

## Clinical Commentary Review

# Economic Evidence for US Asthma Self-Management Education and Home-Based Interventions

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**The health and economic burden of asthma in the United States is substantial. Asthma self-management education (AS-ME) and home-based interventions for asthma can improve asthma control and prevent asthma exacerbations, and interest in health care-public health collaboration regarding asthma is increasing. However, outpatient AS-ME and home-based asthma intervention programs are not widely available; economic sustainability is a common concern. Thus, we conducted a narrative review of existing literature regarding economic outcomes of outpatient AS-ME and home-based intervention programs for asthma in the United States. We identified 9 outpatient AS-ME programs and 17 home-based intervention programs with return on investment (ROI) data. Most programs were associated with a positive ROI; a few programs observed positive ROIs only among selected populations (eg, higher health care utilization). Interpretation of existing data is limited by heterogeneous ROI calculations. Nevertheless, the literature suggests promise for sustainable opportunities to expand access to outpatient AS-ME and home-based asthma intervention programs in the United States. More definitive knowledge about how to maximize program benefit and sustainability could be gained through more controlled studies of specific populations and increased uniformity in economic assessments. Published by Elsevier Inc. on behalf of the American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2016;■:■-■)**

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In the United States, asthma affects more than 22 million persons and costs approximately \$63 billion annually.<sup>1,2</sup> Uncontrolled asthma is common in this population, affecting 50% of adults and 38% of children.<sup>3</sup> Moreover, estimates indicate that asthma-related emergency department (ED) visits and hospitalizations account for 30% of expenditures.<sup>2</sup> Together, these data suggest ample opportunity to improve asthma control and prevent asthma exacerbations, which could reduce the economic burden of asthma.

Certainly, uncontrolled asthma is multifactorial.<sup>3</sup> Access and adherence to medical care consistent with the 2007 National Asthma Education and Prevention Program Guidelines for the Diagnosis and Management of Asthma are fundamental.<sup>4,5</sup> In the 2007 National Asthma Education and Prevention Program Guidelines for the Diagnosis and Management of Asthma, complementary key components of asthma management include asthma self-management education (AS-ME) at multiple points of care, as well as control of environmental factors. Moreover, individually tailored, multifaceted home-based interventions are recommended as a means to provide AS-ME and/or reduce environmental asthma triggers for specific populations.<sup>4</sup>

Despite the 2007 National Asthma Education and Prevention Program Guidelines for the Diagnosis and Management of Asthma and growing emphasis on prevention and health care-public health collaboration in the United States,<sup>4,6-8</sup> there is limited availability of AS-ME outside of the traditional physician's office visit (hereafter referred to as "intensive AS-ME"<sup>4</sup>; examples include AS-ME provided through a group class or an individual visit dedicated to asthma education with an allied health professional) and home-based intervention programs (eg, programs offering individually tailored education or assistance regarding environmental trigger reduction in the home).<sup>4,7,9-11</sup> Economic sustainability is a common concern.<sup>10,12</sup> Improved understanding of these programs' economic implications could be useful to clinicians, health care administrators, public health officials, policymakers, investigators, and others considering such programs for the outpatient or home setting.

Thus, this review examined existing literature regarding economic outcomes reported for intensive outpatient AS-ME or home-based intervention programs for asthma in the United States.

## REVIEW APPROACH

For this narrative review, the following databases were searched in January 2016 for studies on asthma-related education or home-based intervention programs (heretofore referred to as "programs") with cost or economic data (for a complete list of

*Abbreviations used*

AS-ME- asthma self-management education  
 CHW- community health worker  
 ED- emergency department  
 ROI- return on investment

search terms and strategies, see [Table E1](#) in this article's Online Repository at [www.jaci-inpractice.org](http://www.jaci-inpractice.org): PubMed/MEDLINE (1946-present), EMBASE (1947-present), Cochrane Library (1800-present), and CINAHL (1981-present). Other relevant articles were identified through manual searching of articles' reference lists. Similar search terms were used to conduct an online search of non-peer-reviewed materials (eg, white papers and publicly available Web sites) and identify additional documents for reference list review. No data were obtained through personal communication.

Inclusion criteria were as follows: (1) the program included provision of intensive outpatient AS-ME or 1 or more asthma-related home visits; (2) the program was provided to persons with asthma (ie, tertiary prevention rather than primary or secondary prevention); (3) the program was conducted in the United States; and (4) asthma-specific data on return on investment (ROI) or calculated cost savings (positive or negative) were reported. Disease management programs met the first inclusion criterion if intensive outpatient AS-ME or 1 or more asthma-related home visit was specifically mentioned as a program component.

Exclusion criteria were as follows: (1) the program was restricted to an inpatient, ED, school, residential camp, or military setting; (2) the program description mentioned "asthma education" without specifying AS-ME; or (3) reported ROI or cost savings data did not include asthma-specific calculations.

Abstracted data included program participants, personnel, components, health care utilization outcomes (ie, utilization of medical care for asthma), and economic outcomes (ie, ROI or calculated cost savings [positive or negative]). Given this review's focus, the program sample sizes presented herein are those used to calculate ROI or cost savings; these might have differed from the total number of persons who participated.

A descriptive analysis was performed using Microsoft Excel. Programs that offered both intensive outpatient AS-ME and 1 or more asthma-related home visits were classified as asthma-related home visit programs. Also, programs were stratified by whether a benefit-cost ratio (ie, ROI) was explicitly reported, because it could not be ascertained whether calculations of cost savings without accompanying ROI data consistently included program operating costs.

## INTENSIVE OUTPATIENT AS-ME PROGRAMS

We identified 9 US programs that provided intensive outpatient AS-ME and reported the ROI ([Table I](#)).<sup>13-32</sup> All but one were reported in peer-reviewed literature.<sup>15</sup> An additional 18 US programs providing intensive outpatient AS-ME reported cost savings without ROI data (see [Table E2](#) in this article's Online Repository at [www.jaci-inpractice.org](http://www.jaci-inpractice.org)).

All 4 US Census regions were represented among the 9 programs with ROI data (see [Figure E1](#) in this article's Online Repository at [www.jaci-inpractice.org](http://www.jaci-inpractice.org)). Most programs (6 of 9) occurred in exclusively urban settings<sup>15-21,23-25,27-31</sup>; 1 included

both urban and suburban sites<sup>22</sup>; and information was not available for the remaining 2 programs.<sup>13,14,26</sup>

More than half of the programs with ROI data (5 of 9) enrolled only children,<sup>15-20,23-25,29-32</sup> and 2 others included both children and adults.<sup>13,14,26</sup> Only 2 were adult-specific.<sup>22,27,28</sup> Beyond asthma, eligibility requirements for most programs (6 of 9) included some specification of asthma severity, control, or risk. Sample sizes used to determine ROI were available for 8 of 9 programs (median, 220; range, 47-1033).

Most programs (6 of 9) provided intensive outpatient AS-ME in 1 or more group sessions (maximum, 8); 3 provided AS-ME to individuals or individual families (2 face-to-face,<sup>15,18-20</sup> 1 through regular phone calls<sup>13,14</sup>). Program personnel included nurses, respiratory therapists, social workers, and community health workers (CHWs). Also, programs varied widely in scope and type of additional interventions offered (eg, case management, linkage to clinical or social services, supplies such as peak flow meters or bedding encasements).

The methodology used to evaluate program outcomes was primarily randomized controlled trial (5 of 9); pre-post analysis was applied to 4 programs.<sup>13,16-17,26-28</sup> Length of participant follow-up (reported for 8 of 9 programs) ranged from 6 months to 2 years. ROI calculations all incorporated ED visits and hospitalizations but varied substantially in other included considerations (eg, discount rates and costs of medications, nebulizers, ambulances, or scheduled or unscheduled office visits). For all but one program,<sup>27,28</sup> reported ROIs excluded potential cost savings from reductions in work or school absenteeism.

Reductions in asthma-related ED visits or hospitalizations for program participants were reported for most (6 of 9) programs. In another program, decreased ED visits and hospitalizations occurred exclusively among program participants with 1 or more hospitalizations in the past year.<sup>23-25</sup> No effect on asthma-related health care utilization was reported for only 1 program.<sup>15</sup>

Eight of 9 programs were associated with a positive ROI (ie, >\$1 return per \$1 invested) for all or some participants ([Table II](#)); among these, 2 programs achieved positive ROIs only among participants with higher health care utilization for asthma (eg,  $\geq 1$  hospitalization or  $\geq 2$  unscheduled visits within a certain time frame before program participation).<sup>23-25,29-31</sup> Estimated time to achieve ROI ranged from 1 to 3 years.

## ASTHMA-RELATED HOME VISIT PROGRAMS

We identified 17 US programs that provided 1 or more asthma-related home visits and reported the ROI ([Table III](#)).<sup>21,33-85</sup> Approximately half (9 of 17) were identified in peer-reviewed literature.<sup>36,46-48,54,60,63,64,76,77,80,81,83-85</sup> An additional 25 US programs providing 1 or more asthma-related home visits reported cost savings without ROI data (see [Table E3](#) in this article's Online Repository at [www.jaci-inpractice.org](http://www.jaci-inpractice.org)).

All 4 US Census regions were represented among the 17 programs with ROI data, but programs were predominantly located in the midwest (7 of 17) and northeast (6 of 17). Most programs (12 of 17) operated in urban settings,<sup>33-36,42-53,60-75,80-84</sup> and information was not available for the remaining 5 programs.<sup>37-41,54-59,76-79,85</sup> Program descriptions indicated that health insurance plans operated or served as partners in more than one-third (6 of 17) of the programs.<sup>33,43,54,55,59,67,70,71,78,79</sup>

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