

Educational and behavioral interventions for asthma: who achieves which outcomes?

A systematic review

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Objectives: Randomized clinical trial (RCT) data reviewed for outcomes and processes associated with asthma educational and behavioral interventions provided by different types of health professionals.

Methods: Cochrane Collaboration, MEDLINE, PUBMED, Google Scholar search from 1998 to 2009 identified 1650 articles regarding asthma educational and behavioral interventions resulting in 249 potential studies and following assessment produced a final sample of 50 RCTs.

Results: Approaches, intended outcomes, and program providers vary greatly. No rationale provided in study reports for the selection of specific outcomes, program providers, or program components. Health care utilization and symptom control have been the most common outcomes assessed. Specific providers favor particular teaching approaches. Multidisciplinary teams have been the most frequent providers of asthma interventions. Physician-led interventions were most successful for outcomes related to the use of health care. Multidisciplinary teams were best in achieving symptom reduction and quality of life. Lay persons were best in achieving self-management/self-efficacy outcomes. Components most frequently employed in successful programs are skills to improve patient-clinician communication and education to enhance patient self-management. Fifty percent of interventions achieved reduction in the use of health care and one-third in symptom control. A combination approach including self-management and patient-clinician communication involving multidisciplinary team members may have the greatest effect on most outcomes.

Conclusions: The extent to which and how different providers achieve asthma outcomes through educational and behavioral interventions is emerging from recent studies. Health care use and symptom control are evolving as the gold standard for intervention outcomes. Development of self-management and clinician-patient communication skills are program components associated with success across outcomes and providers.

Keywords: interventions, asthma, health professionals, systematic review

Introduction

Nonpharmacological interventions to support children and adults with asthma include self-management education and support, information giving, behavioral change techniques, and efforts to enhance communication between the person with asthma and health care professionals. These diverse interventions have been provided by an equally diverse range of individuals from physicians to nurses, multidisciplinary teams, pharmacists, and lay educators. Evaluation in these trials has utilized a variety of outcome measures. This review set out to determine the type of interventions offered by various professionals and what type of outcomes they achieve.

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In the past decade, the quality and quantity of asthma educational and behavioral interventions have increased, probably as a result of high asthma prevalence, advances in the understanding of clinical management and management by patients, and increasing interest in theories of education and behavior change.¹⁻³ Educational and behavioral programs evaluated in clinical trials have been delivered by a variety of health professionals and lay people. Rigorously evaluated interventions have aimed at achieving a variety of outcomes and have used a variety of program components.

The financial and material costs of delivering interventions for asthma, although not always discussed in reports of findings, can be expected to differ, at least, according to whose time must be covered to implement the program. Theoretically, different types of program providers may differ in their ability to produce desired outcomes. For example, it may be that clinicians could be expected to be more able to address correct use of medical regimens and lay persons more able to advise regarding day-to-day barriers to managing asthma effectively. However, such assumptions have not been tested empirically.

This review of interventions aimed at (a) describing the outcomes of clinical trials of asthma educational and behavioral interventions undertaken by different types of providers in the past decade and (b) exploring differences in program components employed by them.

Methods

Articles appearing in the English language in the Cochrane Collaboration Data Base, MEDLINE, PUBMED, and Google Scholar were searched. Reference lists on identified articles were also searched. Search terms included asthma self-management, asthma behavior, asthma randomized controlled trials, asthma outcomes, asthma education, and asthma patient education. Inclusion criteria were publication in a peer-reviewed journal between 1990 and 2009; randomized clinical trial (RCT) to assess an educational or behavioral intervention for asthma; and evidence of statistical assessment of asthma-related outcomes on at least one variable including asthma symptoms, pulmonary function, medicine use, psychosocial factors, days absent from work or school, days of restricted activity due to asthma, self-management, self-efficacy, quality of life, emergency department use, hospital in-patient stays, and office visits. Success in achieving outcomes was accepted as statistical difference between interventions and control in a patient sample of at least 100 subjects. Virtually no study provided sample size calculations, and as asthma outcomes related to health care

use generally require larger samples, 100 was considered a generous cut point. Studies failing to meet all of these criteria were excluded.

The initial search was broad, accepting any article related to evaluation of social and behavioral interventions to ensure a comprehensive view of available work, and generated 1650 articles. Preliminary application of study criteria identified 249 potential studies for inclusion that met one or more criteria. Further review of these investigations by two independent reviewers yielded 50 RCTs that fully met all inclusion criteria. No individual authors were contacted for information. No further review of methodological quality of the studies was conducted beyond that it appeared in a peer review journal and comprised an RCT. The 50 eligible articles were again closely examined by two individuals and data extracted using a standard protocol regarding target population, sample size, program provider, program content, intervention components, processes, and outcomes. Comparison among provider type was computation of differences between percent of successful program to number attempted. No further statistical analyses were employed.

Results

The majority of the 50 RCT evaluated programs were conducted by teams of providers ($n = 20$) and the least by pharmacists ($n = 4$). Just above 28% were offered to adults with asthma, just under 65% were for children, and 7% included both.

Table 1 illustrates that among the most frequently studied outcomes (health care use, symptoms, self-management/self-efficacy, and quality of life), health care use was the outcome most frequently reported. In the majority of studies, no delineation was made as to which were primary versus secondary goals of the research. A number of studies described more than one outcome resulting from the program, and not all reported about the same or included all the major outcomes. Table 2 provides the outcomes achieved in programs by provider type. Considering the number of interventions undertaken by type of provider and the number reporting success achieving health care use reductions, physicians had a 83% success rate (ie, the percent of times positive health care reduction outcomes were reported given the number of studies by that type of provider), nurses reported success in 73% of their undertakings, pharmacists reported no success, multidisciplinary teams reported 50% success, and lay people 35% success. For reports of symptom reduction, reported success for physicians was 33%, nurses 36%, pharmacists 50%, multidisciplinary teams 51%, and lay

Table 1 Studies by provider and major outcomes (symptoms, health care use, quality of life, self-management/self-efficacy)

Health care use	Symptom reduction	Quality of life	Self-management/ self-efficacy
Physicians (programs n = 5)			
Cabana et al ⁴	Glasgow et al ⁶	–	–
Clark et al ⁵	Yoon et al ⁹	–	–
Glasgow et al ^{6*}	–	–	–
Hoskins et al ⁷	–	–	–
Moudgil et al ⁸	–	–	–
Nurses (programs n = 12)			
Bolton et al ¹⁰	Becker et al ¹⁸	Abdulwadud et al ²⁰	–
Charlton et al ¹¹	Clark et al ¹³	Cleland et al ²¹	–
Choy et al ¹²	Levy et al ¹⁴	–	–
Clark et al ¹³	Madge et al ¹⁵	–	–
Levy et al ¹⁴	Wilson et al ^{19*}	–	–
Madge et al ¹⁵	–	–	–
Webber et al ¹⁶	–	–	–
Wesseldine et al ¹⁷	–	–	–
Pharmacists (programs n = 4)			
Weinberger et al ²² (increased)	Armour et al ²³	Stergachis et al ^{25*}	–
–	Barbonel et al ⁵⁸	–	–
Teams of providers (programs n = 20)			
Butz et al ²⁶	Bruzzese et al ³⁶	Butz et al ²⁶	Chiang et al ²⁷
Chiang et al ²⁷	Cano-Garcinuno et al ³⁷	Krieger et al ³⁰	Clark et al ³⁸
Ghosh et al ^{28*}	Clark et al ³⁸	Lahdensuo et al ³¹	Griffiths et al ⁴⁴
Glasgow et al ^{6*}	Garrett et al ³⁹	Magar et al ⁴⁰	–
Karnick et al ²⁹	Griffiths et al ⁴⁴	Shames et al ⁴³	–
Krieger et al ³⁰	Krieger et al ³⁰	–	–
Lahdensuo et al ³¹	Magar et al ⁴⁰	–	–
Robinson et al ³²	McGhan et al ⁴¹	–	–
Splett et al ³³	Sullivan et al ⁴²	–	–
Walders et al ³⁴	Yoon et al ⁹	–	–
Zeiger et al ³⁵	Zeiger et al ³⁵	–	–
Lay person (programs n = 9)			
Adams et al ⁴⁵	Canino et al ⁴⁸	Henry et al ⁴⁹	Bonner et al ⁵¹
Bryant-Stephens and Li ⁴⁶	–	Shah et al ⁵⁰	Griffiths et al ²⁴
Partridge et al ⁴⁷	–	–	Turner et al ⁵²
(outcomes compared against nurses)			
Total n = 28	21	10	6

Note: *No significant results.

people 11%. Multidisciplinary teams reported achieving quality of life outcomes in 50% of the studied programs and lay persons' self-management and/or self-efficacy outcomes in 33% of programs.

Auxiliary outcomes of a more mediating or psychosocial type beyond the most frequently reported major outcomes were described in some studies. Table 3 presents these other outcomes. The most frequently reported outcome of a mediating or psychosocial type was use of medicines and delivery devices. Team-provided programs reported these results most often.

Table 4 presents the components and processes of the interventions by provider type and outcome. Program approaches varied from providing highly specific asthma information along with specialist consultations, for example,

Levy et al,¹⁴ to enhancing patient–clinician interactions including emphasis on communication, for example, Cabana et al,⁴ to paying indirect attention to asthma in literacy education, for example, Robinson et al.³²

Table 5 presents program focus, content, and processes by outcome. Clinician–patient communication, self-management skills, control of the environment, and medicine and device use were all employed in programs that reduced health care use. Action plans, peak expiratory flow (PEF) monitoring, control of the environment, and clinician–patient communication skills were employed in interventions that reduced asthma symptoms. Patient–clinician communication and patient asthma self-management education were included in interventions improving quality of life and self-management outcomes. Two areas of focus, interactions between patients

Table 2 Which provider group reported major outcomes and percent success*

	Success in health care use	Success in symptom reduction	Success in quality of life	Success in self-management/self-efficacy
Physician-led programs (n = 5)	83% (n = 5)	33% (n = 2)	–	–
Nurse (n = 12)	73% (n = 8)	36% (n = 4)	20% (n = 2)	–
Pharmacist (n = 4)	–	50% (n = 2)	–	–
Teams (n = 20)	50% (n = 10)	55% (n = 11)	25% (n = 5)	15% (n = 3)
Lay person (n = 9)	33% (n = 3)	11% (n = 1)	2% (n = 2)	33% (n = 3)

Notes: *Percent of successful outcomes in number of programs by profession.

and clinicians and patient education for self-management, were evident in all interventions reporting major outcomes, that is, those related to health care use, symptoms, self-management/self-efficacy, or quality of life.

Table 6 presents activities most used by different types of program providers. Physician-directed programs emphasized one-on-one counseling, self-monitoring, and use of diaries/action plans. Nurses used individual, group, and telephone learning sessions and employed activities to elicit patient participation such as role plays and problem-solving exercises. They also engaged in home visiting. Teams used a range of these activities and, in addition, case managers. Lay people-led programs involved individual, group, and home visit sessions and use of peer educators. Pharmacists used one-on-one counseling.

Discussion and conclusion

Findings from this review of asthma interventions demonstrate that several types of providers have led programs assessed through RCTs using various program components and reporting varying results. No one common outcome has been sought by all the available studies. No rationale was provided in research reports for why given program planners sought to emphasize certain outcomes and not others or included certain program components and not others or deployed certain program providers and not others.

There is a degree of consistency in outcomes achieved across the interventions as measured by frequency of reports of reaching a category of major outcome. Almost half of the interventions achieved reductions in health care use and about one-third reduced frequencies of asthma symptoms. Proportionately, physician-led programs mostly reported health care use improvements.

This review suggests that there is an evolving gold standard for asthma interventions. So many have demonstrated symptom or health care use improvements that these may have become the unofficial bench mark of success. This review also suggests that clinician–patient communication and patient self-management may be the most promising

to include in efforts to change health care use and reduce asthma symptoms as these elements have been included in all programs to date reporting such outcomes.

A number of studies have described only outcomes related to self-efficacy, medicine use, school/work absenteeism, feelings about asthma, etc. Each of these clearly can be important outcomes for patients. Some, in fact, may be the mediating factors producing what we have termed major outcomes. The frequency with which these auxiliary results have been sought and achieved has been less than attempts to achieve change in symptoms, health care use, self-management/self-efficacy, and quality of life. These more distal outcomes have likely been assumed by program planners to be associated with major outcomes. However, their connection has not, as yet, been empirically demonstrated in intervention research. In other words, support for these being the sole outcome sought and achieved in interventions, until they are proven to be the route to clinical changes, is questionable.

Important considerations regarding the type of program leader and interventions themselves could not be addressed in this exploration. For example, the relative costs of delivering a program and the cost of training different types of individuals to lead programs differ. Physician time is usually expensive whether providing an intervention solo or as part of a team. Teams may cost more than a nurse delivering a program alone. Peer leaders may be the least expensive in implementation but not in training and needed backup support. A program with many components may be the most powerful or as this study suggests one or two very effective elements may produce the best results. Knowing program costs and savings is important in choosing types of interventions.

Several limitations to this description of interventions are apparent. The number of studies in each provider category was uneven and often very small. For example, many trials involving teams have been conducted, while only four concern pharmacists. Exclusion of studies of fewer than 100 subjects may have worked against some studies where

Table 3 Success in reaching auxiliary outcomes reported by profession*

	Pulmonary function	Appropriate medication/device use	Less limited activity	Environmental modifications	Work/school absenteeism	School grades	Depression	Parent/patient feelings
Physicians	Glasgow et al ⁶	Moudgil et al ⁸	Cabana et al ⁴	-	-	-	-	Colland ⁵³
Nurses	Choy et al ¹² Levy et al ¹⁴	Choy et al ¹² Levy et al ¹⁴	-	Becker et al ¹⁸	Heard et al ⁵⁴ Lahdensuo et al ³¹	-	-	-
Teams of providers	-	-	-	-	-	-	-	-
	-	Chiang et al ²⁷ Lozano et al ⁵⁵ Magar et al ⁴⁰ McGhan et al ⁴¹ Windsor et al ⁵⁶	McGhan et al ⁴¹ Shames et al ⁴³	-	Bruzzese et al ³⁶ Clark et al ³⁸ Glasgow et al ⁶	Clark et al ³⁸	-	-
Lay person	-	-	-	Bryant-Stephens and Li ⁴⁶	-	-	Griffiths et al ²⁴	Canino et al ⁴⁸
Total	3	3	2	2	5	1	1	2

Notes: *Three additional studies were undertaken (Gallefoss et al, Smeele et al, Premaratne et al), but reported no significant outcomes.

sample size recalculation would indicate smaller numbers could ascertain differences. Studies of teams of providers did not describe fully the relative roles of team members or assess which provider had the most influence on success. No multifactorial research designs were used in the studies included here to uncover which element or combination of elements in the intervention produced the outcome. Reports of only five negative studies could be located. The publication of negative studies in the literature is quite rare. Thus, our findings may be subject to publication bias. In one study, for example, Griffiths et al²⁴ not all patients had asthma and the whole may not reflect subgroup differences. A few studies focused on specific ethnic/racial groups (eg, African-American, Chinese, South Asian), but no comparison between approaches for differing ethnicities was available. As components of interventions may have differing effects on subgroups of the population, comparative effective studies appear needed. Further, investigations in this review comprise those targeted at children, at adults, and sometimes both. The relative advantages of approaches identified here for younger and older patients were not clear in the available data and deserve attention in future studies.

How, by necessity, we have looked at the extant studies that also reflect weaknesses in the field more generally. For example, measures used to assess asthma outcomes are not standard and/or are not applied in a standard way. The rationale and/or theory underlying the components of an intervention were not described in study reports inhibiting theoretical conclusions regarding why an intervention may or may not have worked. Descriptions of the organizational context for program delivery, or success in institutionalizing an effective intervention, were not presented, so characteristics of sustainability or longevity of programs cannot be assessed. Nonetheless, the findings from this review are instructive concerning the current situation regarding the type of providers and components of interventions apparently associated with specific asthma outcomes.

A number of recommendations are evident in the results of this review. One, as noted, is the need for standard asthma outcome measures and uniform application of them. New efforts by the US National Heart, Lung, and Blood Institute and a joint Committee of the European Respiratory Association and American Thoracic Society to identify and assess the validity and reliability of asthma outcome measures should help in this regard.⁶⁰ Another is to consider health care use and symptom reduction as the gold standards of intervention success. If programs do not, at minimum, achieve these results, their added value and a strong rationale for their

Provider	Outcome	Investigator	Focus of intervention
Physicians	Symptom reduction	Glasgow et al ⁶	Education of MD
		—	• 3+ plan review
		—	• Action plan
	Health care use	Yoon et al ⁹	Patient and family one session group management skills
		Glasgow et al ⁶	As above
		Moudgil et al ⁸	Emphasis on treatment plan
		—	PFM
		—	Individualized management plan
		Clark et al ⁵	Education of MD
		—	• MD self-regulation
		—	• 10 MD communication behaviors
		—	• 10 Pt education message
		Cabana et al ⁴	As above (Clark et al)
		Hoskins et al ⁷	Education of MD
		—	• Individualized, three-step management plan for use with patients
		—	• Asthma specialist consultation
		—	• Telephone follow-up
Nurses	Symptom reduction	Becker et al ¹⁸	• Encasement of mattresses
		—	• Instructions for bed washing
		—	• Current attacks as a model for management of future attacks
	Health care use	Madge et al ¹⁵	• Telephone advice regarding individual management plans
		—	• Written management information
		Webber et al ¹⁶	Individualized management plan
		Choy et al ¹²	• Pathophysiology of asthma
		—	• Triggers
		—	• Use of medications/devices
		Wesseldine et al ¹⁷	• Discharge education
		—	• Guided self-management plan
		Levy et al ¹⁴	As above
		Madge et al ¹⁵	As above
		Charlton et al ¹¹	• Nurse review of self-monitoring and self-management
		—	• Patient priority questions addressed
		Bolton et al ¹⁰	Three education sessions
		—	• Medication
Physicians	Symptom reduction	—	• Relaxation exercises
		—	• Smoking cessation
		—	• Role play with feedback
	Quality of life	Cleland et al ²¹	• Clinical priorities
		—	• Communication skills
		—	• Patient teaching techniques
		—	• Attack prevention and control
		—	• Three education sessions
		—	• Patient priority questions addressed
		—	• Nurse review of self-monitoring and self-management
		—	• As above
		—	• As above
		—	• Guided self-management plan
		—	• Discharge education
		—	• Use of medications/devices
		—	• Triggers
		—	• Pathophysiology of asthma
Nurses	Symptom reduction	—	• Written management information
		—	• Individualized management plan
		—	• Telephone advice regarding individual management plans
	Health care use	—	• Current attacks as a model for management of future attacks
		—	• Instructions for bed washing
		—	• Encasement of mattresses
		—	• Telephone follow-up
		—	• Asthma specialist consultation
		—	• Step up medications
		—	• PFM and SX monitoring
		—	• Benzyl benzoate application
		—	• Pt counseling re triggers
		—	• Self-management skills
		—	• Pt self-rating of asthma
		—	• Nature of asthma and risk factors
		—	• Medications/devices
		—	• As above
		—	• As above

Pharmacists (4)	Self-management/self-efficacy	Abdulwadud et al ²⁰ — van der Palen et al ⁵⁷ — Abdulwadud et al ²⁰	Education of nurses • Asthma group counseling skills • Self-management skills • Meds and side effects As above	— — • Triggers • Importance of compliance —
	Symptom reduction	Armour et al ²³ — — — Barbanel et al ⁶⁸ — — — Weinberger et al ²² — — Stergachis et al ²⁵ — MeGhan et al ⁴¹ — Griffiths et al ⁴⁴ — Sullivan et al ⁴² — — — Bruzese et al ³⁶ Cano-Garcinuno et al ³⁷ Magar et al ⁴⁰ — Clark et al ³⁸ — Krieger et al ³⁰ — Garrett et al ³⁹ — — Yoon et al ⁹ Zeiger et al ³⁵ — — Butz et al ²⁶ Robinson et al ³² —	Education of pharmacists • Asthma education manual • Risk assessment • Pathophysiology • Inhaler technique • Trigger avoidance • Self-management skills • Smoking cessation Pharmacist given • Pt data • FEV info Training for individualized asthma management services Parent teacher asthma awareness event at school Information letter for doctors with suggested actions plan • Pt reviews by clinic nurse • Liaison with physicians Physician education regarding guidelines at practice site Asthma nurse • Standard assessments • Care planning Teams worked with families and PCP to encourage asthma management plans Asthma management skills for parents alone, children alone, then together • Team interview techniques • Teaching skills Education for all school personnel • Education for students with asthma CHW provide visits reaction plans, education, social support, resources given to reduce environmental exposures: bedding, vacuums, etc. Community health worker instruction • Trigger avoidance • Medications As above Written asthma instructions for: • PFM and spacer • Attack management Group session with nurse and physiotherapist Pt brochure • Literacy training • Oral reading	• Medications • Six-step management plan • Adherence assessment — — — — — • ED use info • PT ed materials — • Education outreach by nurse — — • Self-management tools for patients • Active follow-up Asthma management plans Asthma management skills for parents alone, children alone, then together • Action plans — • Environmental education for all students — • Self-management • Accessing medical care • PFM — • Instruction • MDI — • Asthma education —
	Health care use (increased)			
	No outcomes			
Teams of providers (20)	Symptom reduction			
	Health care use			

(Continued)

Table 4 (Continued)

Provider	Outcome	Investigator	Focus of intervention	
Lay person (9)	Quality of life	Walders et al ³⁴	<ul style="list-style-type: none"> • Asthma management plans • PFM • Medications/devices 	<ul style="list-style-type: none"> • Risk profile • Problem solving –
		Chiang et al ²⁷	Group education regarding self-management, demonstration of med use discussion	• Communication between parents and school
		Splett et al ³³	• Provided medication	• Clinic activities regarding asthma guidelines
		–	• Action plans	–
	Self-management/self-efficacy	–	• PFM	–
		–	• PT educations	–
		Karnick et al ²⁹	• Individualized education reinforcement of leadership	–
		–	• Case management	–
	No outcomes	Lahdensuo et al ³¹	Education	• PFM
		–	• Medication use	–
		Krieger et al ³⁰	As above	–
		Zeiger et al ³⁵	As above	–
	Symptom reduction Health care use	Magar et al ⁴⁰	As above	–
		Shames et al ⁴³	• Case manager	• Video game
		–	• Self-management educations	• Visits with allergists
		–	• Follow-up	• Hotline
Lay person (9)	Quality of life	Lahdensuo et al ³¹	As above	–
		Butz et al ²⁶	As above	–
		Chiang et al ²⁷	As above	–
		Griffiths et al ⁴⁴	As above	–
	Self-management/self-efficacy	Clark et al ¹³	As above	–
		Kauppinen et al ⁵⁹	–	–
		Canino et al ⁴⁸	Family education regarding self-management	–
		Bryant-Stephens and Li ⁴⁶	Home visitors for environmental control: bedding, pest reduction, self-management	–
	Quality of life	–	Classes, symptom diaries	–
		Adams et al ⁴⁵	Monthly contacts to assess	• Self-management plans
		–	• Morbidity outcomes	• Patient education
		Partridge et al ⁴⁷	• Consultation	• Medications/devices
	Self-management/self-efficacy	–	• Telephone follow-up	• Pt history guides
		Henry et al ⁴⁹	• Self-management counseling	• Counseling
		Shah et al ⁵⁰	Three-lesson package of asthma education	–
		Bonner et al ⁵¹	Peer leaders in schools provide asthma education	–
Lay person (9)	Quality of life	–	• Lay person facilitated interaction between pt and doctor	–
		–	• Family education	• PFM
		–	• Diaries	–
		Turner et al ⁵²	• Problem solving	• Management plan
	Self-management/self-efficacy	–	• Asthma management skills	• PFM
		Griffiths et al ²⁴	As above	–

Table 5 Most common intervention elements by outcome

Health care use	Symptoms	Quality of life	Self-management
<ul style="list-style-type: none"> • Patient–clinician communication • Patient education regarding self-management • Environment control/modification techniques/materials • Use of medications/devices/action plans 	<ul style="list-style-type: none"> • Patient–clinician communication • Action plans • PEF monitoring • Environment control/modification 	<ul style="list-style-type: none"> • Patient–clinician communication • Patient education regarding asthma management 	<ul style="list-style-type: none"> • Patient–clinician communication • Patient education regarding asthma management

association with clinical or quality of life improvements would appear to be needed. Also needed as part of standard practice in program planning is a clearer rationale for selection of a) intended outcomes b) program provider selected to pursue the outcomes, and c) the program components included to achieve it.

Specific intervention studies are needed that evaluate the comparative effectiveness of programs as provided by one type of health professional versus another. The only

such study identified in this review was one by Partridge et al,⁴⁷ where lay providers were compared to nurse program providers. The relative advantage of different providers appears to have important implications for both the type of outcomes achieved and the frequency of achieving them, as well as, cost of program implementation. An implication of these findings is that those with a specific professional background may benefit from adopting the techniques successfully used by other professionals. Multifactorial studies are needed to compare program components for their relative effectiveness in producing outcomes. Needed personnel, supervision, as well as, intensity and duration evident in the interventions studied varied greatly. Research is needed to examine the costs of program delivery against the savings generated by outcomes. Cost pressures in most health care systems make acquisition of this information necessary to ensure adoption and institutionalization of interventions that can assist patients to reduce the burden of asthma on them, their families, and their communities.

Table 6 Teaching/learning approaches most used by provider

Provider	Teaching/learning approaches
Physicians	Individualized sessions with patients one-on-one Self-monitoring/regulation Patient diaries/action plans
Nurses	Group and individual patient education sessions face-to-face Role plays Problem solving Home visits for environment control and pt education Patient diaries Telephone counseling
Pharmacists	Patient assessment Individual pt medication monitoring and counseling
Teams of providers	Groups and individual pt educational sessions face-to-face Information for patient physician Peer educators Telephone consultation Web-based team discussion Telephone advice line Case managers Home visits for environmental control and pt education
Lay person	Groups and individual patient education sessions Home visits for environmental control and pt education Peer educators

Conclusion

In the past decade, multidisciplinary teams have been the most frequent providers of asthma educational and behavioral interventions. Health care use and symptom reduction have been the most frequent outcomes of interventions. Physician-led programs have most reported health care use reductions. Teams have most reported symptom reductions. Two elements, self-management skills and physician-patient communication, have been the program components most deployed by providers successfully reaching these outcomes. Costs have not been assessed. Apparent emerging gold standards for asthma interventions are outcomes related to reductions in symptoms and/or health care use. Outcomes produced by different program components and different providers vary with some having more success with clinically related results and some with more potentially mediating psychosocial-related results. Comparative effectiveness studies are needed to assess outcomes associated with different program providers and program components.

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Disclosure

The authors report no conflicts of interest in this work.

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