and Implications

Guiding Question 1: Structure and Content of Asthma Self-Management Education Packages

Our review of 14 asthma self-management education (AS-ME) packages currently available in the United States found that robust packages exist for adults, adolescents, children, and parents of children with asthma. A few widely used packages are designed for use in schools, while numerous packages are intended for implementation in community-based sites, healthcare facilities, patient homes, or all of these settings. A few packages focus on specific asthma populations including Latino patients, women, multicultural or minority communities, or low-income areas. Three packages focused on patients with severe asthma, but we did not identify any packages designed specifically for patients with significant comorbidity.

Most packages require or offer education facilitated in-person by a trained instructor, while fewer packages rely mainly on self-directed education by a patient at home. In-person programs are usually led by a nurse, school nurse, respiratory therapist, community health worker, or other trained asthma educator. Learning materials are typically paper-based and include workbooks and handouts for patients, and useful tools such as asthma action plans and checklists to identify asthma triggers at home. All packages are available in English and many have been translated into Spanish, but materials are not available in other languages. Most packages are freely accessible and can be downloaded by anyone, but some are only available for a fee. We note that we were unable to access several potentially relevant packages.

Educational content across AS-ME packages had many similarities, addressing basic knowledge of asthma, medication and device use, symptom management, environmental and behavioral triggers, goal setting, and learner evaluation. However, specific details vary between packages, including techniques for device use or medication guidelines. Most packages were developed or updated in the past 6 years, but older packages may require revision or updating. Additionally, an update to widely disseminated guidelines for asthma care is expected soon and may require review and revision of packages to ensure content is evidence-based.

Guiding Question 2: Implementation of AS-ME Packages

Implementation of AS-ME packages varies widely. Instructors often tailor packages to best suit their patients, settings, or available resources, an affirmation of the importance of adaptability for successful packages. Numerous homegrown packages also exist, though we know less about those efforts as they are generally more difficult for the general public to access. Guidance for facilitators also varies, with some packages providing comprehensive instructional manuals while others supply minimal or no instruction. Prominent organizations including the American Lung Association, Asthma and Allergy Foundation of America, and Association of Asthma Educators, offer online or in-person courses to prepare educators to implement AS-ME. Three packages we reviewed were train-the-trainer programs intended specifically for clinicians, community health workers, and other asthma educators.

Most packages were developed or are disseminated by a small number of leading professional or patient advocacy organizations. Little is known about the financial resources, staffing, and time needed to develop AS-ME packages. Many of the packages currently available were funded in part by government agencies, especially the Centers for Disease Control and Prevention.

Guiding Question 3: Effectiveness of AS-ME Packages

We identified a substantial evidence base assessing the effectiveness of AS-ME in the United States. Our searches identified 7 systematic reviews published since 2007, as well as 16 randomized controlled trials, 16 observational studies, and 1 descriptive study. Half of published studies evaluated school-based packages, while community- or hospital-based packages accounted for most of the remainder. Only a few studies examined home-based interventions. Similarly, three-quarters of the studies were conducted in child and/or adolescent populations, while far fewer studies focused on adult patients. Most studies occurred in communities with large racial and/or ethnic minority populations and low markers of socioeconomic status.

Outcomes most frequently reported in primary studies were asthma knowledge, asthma-related quality of life, and asthma symptoms. Numerous studies also reported asthma-related hospitalizations, emergency department use, and asthma control. Few studies examined asthma-related school absences, use of maintenance or rescue medications, or avoidance of asthma triggers. In general, AS-ME packages were associated with improved asthma control, reduced symptom frequency, increased asthma knowledge, and fewer school absences. Results across the studies were mixed when examining hospitalizations, emergency department visits, and quality of life.

Only 4 of 14 AS-ME packages included in this Technical Brief were evaluated in the research studies we identified. Instead, nearly half of studies examined homegrown AS-ME packages, which we were unable to access. However, of the studies assessing four packages evaluated in this Technical Brief, 7 of 8 studies found that AS-ME packages were associated with substantial improvement in key outcomes.

Guiding Question 4: Next Steps

Developers and Disseminating Organizations can:
- address patient population needs by expanding translation of AS-ME materials to audiovisual components and additional languages; indicating the literacy level required for comprehension; designing packages for learners with differing learning styles; and developing packages for patients across the spectrum of asthma severity and with substantial comorbidity
- ensure current content through revision and updating
- inform future AS-ME initiatives by sharing data on costs, staffing, and time needed for development, testing, and dissemination
- expand availability of materials by reducing or eliminating barriers to access
- improve cross-pollination of ideas and foster innovation by sharing homegrown approaches
- invest in technological platforms that can expand the reach of AS-ME packages in a variety of ways, including web-based programs, mobile apps, and telehealth

- improve usability by identifying components of a package that may require specific skills or knowledge by a facilitator
- develop content to address the challenges of managing asthma across different settings and coordinating care among across providers and caregivers

Researchers can:
- address patient population needs by evaluating AS-ME packages designed for adult asthma patients; increase study of home-based, community-based and self-directed packages; routinely report asthma severity, comorbidity, and socioeconomic factors in published studies; and examine how patient literacy/health literacy, cultural competence of AS-ME educators/providers, and social determinants of health influence the use and effectiveness of AS-ME packages
- examine the extent to which current AS-ME packages are being used, for all asthma patients and among higher risk subgroups
- describe and evaluate how packages are modified and adapted to local circumstances
- improve the rigor of outcome reporting by including standard measures of asthma control and absenteeism, and developing methods to more effectively assess and report medication use and trigger avoidance
- strengthen the body of evidence for AS-ME packages by researching packages that have not been widely studied, and conducting head-to-head studies that compare packages to other packages and to other widely used interventions
- examine how current evidence could guide development of model AS-ME packages for different audiences and patient populations

Policymakers can:
- support new research and development with increased and new funding sources
- promote training for asthma educators and other instructional facilitators by exploring payment models to reimburse their services
- foster innovation by supporting the coordination of strategic efforts by developers to share data and ideas
- amplify the work of developers and disseminators through the nation's public health infrastructure
- encourage and guide standardization or alignment of AS-ME components across packages to enable more efficient implementation

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37. Tousman S, Zeitz H, Taylor LD, et al. Development, implementation and evaluation of a new adult asthma self-management program. J Community Health Nurs. 2007 Win;24(4):237-51. http://dx.doi.org/10.1080/07370010701645893. PMID: 18092916.

38. Davis AM, Benson M, Cooney D, et al. A matched-cohort evaluation of a bedside asthma intervention for patients hospitalized at a large urban children's hospital. J Urban Health. 2011 Feb;88 Suppl 1:49-60. http://dx.doi.org/10.1007/s11524-010-9517-6. PMID: 21337051.

39. Tolomeo C, Savrin C, Heinzer MM. Impact of asthma self-management on pediatric emergency department visits and hospitalizations. J Asthma Allergy Educ. 2010;1(2):61-70. http://dx.doi.org/10.1177/2150129710367803.

40. Rasberry CN, Cheung K, Buckley R, et al. Indicators of asthma control among students in a rural, school-based asthma management program. J Asthma. 2014 Oct;51(8):876-85. http://dx.doi.org/10.3109/02770903.2014.913620. PMID: 24730771.

41. McCarty K, Rogers J. Inpatient asthma education program. Pediatr Nurs. 2012 Sep-Oct;38(5):257-63, 69. PMID: 23189776.

42. Kneale D, Harris K, McDonald VM, et al. Effectiveness of school-based self-management interventions for asthma among children and adolescents: findings from a Cochrane systematic review and meta-analysis. Thorax. 2019 May;74(5):432-8. http://dx.doi.org/10.1136/thoraxjnl-2018-211909. PMID: 30686788.

43. Ahmad E, Grimes DE. The effects of self-management education for school-age children on asthma morbidity: a systematic review. J Sch Nurs. 2011 Aug;27(4):282-92. https://dx.doi.org/10.1177/1059840511403003. PMID: 21478414.

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42.http://dx.doi.org/10.1542/peds.2008-2085. PMID: 19651589.

45.	Isik E, Fredland NM, Freysteinson WM. School and community-based nurse-led asthma interventions for school-aged children and their parents: a systematic literature review. J Pediatr Nurs. 2019 Jan-Feb;44:107-14. Epub 2018 Nov 21. http://dx.doi.org/10.1016/j.pedn.2018.11.007.

46.	Saxby N, Beggs S, Battersby M, et al. What are the components of effective chronic condition self-management education interventions for children with asthma, cystic fibrosis, and diabetes? A systematic review. Patient Educ Couns. 2018 Nov 13;102(4):607-22. Epub 2018 Nov 13. http://dx.doi.org/10.1016/j.pec.2018.11.001. PMID: 30471988.

Appendix A. Search Strategies

Resources Searched

ECRI Institute information specialists searched the following bibliographic databases and websites for relevant information. Detailed search strategies for each bibliographic database appear below.

Bibliographic Databases

Name	Date Limits	Platform/Provider
Cochrane Database of Systematic Reviews (Cochrane Reviews)	2007 through December 15, 2019	Wiley
Cumulative Index of Nursing and Allied Health Literature (CINAHL)	2007 through December 15, 2019	EBSCOhost
EMBASE (Excerpta Medica)	2007 through December 15, 2019	Embase.com
MEDLINE	2007 through December 15, 2019	Embase.com
PubMed (publisher supplied/in process citations)	September 1, 2018 through December 15, 2019	NLM

Grey Literature Resources

Name	Date Limits	Platform/Provider
Allergy and Asthma Control Network	All data published through May 3, 2019	allergyasthmanetwork.org
American Academy of Allergy, Asthma & Immunology	All data published through May 3, 2019	aaaai.org
American Association for Respiratory Care	All data published through May 3, 2019	aarc.org
American Lung Association	All data published through May 3, 2019	lung.org
Asthma and Allergy Foundation of America	All data published through May 3, 2019	aafa.org
Association of Asthma Educators	All data published through May 3, 2019	asthmaeducators.org
Centers for Disease Control	All data published through May 3, 2019	cdc.gov
ClinicalTrials.gov	Open/Ongoing trials searched May 2, 2019	clinicaltrials.gov
Environmental Protection Agency	All data published through May 3, 2019	epa.gov
National Heart, Lung, and Blood Institute	All data published through May 3, 2019	nhlbi.nih.gov

Grey Literature

Websites from professional organizations and government agencies were also screened for relevant grey literature. (Grey literature consists of reports, educational materials, promotional documents, and articles produced by government agencies, professional associations and educational facilities. These documents do not appear in the peer-reviewed journal literature.)

Search Strategies

EMBASE/MEDLINE (searched via Embase.com)

Set Number	Concept	Search Statement
1	Asthma self-management education	'asthma self-management education' OR 'asthma self-management education'
2	Specific exemplar programs cited in AHRQ SOW document	'a breath of life' OR 'asthma control for my child' OR 'asthma 101' OR 'asthma basics for children' OR 'asthma education for the community health worker' OR 'breathe well, live well' OR 'community health worker training manual' OR 'open airways for schools' OR 'power breathing' OR 'wee breathers'
3	Asthma	asthma/mj OR asthma*:ti
4	Self Care	'self care'/mj OR 'self help'/mj OR self*:ti
5	Education Programs	education/mj OR (educat* OR program* OR train*):ti
6	Combine Concepts	#1 OR #2 OR (#3 AND #4 AND #5)
7	Apply Date Limits	#6 AND [2007-2019]/py

EMBASE.com Syntax:

*	=	truncation character (wildcard)
/mj	=	denotes a term that has been searched as a major subject heading
/py	=	limit to publication year(s)
:ti	=	limit to title

PubMed

PubMed Publisher-Supplied/In-Process Citations

Set Number	Concept	Search Statement
1	Asthma self-management education	"asthma self-management education" OR "asthma self-management education"
2	Specific exemplar programs cited in AHRQ SOW document	"a breath of life"[tiab] OR "asthma control for my child"[tiab] OR "asthma 101"[tiab] OR "asthma basics for children"[tiab] OR "asthma education for the community health worker"[tiab] OR "breathe well, live well"[tiab] OR "community health worker training manual"[tiab] OR "open airways for schools"[tiab] OR "power breathing"[tiab] OR "wee breathers"[tiab]
3	Asthma	asthma[ti] OR asthma*[ti]
4	Self Care	"self care"[ti] OR "self help"[ti] OR self*[ti]
5	Education Programs	educat*[ti] OR program*[ti] OR train*[ti]
6	Combine Concepts	#1 OR #2 OR (#3 AND #4 AND #5)
7	Apply Date Limits	#6 AND ((inprocess[sb] OR publisher[sb]) NOT pubmednotmedline[sb]) AND 2018/09/01[edat]:2019[edat]

PubMed Syntax

*   =   truncation character (wildcard)
[edat] =   entrez date (date added to database)
[sb]   =   subset
[ti]   =   limit to title field
[tiab] =   limit to title and abstract fields

CINAHL

Set Number	Concept	Search Statement
1	Asthma self-management education	"asthma self-management education" OR "asthma self-management education"
2	Specific exemplar programs cited in AHRQ SOW document	"a breath of life" OR "asthma control for my child" OR "asthma 101" OR "asthma basics for children" OR "asthma education for the community health worker" OR "breathe well, live well" OR "community health worker training manual" OR "open airways for schools" OR "power breathing" OR "wee breathers"
3	Asthma	asthma OR asthma*
4	Self Care	"self care" OR "self help" OR self*
5	Education Programs	educat* OR program* OR train*
6	Combine Concepts and apply date and language limits	#1 OR #2 OR (#3 AND #4 AND #5) Published Date: 20070101-20190431; English Language; Exclude MEDLINE records

CINAHL Syntax

*   =   truncation character (wildcard)

Appendix B. Excluded Asthma Self-Management Education Packages

We reviewed or attempted to review numerous asthma self-management education packages that were not included in the draft Technical Brief. This appendix identifies those packages, their sponsoring organization, and the reason for exclusion.

Package	Sponsor	Reason for Exclusion
Asthma Education for the Community Health Worker	Association of Asthma Educators	Unable to acquire: Requests for access received no response, and we did not identify any online links to the materials.
Breathe Michigan	Unknown	Unable to acquire: We could not identify a contact with direct knowledge of or access to the materials, and we found no online links to the package.
Community Asthma Initiative	Boston Children's Hospital	Did not meet AS-ME criteria as described in Technical Brief protocol
Community Health Worker Training Manual: CURA 2 for Pediatric Asthma	Rush Center for Urban Health Equity	Unable to acquire: Requests for access received no response, and we did not identify any online links to the materials.
Green Means Go	Vanderbilt University	Did not meet AS-ME criteria as described in Technical Brief protocol
Inspire at Work	Medavie Blue Cross	Canadian program, not implemented in United States
Peak Performance USA	American Association for Respiratory Care	Unable to acquire: We could not identify a contact with direct knowledge of or access to the materials, and an online link to the package did not function.
Power Breathing	Asthma and Allergy Foundation of America	Discontinued
Puff City	University of Michigan/Henry Ford Health System	Unable to acquire: We could not identify a contact with direct knowledge of or access to the materials, and we found no online links to the package.
SPARK	Unknown	Unable to acquire: We could not identify a contact with direct knowledge of or access to the materials, and we found no online links to the package.
Yes We Can	Community Health Works	Did not meet AS-ME criteria as described in Technical Brief protocol

Appendix C. Excluded Studies Based on Review of Full-Length Articles

Conference abstract, letter, or editorial

1. Effectiveness of asthma self-management plans. Practice Nursing. Dec 2008. 19:588-589

2. Burbank A, Rettiganti M, Brown RH, et al. Asthma education via telemedicine: Effects on asthma knowledge and self-efficacy. Journal Of Investigative Medicine. January 2012. 60

3. Cicutto L, O'Brien A, DeGolyer J. A school-centered approach for improving the process of asthma care in rural schools. American Journal Of Respiratory And Critical Care Medicine. 2015.

4. Couch CE, Speck AL, Baptist AP. Electronic asthma self-management program can improve asthma control and quality of life in young, African Americans. Journal Of Allergy And Clinical Immunology. February 2015. 135

5. Federman A, O'Conor R, Mindlis I, et al. A comprehensive self-management support program improves asthma control and quality of life among older adults: Results of a randomized controlled trial. American Journal Of Respiratory And Critical Care Medicine. 2018. 197

6. Graham DJ, Instone S. Improving asthma management in pediatric patients 12 to 17 years of age. Communicating Nursing Research. Jan 2013. 46:442-443

7. Haniotou A, Grammatopoulou E, Koutsouki D. The effect of a self-management program on quality of life in patients with stable asthma: A pilot study. American Journal Of Respiratory And Critical Care Medicine. 2012.

8. Harris KM, Kneale D, Lasserson T, et al. School-based self-management educational interventions for asthma in children and adolescents: A systematic review. Journal Of Allergy And Clinical Immunology. 2018. 141

9. Hodder R. Collaborative self-management education in asthma and COPD. Canadian Pharmacists Journal. November/December 2007. 140

10. Hsu J. A novel framework to facilitate multisector activities to improve population-level asthma control: The EXHALE technical package. Journal Of Allergy And Clinical Immunology. 2018. 141

11. Jayasinghe H, Carson K, Schultz T, et al. Asthma self-management education with either regular healthcare professional review or written action plan or both in adults: A cochrane review. Respirology. March 2015.

12. Jayasinghe H, Carson K, Schultz TJ, et al. Asthma self-management education with either regular healthcare professional review or written action plan or both in adults: A cochrane review. American Journal Of Respiratory And Critical Care Medicine. 2017.

13. Koinis MD, McQuaid EL, Fritz GK, et al. Culturally and contextually tailored asthma self-management for urban, latino middle school students: The Rhode Island-Puerto Rico ASMAS program. American Journal Of Respiratory And Critical Care Medicine. 2017.

14. Rikkers-Mutsaerts N, Beerthuizen T, Winters A, et al. Internet-based self-management in adolescents with asthma: The role of education, monitoring and symptom perception. European Respiratory Journal. 1 Sep 2014.

15. Smith BJ, Carson KV, Schultz T, et al. Asthma self-management education with either regular healthcare professional review or written action plan or both in adults: A cochrane review. American Journal Of Respiratory And Critical Care Medicine. 2014.

16. Tolomeo C. Self-management education for our patients. Journal Of Asthma And Allergy Educators. April 2011. 2

17. Wofford J, Stevens S, Brown K. Teaching asthma self-assessment through computer-assisted patient education: A pilot study. Primary Care Respiratory Journal. June 2011. 20

18. Yeh KW, Chen SH, Chen LC, et al. Improving self-efficacy of caregivers and clinical outcomes of asthmatic children by enhanced interactive asthma education program. Allergy: European Journal Of Allergy And Clinical Immunology. September 2014.

Does not address Guiding Questions

1. Asthma: self-management. Pacesetters. Jan 2011. 8:21-22

2. Culture-specific asthma education could improve quality of life. News-Line For Respiratory Care Professionals. Jun 2008. 7:8-10

3. Patient education series. How to manage your asthma. Nursing. Jan 2009. 39

4. Aaron M, Nelson BW, Kaltsas E, et al. Impact of Goal Setting and Goal Attainment Methods on Asthma Outcomes. Health Education & Behavior. Feb 2017. 44:103-113

5. Booth A. Benefits of an individual asthma action plan. Practice Nursing. Dec 2012. 23:594-603

6. Buckner EB, Copeland DJ, Miller KS, et al. School-based interprofessional asthma self-management education program for middle school students: a feasibility trial. Progress In Community Health Partnerships: Research, Education, And Action. Feb. 2018. 12:45-59

7. C R. Increasing Self-Management of Asthma in Adolescents. School Health Alert. Feb 2016. 31:1-1

8. Davis DW, Gordon MK, Burns BM. Educational interventions for childhood asthma: a review and integrative model for preschoolers from low-income families. Pediatric Nursing. 2011 Jan-Feb. 37:31-38

9. Dhruve H. Improving adherence to asthma treatment through patient education. Independent Nurse. Sep 2017. 2017:17-21

10. Elliott JP, Marcotullio N, Skoner DP, et al. Impact of student pharmacist-delivered asthma education on child and caregiver knowledge. American Journal Of Pharmaceutical Education. 15 Dec 2014. 78

11. Gerald LB, McClure LA, Mangan JM, et al. Increasing adherence to inhaled steroid therapy among schoolchildren: randomized, controlled trial of school-based supervised asthma therapy. Pediatrics. 2009 Feb. 123:466-74

12. Hilger KM, Krull H. Controlling Asthma: Self-Management Education For Young Adults. Rt: The Journal For Respiratory Care Practitioners. May 2014. 27:13-16

13. Horner SD, Brown A, Brown SA, et al. Enhancing Asthma Self-Management in Rural School-Aged Children: A Randomized Controlled Trial. Journal Of Rural Health. Jun 2016. 32:260-269

14. Horner SD, Timmerman GM, McWilliams BC. Feasibility study of a combined lifestyle behaviors and asthma self-management intervention for school-aged children. Journal For Specialists In Pediatric Nursing. Jul 2018. 23:N.PAG

15. Kallstrom TJ. Focus on allergies & asthma. Asthma self-management for adults. Aarc Times. Oct 2007. 31:12-14

16. Kaufman G. Involving patients in asthma management and self-care. Independent Nurse. Nov 2012. 1-2

17. Kintner E, Cook G, Marti CN, et al. Comparative effectiveness on cognitive asthma outcomes of the SHARP Academic Asthma Health Education and Counseling Program and a non-academic program. Research In Nursing & Health. 2015 Dec. 38:423-35. Epub 2015 Aug 22

18. Kwong KYC, Redjal N, Scott L, et al. Adaptation of an Asthma Management Program to a Small Clinic. American Journal Of Managed Care. Jul 2017. 23:e231

19. Larson A, Ward J, Ross L, et al. Impact of structured education and self management on rural asthma outcomes. Australian Family Physician. April 2010. 39:141-144

20. Lemanske RF, Kakumanu S, Shanovich K, et al. Creation and implementation of SAMPRO™: A school-based asthma management program. The Journal Of Allergy And Clinical Immunology. 2016 Sep. 138:711-723

21. Mammen JR, Rhee H, Atis S, et al. Changes in asthma self-management knowledge in inner city adolescents following developmentally sensitive self-management training. Patient Education And Counseling. 1 Apr 2018. 101:687-695

22. McIntosh I. Self-management in asthma. Independent Nurse. May 2008. 32-34

23. McMurray A. Supporting children and young people with asthma. British Journal Of School Nursing. Apr 2014. 9:117-119

24. Nafziger G. Proactive On Asthma. Allergy & Asthma Today. Mar 2015. 13:6-6

25. Pruitt B. Asthma Self-Management Education Programs: The Key to Good Control. Rt: The Journal For Respiratory Care Practitioners. May 2011. 24:14-17

26. Reddy AL, Gomez M, Dixon SL. An Evaluation of a State-Funded Healthy Homes Intervention on Asthma Outcomes in Adults and Children. Journal Of Public Health Management & Practice. Mar 2017. 23:219-229

27. Reznik M, Greenberg E, Cain A, et al. Improving teacher comfort and self-efficacy in asthma management. Journal Of Asthma. Jul 2019.

28. Rhee H, Belyea MJ, Hunt JF, et al. Effects of a peer-led asthma self-management program for adolescents. Archives Of Pediatrics And Adolescent Medicine. June 2011. 165:513-519

29. Rhee H, Pesis-Katz I, Xing J. Cost benefits of a peer-led asthma self-management program for adolescents. Journal Of Asthma. August 2012. 49:606-613

30. Scullion J. Standards and competencies to improve inhaler technique. Independent Nurse. Feb 2017. 2017:17-20

31. Shackelford JA. A comparison of an individually tailored and a standardized asthma self-management education program. Dissertation. Jan 2007. 172 p

32. Shah S, Roydhouse JK, Sawyer SM. Asthma education in primary healthcare settings. Current Opinion In Pediatrics. December 2008. 20:705-710

33. Strickland S. Get Involved with Peak Performance USA. Aarc Times. Oct 2015. 39:64-65

34. Warren CM, Dyer A, Blumenstock J, et al. Leveraging Mobile Technology in a School-Based Participatory Asthma Intervention: Findings From the Student Media-Based Asthma Research Team (SMART) Study. American Journal Of Health Education. Mar 2016. 47:59-71

Does not include post-intervention data

1. Liptzin DR, Szefler SJ. Evolution of Asthma Self-Management Programs in Adolescents: From the Crisis Plan to Facebook. Journal Of Pediatrics. 1 Dec 2016. 19-23

2. Quaranta J, Brown K, Logvis K, et al. Using Nursing Students as Open Airways Facilitators Through a Community Partnership to Influence Asthma Outcomes. Journal Of Asthma And Allergy Educators. April 2012. 3:56-63

3. Tambe AP, Kuder M, Corbridge SJ, et al. Utilization of asthma action plans and the acceptability of a new asthma self-management and education tool (ASMET). The Journal Of Allergy And Clinical Immunology. In Practice. 2019 Apr 02.

Does not include U.S. patients

1. Barthwal MS, Katoch CD, Marwah V. Impact of optimal asthma education programme on asthma morbidity, inhalation technique and asthma knowledge. Journal Of The Association Of Physicians Of India. 2009 Aug. 57:574-6, 579

2. Choi JY, Kweon YR. Effects of Education about Action Plans according to Self-Monitoring on Self-Management Adherence, Knowledge, Symptom Control, and Quality of Life among Adult Asthma Patients: A Randomized Controlled Trial. Journal Of Korean Academy Of Nursing. 1 Oct 2017. 47:613-623

3. Huang TT, Li YT, Wang CH. Individualized programme to promote self-care among older adults with asthma: randomized controlled trial. Journal Of Advanced Nursing. 2009 Feb. 65:348-58

4. Kuijer RG, De Ridder DTD, Colland VT, et al. Effects of a short self-management intervention for patients with asthma and diabetes: evaluating health-related quality of life using then-test methodology. Psychology & Health. May 2007. 22:387-412

5. Lemaigre V, Van Den Bergh O, Victoir A, et al. Effects of a shortened asthma self-management group program. Acta Clinica Belgica. 2010. 65:29-36

6. Misa I. Review of Computerized Educational Intervention for Childhood Asthma Patients. Journal Of Japan Academy Of Nursing Science. Sep 2013. 33:23-32

7. Olivera CMX, Vianna EO, Bonizio RC, et al. Asthma self-management model: randomized controlled trial. Health Education Research. Oct 2016. 31:639-653

8. Pedram RS, Piroozmand N, Zolfaghari M, et al. Education of How-to-Use Peak Flow Meter and Following up via SMS on Asthma Self-Management. Hayat. Sep 2012. 18:1-10

9. Plaza V, Peiró M, Torrejón M, et al. A repeated short educational intervention improves asthma control and quality of life. European Respiratory Journal. 2015 Nov. 46:1298-307. Epub 2015 Sep 24

Appendix D. Evidence Tables

Table D-1. Asthma self-management education packages: characteristics

Package	Participants and Setting	Intended Patients	Language and Literacy	Delivery of Education	Accessibility

A Breath of Life
NHLBI
2014
	• Training program for:
	  o promotoras who teach parents
	  o parents of children with asthma
	• Appropriate for health care or community settings
		• Children/ Adolescents
		• Ages 5 to 11
		• Latino families
			• English
			• Spanish
			• Literacy level NR
				• In-person classes
				• Trained educators teach promotoras, who then teach parents
				• Formal instruction, opportunities for questions and feedback
					• Downloadable from NHLBI
					• No fee
					• No evidence of copyright
					• Package includes videos in English and Spanish; also available for online viewing or a DVD that can be ordered from NHLBI

Asthma 101 ALA Year NR	• Asthma patients • Home-based	• Adults	• English • Literacy level NR	• Self-directed learning • Paper-based materials • Self-evaluation activities, home trigger assessment, guidance on when to call physician	• Downloadable from ALA • No fee • Copyrighted
Asthma Basics for Children AAFA 2010	• *ABC for Parents*: home-based learning for parents • *ABC for Child Care Centers*: training for preschool teachers	• Preschool-age children	• English • Spanish • Literacy level NR	• Parents self-learn using paper-based materials • Preschool teachers learn from trained asthma educators during in-person classes	• Downloadable from AAFA • No fee • Copyrighted
Asthma Care for Adults AAFA 2018	• Asthma patients • Home-based or community-based	• Adults • Mild to severe asthma • Appropriate for multicultural audience	• English • Literacy level described by developer as "easy reading in plain language"	• In-person facilitation by asthma educator or self-directed at home • Paper-based materials for in-person course; self-directed version includes videos and animation	• Downloadable from AAFA • No fee to download, but printed copies of in-person facilitation materials can be purchased • Copyrighted

Package	Participants and Setting	Intended Patients	Language and Literacy	Delivery of Education	Accessibility
Asthma Workbook University of Michigan 2018	•Asthma patients •Combination of home and physician office-based activities	•Adults	•English •Literacy level NR	•Facilitated by nurse educator during multiple in-person sessions and telephone calls •Paper-based materials	•Downloadable from University of Michigan •No fee •Protected by Creative Commons license
Breathe Well, Live Well ALA 2019	•Asthma patients •Home-based or community-based	•Adults	•English •Spanish •Literacy level NR	•In-person facilitation by asthma educator in small groups or home visits; or self-directed •Paper-based materials •Instructional video	•Available from ALA upon request •Fee required but often waived due to grants •Copyrighted
Creating Asthma-Friendly Environments and Promoting Access to Guidelines-Based Care for Children with Asthma NEEF & NASN 2018	•Professional training package for school nurses	•Children/ Adolescents	•English	•In-person •Audio-visual presentation	•Downloadable from NASN •No fee •Copyrighted
Kickin' Asthma ALA 2015	•Asthma patients •School-based	•Adolescents •Grades 6 to 10 / Ages 11 to 16	•English •Spanish •Literacy level NR	•In-person classes facilitated by school staff or asthma educators •Paper-based materials	•Available from ALA upon request •Fee required •No evidence of copyright •Requestors must complete 1-hour online module before ordering
Open Airways for Schools ALA 2018	•Asthma patients •School-based	•Children/ Adolescents •Ages 8 to 11	•English •Spanish •Literacy level NR	•In-school learning facilitated by asthma educators •Interactive program for students	•Available from ALA upon request •Fee required but is often waived due to grants and sponsorships •Copyrighted
Pediatric Asthma Initiative NEEF Year NR	•Professional education for clinicians	•Children/ Adolescents	•English	•In-person •Audio-visual presentation	•Downloadable from NEEF •No fee •Copyrighted

Package	Participants and Setting	Intended Patients	Language and Literacy	Delivery of Education	Accessibility
Severe Asthma Care for Adults AAFA 2019	• Asthma patients and caregivers	• Adults with severe asthma	• English	• On-line or printable materials	• Downloadable from AAFA • No fee • Copyrighted
Wee Breathers AAFA 2013	• Parents and caregivers of asthma patients • Home-based	• Children under age 7 • Designed for low-income and minority families	• English • Spanish (some materials not available in Spanish) • Literacy level 6th grade	• In-person facilitation by asthma educator • Paper-based materials • Opportunities for parents to ask questions	• Downloadable from AAFA • No fee • Copyrighted
Women Breathe Free University of Michigan 2010	• Asthma patients • Home-based or community-based	• Adult women	• English • Literacy level NR	• Asthma educator facilitates phone-based or in-person counseling • Paper-based materials • Opportunities for patient questions and feedback	• Downloadable from Women Breathe Free website • No fee • Copyrighted
You Can Control Asthma AAFA 2005	• *A Book for the Kids*: home, school, or community-based teaching for asthma patients • *A Book for the Family:* home, school, or community-based teaching for parents	• Children/ Adolescents • Ages 6 to 12 • Moderate to severe asthma • Appropriate for multicultural audience	• English • Spanish • Appropriate for patients speaking English as a second language • Parent materials: 6th grade reading level • Children's materials: 3rd grade reading level	• In-person sessions with group discussion • Paper-based materials • Device demonstration and visual aids	• Available to AAFA members upon request • Fee required • Copyrighted

AAFA=Asthma and Allergy Foundation of America; ALA=American Lung Association; NASN=National Association of School Nurses; NEEF=National Environmental Educational Foundation; NHLBI=National Heart, Lung, and Blood Institute; NR=Not reported

Note: Children defined as under age 10; adolescents defined as ages 10 to 17

Table D-2.   Asthma self-management education packages: structure and content

Package	Educational Materials	Guidance for Instructors	Patient Tools	Curriculum: Physiology	Curriculum: Medication/ Device Use	Curriculum: Symptoms/ Management	Curriculum: Triggers	Participant Assessment	Validity
A Breath of Life NHLBI 2014	•Five 2 ½ hour sessions for promotoras and parent training (316 pages) •Promotoras also trained to conduct home visits	•Instructions, lesson plans •Handouts, games, feedback tools •Companion videos illustrate key concepts	•Action plan •Numerous handouts for each module •Checklist for triggers	•Asthma process and physiology •Lung anatomy/ inflammation	•Controller and rescue medications •Inhaler, peak flow meter use •Adherence strategies	•Identifying and preventing asthma symptoms •How parents can talk with children about asthma	•Identifying common triggers •Avoiding/ reducing exposure to triggers	•Knowledge assessed before and after modules •Certificate of completion	•Consistent with clinical guidelines •Reviewed by asthma experts and promotoras •Pilot tested in Latino communities
Asthma 101 ALA Year not reported	•44-page compendium of materials	•Not relevant	•Action plan •Medication charts •Asthma Control Test •Checklist for triggers	•Lung anatomy/ inflammation	•Controller and rescue medications •Inhaler, spacer, peak flow meter use	•Monitoring and preventing symptoms	•Identifying common triggers •Avoiding/ reducing exposure to triggers	•No assessment •Certificate of completion	•Controlled trials
Asthma Basics for Children AAFA 2010	•*ABC for Parents*: 6 chapters (80 pages), self-directed •*ABC for Child Care Centers*: 7 chapters (97 pages), two 3-hour sessions o Includes handouts, games	•Not reported	•Action plan •Symptom log •Checklist for triggers	•Lung anatomy and function	•Controller and rescue medications •Complemen-tary and alternative medications	•Monitoring asthma symptoms •Emergency plans •Relaxation techniques and behavioral interventions	•Identifying common triggers at home and daycare setting •Avoiding/ reducing exposure to triggers	•No assessment	•Pilot tested in New York •Controlled trials

Package	Educational Materials	Guidance for Instructors	Patient Tools	Curriculum: Physiology	Curriculum: Medication/ Device Use	Curriculum: Symptoms/ Management	Curriculum: Triggers	Participant Assessment	Validity
Asthma Care for Adults AAFA 2018	•Seven 60 to 75 minute sessions •Handouts for patients •Also available as self-directed, free online course with video, animation	•Instructor's manual (30 pages)	•Action plan •Checklist for triggers •Medication list	•Lung anatomy/ inflammation	•Controller and rescue medications •Inhaler and nebulizer use	•Monitoring symptoms	•Identifying common triggers •Avoiding/ reducing exposure to triggers	•Pre- and post-test of knowledge	•Consistent with clinical guidelines
Asthma Workbook University of Michigan 2018	•6 sessions: 3 physician office visits and 3 phone calls over 6 months •48-page workbook	•Not reported	•Action plan •Symptom log •Worksheet to develop goals	•Lung anatomy/ inflammation	•Inhaler, spacer, and peak flow meter use	•Monitoring symptoms •Motivational tools for attaining goals	•Brief references to triggers	•Nurse facilitator monitors patient learning •Patient self-assessment	•Not reported
Breathe Well, Live Well ALA 2019	•3 to 4-hour program in multiple formats: ○ 1-day session ○ two 90-minute sessions ○ three 60-minute sessions ○ home visits ○ self-directed •68-page patient workbook	•Brief instructor's manual 5 pages) and tips for working with adult asthma patients •ALA offers free online Educator Training	•Action plan •Checklist for triggers	•Lung anatomy/ inflammation	•Controller and rescue medications •Inhaler, nebulizer, peak flow meter use	•Monitoring symptoms •Relaxation, stress management strategies	•Identifying common triggers •Avoiding/ reducing exposure to triggers	•Pre- and post-assessment of asthma morbidity	•Controlled trials

Package	Educational Materials	Guidance for Instructors	Patient Tools	Curriculum: Physiology	Curriculum: Medication/ Device Use	Curriculum: Symptoms/ Management	Curriculum: Triggers	Participant Assessment	Validity
Creating Asthma-Friendly Environments and Promoting Access to Guidelines-Based Care NEEF & NASN 2018	•2-hour training program •Slide deck available •Hands-on exercises, case studies, discussion points	•Not reported	•None	•Lung function	•Controller and rescue medications •Inhaler use	•Monitoring symptoms	•Identifying common triggers in schools •Avoiding/ reducing exposure to triggers	•Can earn continuing education credit if taken with post-program assessment	•Consistent with clinical guidelines
Kickin' Asthma ALA 2015	•Four 45-minute sessions, optional 3-month follow-up •Student workbook (24 pages), games, skits	•Instructor's manual (52 pages)	•Action plan	•Lung anatomy/ inflammation	•Controller and rescue medications •Inhaler, spacer, peak flow meter use	•Monitoring and preventing symptoms	•Identifying common triggers •Avoiding/ reducing exposure to triggers	•Baseline, follow-up evaluations of asthma morbidity •Certificate of completion	•Pilot tested over 5 years •Controlled trials
Open Airways for Schools ALA 2018	•Six 40-minute lessons •Student handouts, role playing activities, games, stories	•Instructor's manual and supporting materials (132 pages) •ALA offers Facilitator Training	•Action plan	•Lung anatomy/ inflammation	•Controller and rescue medications •Inhaler use	•Monitoring and preventing symptoms •Managing asthma at school	•Identifying common triggers •Avoiding/ reducing exposure to triggers	•Verbal questions and surveys •Certificate of completion	•Pilot tested •Controlled trials
Pediatric Asthma Initiative NEEF Year not reported	•Training program, can be divided into multiple lessons •Slide deck available	•Not reported	•None	•Asthma process and physiology •Lung anatomy/ inflammation	•Controller and rescue medications •Inhaler use	•Monitoring symptoms	•Extensive content on environ-mental triggers •Avoiding/ reducing exposure to triggers	•Not reported	•Consistent with clinical guidelines

Package	Educational Materials	Guidance for Instructors	Patient Tools	Curriculum: Physiology	Curriculum: Medication/ Device Use	Curriculum: Symptoms/ Management	Curriculum: Triggers	Participant Assessment	Validity
Severe Asthma Care for Adults AAFA 2019	•Five self-paced lessons	•Not reported	•Action plan •Symptom log •Checklist for triggers	•Physiology of severe asthma	•Controller and rescue medications	•Monitoring and preventing symptoms	•Identifying common triggers •Avoiding/ reducing exposure to triggers	•Pre and post-test of knowledge •Certificate of completion	•Not reported
Wee Breathers AAFA 2013	•Seven 1-hour lessons	•Instructor's manual (203 pages) with content on communica-tion skills, cultural sensitivity	•Action plan •Checklist for triggers	•Lung anatomy/ inflammation	•Controller and rescue medications •Inhaler, spacer, nebulizer use	•Monitoring symptoms •Prevention strategies	•Identifying common triggers •Avoiding/ reducing exposure to triggers	•Pre and post-test of knowledge	•Not reported
Women Breathe Free University of Michigan 2010	•Four sessions conducted over 8 to 12 weeks •Workbook and handouts (40 pages)	•Not reported	•Action plan •Asthma diary	•None	•Controller and rescue medications •Inhaler use	•Monitoring, preventing symptoms •Focus on setting and achieving goals	•Identifying common triggers •Avoiding/ reducing exposure to triggers	•Patient self-assessment of progress towards goals	•Not reported
You Can Control Asthma AAFA 2005	•Five 1-hour modules •*A Book for the Family*: 72 pages •*A Book for the Kids*: 60 pages	•Instructor's manual (72 pages) •Sample teaching plans •Student tracking forms	•Symptom log	•Lung anatomy and inflammation	•Controller and rescue medications •Inhaler, spacer, peak flow meter use •Adherence strategies	•Monitoring, preventing symptoms •Managing decisions and feelings	•Identifying common triggers •Avoiding/ reducing exposure to triggers	•Pre and post-test of knowledge •Program evaluation form •Certificate of completion	•Consistent with clinical guidelines •Pilot tested at 8 sites over 3 years

AAFA=Asthma and Allergy Foundation of America; ALA=American Lung Association; NASN=National Association of School Nurses; NEEF=National Environmental Educational Foundation; NHLBI=National Heart, Lung, and Blood Institute

Table D-3.   Systematic reviews of asthma self-management education

Author Year	Primary Purpose	Patient/Participant Population and Setting	Study Design and Search Timeframe	Key Findings
Isik et al. 2019[45]	Evaluate effectiveness of school or community nurse-led interventions	• Children, adolescents, parents • School or community • USA, India, Iran, The Netherlands	• 5 RCTs • 3 quasi-experimental • 2013-2018	• School-nurse led interventions significantly improved asthma knowledge and self-management skills
Kneale et al. 2019[42]	Evaluate effectiveness of school-based interventions	• Children, adolescents • School • USA, Australia, Canada, China, Jordan, Spain, United Kingdom	• 33 RCTs • 1995-2017	• School-based interventions reduced hospitalizations and ED visits • Unclear if programs reduced school absences
Saxby et al. 2019[46]	Describe components of self-management education for asthma, diabetes, cystic fibrosis	• Children, adolescents, parents • School, community, health care facility • USA, Argentina, Australia, Canada, Germany, Iran, The Netherlands	• 19 RCTs • 2 quasi-experimental • 1 cohort • 5 pre-post • 2 descriptive • Prior to February 2018	• Outcomes generally improved • 8 key components identified for success: 1) structured and sequenced curricula; 2) reinforcement; 3) active participation; 4) collaboration; 5) autonomy; 6) feedback; 7) multiple exposures; 8) problem-solving • Most studies were high or unclear risk of bias
McCleary et al. 2018[7]	Evaluate effectiveness of training for healthcare professionals who implement asthma education	• Pediatricians, primary care clinicians, nurses • Outcomes measured in schools, physician practices • USA, Australia, Israel, The Netherlands, Singapore, Sweden, the United Kingdom	• 11 RCTs • 4 non-randomized controlled trials • 1993-2016	• Approximately half of interventions were associated with changed professional behavior and/or improved patient outcomes • Most studies were rated as high or unclear risk of bias
Zhong & Melendez-Torres 2017[8]	Evaluate effectiveness of peer-led interventions	• Adolescents • School or camp • USA, Australia, Jordan	• 4 RCTs • Prior to May 2015	• Meta-analysis found no significant change in lung function or quality of life • Studies were rated as high or unclear risk of bias
Ahmad & Grimes 2011[43]	Evaluate effectiveness of school-based interventions	• Children, adolescents • School • USA, Australia, Canada, China	• 6 RCTs • 1 quasi-experimental • 2 pre-post • 1995-2010	• School-based interventions reduced school absences • Mixed findings on whether hospitalizations and ED visits were reduced
Coffman et al. 2009[44]	Evaluate effectiveness of school-based interventions	• Children, adolescents, parents • School • Location not reported	• 18 RCTs • 6 observational • Prior to 2008	• School-based interventions improved knowledge of asthma, self-efficacy, and self-management behaviors • Mixed findings on whether interventions improved quality of life, reduced school absences, or reduced frequency of symptoms

ED=emergency department; RCT=randomized controlled trial

Note: Children defined as under age 10; Adolescents defined as ages 10 to 17

Table D-4.   Randomized controlled trials of asthma self-management education packages

Author Year Package	Setting Population	Intervention and Comparison	Outcomes
Marsland et al. 2019[13] **I Can Cope (ICC)** and **Open Airways for Schools (OAS)**	**School-based** 12 urban public schools, grades 3-8 **N=104** 35 ICC 34 OAS 35 No treatment **Mean age:** 11 (range 814) **% Female:** 46% **Race** African American: 70% White: 15% Mixed/other: 15% **Socioeconomic status** Annual income <$25,000: 39% Between $25,000 and $50,000: 36% >$50,000: 16% Not reported (NR): 9% **Severity** Mild: 50% Moderate: 44% Severe: 6%	**Intervention** Students participated in 6 sessions (50 minutes each) of psychoeducation and relaxation training, led by psychologists and graduate students. Program also included educational games, activities, homework, and review. Parents were notified of child's progress by phone or text. **Comparison 1** Modified OAS, including six 50 minute sessions on asthma education and stress management **Comparison 2** No intervention	**Asthma control** Increased level of asthma control for ICC and OAS compared with control • ICC versus no intervention: standardized mean difference (SMD) -0.71, p=0.01 • OAS versus no intervention: SMD -0.69, p=0.02 **Asthma self-management** OAS participants had greater confidence performing behaviors to manage asthma • OAS: SMD 0.42, p=0.04 • Similar effects not observed for ICC **Asthma-related quality of Life (QoL)** ICC and OAS associated with improvement in physical QoL when compared with no intervention • ICC versus no intervention: SMD 0.15, p=0.07 • OAS versus no intervention: SMD 0.37, p=0.05 • Parallel improvements in emotional or activity related QoL were observed for ICC or OAS **Feasibility and Acceptability** • 93% of participants completed all intervention sessions and questionnaires • 60% completed at least 80% of the 4 weeks of daily records • Participants rated ICC as highly acceptable (mean satisfaction score, highest score=18) Children: 16.13 (standard deviation [SD] 2.59) Parents: 12.59 (1.94) • Participants rated OAS as highly acceptable Children: 15.93 (2.83) Parents: 12.37 (2.68)

Author Year Package	Setting Population	Intervention and Comparison	Outcomes
Kintner et al. 2015[25] **SHARP: Staying Healthy-Asthma Responsible & Prepared**	**School-based (cluster randomization)** Grades 4-5 **N=205 dyads** 117 SHARP 88 OAS **Mean age:** 10 **% Female** Students: 40% Caregivers: 88% **Race:** Primarily minority, details NR **Socioeconomic status:** NR **Severity** Mild: 55% Moderate: 37% Severe: 8%	**Intervention** Nurse delivered ten 50-minute sessions to students. Content included asthma pathophysiology, symptom level, severity, medications, health behaviors, beliefs about asthma, QoL. Nurse facilitated 90-minute health fair for caregivers, distributed booklets to non-attendees. **Comparison** OAS, six 50-minute sessions for students; caregivers received informational handout	**Symptom management** All participants in SHARP and OAS had an average increase in symptom management ($f[171]=3.96$, p<0.001). SHARP participants had a greater increase ($f[168]=2.08$, p=0.39). **Medication adherence** No significant effect observed from pre-to-posttest for SHARP or OAS
Bowen et al. 2013[14] **OAS** (modified)	**School-based** Urban, grades 2-7 **N=32** 15 OAS 17 control **Mean age:** 9 (range 8-12) **% Female:** 44% **Race** African American: 83% Hispanic: 10% White: 3% Other: 4% **Socioeconomic status** Medicaid coverage: 73% **Severity:** Moderate or severe persistent	**Intervention** Trainer delivered modified OAS three 90-minute sessions over 3 weeks. Content included feelings about asthma, deep-breathing, problem solving, medications, managing exacerbations, staying active. **Comparison** No intervention	**Asthma control** No significant difference between groups on the Child Asthma Control Test, $F=1.001$, p=0.32 **QoL** No significant difference between groups on the Pediatric Asthma QoL Questionnaire, $F=2.708$, p=0.111

Bruzzese et al. 2011[17] **ASMA: Asthma Self-Management for Adolescents**	**School-based** Five high schools, grades 9-10 **N=345** 175 ASMA 170 wait-list **Mean age:** 15 **% Female:** 70% **Race** Hispanic: 45% African American/ Caribbean/African: 38% Mixed: 12% Other: 5% **Socioeconomic status** 82% eligible for free or reduced price school lunch **Severity** Moderate: 69% Severe: 31%	**Intervention** Health educators delivered 8 week program with three 45 to 60 minute group sessions and individual coaching sessions weekly for 5 weeks. Content included management skills and coping. Individual sessions reinforced group session material. Medical providers received presentation about program and tracking materials. **Comparison** No intervention	**Acute medical visits** Intervention associated with fewer acute care visits • Risk ratio (RR) 0.72 (95% confidence interval [CI] 0.60 to 0.85), p=0.0002 **ED visits** Intervention associated with fewer ED visits • RR 0.52 (0.40 to 0.68), p<0.0001 **Hospitalizations** Intervention associated with fewer hospitalizations • RR 0.24 (0.09 to 0.66), p=0.0042 **Use of controller medication** Intervention participants more likely to use controller medication at 6 months, but this difference did not remain significant at 12 months • ASMA versus no intervention at 6 months: odds ratio (OR) 2.25 (1.28 to 3.93), p=0.006 • ASMA versus no intervention at 12 months: OR 1.22 (0.71 to 2.08), p=0.47 **Symptom days** No significant difference between groups • RR 0.88 (0.74 to 1.04), p=0.12 **Night wakening** Intervention associated with reduced night wakening • RR 0.69 (0.60 to 0.86), p=0.001 **QoL** Intervention associated with improved QoL • ASMA versus no intervention at 6 months: Adjusted Mean Difference (AMD) 0.1 (-0.1 to 0.3), p=0.38 • ASMA versus no intervention at 12 months: AMD 0.3 (0.09 to 0.5), p=0.0045 **Days with activity restriction** Intervention associated with fewer restricted days • RR 0.58 (0.43 to 0.78), p=0.003 **School absences** Intervention associated with fewer school absences • RR 0.63 (0.46 to 0.85), p=0.004 **Asthma prevention** Intervention participants took significantly more steps to prevent asthma from starting • ASMA versus no intervention at 6 months: AMD 1.34 (0.93 to 1.76), p<0.0001

Author Year Package	Setting Population	Intervention and Comparison	Outcomes
			• ASMA versus no intervention at 12 months: AMD 0.50 (0.02 to 0.98), p=0.04 **Asthma management** No significant differences in the number of steps taken to manage asthma • ASMA versus no intervention at 6 months: AMD 0.27 (-0.19 to 0.74), p=0.24 • ASMA versus no intervention at 12 months: • AMD 0.01 (-0.59 to 0.62), p=0.96 **Use of written treatment plan** Intervention participants more likely to use a written treatment plan at 6 and 12 months • ASMA versus no intervention at 6 months: OR 3.60 (2.25 to 5.77), p<0.0001 • ASMA versus no intervention at 12 months: OR 4.57 (2.97 to 7.04), p<0.0001
Mancuso et al. 2011[27] **Homegrown**	**Hospital-based** Urban emergency department **N=296** 148 intervention 148 control **Mean age:** 44 **% Female:** 48% **Race** White: 43% African American: 21% **Socioeconomic status** Medicaid coverage: 17% No health insurance: 6% **Severity** (Severity of Asthma Scale Mean Score) Intervention: 12 (SD 5) Control: 13 (SD 4)	**Intervention** Delivered shortly after emergency department (ED) visit, then reinforced during weekly phone calls for 8 weeks. Content included asthma knowledge, peak flow meter training, inhaler training, behavioral contract, brochures, self-management workbook. **Comparison** Instruction on asthma knowledge, peak flow meter training, brochures.	**Asthma control** 89% of intervention group and 80% of comparison group reported that the trial made their asthma better, at 8 weeks **QoL** (Asthma Quality of Life Questionnaire [AQLQ]) No difference between intervention and comparison at 8 weeks or 1-year follow-up. Each group improved on within-group measure at 8 weeks compared to baseline. • 8 weeks: mean change in score 0.11 (95% CI -0.17 to 0.40) • 1 year: mean change in score 0.22 (-0.15 to 0.60)

Author Year Package	Setting Population	Intervention and Comparison	Outcomes
Mosnaim et al. 2011[20] **Fight Asthma Now**	**School-based (cluster randomization)** 26 urban public schools in 1 city, grades 3-6 ("Youth") and grades 7-12 ("Teen") **N=536 students** 344 Youth/192 Teen 416 intervention (275/141) 120 control (69/51) **Median Age** 10/13 **% Female** 43%/45% **Race** African American: 65%/79% Hispanic: 15%/12% Other: 20%/9% **Socioeconomic status** All schools had ≥70% of students eligible for subsidized lunch **Severity:** NR	**Intervention** Specially trained health educators delivered a 45 minute educational session each day for 4 consecutive days. Content included physiology, medications, symptoms, device use, triggers, asthma action plans **Comparison** No intervention	Multivariate modeling was performed to adjust for school, class, sex, ethnicity, treatment group, and pre-existing knowledge about asthma, based on scores from pre- and post-test instruments designed for the program. **Asthma knowledge** Intervention associated with improved knowledge among youth ($p<0.001$) and teens, $p=0.01$ **Spacer competency** Intervention associated with improved knowledge among youth ($p<0.001$) and teens, $p<0.001$
Tousman et al. 2011[28] **Homegrown**	**Setting:** Community **N=45** 21 intervention 24 control **Mean age** Intervention: 51 (SD 14.7) Control: 55 (SD 10.0) **% Female** Intervention: 81% Control: 58% **Race** White: 93% All other: 7% **Socioeconomic status:** NR **Severity:** NR	**Intervention** Health care professionals delivered 7 weekly 2-hour meetings consisting of interactive discussions, problem-solving, social support, behavior modification **Comparison** No intervention	**Medication use** No significant difference observed between groups for use of rescue or controller medication (data NR) **QoL** (Juniper's mini-asthma survey) Intervention associated with improved QoL: $F(1, 43)=4.97$, $p=0.031$ **Reducing asthma triggers** Intervention associated with reduced asthma triggers: $F(1, 43)=8.744$, $p=0.005$ **Asthma self-efficacy** Intervention associated with improved self-efficacy: $F(1, 43)=6.1$, $p=0.018$ **Patient activation** Intervention associated with improved activation: $F(1, 42)=15.96$, $p<0.001$

Author Year Package	Setting Population	Intervention and Comparison	Outcomes
Clark et al. 2010[15] **OAS for Preteens or OAS plus Peer Asthma Action (PA2)**	**School-based** Middle schools in low-income communities **N=1292** 468 OAS for Preteens 416 OAS+PA2 408 control **Mean age:** 12 **% Female:** 84% **Race** African American: 93% All other: 7% **Socioeconomic status** Household income <$15,000: 48% Between $15,000 and $40,000: 38% **Severity** Mild intermittent: 55% Mild persistent: 20% Moderate persistent: 12% Severe persistent: 11%	**Intervention 1** *OAS for Preteens*: 7 lesson curriculum, preteen groups met for 1.5 hours weekly for 6 weeks, sessions led by graduate students and community leaders **Intervention 2** *OAS+ PA2*: peer component created positive social environment for 6th graders managing asthma with support from 7th & 8th graders. Sessions included asthma awareness lessons, translated message into performances (e.g., game show, skit) **Comparison** No intervention	**Daytime symptoms** Both interventions associated with decreased daytime symptoms compared with no intervention • OAS: OR=1.1, p>0.5 • OAS+PA2: OR=1.3, p=0.3 **Child Self-Regulation Score** (mean change) No significant difference for OAS; OAS+PA2 was associated with improved self-regulation • OAS: 0.26, No intervention: 0.14, p=0.10 • OAS+PA2: 0.35, No intervention: 0.14, p=0.01 **Parent Asthma Management Score** (mean change) No significant difference between groups • OAS: 0.04, No intervention: 0.03, p=0.93 • OAS+PA2: 0.13, No intervention: 0.03, p=0.25 **QoL** No significant difference between groups (data NR)
Mancuso et al. 2010[29] **Homegrown**	**Physician office and home-based** Urban primary care facility **N=180** 90 intervention 90 control **Mean age:** 43 **% Female:** 84% **Race** African American: 34% White: 31% Hispanic: 30% Other: 5% **Socioeconomic status:** NR **Severity:** Moderate persistent asthma	**Intervention** Non-clinical providers conducted 1 in-person interaction, followed by telephone follow-up. Participants agreed to behavior changes and received self-management workbook, weekly reinforcement for 12 weeks, follow-up visits. **Comparison** Participants received 3 asthma brochures.	**ED visits** No difference observed between groups • Intervention: 32% visited ED • Comparison: 30% visited ED **Hospitalizations** No difference between groups. • Intervention: 11% hospitalized • Comparison: 7% hospitalized **QoL** (AQLQ) No difference between groups. Each group improved on within group QoL over baseline (mean AQLQ score increased by 1.0; p<0.001)

Author Year Package	Setting Population	Intervention and Comparison	Outcomes
Janson et al. 2009[30] **Homegrown**	**Community-based** **N=84** 45 intervention 39 control **Mean age** Intervention: 37 (SD 9.4) Control: 40 (SD 9.3) **% Female** Intervention: 53% Control: 54% **Race** White: 64% Asian: 19% African American: 6% Other: 11% **Socioeconomic status** 24% lacked health insurance **Severity:** Moderate to severe	**Intervention** Certified nurse or respiratory asthma educator delivered three 30 minute sessions. Content included asthma information, self-assessment, inhaler technique, individualized action plan, environmental control strategies. Reinforced at 2 week intervals **Comparison** No intervention	**Perceived control of asthma** Intervention associated with improved asthma control • Intervention (mean change): 2.87 • No intervention (mean change): 0.68, p=0.006 **Nighttime awakenings** Intervention associated with reduced awakenings • Intervention (mean): 0.2 • No intervention (mean): 0.8 p=0.03 **QoL and Other measures** No differences were observed between groups for QoL, percent adherence, ≥ 60% adherence, symptom-free days, beta-agonist use

Author Year Package	Setting Population	Intervention and Comparison	Outcomes
Kintner and Sikorskii 2009[26] **SHARP**	**School-based (cluster randomization)** 5 schools Grades 4-6 **N=65** 38 intervention 27 control **Mean age:** 10 **% Female:** 48% **Race** White: 38% African American: 32% Biracial: 15% Other: 15% **Socioeconomic status** (Nam-Powers Index) Intervention: 64.0 Control: 48.5 **Severity** (Severity of Illness Rating Scheme, mean) Intervention: 5.84 Control: 5.93	**Intervention** Ten 50-minute sessions delivered at school, once per week for 10 consecutive weeks **Comparison** No intervention	**Asthma knowledge** Intervention associated with improved knowledge on 20-point scale • Intervention (mean): 10.18 (standard error [SE] 0.43) • No intervention (mean): 7.96 (0.47), p<0.01 **Asthma reasoning** Intervention associated with improved reasoning on 2-point scale • Intervention (mean): 1.42 (0.03) • No intervention (mean): 1.24 (0.03), p<0.01 **Asthma episode management** No difference observed on 4-point scale • Intervention (mean): 1.34 (0.13) • No intervention (mean): 1.09 (0.15), p=0.20 **Asthma risk reduction** Intervention associated with improved behaviors on 4-point scale • Intervention (mean): 2.13 (0.08) • No intervention (mean): 1.66 (0.09), p<0.01 **Asthma acceptance: taking control** No difference observed on 5 -point scale • Intervention (mean): 3.88 (0.15) • No intervention (mean): 3.61 (0.17), p=0.26 **Asthma acceptance: vigilance** No difference observed on 5-point scale • Intervention (mean): 3.77 (0.13) • No intervention (mean): 3.61 (0.15), p=0.42 **Participation in life activities** Intervention associated with increased participation on 3-point scale • Intervention (mean): 2.13 (0.10) • No intervention (mean): 1.70 (0.11), p<0.01

Author Year Package	Setting Population	Intervention and Comparison	Outcomes
Shackelford and Bachman 2009[31] **Homegrown**	**Community-based** **N=88** 44 intervention 44 control **Age:** all participants ≥18 **% Female:** 78% **Race** White: 82% Black: 3% Other: 12% NR: 3% **Socioeconomic status** <u>Household income</u> < $40,000: 23% Between $40,000 and $80,000: 37% >$80,000: 40% **Severity:** NR	**Intervention** One 90-minute educational session, led by nurse facilitator, with groups of 1 to 6 people per group. Session was informal, semi-structured, participatory, conducive to group sharing. Nurse facilitated understanding of content and discussion. **Comparison** Identical content as the intervention. Session was traditional lecture format, taught by a nurse.	**Asthma control** (Asthma Control Test) No difference between groups, but improvement within each group **Asthma symptoms** No difference between or within groups **Shortness of breath** No difference between groups, but improvement with each group **Rescue inhaler use** No difference between or within groups **Limited activities** No difference between or within groups **Peak flow readings** No difference between or within groups

Author Year Package	Setting Population	Intervention and Comparison	Outcomes
Bruzzese et al. 2008[19] **Asthma: It's a Family Affair!**	**School-based** Urban public middle school **N=24 families** (1 student with asthma and 1 caregiver per family) 12 intervention 12 control **Mean age:** 13 **% Female:** 46% **Race** Hispanic: 41% White: 17% African American: 8% Other: 34% **Socioeconomic status:** NR **Severity** Intermittent: 20% Mild persistent: 46% Moderate or severe persistent: 34%	**Intervention** Psychologist delivered intervention; 75 minute sessions once per week for 6 weeks. Content included asthma information, symptom management, medications, prevention, problem-solving, coping with negative feelings, communicating with peers and teachers. Psychologist also delivered five 90 minute sessions to caregivers once per week. Content included maintaining positive relationship with teenager, balancing discipline with guidance, asthma information, symptoms, medications, communication, problem-solving. **Comparison** No intervention	**Symptoms** No significant improvement in daytime symptoms or managing symptoms **Nighttime awakenings** Intervention associated with statistically significant reduction in number of nights awakened by asthma - Intervention: 67% reduction - No intervention: 19% reduction - Intervention versus none: $p<0.01$ **Asthma management** Intervention associated with statistically significant increase in students reporting use of additional strategies to prevent symptoms - Intervention (mean additional strategies): 1.5 - No intervention (mean additional strategies): -3 - Intervention versus none: $p<0.05$ **Usefulness** - All students reported intervention gave them a better understanding of asthma; 91% reported handouts help to understand topics discussed - Caregivers "agreed" or "strongly agreed" that sessions helped to better understand asthma, build positive relationships, improve monitoring and disciplining children, understand challenges teens face, solve problems effectively, teach children effective problem-solving

Author Year Package	Setting Population	Intervention and Comparison	Outcomes
Horner et al. 2008[32] **Homegrown**	**School-based (cluster randomization)** 18 rural schools **N=183** 86 intervention 77 control **Mean age:** 9 **% Female:** 41% **Race** Hispanic: 46% White: 29% African American: 22% Other: 3% **Socioeconomic status:** NR **Severity:** NR	**Intervention** Lay health educators delivered 7-step asthma management plan; content included pathophysiology, symptoms, management, skills practice with placebo metered dose inhaler and peak flow meters, problem-solving vignettes **Comparison** Lay health educators delivered content on health promotion, nutrition, exercise, cold/ flu avoidance, hand washing, brushing teeth	**Asthma management** (mean change) Intervention associated with overall improvement • Intervention: -0.208 (SE 0.064) • Comparison: 0.011 (0.069) **Metered dose inhaler skill** (mean change) Intervention associated with improved skills • Intervention: -1.758 (0.184) • Comparison: -0.530 (0.212) **Asthma knowledge** (mean change) Intervention associated with improved knowledge • Intervention: -9.325 (1.392) • Comparison: -4.853 (1.486) **Self-efficacy** (mean change) Intervention associated with increased self-efficacy • Intervention: -0.380 (0.109) • Comparison: -0.139 (0.124)
Joseph et al. 2007[24] **Puff City**	**School-based** Six urban public high schools **N=314** 162 Puff City 152 control **Mean age:** 15 **% Female:** 63% **Race** African American: 98% **Socioeconomic status** Estimated income (mean): $12,049 Medicaid coverage: 49% **Severity** Mild intermittent: 62% Mild persistent: 20% Moderate: 9% Severe: 9%	**Intervention** Four consecutive educational computer sessions with feedback, applied trans theoretical or health belief model. Focused on controller medication adherence, rescue inhaler availability, smoking cessation/ reduction. **Comparison** Generic asthma websites, four computer sessions for 30 minutes each	**Hospitalizations** Intervention associated with fewer hospitalizations • RR 0.2 (95% CI 0.2 to 0.9), p=0.01 **ED visits** No significant difference between groups • RR 0.5 (0.3 to 1.3), p=0.08 **Symptom days** Intervention associated with reduced frequency • RR 0.5 (0.4 to 0.8), p=0.003 **Symptom nights** Intervention associated with reduced frequency • RR 0.4 (0.2 to 0.8), p=0.009 **School days missed** Intervention associated with fewer missed days • RR 0.3 (0.1 to 0.7), p=0.006 **QoL cumulative score** No significant difference between groups • RR 1.2 (0.9 to 1.6), p=0.35

Author Year Package	Setting Population	Intervention and Comparison	Outcomes
Bartholomew et al. 2006[23] **Partners in School Asthma Management**	**School-based (cluster randomization)** 60 urban elementary schools **N=835** **Mean age:** 8 **% Female:** 48% **Race** Hispanic: 51% African American: 45% White: 3% Other: 1% **Socioeconomic status** Household income Majority <$20,000 28% <$10,000 **Severity:** NR	**Intervention** Computer-based tailored educational program and school environmental assessment and intervention. 15 schools also received an enhanced intervention allowing children and parents to meet with project physician, develop asthma action plan, receive 1-month supply of medication **Comparison:** No intervention	**Hospitalizations** No significant difference between groups (data NR) **Symptom level or rate of decline** No significant difference between groups (data NR) **Episodes away from home** No significant difference between groups (data NR) **Everyday self-management** Intervention associated with increased self-management: $t(456)=3.30$, $p=0.001$ **Trigger management** Intervention associated with higher levels of trigger management: $t(456)=4.27$, $p<0.0001$ **Exercise pretreatment self-management** Intervention associated with increased exercise: $t(456)=2.83$, $p=0.0049$ **Self-management of episodes at home** Intervention associated with increased self-management: $t(1188)=263$, $p=0.0087$

AMD=adjusted mean difference; AQLQ=Asthma Quality of Life Questionnaire; ASMA=Asthma Self-Management for Adolescents; CI=confidence interval; ED=emergency department; ICC=I Can Cope; NR=not reported; OAS=Open Airways for Schools; OR=odds ratio; PA2=Peer Asthma Action; QoL=quality of life; RR=risk ratio; SD=standard deviation; SE=standard error; SHARP=Staying Healthy-Asthma Responsible & Prepared; SMD=standardized mean difference

Table D-5.   Observational studies of asthma self-management education packages

Author Year Package	Study Design Setting Population	Intervention and Comparison	Outcomes
McClure et al. 2018[21] **Green Means Go**	**Pre-post** **School-based** Urban elementary school Grades preK-4 **N=103** 90 students 12 teachers 1 parent **Mean age:** Not reported (NR) **% Female:** NR **Race** African American: 90% Hispanic: 5% White: 2% Other: 3% **Socioeconomic status** 97% of students "economically disadvantaged" **Severity:** NR	**Intervention** Nursing students led 4 sessions for grades K-4 and 2 sessions for pre-K students. Content included symptom awareness and reporting symptoms to teachers or staff. Training also provided to teachers, focused on symptom identification, use of symptom log, and communication with parents. Training was offered to parents, including symptom identification and management, communication with teachers, and home environmental triggers. Home visits were offered to develop individual trigger strategies. **Comparison** Pre-post	**Student identification of symptoms** 100% of students could correctly identify their asthma zone and action steps after the program. **Teacher preparedness** 71% of teachers reported that they felt well-prepared to assist students with asthma.
Crane et al. 2015[16] **Open Airways for Schools (OAS)** (modified)	**Cohort** **School-based** 5 urban elementary schools **N=65** 45 intervention 20 control **Mean age:** 10 **% Female:** 40% **Race:** NR **Socioeconomic status** Schools in "area with limited incomes" **Severity:** NR	**Intervention** OAS modified to include ten 20-minute sessions covering same material as traditional OAS. Volunteer facilitators delivered sessions during school lunch periods in 4 schools. **Comparison** Original OAS delivered in 1 school.	OAS includes a participant questionnaire given before and after the program. All students in both groups were given the questionnaires. **General knowledge of symptoms and self-management** Students' knowledge of asthma symptoms and management improved between pre- and post-test, within both groups. Authors did not report if the differences between groups were statistically significant for the first 10 questions of the survey. **Identification of asthma triggers** Question 11 of the questionnaire asks students to identify potential asthma triggers. Students receiving the original OAS improved trigger recognition by 35%; students in the modified OAS group improved by 89%. The difference between groups was statistically significant ($\alpha=0.001$).

Author Year Package	Study Design Setting Population	Intervention and Comparison	Outcomes
Kapheim et al. 2015[33] **Homegrown**	**Pre-post** **Home-based** 6 inner-city public housing buildings **N=59** **Mean age:** 9 **% Female:** 49% **Race** Non-Hispanic Black: 95% Hispanic Black: 5% **Socioeconomic status** Household income <$10,000: 45% Between $10,000 and $20,000: 21% Between $20,000 and $30,000: 11% **Severity** Well controlled: 24% Not well controlled: 22% Very poorly controlled: 54%	**Intervention** Community health workers visited participants' homes 6 times over 1 year. Content included physiology, symptoms, medications, triggers. Strategies for minimizing triggers were individually tailored to each home. **Comparison** Pre-post	**Asthma control** Intervention associated with better asthma control - Children with well controlled asthma increased: 24% to 78%, p<0.001 - Not well controlled asthma decreased: 22% to 10%, p<0.001 - Very poorly controlled asthma decreased: 54% to 12%, p<0.001 **Hospitalizations** Intervention associated with fewer children having ≥2 hospitalizations - Decreased: 8% to 2%, p<0.001 Intervention associated with more children having no hospitalizations - Increased: 69% to 91%, p<0.001 **Emergency department (ED) visits** Intervention associated with fewer children having ≥2 ED visits - Decreased: 27% to 5%, p<0.001 Intervention associated with more children having no ED visits - Increased: 56% to 80%, p<0.001 **Daytime symptoms** (mean days per week) Intervention associated with reduced frequency - Decreased: 4.1 days to 0.8, p<0.001 **Nighttime symptoms** (mean days per week) Intervention associated with reduced frequency - Decreased: 3.0 days to 0.8, p<0.001 **Rescue medication use** (mean days per week) Intervention associated with reduced frequency - Decreased: 3.1 days to 0.9, p=0.004 **Quality of life** (Pediatric Asthma Caregiver's Quality of Life Questionnaire, 7-point scale) Intervention associated with improved overall score - Increased: 5.4 to 6.1, p<0.05

Author Year Package	Study Design Setting Population	Intervention and Comparison	Outcomes
Rasberry et al. 2014[40] **Homegrown**	**Cross-sectional** **School-based** Rural school district **N=456** 299 intervention 157 control **Mean age** Intervention: 12 Control: 12 **% Female** Intervention: 43% Comparison: 43% **Race** White: 58% African American: 38% Other: 4% **Socioeconomic status:** NR **Severity** Well-controlled: 64% Poorly controlled: 36%	**Intervention** Computer-based programs (IMPACT Asthma—Kids) for kindergarten through 5th grade, support groups and all day workshops throughout the year, case management provided by school nurses and asthma educators, staff training in partnership with Asthma Ready Communities **Comparison** Cross-sectional	**Asthma control** (Asthma Control Questionnaire mean score, range 0 to 6) Intervention associated with better asthma control • Intervention: 0.93 (standard deviation [SD] 0.73) • Control: 1.14 (SD 0.84) • $F_{(1, 456)}$=8.17, p=0.0045 • Intervention associated with greater likelihood of well-controlled asthma: odds ratio (OR)=1.548 (95% confidence interval [CI] 1.017 to 2.358)
Saiyed et al. 2013[18] **Asthma Blues**	**Pre-post** **Hospital-based** Urban academic medical center **N=10** **Mean age:** 54 **% Female:** 70% **Race** Black: 50% Hispanic: 20% White: 20% Other: 10% **Socioeconomic status:** NR **Severity:** NR	**Intervention** Respiratory therapist delivered 1 session using educational modules and recorded songs from Asthma Blues album. Therapist modeled proper use of nebulizer, peak flow meter, and spacer. **Comparison** Pre-post	**Asthma knowledge** (Asthma Blues pre/post-test, 15 questions) Intervention associated with improved knowledge • % correct responses increased: 45% (range 9-74) to 71% (43-91) **Device knowledge** (Device Knowledge Questionnaire, a set of checklists demonstrating proper use of nebulizer, peak flow meter, spacer) Intervention associated with improved knowledge • Correct use of nebulizer increased: 50% to 100% • Correct use of peak flow meter increased: 20% to 100% • Correct use of spacer increased: 60% to 100%

Author Year Package	Study Design Setting Population	Intervention and Comparison	Outcomes
Sweet et al. 2013[22] **Healthy Homes**	**Pre-post** **Home-based** Urban community **N=115** **Mean age:** 7 **% Female:** 42% **Race** African American: 72% White: 17% Hispanic: 5% Other: 6% **Socioeconomic status** All participants had family income <80% of median county income **Severity:** NR	**Intervention** Nurses and health educators conducted home visits to identify asthma triggers and provide education on symptoms, medications, and triggers. Participants also received mattress covers, vacuum cleaners, cleaning supplies, pest management supplies, and dehumidifiers as needed. **Comparison** Pre-post	**Hospitalizations** (mean, prior 3 months) Intervention not associated with significant change • Decreased: 0.15 to 0.08, p=0.33 **ED visits** (mean, prior 3 months) Intervention associated with fewer ED visits • Decreased: 1.17 to 0.50, p<0.01 **Daytime symptoms** (mean days per week) Intervention associated with fewer symptoms • Decreased: 5.01 to 2.66, p<0.01 **Nighttime awakenings** (mean days per week) Intervention associated with fewer awakenings • Decreased: 3.18 to 1.31, p<0.01 **Albuterol use** (mean days per week) Intervention associated with less use • Decreased: 4.58 to 2.17, p<0.01 **Missed school days** (mean days, prior 6 months) Intervention associated with fewer absences • Decreased: 6.24 to 2.81, p<0.01 **Missed work days** (mean days, prior 6 months) Intervention not associated with significant change • Decreased: 3.41 to 0.83, p=0.04 **Activity limitations** (mean days per week) Intervention associated with fewer absences • Decreased: 3.84 to 1.62, p<0.01

Author Year Package	Study Design Setting Population	Intervention and Comparison	Outcomes
Turyk et al. 2013[34] **Homegrown**	**Pre-post** **Community-based** Inner-city neighborhood **N=218** **Age distribution** <5 years: 24% 5-11: 47% 12-18: 29% **% Female**: 44% **Race** African American: 100% **Socioeconomic status** Inner-city poverty **Severity** 43% had persistent symptoms	**Intervention** Health educator performed 2 home visits and multiple follow-up phone calls. Content included physiology, medications, triggers, action plans, use of inhalers, peak flow meters, spacers. Environmental remediation was tailored to each home. **Comparison** Pre-post	**Uncontrolled asthma** (composite measure) Intervention associated with reduced likelihood of uncontrolled asthma • Decreased: 62.8% to 30.4%, p<0.001 **Hospitalizations** Intervention associated with fewer hospitalizations • Decreased: 15.6% to 4.6%, p<0.001 **ED visits** Intervention associated with fewer ED visits • Decreased: 46.8% to 23.9%, p<0.001 **Urgent care** Intervention associated with fewer visits • Decreased: 46.1% to 19.4%, p<0.001 **Missed school days** (mean, prior 12 months) Intervention associated with fewer absences • Decreased: 4.3 to 1.3, p<0.001 **Missed work days** (mean, prior 12 months) Intervention associated with fewer absences • Decreased: 2.5 to 0.9, p<0.001
McCarty and Rogers 2012[41] **Homegrown**	**Descriptive** **Hospital-based** Urban pediatric hospital **N=156 parents** **Age**: NR **% Female**: NR **Race**: NR **Socioeconomic status**: NR **Severity**: NR	**Intervention** Nurses provided group education for parents while children receive inpatient care. Content included physiology, medications, symptom management, triggers. **Comparison** Descriptive	**Learning new information** 93% of parents reported that they learned new information during the classes, even though 44% also reported they had received prior asthma education **Usefulness of materials** 97% of parents reported that the materials were helpful **Overall satisfaction** 79% of parents rated the class as Excellent, 19% rated the class as Very Good, 2% rated the class as Good

Author Year Package	Study Design Setting Population	Intervention and Comparison	Outcomes
Davis et al. 2011[38] **Homegrown**	**Cohort** **Hospital-based** Urban pediatric hospital **N=1,398** 698 intervention 698 control **Age range:** 1 to 18 **% Female** Intervention: 8% Control: 37% **Race** African American: 39% Hispanic: 24% White: 12% Other: 24% **Socioeconomic status** Medicaid coverage: 71% **Severity:** NR	**Intervention** Nurse or respiratory specialist delivered 45-minute session in patient's room. Content included physiology, medications, action plans, warning signs, triggers and avoidance, communication with provider. Families received 12 page booklet and information about community services **Comparison** No intervention	**Repeat ED visits** Intervention group had a significantly higher risk of returning to the ED during the 365 days post-intervention compared with no intervention group: • Basic model: hazard ratio 2.38 (95% CI 1.77 to 3.22) • Fitted model: hazard ratio 2.45 (95% CI 1.82 to 3.31)

Author Year Package	Study Design Setting Population	Intervention and Comparison	Outcomes
Findley et al. 2011[10] **Asthma Basics for Children**	**Pre-post** **School-based** Urban early childhood centers **N=874** **Mean age:** 4 **% Female:** 44% **Race** Latino: 80% African American: 15% White or Asian: 5% **Socioeconomic status:** NR **Severity:** NR	**Intervention** Components included training and staff support, 2 hour parent educational workshop, parent and child educational activities, making the center asthma-friendly, evaluation, and feedback **Comparison** Pre-post	**Hospitalizations** Intervention associated with fewer hospitalizations • Decreased: 24% to 11%, p<0.001 **ED visits** Intervention associated with fewer ED visits • Decreased: 74% to 47%, p<0.001 **Daytime symptoms** Intervention associated with fewer symptoms • Decreased: 78% to 42%, p<0.001 **Nighttime symptoms** Intervention associated with fewer symptoms • Decreased: 81% to 49%, p<0.001 **Daycare absences** Intervention associated with fewer absences • Decreased: 56% to 38%, p<0.001 **Staff and parent knowledge** Intervention associated with increased staff and parent knowledge • Staff correct responses increased: 49% to 82% • Parent correct responses increased: 62% to 79% **Use of asthma action plan by providers** Use of actions plans increased: 47% to 70% **Parents asthma management behaviors** • Obtained asthma action plan from provider increased: 46% to 57% • Confidence in ability to manage child's asthma increased: 57% to 80%

Author Year Package	Study Design Setting Population	Intervention and Comparison	Outcomes
Tolomeo et al. 2010[39] **Homegrown**	**Cohort** **Hospital-based** Urban pediatric hospital **N=298** 126 intervention 172 comparison **Mean age:** 6 **% Female:** 34% **Race** White: 36% Black: 35% Hispanic: 24% Other: 5% **Socioeconomic status** 44% of households had income below national median **Severity** Mild intermittent: 20% Mild persistent: 13% Moderate persistent: 14% Severe persistent: 6% Unidentified: 47%	**Intervention** Single 1-hour session delivered by health educators. Content included physiology, symptoms, triggers, asthma action plan. **Comparison** No intervention	**Hospitalizations** No statistically significant difference was observed between groups • 14% of intervention group had at least one hospitalization in prior year, vs. 21% of control group, p=0.14 **ED visits** No statistically significant difference was observed between groups • 29% of intervention group had at least one ED visit in prior year, vs. 31% of control group, p=0.60

Author Year Package	Study Design Setting Population	Intervention and Comparison	Outcomes
Tousman et al. 2010[35] **Homegrown**	**Pre-post** **Community-based** **N=21** **Mean age:** 60 (range 19-82) **% Female:** 76% **Race:** NR **Socioeconomic status:** NR **Severity:** NR	**Intervention** Health care professionals delivered seven 2 hour classes over 7 consecutive weeks. Content included asthma control, asthma action plans, medications, triggers, exercise, relaxation, and hydration. **Comparison** Pre-post	**Asthma Control Questionnaire** Intervention associated with improved control • Mean score improved: t(20)=2.19, p=0.04, original data NR **Quality of Life (QoL) (Juniper QoL survey)** Intervention associated with improved QoL (mean score) • Increased: 4.5 (SD 1.3) to 5.6 (1.1), p=0.001 **Asthma knowledge** Intervention associated with improved knowledge on homegrown test (14 items, mean score) • Improved: t(20)=9.1, p<0.001 **Peak flow meter use** (mean days per week) Intervention associated with greater frequency • Increased: 1.3 days (SD 2.5) to 5.5 (2.1), p<0.001 **Controller medication use** (mean days per week) Intervention associated with greater frequency • Increased: 4.5 days (2.9) to 5.9 (2.4), p<0.05 **Rescue medication use** (mean days per week) No difference reported between groups • 2.9 days (2.9) to 2.8 (2.8), t<1 **Patient spent at least 20 minutes reducing or removing asthma triggers** (mean days per week) Intervention associated with greater frequency • Increased: 1.7 days (1.6) to 3.5 (1.9), p<0.001 **Patient spent at least 20 minutes reading about asthma** (mean days per week) Intervention associated with greater frequency • Increased: 0.6 days (1.0) to 2.9 (2.9), p<0.001

Author Year Package	Study Design Setting Population	Intervention and Comparison	Outcomes
Zografos et al. 2010[12] **Kickin' Asthma** (modified)	**Cohort** **School-based** Six middle and/or high schools **N=87** **Mean age:** 13 **% Female:** 38% **Race** White: 48% Hispanic: 13% African American: 6% All other: 33% **Socioeconomic status:** NR **Severity:** NR	**Intervention** Six 40 minute sessions, delivered twice per week over a 3-week period. Content included pathophysiology, warning signs and triggers, how to reduce and eliminate triggers, medications, devices **Comparison** Non-equivalent comparator, received intervention three weeks after the study start	**Note:** Since both groups received same intervention, comparisons from baseline to follow-up were made after collapsing across study conditions. **Peak flow meter use** (mean days per week) Intervention associated with greater frequency • Increased: 0.60 days (SD 1.44) to 2.24 (2.50), p<0.001 **Spacer use** (mean days per week) Intervention associated with greater frequency • Increased: 1.45 days (SD 2.33) to 2.28 (2.67), p=0.011 **Rescue medication use** (mean days per week) No statistically significant change reported • 2.17 days (SD 1.45) to 1.91 (1.46), p=0.366 **Avoidance of triggers** (mean times per week) No statistically significant change reported • 2.30 days (SD 1.35) to 2.11 (1.37), p=0.419 **Avoidance of anti-inflammatory** (mean times per week) No statistically significant change reported • 2.13 days (SD 1.36) to 2.00 (1.36), p=0.851
Zuniga et al. 2010[9] **Asthma 101**	**Pre-post** **Train the trainer program** Nursing students in senior year at one nursing school, over two consecutive years **N=158** 2009: 93 students 2010: 65 students	**Intervention** Nursing students received formal training using the Asthma 101 curriculum. Content included asthma symptoms, medications, triggers, management, and use of action plans. **Comparison** Pre-post	**Asthma knowledge** Training associated with improved knowledge, measured by mean score on 5 question pre- and post-test • In 2009, overall mean score increased: 4.21 (SD 0.86) to 4.81 (0.47), p<0.001 • In 2010, overall mean score increased: 4.26 (1.00) to 4.66 (0.57), p<0.001

Author Year Package	Study Design Setting Population	Intervention and Comparison	Outcomes
Magzamen et al. 2008[11] **Kickin' Asthma**	**Pre-post** **School-based** 18 urban middle and high schools Grades 6-12 **N=513** **Age:** NR **% Female:** 50% **Race:** NR **Socioeconomic status:** NR **Severity:** NR	**Intervention** Nurse delivered four 50-minute sessions. Content included physiology, symptoms, medications, triggers, managing emergencies. **Comparison** Pre-post	**Note:** Data reported for each of three years of study implementation, but not aggregated; data below is presented as Year 1/Year 2/Year 3 **ED visits** Intervention associated with lower risk • OR of improvement (95% CI): 3.13 (1.41 to 6.92) / 3.83 (2.03 to 7.23) / 2.36 (1.26 to 4.40) **Asthma outpatient visits** Intervention associated with lower risk in 2 of 3 years • OR of improvement: 3.00 (1.41 to 6.39) / 2.5 (1.59 to 3.93) / 1.21 (0.74 to 2.00) **Daytime symptoms** Intervention associated with lower risk in 2 of 3 years • OR of improvement: 1.22 (0.62 to 2.42) / 1.71 (1.35 to 2.17) / 2.97 (2.10 to 4.21) **Nighttime symptoms** Intervention associated with lower risk in 2 of 3 years • OR of improvement: 2.61 (1.64 to 4.16) / 3.84 (2.51 to 5.89) / 6.53 (3.40 to 12.50) **Missed school days** (mean per month) Intervention associated with fewer absences in 2 of 3 years • Decreased from 1.12 days to 0.58, $p<0.05$ / decreased from 0.98 to 0.72, $p<0.05$ / no significant change from 0.93 to 0.85, $p=0.44$ **Activity limitations** (mean per month) Intervention associated with fewer limitations in all 3 years • Decreased from 3.06 to 2.36, $p<0.015$ / decreased from 3.38 to 2.76, $p<0.001$ / decreased from 3.36 to 2.24, $p<0.001$

Author Year Package	Study Design Setting Population	Intervention and Comparison	Outcomes
Joshi et al. 2007[36] **Homegrown**	**Pre-post** **Hospital-based** Urban pediatric hospital **N=69** **Mean age:** 8 (SD 4) **% Female:** 30% **Race:** African American: 88% White: 6% Hispanic: 3% Other: 3% **Socioeconomic status:** NR **Severity:** NR	**Intervention** During an asthma-related ED visit, patients completed a computerized educational program that lasted 15-30 minutes. Content included physiology, symptoms, triggers, medications, inhaler and spacer use, and an asthma action plan. Program included audio-visual and animation features, positive reinforcement, and evaluation with constructive feedback. **Comparison** Pre-post	**Asthma knowledge** (homegrown 12-item survey) Intervention associated with improved knowledge for all patients and for the subgroup of patients ≤11 years old. Improvement was not significant in subgroup of patients >11 years old. • All patients: 13% increase, p=0.01 • Patients ≤11 years: 15% increase, p=0.02 • Patients >11 years: 5% increase, p=0.23 **Usability and satisfaction** Patients reported that the program was easy to use, interesting, and enjoyable • 81% reported the program was Very Easy to use, 16% reported it was Easy • 65% reported it was Very Interesting, 26% reported it was Interesting • 64% reported it was Very Enjoyable, 25% reported it was Enjoyable
Tousman et al. 2007[37] **Homegrown**	**Pre-post** **Community-based** **N=21** **Mean age:** 53 (range 23-75) **% Female:** 76% **Race:** NR **Socioeconomic status:** NR **Severity:** NR	**Intervention** Health care professionals delivered seven 2 hour classes over 7 consecutive weeks. Content included asthma control, asthma action plans, medications, triggers, exercise, relaxation, and hydration. **Comparison** Pre-post	**Quality of Life (QoL) (Juniper QoL survey)** Intervention associated with improved QoL (mean score) • Increased: 4.5 (SD 1.4) to 5.5 (1.1), p=0.001 **Asthma knowledge** Intervention associated with improved knowledge on homegrown test (14 items, mean score) • Improved: t(19)=7.8, p<0.001 **Peak flow meter use** (mean days per week) Intervention associated with greater frequency • Increased: 0.58 days (SD 1.1) to 7.8 (6.4), p<0.001 **Rescue medication use** (mean days per week) Intervention associated with reduced frequency • Decreased: 3.25 days (1.3) to 1.3 (2.2), p=0.002

CI=confidence interval; ED=emergency department; NR=not reported; OAS=Open Airways for Schools; OR=odds ratio; QoL=quality of life; SD=standard deviation