

PROGRESSIVE CLINICAL PRACTICE

Effectiveness of Educational Interventions to Increase Primary Care Follow-up for Adults Seen in the Emergency Department for Acute Asthma: A Systematic Review and Meta-analysis

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Abstract

Objectives: Patients with asthma commonly present to emergency departments (ED) with exacerbations. Asthma guidelines recommend close follow-up with a primary care provider (PCP) after ED discharge; however, this linkage is often delayed or absent. The objective of this study was to assess whether ED-directed educational interventions improve office follow-up with PCPs after ED discharge for acute asthma.

Methods: Comprehensive literature searches were conducted in seven electronic databases (1946 to 2014). Randomized controlled clinical trials examining the effectiveness of educational interventions to increase office follow-up with a PCP were included. Study quality was determined using the Cochrane risk of bias tool; fidelity of the interventions was assessed using the Treatment Fidelity Assessment Grid. Using study data, risk ratios (RRs), and the number needed to treat for benefit (NNTB) with 95% confidence intervals (CI) were calculated using random-effects models.

Results: From 427 potentially relevant studies, five ($n = 825$) were included. The overall risk of bias was unclear, and the description of intervention fidelity varied across the studies. Educational interventions targeting either patients or PCPs led to a greater likelihood of having primary care follow-up after ED discharge ($RR = 1.6$; 95% CI = 1.31 to 1.87; $I^2 = 0\%$). The number needed to treat for benefit was six (95% CI = 4 to 11). No significant benefit was observed in reductions of relapses ($RR = 1.3$; 95% CI = 0.82 to 1.98; $I^2 = 23\%$) and admissions ($RR = 0.51$; 95% CI = 0.24 to 1.06; $I^2 = 0\%$). Due to the small number of studies for each comparison, publication bias was not formally assessed.

Conclusions: ED-directed educational interventions targeting either patients or providers increase the chance of having office follow-up visits with PCPs after asthma exacerbations. Their impact on health-related outcomes (e.g., relapse and admissions) remains unclear.

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Asthma exacerbations are common presentations to emergency departments (EDs),¹ representing a significant burden to patients and their families and generating substantial costs for patients and the health care system.^{2,3} Most of the patients who present to the ED with acute asthma are treated and safely discharged.⁴ Current asthma guidelines recommend scheduling a close follow-up visit with a primary care provider (PCP) after ED discharge;^{5–9} however, studies have shown this linkage to be delayed or absent.^{10,11} Guidelines also recommend that patients who have come to the ED with an asthma exacerbation should be targeted for educational interventions; nonetheless, no clear ED-directed strategies promoting return to routine primary care are proposed.

There is controversy regarding EDs being appropriate settings for the delivery of formal asthma education.¹² Despite the well-known challenges of these environments, ED visits have been identified as potential “teachable moments” during which patients are ready to accept new information.¹³ Most patients presenting to the ED with acute asthma have gaps in knowledge and asthma care and often have never received asthma education.¹⁴ Particularly in those with inadequate primary care support, an ED visit may offer a unique opportunity to receive guidance on the chronic nature of their respiratory condition, tools for self-management, and other preventive strategies.^{15–17}

Systematic reviews on educational interventions in adult patients with asthma have identified positive outcomes associated with education components such as information only (limited asthma education)¹⁸ and self-management coupled with regular medical review and written asthma action plans (AAPs).¹⁹ Positive outcomes include reduction in symptoms, hospitalizations, ED visits for asthma, unscheduled doctors’ visits, work absenteeism, episodes of nocturnal asthma, indirect costs, and improvement of quality of life. While some of these interventions have been associated with reduction of future hospital admissions and improvement of outpatient follow-up in patients who attend the ED, their fidelity and effect on health-related outcomes, like relapses, are still unclear.²⁰

The objective of this review was to assess and describe the evidence from randomized controlled trials (RCTs) on the effectiveness of ED-directed educational interventions to improve office follow-up visits with PCPs in adults who were discharged from the ED after being treated for acute asthma.

METHODS

A study protocol was developed a priori to define the objectives, search strategy, eligibility criteria, outcomes of interest, the process for abstracting and synthesizing information from eligible studies, and the methods for data analysis. The systematic review conforms to PRISMA guidelines. No ethics approval was required.

Data Sources and Searches

Comprehensive searches of seven electronic databases (Medline, EMBASE, Cochrane Library, CINAHL,

SCOPUS, ERIC, and ProQuest Dissertations and Theses Database) were conducted from database inception to June 2014. The search strategy was designed by an information specialist and comprised both controlled vocabulary and keywords adapted to each database (Data Supplement S1, available as supporting information in the online version of this paper, includes Medline search strategies; the complete search strategy is available upon request).

Google Scholar was also searched and references were manually selected from the first 10 pages of Google Scholar results. Conference proceedings from 2004–2014 Canadian (Canadian Association of Emergency Physicians) and U.S. (Society for Academic Emergency Medicine) emergency medicine conferences were hand-searched. No limits were applied on the basis of date, language, or publication status.

Study Selection

Studies were included in the review if they were RCTs assessing any educational intervention directed from the ED targeting adults (or adults and children with $\geq 80\%$ of the study population being ≥ 16 years of age) discharged from the ED after an asthma exacerbation. Educational interventions could have taken place in any setting (e.g., hospital, community, home) and had to occur within a week of the ED visit. The control was the provision of usual or standard care following the ED presentation. The primary outcome was the percentage of PCP office follow-up visits after an asthma exacerbation. PCPs may have included family physicians, general practitioners, general internists, and nurses. Secondary outcomes included the percentage of subsequent unscheduled visits to the doctor/EDs for asthma care (relapses), admissions, time to first PCP office follow-up visit, and time to first relapse.

Two reviewers (TN, BV) independently screened the titles and abstracts of studies identified by the literature search. The full-text of articles deemed relevant and those whose abstracts and titles provided insufficient information were retrieved and independently reviewed (TN, BV) to determine study eligibility. Disagreements were discussed and resolved with a third party (CVR).

Data Extraction and Quality Assessment

Information on patients, methods, interventions, and outcomes was extracted from the original reports onto standardized data collection forms. The detailed data extraction process involved contact with authors to clarify study methods and to obtain nonpublished original data.

Two reviewers (TN, BV) independently assessed the internal validity of the studies that met our inclusion criteria using the risk of bias tool. Disagreements were discussed and resolved with a third party (CVR).²¹

Fidelity assessment refers to the methodologic strategies used to monitor and enhance the reliability and validity of behavioral interventions.²² In other words, how was the planned delivery of an intervention measured and reported in a trial? Intervention fidelity in individual studies was assessed using the five domains

of the Treatment Fidelity Assessment Grid (CVR).²³ 1) congruence with theory (i.e., did the intervention include the relevant “active ingredients” based on the proposed fidelity theory?), 2) provider training (i.e., were the treatment providers capable of delivering the intervention as designed?), 3) treatment implementation (i.e., did the treatment providers actually implement the intervention as it was designed and described?), 4) treatment receipt (i.e., did the participant receive the relevant active ingredients as intended?), and 5) treatment enactment (i.e., did the participant put new skills or behaviors into practice?).

Data Analysis

Abstracted data were entered and analyzed using Review Manager (RevMan) software (IMS Inc., Nordic Cochrane Centre, Copenhagen, Denmark), version 5.2 and a recognized Cochrane-endorsed EBM Web Site (www.nntonline.net). For studies including more than one intervention arm, a combination of event data was considered for dichotomous outcomes. Pooled estimates were calculated as risk ratios (RRs) with a 95% confidence interval (CI) using a random-effects model (anticipating variation in sample sizes and substantial between-trial heterogeneity). Heterogeneity was tested using the I^2 statistic with I^2 values of 25, 50, and 75% representing low, moderate, and high degrees of heterogeneity, respectively.²⁴ Studies were pooled only if they had similar populations, interventions, controls, outcomes, and study designs, while still allowing for variation among study protocols. Subgroup analyses were performed based on the time to relapse assessment (3 weeks, 3 months, and 12 months).

RESULTS

Search Results

Figure 1 shows the study selection process; five articles satisfied the eligibility criteria for the review.^{25–29} Fifty-five manuscripts were excluded for the following reasons: not ED-based studies ($n = 22$), not primary research ($n = 8$), not RCT study designs ($n = 6$), studies included admitted patients ($n = 5$), or improving linkages with PCPs was not the main purpose of the study interventions ($n = 4$). Ten studies were excluded for “other reasons” (e.g., type of publication and nature of the intervention). The complete list of excluded studies is available on request.

Study Characteristics

Included studies were conducted in the United States ($n = 2$) and Canada ($n = 3$) and published between 2001 and 2013. Two studies included a post-ED phone call to the patient to remind or help arrange a follow-up appointment with the PCP at his or her office,^{28,29} two studies provided a short course of oral corticosteroids (50 mg/day prednisone for 5 days) and transportation vouchers,^{27,28} two studies faxed letters with tailored recommendations to the patient’s PCP office,^{25,26} and one study provided an AAP at ED discharge.²⁶ All studies evaluated the effectiveness of educational interventions compared to usual care. Usual care mostly involved discharge instructions and medication prescription at the

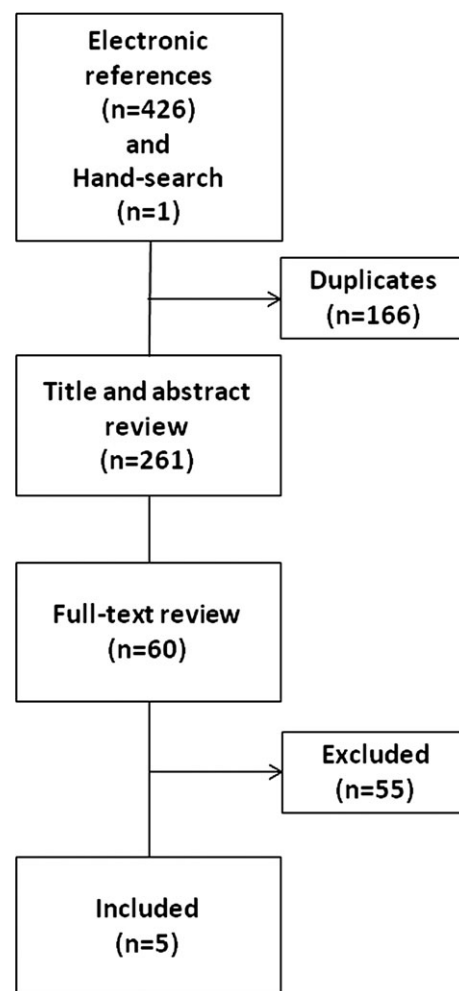


Figure 1. Literature search.

discretion of the treating emergency physician; however, two studies had the provision of printed educational material about asthma, medication use, and compliance as standard care.^{25,26} For more details see Table 1.

Quality Assessment

The overall risk of bias of all five included studies was rated as unclear. Sequence generation and allocation concealment were judged to be at *low* risk of bias in all but one of the included studies.²⁹ This study reported the randomization of weeks following a “time-series method”; however, no details were provided with regard to the methods used to generate this allocation sequence or to prevent this sequence from being predicted in advance of enrollment. Four studies reported having outcome assessors blinded to the study interventions^{25–28} and two were free of incomplete outcome data.^{27,28} All studies were judged to be at unclear risk of bias for selective outcome reporting due to the lack of registered protocols or full-text publication. Finally, one study reported data to be analyzed on an “intention-to-treat” basis; however, it was unclear how missing information and dropouts were handled in the analyses.²⁹ The principal investigator of two studies provided

Table 1
Characteristics of Included Studies

Authors	Year	Country	Sample size	Age (years)	Outcomes	Follow-up period
Baren et al. ²⁸	2001	United States	192	16–46	PCP follow-up visit after ED discharge, Relapses	4 weeks 21 days
Sin et al. ²⁹	2004	Canada	125	5–50	Quality of life, Asthma control, Use of antiasthma medications and written asthma action plans, PCP follow-up visit after ED discharge, Relapses	1, 2, 3, 6 and 12 months
Baren et al. ²⁷	2006	United States	384	2–54	PCP follow-up visit after ED discharge, Relapses ED visits, Hospitalizations for asthma, Use of anti-asthma medications, Symptoms, Activity limitation	30 days 12 months
Rowe et al. ²⁶	2006	Canada	104	8–60	PCP follow-up visit after ED discharge, Relapses	3 and 6 weeks
Rowe et al. ²⁵	2013	Canada	80	18–94	PCP follow-up visit after ED discharge, Relapses	30 and 90 days

PCP = primary care providers

details on study methods and original data;^{25,26} the risk of bias assessment of these studies was based on the information provided by the study author and the available publications (abstracts; please see Figure 2).

Fidelity of the Interventions

None of the trials reported that the study intervention included active ingredients based on theory. While all studies reported who delivered the interventions (providers), the description of their skills, and training protocols varied. Treatment implementation was described in all the included studies, and the provision of standard delivery materials was the most common method to ensure that providers actually implemented the intervention as designed. Treatment receipt (methods to ensure that participants received the active ingredients as intended) was not reported in any of the included studies. Finally, steps taken to ensure/assess treatment enactment (participants put new skills or behaviors in practice) were not described (Table 2).

Primary Outcome

All the included studies ($n = 825$ participants) reported the percentage of PCP office follow-up visits after an asthma exacerbation. ED-directed educational interventions significantly increased the proportion of office follow-up visits after ED discharge for acute asthma ($RR = 1.6$; 95% CI = 1.31 to 1.87); there was no statistical heterogeneity for this outcome ($I^2 = 0\%$; Figure 2). The median time to outcome assessment was four weeks from the index ED presentation (interquartile range [IQR] = 4 to 6 weeks). Based on an absolute risk reduction of 0.19 (95% CI = 0.11 to 0.26), the number needed to treat for benefit was six (95% CI = 4 to 11).

Secondary Outcomes

All the included studies reported the percentage of relapses. There was no statistically significant difference in the proportion of relapses between ED-directed educational interventions and usual care ($RR = 1.3$; 95% CI = 0.82 to 1.98); statistical heterogeneity for this outcome was low ($I^2 = 23\%$; Figure 3). The median time to

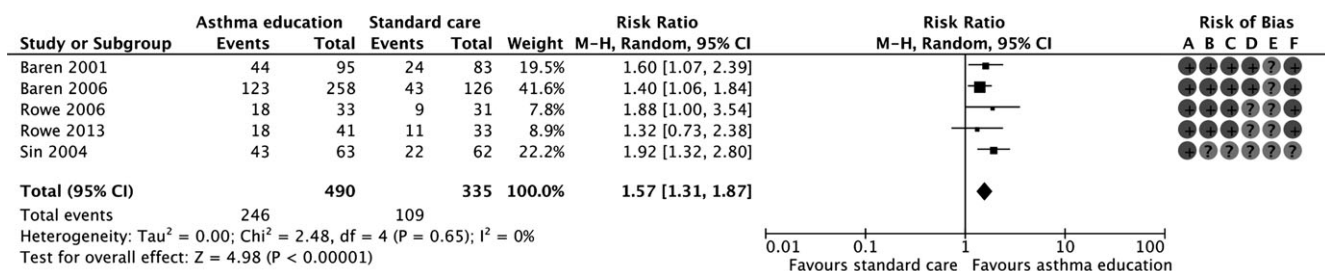


Figure 2. Effect of ED-directed educational interventions on percentage of primary care provider follow-up after an ED visit for acute asthma. M-H = Mantel-Haenszel test.

Table 2
Fidelity Assessment of Studies' Interventions

Study	Domains	Steps Taken to Ensure Fidelity	How Was Fidelity Assessed?
Baren et al. 2001 ²⁸	Theory congruence Provider training Treatment implementation	No theoretical framework. Trained research assistants. Intervention: Self-contained "fanny pack" including: 5-day course of oral prednisone (50 mgs/day) + two taxicab vouchers for transportation to the PCP office + asthma information card + written instructions for the use of medication and vouchers. Participants were contacted by phone within 48 hours of ED release and reminded to make an appointment with the PCP. Control: ED-discharge instructions and medication prescription at the discretion of the treating physician. All study participants with no PCP were referred to a hospital-based asthma clinic that had agreed to accept referrals.	N/A N/A Standard delivery materials were used. The study personnel tracked utilization of transportation vouchers; no subgroups analyses were made. No measures of provider monitoring and no strategies to prevent contamination are described.
	Treatment receipt Treatment enactment	No No	N/A N/A
Sin et al. 2004 ²⁹	Theory congruence Provider training Treatment implementation	No theoretical framework. A study coordinator. Intervention: A study coordinator made an appointment with the patient's PCP on behalf of the patient. Patients received a phone call 1–2 days before the scheduled follow-up visit. Control: Patients were encouraged to visit their regular PCP within 4 weeks of discharge.	N/A N/A There is no mention that standard delivery materials were used. No measures of provider monitoring are described.
	Treatment receipt Treatment enactment	No No	N/A N/A
Baren et al. 2006 ²⁷	Theory congruence Provider training Treatment implementation	No theoretical framework. Research assistants. Intervention: B = 5-day course of prednisone (2 mg/kg/day up to 50 mg/day) + two taxicab transportation vouchers (\$15.00 each) to travel to and from the PCP office (patients were instructed on how to use them); C = interventions stated above (B) + patients completed a preference-for-appointment form to assist in arranging their follow-up. Control: Usual discharge instructions from treating physician.	N/A N/A Standard delivery materials were used. No subgroups analyses were made. No measures of provider monitoring and strategies to prevent contamination are described.
	Treatment receipt Treatment enactment	No No	N/A N/A
Rowe et al. 2006 ^{*26}	Theory congruence Provider training Treatment implementation	No theoretical framework. Research nurses. Intervention: At discharge, patients were provided a written asthma action plan (AAP) from the Canadian Thoracic Society. They were also encouraged to visit their PCP and review the AAP in detail. A typed letter was faxed to the patients' PCP office outlining the need for a follow-up and the gaps in care identified during the interview. Control: Usual discharge instructions. All study patients received a package including a standardized discharge plan: Web resources, information about asthma exacerbations, education on medication use, and compliance.	N/A N/A Standard delivery materials were used. No measures of provider monitoring are mentioned; strategies to prevent contamination are not described.
	Treatment receipt Treatment enactment	No No	N/A N/A

(Continued)

Table 2 (continued)

Study	Domains	Steps Taken to Ensure Fidelity	How Was Fidelity Assessed?
Rowe et al. 2013 ^{25†}	Fidelity to theory Provider training Treatment implementation	No theoretical framework. Research nurses. Intervention: An individualized "Lung Attack Letter" was faxed to the patients' PCP. The "Lung Attack Letter" summarized the following points: 1) that the PCP's asthma/COPD patient has had a presentation to the ED for an exacerbation but did not require a prolonged hospital admission; 2) description of the ED and discharge management plan; 3) recommendation to the PCP to follow up with the patient within 1–2 weeks after discharge from the ED; 4) care gaps identified in the patients chronic management of asthma/COPD based on the Canadian Thoracic Society guidelines. Control: Usual discharge instructions. Patients received a standardized outpatient protocol including printed asthma/COPD educational materials from the Canadian Lung Association; they were advised to follow up with their PCP.	N/A N/A Standard delivery materials were used. No measures of provider monitoring are mentioned; strategies to prevent contamination are not described.
	Treatment receipt	No	N/A
	Treatment enactment	No	N/A

AAP = asthma action plan.

*Fidelity was assessed based on a manuscript draft provided by the study authors.

†Fidelity was assessed based on a study protocol provided by the study authors.

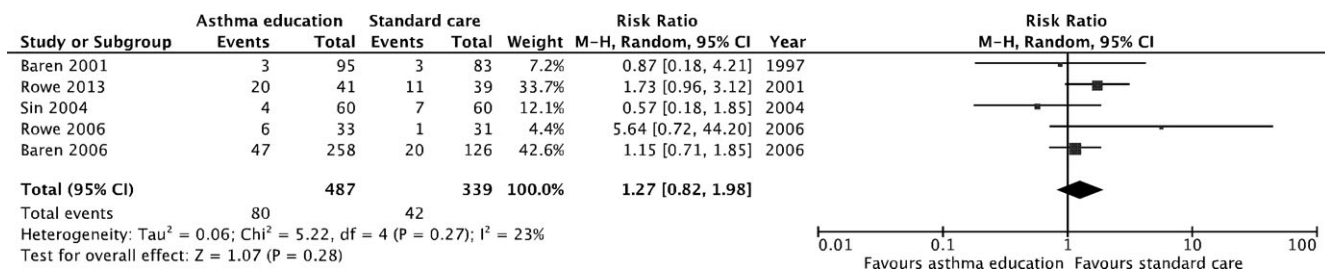


Figure 3. Effect of ED-directed educational interventions on percentage of relapses after an ED visit for acute asthma M-H = Mantel-Haenszel test.

outcome assessment was 3 months from the index ED presentation (IQR = 1 to 3 weeks). Time to first PCP office follow-up visit and relapse was not consistently reported among the included studies. Nonpublished data from one of the studies revealed that the median time for a first PCP office follow-up visit was 18 days (IQR = 11 to 45 days) in the educational intervention arm compared to a median time of 16 days (IQR = 3 to 52 days) in the usual care arm. This study also found that the median time to first relapse in the educational group was 45 days (IQR = 4 to 65 days) compared to 28 days (IQR = 12 to 45 days) in the usual care arm.²⁵ Three studies reported the percentage of admissions, assessed at 2, 3, and 12 months, respectively.^{25–27} No statistically significant difference was observed between the groups that received ED-directed education interventions compared to usual care (RR = 0.51; 95%

CI = 0.24 to 1.06); there was no statistical heterogeneity for this outcome ($I^2 = 0\%$). Self-efficacy and self-management metrics were poorly reported in the included studies. One study reported a higher proportion of patients having written AAPs (46% vs. 25%, $p = 0.02$) and higher quality-of-life scores (5.7 ± 1.2 vs. 5.0 ± 1.3 , $p = 0.01$) in the educational intervention arm at the 6-month follow-up; however, these differences disappeared at 12 months.²⁹ Most of the studies reported no difference in medication compliance between their comparison groups (data not available).^{25–29}

Subgroup Analysis

Subgroup analyses based on time to relapse (i.e., 3 weeks, 3 months, and 12 months) did not show a specific change in the direction of the effect or significant changes in the magnitude and precision of the pooled estimates.

DISCUSSION

This systematic review revealed that ED-directed educational interventions targeting either adult asthma patients or their PCPs led to a greater likelihood of having follow-up with a clinician after ED discharge for an acute exacerbation. Approximately six patients would need to receive ED-directed education after being discharged in order to generate one office follow-up visit with a PCP. This conclusion arises from five RCTs involving 825 participants and usually measuring this outcome four weeks after the index ED presentation. Our results add value to previous findings²⁰ because they clarify the benefit of ED-directed educational interventions on a specific subgroup of the asthma population³⁰ and point out the important contribution of having an effective ED-PCP linkage to improve the continuum of asthma care.³¹

The review failed to identify a significant reduction in the proportion of relapses after the index ED presentation resulting from educational interventions. Similar to previous reviews, statistical imprecision and unclear risk of bias of the individual studies precluded a meaningful interpretation of their pooled estimate.²⁰ Differences in the direction of the effect could be explained by the specific population targeted in this review (only those with asthma who were discharged from the ED); however, the lack of a significant reduction on relapses in this and a previous systematic review²⁰ may be interpreted in several ways. First, the low frequency of events and the small samples in individual studies highlight the need of more research in this area. Second, increased proportions of both PCP office follow-up visits and relapses in those who attend the ED and are discharged may be related to issues outside the hospital (e.g., problems filling prescriptions and difficulties accessing counselling or educational programs). These post-ED issues may play an important role in specific subgroups of patients such as those with low income, minority groups, documented noncompliance, and poor access to health care.¹⁵ Third, different levels of interventions during these post-ED PCP office follow-up visits could be influencing these results; as it has been shown for medication adjustment,³² the provision or revision of written AAPs, counseling on adequate inhaler techniques, smoking cessation, influenza vaccination, and referral to asthma education could have a positive impact on such asthma-related outcomes. In previous reviews, education reduced hospital admissions during the studies' follow-up periods.²⁰

Similarities in the components of the educational interventions across the included studies may explain the low statistical heterogeneity observed for the two outcomes evaluated in the meta-analysis; interventions such as the provision of a short course of oral corticosteroids, transportation vouchers, and letters faxed to the patient's PCP office were delivered in more than one study. The assessment of intervention fidelity confirmed that description of the objectives, methods, and content of educational interventions targeting adults with asthma is quite variable.³³ The most common fidelity factors lacking in the included studies were a clear theoretical foundation, the use of measures of partici-

pants' acquisition of knowledge (e.g., better understanding), and implementation of new behaviors (e.g., development of new skills and change in practices).

Despite the positive impact on health-related outcomes, educational interventions in asthma have been strongly criticized due to difficulties in replication and limited applicability.³⁴ While progress has been made on identifying what works and what does not work in adult asthma education,^{18–20,35–37} a call to standardize the description and evaluation of proposed interventions still needs to be made.^{22,33} Similar to what exists for other study designs,³⁸ research on predictors of effectiveness such as intervention fidelity can help researchers reach a consensus on the information that should consistently be measured and reported. The overall goal of enhancing the fidelity and integrity of these interventions can be supported by demonstrating that changes in effect sizes are attributable to one or more independent variables (fidelity domains). Finally, the cost-effectiveness of educational interventions in asthma such as the ones included in this review is unknown. High costs and inadequate implementation fidelity have been proposed as important barriers to the dissemination of innovative and effective programs in other settings.³⁹

LIMITATIONS

The strengths of this systematic review pertain to its rigor in searching the literature, the criteria-based selection of studies, the approach to assessing study validity and implementation fidelity assessment, and the evidence-based inferences. The review has several limitations that should be noted. First, study inclusion was restricted to RCTs based on our interest in summarizing the highest quality evidence to provide support to current guideline recommendations. Six studies identified by our searches were excluded due to nonexperimental ($n = 3$),^{40–42} before-and-after ($n = 2$),^{43,44} and pilot ($n = 1$)⁴⁵ designs. While some of these studies showed a positive effect on indicators such as asthma control, asthma knowledge, medication use, and health-resources utilization and found relatively good acceptability among patients and ED staff, they consistently highlighted the need for evaluations of repeated measures in randomized trials before this evidence can be implemented in clinical practice. Second, due to the small number of studies for each comparison, we were unable to formally assess the potential for publication bias. Nonetheless, a comprehensive search of the published and gray literature was conducted without restrictions on publication status or language of publication. Consequently, the risk of publication bias should be low. There is also the possibility of study selection bias. To address this, at least two independent reviewers identified potentially relevant studies and the authors are confident that the studies that were excluded were done so for consistent and appropriate reasons.

There are other limitations in this review that are inherent to the characteristics of the individual studies. First, while statistically robust, meta-analysis results are derived from studies rated as unclear in the risk of bias assessment (only moderate quality evi-

dence). Second, inconsistent and incomplete outcome reporting precluded the statistical pooling of other outcomes such as time to first PCP office follow-up visit, time to first relapse, self-efficacy, and self-management metrics. Third, despite similarities in the components of education interventions across the studies, variation in the reporting of their characteristics limited the assessment of intervention fidelity and the analysis of the relative effectiveness of specific domains. Consequently, it was difficult to determine which specific component(s) of the intervention were beneficial and under which circumstances. Fourth, the poor description of factors that could be influencing study outcomes (e.g., different levels of health literacy, multilingual populations) limited the interpretation of individual and pooled effects.

CONCLUSIONS

This review provides evidence supporting consideration of ED-directed educational interventions (targeting either adult patients or providers) as effective strategies to increase office follow-up visits with a primary care provider after asthma exacerbations. It does not provide evidence to suggest that these interventions are effective in improving other health-related outcomes such as relapses or admissions. The decision to implement ED-directed educational interventions should rely on more than an indicator of effectiveness and take into account factors limiting the external validity of systematic review findings (e.g., targeted populations, ED setting, health system characteristics of included studies). What exactly works, in whom, under which conditions, and based on what cost should be further assessed and incorporated into evidence synthesis methods of behavioral trials. Future research should focus on standardizing the reporting of non-pharmacological interventions among scientific journals and evaluating their costs. This will promote the sharing, comparison, and synthesis of experience and facilitate the translation of research results into clinical practice.¹²

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Supporting Information

The following supporting information is available in the online version of this paper:

Data S1. Search strategies.

Data Supplement 1. Search strategies

Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>
Searched June 3, 2014

Search Strategy:

- 1 asthma.mp. or exp Asthma/ (136623)
- 2 (emergen? adj2 (department* or doctor* or ward or wards or medic* or unit or units or care or room* or service* or physician or nurse* or resident*)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier] (367)
- 3 exp Emergency Service, Hospital/ or exp Emergency Medical Services/ (95231)
- 4 2 or 3 (95492)
- 5 (Patient adj2 (educat* or instruct* or brochure* or teach* or train*)).mp. (83418)
- 6 exp Patient Education as Topic/ (70082)
- 7 random*.ti,ab. or rct.mp. (713824)
- 8 (workbook* or ((behaviour* or behavior*) adj2 (contract* or agreement*))).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier] (1232)
- 9 (telephone adj2 (reminder* or call or reinforc*)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier] (990)
- 10 5 or 6 or 8 or 9 (85493)
- 11 1 and 4 and 10 (219)
- 12 11 (219)
- 13 limit 12 to randomized controlled trial (40)
- 14 7 and 12 (51)
- 15 Emergency Treatment/ or Emergency Medicine/ or emergency medical services/ or emergency service, hospital/ or trauma centers/ or triage/ or exp Evidence-Based Emergency Medicine/ or exp Emergency Nursing/ or Emergencies/ or emergicent*.mp. or ((emergenc* or ED) adj1 (room* or accident or ward or wards or unit or units or department* or physician* or doctor* or nurs* or treatment* or visit*)).mp. or (triage or critical care or (trauma adj1 (cent* or care))).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier] (201348)
- 16 asthma*.mp. or exp Asthma/ [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier] (139965)
- 17 10 and 15 and 16 (419)
- 18 exp child/ or exp congenital/ or exp infant/ or exp adolescence/ or exp infant,

newborn/ or exp child, preschool/
or (pediatric* or paediatric* or child* or newborn\$ or adolescen* or newborn* or
congenital* or infan* or preschool* or
pre-school* or teen\$ or kindergarden\$ or kindergarten* or elementary school\$ or nursery
school\$ or youth\$ or baby\$ or
babies or neonat\$ or schoolchild* or toddler\$ or boy or boys or girl* or pubescen* or
juvenile* or adolesc*or
pre-pubesc*).mp. or (child* or adolesc* or pediat* or paediat*).jn. (3511151)

19 17 not 18 (129)

20 17 (419)

21 exp Adult/ (5549596)

22 17 not 19 (290)

23 21 and 22 (107)

24 19 or 23 (236)

25 7 or 13 (713827)

26 24 and 25 (58)

27 14 or 26 (86)