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Background
The use of educational and behavioural interventions in the management of chronic asthma have a strong evidence base. There may be a role for educative interventions following presentation in an emergency setting in adults.

Objectives
To assess the effectiveness of educational interventions administered following an acute exacerbation of asthma leading to presentation in the emergency department.

Search strategy
We searched the Cochrane Airways Group trials register. Study authors were contacted for additional information. Searches are current to November 2006.

Selection criteria
Randomised, parallel group trials were eligible if they recruited adults (> 17 years) who had presented at an emergency department with an acute asthma exacerbation. The intervention of interest was any educational intervention (for example, written asthma management plan).

Data collection and analysis
Two review authors independently assessed trial quality and extracted data. Study authors were contacted for additional information.

Main results
Twelve studies involving 1954 adults were included. Education significantly reduced admission to hospital (relative risk 0.50; 95% confidence interval 0.27 to 0.91); but did not significantly reduce the risk of re-presentation at emergency departments (ED) during follow up (relative risk 0.69; 95% confidence interval 0.40 to 1.21). The lack of statistically significant differences between asthma education and control groups in terms of peak flow, quality of life, study withdrawal and days lost were hard to interpret given the low number of studies contributing to these outcomes. One study from the early 1990s measured cost and found no difference for total costs and costs related to physician visits and admissions to hospital. If data were restricted to emergency department treatment, education led to lower costs than control.

Authors' conclusions
This review found that educational interventions applied in the emergency department reduce subsequent asthma admissions to hospital. The interventions did not significantly reduce ED re-presentations; while the trend in effect favours educational interventions, the pooled results were not statistically significant. The impact of educational intervention in this context on longer term outcomes relating to asthma morbidity is unclear. Priorities for additional research in this area include assessment of health-related quality of life, lung function assessment, exploration of the relationship between socio-economic status and asthma morbidity, and better description of the intervention assessed.
**BACKGROUND**

Acute asthma presentations to emergency departments are common, can be severe, and may lead to hospitalisations. Despite many systematic reviews regarding the medical management of asthma exacerbations, hospitalisations and re-presentations appear common. The frequency of acute asthma presentations has stimulated research into whether initiating non-pharmacological measures to reduce future use of healthcare in this context is useful and appropriate (Boudreaux 2003). Hospital admissions are a strong marker of severe asthma, increased risk of readmission, and death (Martin 1995; Mitchell 1994). There is evidence to suggest that many hospital admissions could be prevented if individuals with asthma were to use an asthma action plan, had improved knowledge of asthma, adhered to their preventive treatment, initiated medication early during an asthma attack, and sought medical assistance early if their condition was not improving (Ordoñez 1998). While emergency physicians feel asthma education is important, they feel unprepared and under excessive time pressure (Emond 2000). Consequently, educational interventions need to be proven efficacious and cost-effective in order to be adopted in this frenetic environment.

Two Cochrane reviews in adults have addressed the role of educational and behavioural interventions in asthma. Gibson 2002a focuses on ‘information only’ education programs. While this review reported such interventions were effective, only one study reported a reduction in emergency room visits; the other studies reported no impact on unscheduled physician visits, lung function, admissions, medication use, or lost workdays. However, a positive effect upon patient perceived asthma symptoms was detected; one study found a cost savings attributable to the education; three studies found a positive change in knowledge in the intervention group, while two studies found no difference. Gibson 2002c focused on ‘self-management’ education interventions for adults with asthma. Asthma self-management education provides individuals with the skills and resources necessary to effectively manage their illness. These programs include information such as preventing asthma exacerbations, communicating with health care professionals, and attack management (Clark 1993). Significant reduction in hospital admissions, emergency room visits, lost work/school days, and unscheduled physician visits were found. The five trials that addressed self-management versus physician managed asthma found no difference in hospitalizations, emergency room visits, physician visits, nocturnal asthma, and one study found a difference in lost work days (self-management group benefited).

The population to be addressed in this review has unique characteristics and possibly different learning needs than those previously described. While much literature has been published addressing self-management education for individuals with chronic asthma there is not a general consensus on its effectiveness, particularly concerning patients in the emergency department (Bernard-Bonnin 1995). There is research which suggests that even limited education (information only) may be effective if initiated in the emergency department setting where patients’ asthma is often severe (Bolton 1991; Madge 1997). This review is being conducted to summarize the results of literature evaluating the effect of asthma education given to adult patients while attending the emergency department, and to determine whether this education results in positive health outcomes for individuals with asthma.

**OBJECTIVES**

The aim of this study is to conduct a systematic review of the literature in order to determine whether asthma education given to adults while attending the emergency department for asthma exacerbation therapy leads to improved health outcomes. A secondary aim is to identify the characteristics of the asthma education programs that had the greatest positive effect on health outcomes. To our knowledge, no previous systematic review has been completed on this topic.

**CRITERIA FOR CONSIDERING STUDIES FOR THIS REVIEW**

**Types of studies**

Randomised controlled trials (RCTs), of parallel group design.
Types of participants
Adults (> 17 years of age) who have attended an emergency department or equivalent setting for the treatment of an asthma exacerbation (defined by doctor's diagnosis or objective criteria). Studies with participants under the age of 17 have been included (on the assumption that such studies are unlikely to be considered in a paediatric setting), and sensitivity analyses have been used to assess whether this characteristic affects the findings of the review (see 'Methods' of the review).

Types of intervention
Any educational intervention targeted at adults individually or as a group. The educational intervention may take place in the emergency department, the hospital, the home or in the community, occurring within one week of the emergency room visit. The intervention could involve a nurse, pharmacist, educator, health or medical practitioner associated with the hospital or referred to by the hospital. The intervention may include information, counseling, a change in therapy, the use of home peak flow or symptom monitoring or a written action plan or all three.

The control should consist of usual care following presentation or admission with acute asthma.

Types of outcome measures
1. Hospital admission/re-admission rate
2. Subsequent emergency room visits
3. Primary care practitioner visits
4. Lung function: fixed expiratory volume in one second (FEV1), peak expiratory flow rate (PEFR)
5. Symptoms
6. Use of rescue (or reliever) medications
7. Quality of life, functional health status
8. Days home sick (lost from school, child care)
9. Cost
10. Withdrawals/loss to follow up

SEARCH METHODS FOR IDENTIFICATION OF STUDIES
See: methods used in reviews.

The Cochrane Airways Review Group (ARG) has developed an "Asthma and Wheez* RCT" database through regular searches of CENTRAL (the Cochrane Central Register of Controlled Trials), and comprehensive searches of MEDLINE (1966 to present), EMBASE (1980 to present), and CINAHL (1982 to present). In addition, handsearching of 20 respiratory care journals has been completed and relevant articles included in the database. The current overview includes a search of ARG register with updates to November 2006.

The register was searched using the following terms: (emerg* or acute* or adm* or exacerb* or status* OR severe* or hospital*) AND (educat* or instruct* or self-manag* or "self manag*" or self-care or "self care")

The ARG register contains studies published in foreign languages, and we did not exclude trials on the basis of language. If necessary, attempts were made to translate the articles from the foreign language literature.

In addition, we checked reference lists of each primary study and review article to identify additional potentially relevant citations. We also contacted the primary authors of included studies regarding other published or unpublished studies. Finally, we contacted colleagues, collaborators and other investigators working in the field of asthma to identify potentially relevant studies.

METHODS OF THE REVIEW

Study eligibility
Two review authors (ST and TL) screened and sorted studies identified by the above search strategy based on the title, abstract and key words (see below).

1) Include: definitely a RCT; participants > 17 years recruited following emergency room attendance; and received an asthma education intervention.
2) Possible/unclear: appears to fit inclusion criteria but insufficient information available to be certain, review of the methods necessary to verify inclusion.
3) Exclude: definitely not a RCT; participants not > 17 years; not recruited following emergency room attendance; or intervention is not asthma education

The complete article was retrieved for studies in categories 1 and 2. Two review authors (ST and TL) independently assessed these articles for eligibility using objective criteria. Inter-rater agreement was calculated using simple agreement. Disagreements were resolved by consensus or a third review author.

Quality of included studies
Study quality was scored by the Cochrane system based on allocation concealment (Schulz 1995) as follows:
A: ADEQUATE if there is true randomisation, i.e. a central randomisation scheme, randomisation by external person or use of coded containers/envelopes;
B: UNCLEAR;
C: INADEQUATE if there was alternate allocation, reference to case record number, date of birth, day of the week, or an open list of random numbers.

Jadad scores (Jadad 1996) were not calculated due to the nature of the intervention, as it was practically impossible to blind either participants or investigators. Blinding of outcome assessor was recorded.

Data extraction
TL and ST independently extracted data, including the characteristics of included studies (methods, participants, interventions, outcomes) and results of the included studies. Authors of included studies were asked to verify the data extracted for their study and to provide details of missing data, if applicable. Any discrepancies between the data extracted by the review authors were discussed and resolved between study team authors. Data were entered into the Cochrane Collaboration software (Review Manager 4.2) by TL, with random checks on accuracy by ST.

Some additional quality variables were also recorded:
Follow up - Withdrawals/dropouts (> 15%), intention to treat analysis.

Other ‘Characteristics of included studies’
i) Demographics: age, gender, ethnicity, socioeconomic status.

ii) Type of intervention
• Who delivered it (e.g.: nurse, asthma educator, primary care provider);
• What was delivered (e.g.: written action plan, modification of drug therapy, peak expiratory flow or symptom monitoring or both, information only);
• To whom delivered (adults, families, both); and
When was the intervention delivered in relation to the emergency department visit.

iii) Type of control:
• Usual care (which may or may not involve a degree of education);
• Waiting list control or lower intensity educational intervention.

iv) Setting of intervention
• This is referring to the place the intervention was actually delivered: e.g.: hospital, home, or community setting.

v) Duration of intervention
• Number of sessions;
• Total hours of teaching.

vi) Sample size

vii) Asthma severity

viii) Number of previous emergency department visits

ix) Intermediate outcomes: asthma knowledge, skills

x) Previous asthma education

Outcomes
Data were extracted for the following health outcomes (if available):
1. Hospital admission/readmission rate
2. Subsequent emergency room visits
3. Primary care practitioner visits
4. Lung function: FEV1, PEFR
5. Symptoms
6. Use of rescue (or reliever) medications
7. Quality of life, functional health status
8. Days home sick (lost from school, child care)
9. Cost
10. Withdrawals/loss to follow up

Analysis
Numerical data were entered and analyzed using Review Manager 4.2. For individual studies, continuous variables were reported as mean difference (MD) and 95% confidence intervals (CI). If appropriate, continuous variables were pooled using mean differences (MD) or standardised mean difference (SMD) with 95% CIs. For dichotomous variables, a relative risk (RR) and associated 95% CI was calculated for individual studies; RR and 95% CI were reported for the pooled results using a random-effects model. For estimates of RR, a NNT(benefit) or NNT (harm) was calculated (www.nntonline.net).

For pooled results, heterogeneity was tested using the I-squared ($I^2$) statistic (Higgins 2003). If statistically significant heterogeneity was identified, a priori subgroups were used to explore this finding.

Subgroup analysis
The following subgroup analyses were planned provided there were sufficient studies within subgroups:
Type of participants - the number of prior admissions may have an impact on how effective an education programme is in reducing further asthma morbidity. If data were available we subgrouped studies (or participants from studies where this information was available) according to hospital admission history (one versus more than one admission to hospital with asthma).

Type of intervention - each of the variables (who delivered the intervention, what was delivered, to whom was it delivered and when it was delivered) were tested to determine if there were any associations with the magnitude of the effect found.

Sensitivity Analysis
We conducted sensitivity analyses as needed to determine the robustness of the findings under different assumptions. Analyses include the effect of the following variables on the results: methodological quality and statistical model (random versus fixed-effect modelling). Studies where participants under the age of 17 were recruited were removed from the analyses to determine the robustness of the effect.

DESCRIPTION OF STUDIES

From electronic literature searches to November 2006, a total of
565 references were identified. Of these, 57 unique studies were identified and retrieved for further scrutiny. Five of these references are ongoing trials identified through clinical trials registration searching. Of the remaining 52 studies, 40 did not meet the entry criteria. A recently discovered published study awaits assessment (Baren 2006). The most common reason for exclusion was recruitment of participants from an outpatient setting (N = 22). Two excluded studies were translated from Spanish (Martín Olmedo 2001; Segura 2001), and one was translated from German (Worth 2002). This review summarises evidence from 12 randomised controlled trials which met the review entry criteria. For full details of included studies, see table ‘Characteristics of included studies’.

Participants
A total of 1954 adults who had presented with an exacerbation of asthma were recruited to the studies. If data on gender were available it was evident that the majority of study participants across the trials were female (1139/1874; 61%). Although presentation with acute asthma featured as an entry criterion in all the studies, there was some variation between the studies as to how participants were identified and when they were recruited to the trials. This occurred either within the emergency department/hospital setting (Baren 2001; Bolton 1991; George 1999; Godoy 1998; Maiman 1979; Morice 2001; Osman 2002; Perneger 2002; Yoon 1993), or was conducted subsequent to a recent presentation with acute asthma at an emergency setting (Brown 2006; Levy 2000). One study reported in abstract form did not provide adequate information to determine the setting of recruitment (Smith 2005). Communication with the author was unsuccessful.

Interventions
Type and duration of education
Overall, these educational interventions could be described as ‘mixed’. That is, each program contained some combination of interventions. Interventions conducted as part of the education programs were classified according these five important groups:

- written self-management plan

61% of the 13 retained studies (Brown 2006; Levy 2000; Maiman 1979; Morice 2001; Osman 2002; Perneger 2002; Yoon 1993);

- education on symptoms and triggers control

54% studies (George 1999; Godoy 1998; Levy 2000; Morice 2001; Osman 2002; Perneger 2002);

- information booklet or card

38% studies (Baren 2001; Maiman 1979; Morice 2001; Osman 2002; Smith 2005);

- teaching of use of medication and inhalers (including peak flow meters)

38% studies (George 1999; Maiman 1979; Osman 2002; Yoon 1993);

- enhancing importance of follow up

38% studies included teaching of importance of medical follow up (Bolton 1991; Baren 2001; George 1999; Godoy 1998; Maiman 1979).

In one study (Godoy 1998), there was a 24 hours asthma hotline included to the education intervention.

Most education sessions were conducted by asthma or ED nurses except in one study where they were given by respiratory specialists and a physiotherapist (Perneger 2002). The average timing for follow up was 7.4 months (range 6 to 18 months).

Timing of education
Educational interventions were given at different times either at post discharge (Bolen 1991; Brown 2006; Levy 2000; Perneger 2002; Yoon 1993), during hospitalisation (George 1999; Morice 2001) or ED visits for exacerbation (Godoy 1998; Osman 2002), or at discharge (Baren 2001; Maiman 1979). In one study (Smith 2005), reported as a conference abstract, it is still unclear when the educational program was provided.

Control groups
Usual care was cited as the control group treatment in all the studies.

Outcomes
The principal outcome of interest to this review was reported in all the studies as either presentation to an emergency setting or re-hospitalisation during follow up. However, the different endpoints reported as primary outcomes within each study suggested that there was some variation in the aims of each intervention that the trialists assessed. Baren 2001 and Godoy 1998 cited scheduled clinic attendance as the primary outcome, indicating that the aim of intervention in these studies was to encourage and enhance follow up. Morice 2001 reported the results of the two treatment groups as the preferred action on deterioration of symptoms, suggesting that the primary aim of the intervention was to help study participants seek appropriate medical assistance in the event of an asthma attack. Levy 2000 and Perneger 2002 measured diary data and in this respect the study was primarily concerned with the effect of education on chronic management of asthma. In the remaining studies readmission/re-presentation at an acute setting was cited as the primary outcome.

Methodological quality
The quality of the studies as measured from the reported methods was mixed, with five of the 12 studies obtaining Cochrane ratings of A for concealment of allocation, follow up and adequate analysis of randomised participants was mixed. In eight studies the intention to treat principle was undertaken, or all participants completed the study (Baren 2001; Bolton 1991; Brown 2006; Godoy 1998; Levy 2000; Morice 2001; Perneger 2002). In the remaining
five studies the analysis of data was either on an available case basis or was not clear.

**RESULTS**

**Hospital admission/presentation to the emergency department to the end of follow up**

From six studies involving 665 participants, there was a clinically and statistically significant reduction in subsequent hospital admission in the educational intervention groups (RR 0.5; 95% CI 0.27 to 0.91). The varying degree of risk in the control groups (see Table 01) means that a NNT based on a pooled control group event rate might be strongly influenced by the higher rate of admission in the control group in George 1999. In lower risk patients (that is, where baseline risk of admission was around 10%) the NNT is 20; in patients with a risk of between 25 to 28% of readmission, the NNT is eight and amongst the highest risk of admission (60%) the NNT is four.

Overall this translates into an average NNT(benefit) of nine (95% CI 6 to 27, see Figure 01). This estimate assumes a control group event rate of approximately 25%, and is derived from clinical trials with follow up of between six and 18 months. There was a moderate level of statistical heterogeneity for this outcome ($I^2 = 41.8$%). The modelling used for this outcome was random-effects, which assumes a distribution of treatment effects across the different studies. A sensitivity analysis on the basis of study quality whereby two studies with a quality rating of A were retained (N = 386) produced a statistically significant and homogenous result (RR 0.63; 95% CI 0.40 to 0.97; $I^2 = 0$%).

From seven studies involving 690 participants, there was no significant difference on the number of people who re-presented at an emergency department setting (rather than were admitted) between education and control (RR 0.69; 95% confidence interval 0.40 to 1.21).

Individual clinical trial data indicated no significant difference in mean hospitalisations for asthma per 100 persons at 12 months; mean length of hospital stay (days); mean emergency department visits/100 persons; physician visits per 100 persons (Bolton 1991); physician visits (Perneger 2002); severe episodes of asthma (including sleep disturbance, GP urgent visits, presentation at emergency department) (Levy 2000); and primary care physician urgent visits or call outs (Morice 2001).

**Scheduled clinic attendance**

Educational intervention led to a greater likelihood of scheduled outpatient follow-up appointment in two studies (RR 1.73; 95% CI 1.17 to 2.56) involving 198 participants.

**Lung function**

From two studies involving 312 participants, there was no significant difference between education and control in PEF (MD 5.29 L/min; 95% CI -31.04 to 41.63). Although there was a high level of heterogeneity observed for this outcome, the low number of studies contributing to this endpoint makes exploration of statistical variation here potentially misleading.

**Quality of life**

Levy 2000 reported no significant difference between treatment groups for impacts, activity and total domains of the St George Respiratory Questionnaire. A significant difference in favour of control was evident at six months (of approximately six units). The reason for this apparent difference is difficult to assess, but could be related to an increased awareness of symptoms as a result of enhanced knowledge of asthma and self-management in the intervention group.

**Days lost from school/work and functional impairment**

From two studies involving 171 participants, there was no significant difference between the groups in the number of participants experiencing days lost from school/work in (RR 0.88; 95% CI 0.44 to 1.73). One study reported no significant difference in mean days of limited activity per 100 persons (Bolton 1991), and a further trial reported no significant difference in mean work days lost during treatment (Perneger 2002).

**Number of participants experiencing symptoms**

Perneger 2002 reported no significant difference between education and control in the number of participants experiencing sleeping problems, physical limitations, emotional problems and social difficulties; however, there were few studies contributing to these results.

**Cost**

One US study published in 1991 reported estimated costs of treatment (Bolton 1991). This was significantly lower in favour of education in terms of cost of emergency department visits per person per year ($638). The differences were not significant for physician visits, hospital admissions and total costs.

**Withdrawals/loss to follow up**

From eight studies involving 1311 participants, there was no significant difference between the groups with respect to study withdrawal or loss to follow up between education and control (RR 0.95; 95% confidence interval 0.74 to 1.21).

**Effects of education on self-management techniques**

Perneger 2002 reported that significantly more patients were able to demonstrate adequate inhalation technique and were aware of their peak flow reading following education compared to the control groups. When data were measured in terms of performance of correct actions, however, there was no significant difference between the treatment groups for outcomes relating to mean number of correct actions observed for inhalation technique, peak flow reading technique and the frequency of peak flow in the previous six months.
**DISCUSSION**

Using comprehensive search strategies and efforts to reduce bias, this systematic review identified 13 studies addressing the efficacy of educational interventions administered following an exacerbation of asthma leading to presentation in the emergency department. From 1954 participants enrolled in these studies, the results demonstrated that educational interventions given in or after the ED visit to adult patients with acute asthma can decrease the risk of hospital re-admissions, improve scheduled appointment attendance, reduce costs of emergency departments visits, and improve correct use of self-management techniques. There was no significant effect of these educational interventions, however, on decreasing the number of ED visits during follow up, improving control in PEF, reduction in days absent from school/work, increasing of the quality of life, and decreasing the number of participants experiencing symptoms.

The effect observed on the primary outcome translates to a reduction in the absolute risk of readmission of approximately 13%, although the admission rates in the control groups did indicate variation in baseline risk (see Table 01). The results of sensitivity analysis also require some consideration. Common elements to the content of intervention delivered by the high quality studies include written asthma plans and education on symptoms and triggers of asthma. Education was also delivered by specialists in follow-up sessions (Osman 2002; Perneger 2002). The number of ED visits did not demonstrate significant results in favour of intervention in seven of the 13 studies. Despite this, Bolton 1991 reported positive results with the mean of ED visits/100 persons. A significant decrease of the ED visits as much as hospital admissions would mean a decrease of direct and indirect costs involved. The lack of statistical significance on re-presentation to the ED may be interpreted in several ways. First, the effect does trend towards educational interventions being effective; however, this result is not statistically significant. This may imply that ED visits can be reduced, and simply more studies are required to indicate this. Second, it may indicate that whilst education may not have affected the frequency of visits to the emergency setting, it may have led to an earlier referral during the course of an episode by improving recognition of the onset of acute asthma (Kelly 2002).

Written personalised action plans as part of self-management education have been shown to improve health outcomes for adults with asthma (Cote 2001; Gibson 2002a; Gibson 2002c; Gibson 2002b; Ladhensuo 1996). The Canadian Consensus Asthma Guidelines recommends that a written action plan for guided self-management, usually based on an evaluation of symptoms, must be provided for all patients (Becker 2005). Despite this advice there has until now been very little evidence that this is being done in the published literature. The asthma education programmes for adults described here contained education sessions, visual material and more. According to the British Guideline on Management of Asthma, successful programmes vary considerably, but encompass:

- structured education, reinforced with written personal action plans, though the duration, intensity and format for delivery may vary;
- specific advice about recognizing loss of asthma control, though this may be assessed by symptoms or peak flows or both;
- action to take if asthma deteriorates, including seeking emergency help, commencing oral steroids (which may include provision of an emergency course of steroid tablets), and recommencing or temporarily increasing inhaled steroids, as appropriate to clinical severity. Many plans have used a ‘zoned’ approach (BTS 2003).

Although this review has not attempted to explore the impediments to widespread use of action plans, the interpretation of the significant effects observed should be viewed cautiously, particularly if low uptake of self-management plans are a contributory factor in the presentation at emergency departments of adults with acute asthma (Douglass 2002; Walters 2003). Adults may have limited opportunities to attend educational sessions in practice due to work and childcare commitments, and the format and experience of educational intervention still requires quantitative and qualitative evaluation (Zayas 2006).

There are several limitations of this review. First, there was heterogeneity in the elements of each education interventions, and these were described in varying degrees of detail. Therefore, it is difficult to determine the relative effectiveness of the individual elements of the educational interventions. Additional variables which could affect the degree of success of this class of intervention include prior asthma education, baseline level of educational attainment and socio-economic status; however, this was hard to assess formally. Second, among the 13 studies, 25 different outcomes were measured and many of the outcomes are reported in only one study, making these results hard to use for a meta-analysis. Finally, publication bias and selection bias are a constant threat to the validity of any review. Despite conducting a comprehensive search and using independent assessors for relevance, inclusion and quality assessment, there may be additional study results that were missed. Indeed, there are at least five potential studies ongoing and we recognize that this review will need to be updated in the near future (see table ‘Characteristics of ongoing studies’).

**AUTHORS’ CONCLUSIONS**

**Implications for practice**

- Whilst broadly supportive of educational interventions to reduce readmission following an episode of acute asthma in adults, this review does not provide evidence to suggest that other important markers of long-term asthma morbidity are affected.
Although we observed high levels of statistical heterogeneity in re-admissions, the result was sufficiently robust to provide evidence of an effect across the studies. Better understanding of the strength of this effect would be provided by additional randomised evidence.

- The evidence to date regarding the cost-effectiveness is sparse and the decision to implement an educational intervention is currently based predominantly on effectiveness arguments.

### Implications for research

Studies are required to provide information on the following sources of uncertainty surrounding educational interventions.

- **Efficacy** Are the findings of this review repeatable? In particular, what are the effects of treatment on health-related quality of life, symptoms and lung function?

- **Educational intervention intensity** The intensity of the intervention may present a barrier to the widespread uptake of post-ED education, particularly where resources are scarce and continuation contingent on accommodation of a course of education in the routine of daily life.

- **Educational intervention format** We have pooled data from studies where different combinations of various educational elements have been used in an intervention. Better reporting of the intervention provided, and how it can be delivered are required.

- **Confounders of effect** The impact of socio-economic status of patients on access and continuation with these interventions.

- **Cost-benefit of educational interventions** In an era of diminishing resources available for additional services, there is an urgent need for studies which examine the cost-effectiveness of individual components of educational interventions.

### Potential Conflict of Interest

The authors who are involved in this review have done so without any known conflicts of interest. They are not involved with the primary studies. Dr. Rowe has received unrestricted educational grants for research, participated in industry-sponsored research and received honoraria from the following industry sponsors with respiratory divisions: AstraZeneca, GlaxoSmithKline, Boehringer-Ingelheim, and Abbott. None of the authors are considered paid consultants to any pharmaceutical company and do not benefit financially from the work of this review.

### Acknowledgements

The authors would like to the staff of the Cochrane Airways Group editorial base, namely Elizabeth Arnold, Susan Hansen and Veronica Stewart for providing extensive support in the identification, location and retrieval of papers for this review, and for providing constructive assessment of the search strategy.

### Sources of Support

**External sources of support**

- No sources of support supplied

**Internal sources of support**

- No sources of support supplied

### References

**References to studies included in this review**

**Baren 2001** *(published data only)*


**Bolton 1991** *(published data only)*


**Brown 2006** *(published data only)*


**George 1999** *(published data only)*


**Godoy 1998** *(published data only)*

Godoy N, Howard K, Cassino C, Ciotoli C, Ziegler P, Reibman J. Asthma education in the emergency department improves patient

**Levy 2000** [published data only]


**Maiman 1979** [published data only]


**Morice 2001** [published data only]


**Osman 2002** [published data only]


**Perneger 2002** [published data only]


**Smith 2005** [published data only]


**Yoon 1993** [published data only]


**References to studies excluded from this review**

**Abdulwadud 1997**


**Abdulwadud 1999**


**Adams 2001**


**Allen 1995**


**Anonymous 1994**


**Bailey 1990**


**Bailey 1999**


**Baldwin 1997**


**Berg 1997**


**Choy 1999**


**Cote 2001**


**Cowie 1997**


**Cowie 2002**


**D’Souza 1996**

de Oliveira 1997


de Oliveira 1999


Demiralay 2004


Emond 1999


Janson 2003


Kaupinnen 1998


Khan 2004


Klein 2001


Lahdensuo 1996


Lahdensuo 2005


Magar 2005


Marabini 2002


Marabini 2005


Martin Olmedo 2001


McDonald 1998


Mulloy 1996


Osman 1994


Ringsberg 1990


Segura 2001


Singh 2001


Smith 2005a

Smith JR, Mildenhall S, Noble MJ, Shepstone L, Koutantji M, Mugford M, et al. The Coping with Asthma Study: a randomised con...

**Stiegler 2005**

**Sundberg 2005**

**Wang 2004**

**Worth 2002**
Worth H. Effects of patient education in asthma and COPD - what has been shown? [Effekte der Patientenschulung bei Asthma und COPD - was ist belegt?]. *Medizinische Klinik* 2002;97(2 Suppl):20–4.

**Yilmaz 2002**

### References to studies awaiting assessment

**Baren 2006**

**Schatz 2006**

### References to ongoing studies

**NHBLI 2005**

**Partridge 2002**
Partridge M. A multi centre randomised controlled trial of lay-led, individualised self management education of adults with asthma. Hounslow Primary Care Trust. *National Research Register*.

**Partridge 2003**
Partridge MR. A multi-centre randomised controlled trial of lay-led, individualised self-management education for adults with asthma. *National Research Register*.

**Partridge 2003a**

**Partridge 2003b**

### Additional references

**Becker 2005**

**Bernard-Bonnin 1995**

**Boudreaux 2003**

**BTS 2003**

**Clark 1993**

**Douglas 2002**

**Emond 2000**

**Gibson 2002a**

**Gibson 2002b**

**Gibson 2002c**
Higgins 2003

Jadad 1996

Kelly 2002

Krahn 1996

Madge 1997

Martin 1995

Mitchell 1994

Oroñez 1998

Schulz 1995

Walters 2003

Zayas 2006

* Indicates the major publication for the study

### Tables

## Characteristics of included studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Baren 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Methods</strong></td>
<td>STUDY DESIGN: Parallel group</td>
</tr>
<tr>
<td></td>
<td>LOCATION, NUMBER OF CENTRES: North America, single centre.</td>
</tr>
<tr>
<td></td>
<td>DURATION OF STUDY: 8 weeks</td>
</tr>
<tr>
<td></td>
<td>CONCEALMENT OF ALLOCATION: Adequate (prepared by third party)</td>
</tr>
<tr>
<td></td>
<td>COCHRANE QUALITY SCORE: A</td>
</tr>
<tr>
<td></td>
<td>DESCRIBED AS RANDOMISED: Yes</td>
</tr>
<tr>
<td></td>
<td>METHOD OF RANDOMISATION WELL DESCRIBED/APPROPRIATE: Computer-generated block randomisation schedule.</td>
</tr>
<tr>
<td></td>
<td>DESCRIPTION OF WITHDRAWALS/DROPOUTS: 14/192 participants</td>
</tr>
<tr>
<td></td>
<td>TYPE OF ANALYSIS (AVAILABLE CASE/TREATMENT RECEIVED/ ITT): Intention-to-treat analysis</td>
</tr>
<tr>
<td></td>
<td>COMPLIANCE: Not assessed</td>
</tr>
<tr>
<td></td>
<td>CONFOUNDERS: Even distribution between groups in terms of baseline lung function, age, sex and maintenance therapies.</td>
</tr>
<tr>
<td><strong>Participants</strong></td>
<td>N SCREENED: 197</td>
</tr>
<tr>
<td></td>
<td>N RANDOMISED: 192</td>
</tr>
<tr>
<td></td>
<td>N COMPLETED: 178</td>
</tr>
<tr>
<td></td>
<td>M = 64</td>
</tr>
<tr>
<td></td>
<td>F = 128</td>
</tr>
<tr>
<td></td>
<td>MEAN AGE: 31</td>
</tr>
</tbody>
</table>
Characteristics of included studies (Continued)

INCLUSION CRITERIA: Aged between 16-46 years; attendance at emergency department with symptoms of acute asthma
EXCLUSION: Admission to hospital; unable to speak English; unwilling/unable to provide informed consent

Interventions

Education group: On discharge, participants were provided with a pack containing oral steroids, transportation vouchers to attend a primary care follow up; asthma information card; written instructions on use of vouchers and medication. Attempts made to contact all intervention group participants to remind them to attend a primary care follow up.

Control group: Participants discharged with short course of oral steroids; further instructions and medication at discretion of discharging physician

FOLLOW-UP PERIOD: Participants were followed up for two months.

Outcomes

Scheduled attendance at primary care physician/clinic; relapse (re-presentation at ED within 21 days of discharge); withdrawal/loss to follow-up.

Study Bolton 1991

Methods

STUDY DESIGN: Parallel group
LOCATION, NUMBER OF CENTRES: North America, Two sites (urban and suburban emergency departments)
DURATION OF STUDY: 12 months. CONCEALMENT OF ALLOCATION: Unclear
COCHRANE QUALITY SCORE: B
DESCRIBED AS RANDOMISED: Yes
METHOD OF RANDOMISATION WELL DESCRIBED/APPROPRIATE: Block randomisation (block size: 4, 6 or 8) stratified by site. DESCRIPTION OF WITHDRAWALS/DROPOUTS: 56/241
TYPE OF ANALYSIS (AVAILABLE CASE/TREATMENT RECEIVED/ITT): ITT (data reported for 224/241 participants at 12 months)
COMPLIANCE: 41% participants randomised to intervention did not attend any of the educational classes. CONFOUNDERS: Slightly higher ER visits for asthma in control group in 6 months prior to study

Participants

N SCREENED: 537
N RANDOMISED: 241
N COMPLETED: 185/241
M = 122 (82/241)
F = 119 (159/241)
MEAN AGE: 37 years
BASELINE DETAILS: 13% of sample had been admitted at initial ED visit; Ethnicity: white: 34% (31%); ED visit at inner-city site: 64%; < 13 years education: 57%; 13-14 years of education: 32%; > 14 years of education: 11%. Insurance coverage: 93%. INCLUSION CRITERIA: 18-70 years; Attendance at ED with acute asthma episode.
EXCLUSION: Language/psychiatric barrier

Interventions

Education group: Invitation to attend three small group educational sessions with trained nurse. Participants were reminded of importance of compliance with maintenance therapy, importance of self-care. Interactive dialogue with emphasis on problem-solving skills was also undertaken. Education aimed to change behaviour and to teach them about their asthma. Participants received instruction in breathing exercises; practiced inhalation techniques, and received smoking cessation advice if necessary. Those who missed their class received educational material by post.

Control group: Usual follow up.
Characteristics of included studies (Continued)

FOLLOW-UP PERIOD: 12 months.

Outcomes
Attendance at emergency department; cost; withdrawal.

Notes
Allocation concealment B – Unclear

<table>
<thead>
<tr>
<th>Study</th>
<th>Brown 2006</th>
</tr>
</thead>
</table>
| Methods     | STUDY DESIGN: Parallel group
LOCATI ON, NUMBER OF CENTRES: USA, one centre.
DURATION OF STUDY: 6 months
CONCEALMENT OF ALLOCATION: Sealed envelopes
DESCRIBED AS RANDOMIZED: Yes
METHOD OF RANDOMIZATION WELL DESCRIBED/APPROPRIATE: Computer-generated random number sequences.
TYPE OF ANALYSIS (AVAILABLE CASE/TREATMENT RECEIVED/ITT): Intention-to-treat analysis
COMPLIANCE: 39% in intervention group did not comply with any aspect of planned educational programme
CONFOUNDERS: Even distribution between groups in terms of baseline lung function, age, sex and maintenance therapies.

Participants
N SCREENED: 1745
N RANDOMISED: 248
M = 107
F = 128
BASELINE DETAILS: Primary care physician: 87%; Asthma action plan: 23%; Spacer: 57%; ICS: 78%; PEF metre: 44%; 37% were African American, 56% had moderate-to-severe persistent asthma, 78% on ICS at baseline
INCLUSION CRITERIA: Children or adults; asthma exacerbation presenting on ED visit, have had asthma symptoms in the prior 2 weeks, or a previous hospitalization or ED visit in the past year.
EXCLUSION CRITERIA: Not described

Interventions
Education group: conducted by trained asthma educators and included a facilitated office visit with patient and primary care provider within 2-4 weeks of enrollment, a home-visit 2-4 weeks thereafter.
Control group: Usual follow up.

FOLLOW-UP PERIOD: 6 months

Outcomes
Urgent asthma visit; treatment compliance; withdrawals

Notes
Follow-up information was obtained from 190 participants. 49% of the 117 intervention participants did not comply with activities

Data for adults (> 18 years) presented in trial report were used in the review

Allocation concealment A – Adequate

<table>
<thead>
<tr>
<th>Study</th>
<th>George 1999</th>
</tr>
</thead>
</table>
| Methods     | STUDY DESIGN: Parallel group
LOCATION, NUMBER OF CENTRES: One centre in USA inner city (Philadelphia, PENN).
DURATION OF STUDY: 6 months
CONCEALMENT OF ALLOCATION: Not clear.
COCHRANE QUALITY SCORE: B
DESCRIBED AS RANDOMISED: Yes
METHOD OF RANDOMISATION WELL DESCRIBED/APPROPRIATE: Random number generator.
DESCRIPTION OF WITHDRAWALS/DROPOUTS: Not explicit.
TYPE OF ANALYSIS (AVAILABLE CASE/TREATMENT RECEIVED/ITT): Available case.
Characteristics of included studies (Continued)

COMPLIANCE: Not assessed.
CONFOUNDERS: Comparable groups at baseline in terms of disease severity.

Participants

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N SCREENED:</td>
<td>88</td>
</tr>
<tr>
<td>N RANDOMISED:</td>
<td>77</td>
</tr>
<tr>
<td>N COMPLETED:</td>
<td>77 (data presented form follow-up based on central records)</td>
</tr>
<tr>
<td>M = 16</td>
<td>F = 61</td>
</tr>
<tr>
<td>MEAN AGE:</td>
<td>29</td>
</tr>
<tr>
<td>BASELINE DETAILS:</td>
<td>Medicaid: 43; self-pay: 9; Private: 25.</td>
</tr>
<tr>
<td>MEAN AGE:</td>
<td>29 years.</td>
</tr>
<tr>
<td>INCLUSION CRITERIA:</td>
<td>18-45 years; participants admitted to hospital with acute asthma exacerbation.</td>
</tr>
<tr>
<td>EXCLUSION:</td>
<td>Admission to intensive care; no telephone access; pregnant females, comorbid disease, inability to speak English.</td>
</tr>
</tbody>
</table>

Interventions

Education group: Inpatient education, consisting of repetitive teaching sessions with an asthma nurse, with the aim of improving inhaler technique, recognition of need for long-term therapy, early warning signs of asthma and action plan in response to them. Asthma nurse also screened for obstacles to care including lack of transportation to OPD, lack of childcare or substance abuse. Social worker collaborated in order to remove/address barriers where possible. Follow-up telephone call 24 hours post-discharge was also made. An appointment was arranged for treatment group participants at an outpatient clinic within 7 days of discharge.

Control group: Usual discharge routine (education, PEF measurements, discharge planning and scheduled follow-up at discretion of nursing and house staff). Both groups received usual treatment for the exacerbation of their asthma (including iv methylprednisone and nebulised SABA)

FOLLOW-UP PERIOD: Six months

Outcomes Length of hospital stay; successful discharge; scheduled follow-up visit; subsequent ED use.

Notes

Allocation concealment B – Unclear

Study

Godoy 1998

Methods

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>STUDY DESIGN:</td>
<td>Parallel group.</td>
</tr>
<tr>
<td>LOCATION, NUMBER OF CENTRES:</td>
<td>USA, inner city hospital.</td>
</tr>
<tr>
<td>DURATION OF STUDY:</td>
<td>4-8 week follow up.</td>
</tr>
<tr>
<td>CONCEALMENT OF ALLOCATION:</td>
<td>Not reported</td>
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<tr>
<td>COCHRANE QUALITY SCORE:</td>
<td>B</td>
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<tr>
<td>DESCRIBED AS RANDOMISED:</td>
<td>Yes</td>
</tr>
<tr>
<td>METHOD OF RANDOMISATION WELL DESCRIBED/APPROPRIATE:</td>
<td>Not described. DESCRIPTION OF WITHDRAWALS/DROPOUTS: 8/20</td>
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<tr>
<td>TYPE OF ANALYSIS (AVAILABLE CASE/TREATMENT RECEIVED/ITT):</td>
<td>All participants accounted for.</td>
</tr>
<tr>
<td>COMPLIANCE:</td>
<td>Assessed as attendance at a clinic. CONFOUNDERS: Not sufficient detail reported.</td>
</tr>
</tbody>
</table>

Participants

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>N SCREENED:</td>
<td>Not reported.</td>
</tr>
<tr>
<td>N RANDOMISED:</td>
<td>20</td>
</tr>
<tr>
<td>N COMPLETED:</td>
<td>12/20 (available for telephone interview at 4-8 weeks)</td>
</tr>
<tr>
<td>M =</td>
<td>Not reported</td>
</tr>
<tr>
<td>F =</td>
<td>Not reported</td>
</tr>
<tr>
<td>MEAN AGE:</td>
<td>Not reported.</td>
</tr>
<tr>
<td>BASELINE DETAILS:</td>
<td>Not reported. Participants completed asthma knowledge questionnaire. INCLUSION CRITERIA: Attending ED for acute asthma, no other criteria were specified. EXCLUSION: Not specified.</td>
</tr>
</tbody>
</table>

Interventions

Education group: Reinforcement of signs of asthma exacerbation and importance of outpatient care as a means of maintaining long-term asthma control. Access to a hotline.
### Characteristics of included studies (Continued)

<table>
<thead>
<tr>
<th>Control group: Usual care</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOLLOW-UP PERIOD: Four-eight weeks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Attendance at outpatient clinic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notes</td>
<td>Presented as conference abstract only</td>
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</table>

<table>
<thead>
<tr>
<th>Allocation concealment</th>
<th>B – Unclear</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Study</th>
<th>Levy 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methods</td>
<td>STUDY DESIGN: Parallel group trial. LOCATION, NUMBER OF CENTRES: UK, two outer-London general hospitals. DURATION OF STUDY: 6 months. CONCEALMENT OF ALLOCATION: Not reported. COCHRANE QUALITY SCORE: B DESCRIBED AS RANDOMISED: Yes METHOD OF RANDOMISATION WELL DESCRIBED/APPROPRIATE: Computer generated equal blocks of 4 from randomly generated number sequence. DESCRIPTION OF WITHDRAWALS/DROPOUTS: All participants accounted for. TYPE OF ANALYSIS (AVAILABLE CASE/TREATMENT RECEIVED/ ITT): See above. COMPLIANCE: 57% participants had three education sessions (either in person or by telephone); 63% had two sessions and 77% had one session. CONFOUNDERS: Comparable groups at baseline.</td>
</tr>
<tr>
<td>Interventions</td>
<td>Education group: 1 hr consultation with specialist nurse two weeks post-study entry, followed by an additional two consultations of 30 minutes at 6 weekly intervals. Asthma control was assessed, followed by some education on recognising and treating acute asthma. Control group: Usual care. FOLLOW-UP PERIOD: 6 months.</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Peak flow; quality of life (as measured by the St George Respiratory Questionnaire); symptom scores; asthma attacks.</td>
</tr>
<tr>
<td>Notes</td>
<td></td>
</tr>
<tr>
<td>Allocation concealment</td>
<td>B – Unclear</td>
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</table>

<table>
<thead>
<tr>
<th>Study</th>
<th>Maiman 1979</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methods</td>
<td>STUDY DESIGN: Parallel group trial. LOCATION, NUMBER OF CENTRES: One centre in USA (Johns Hopkins University, Baltimore). DURATION OF STUDY: 6 months CONCEALMENT OF ALLOCATION: Unclear. COCHRANE QUALITY SCORE: B DESCRIBED AS RANDOMISED: Yes METHOD OF RANDOMISATION WELL DESCRIBED/APPROPRIATE: (3 x 2) x 2 x 2 factorial design DESCRIPTION OF WITHDRAWALS/DROPOUTS: Not clear TYPE OF ANALYSIS (AVAILABLE CASE/TREATMENT RECEIVED/ ITT): Assumed available case.</td>
</tr>
</tbody>
</table>
### Characteristics of included studies (Continued)

COMPLIANCE: Not assessed.
CONFOUNDERS: Baseline characteristics of the groups not presented.

<table>
<thead>
<tr>
<th>Participants</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N SCREENED:</td>
<td>538</td>
</tr>
<tr>
<td>N RANDOMISED:</td>
<td>289</td>
</tr>
<tr>
<td>N COMPLETED:</td>
<td>289 (data presented on 245)</td>
</tr>
<tr>
<td>M = 58</td>
<td></td>
</tr>
<tr>
<td>F = 187</td>
<td></td>
</tr>
<tr>
<td>MEAN AGE:</td>
<td>34.4 years</td>
</tr>
<tr>
<td>INCLUSION CRITERIA: 18-64 years of age; presentation to ED with acute asthma; visit termination interview conducted by a nurse. EXCLUSION: &gt; 65 years.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interventions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Education group 1a: Exit interview from nurse who identified herself as asthmatic; positive written appeal (booklet containing information on what happens during an asthma attack, use medications and how they prevent attacks, coping strategies for asthma attacks, environmental control advice).</td>
<td></td>
</tr>
<tr>
<td>Education group 1b: Exit interview from nurse who identified herself as asthmatic; no booklet.</td>
<td></td>
</tr>
<tr>
<td>Education group 2a: Exit interview from nurse who did not identify herself as asthmatic; positive written appeal (booklet containing information on what happens during an asthma attack, use medications and how they prevent attacks, coping strategies for asthma attacks, environmental control advice).</td>
<td></td>
</tr>
<tr>
<td>Education group 2b: Exit interview from nurse (as above) who did not identify herself as asthmatic; no booklet.</td>
<td></td>
</tr>
<tr>
<td>Education group 3a: Exit interview from ED nurse; positive written appeal (booklet containing information on what happens during an asthma attack, use medications and how they prevent attacks, coping strategies for asthma attacks, environmental control advice).</td>
<td></td>
</tr>
<tr>
<td>Education group 3b: Exit interview from ED nurse; no booklet. All participants received follow-up telephone call.</td>
<td></td>
</tr>
<tr>
<td>FOLLOW-UP PERIOD: 6 months</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Subsequent presentation at ED with asthma symptoms.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Notes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation concealment</td>
<td>B – Unclear</td>
</tr>
</tbody>
</table>

### Study: Morice 2001

<table>
<thead>
<tr>
<th>Methods</th>
<th>STUDY DESIGN: Parallel group trial</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION, NUMBER OF CENTRES: UK, large teaching hospital</td>
<td></td>
</tr>
<tr>
<td>DURATION OF STUDY: 18 months</td>
<td></td>
</tr>
<tr>
<td>CONCEALMENT OF ALLOCATION: not clear</td>
<td></td>
</tr>
<tr>
<td>COCHRANE QUALITY SCORE: B</td>
<td></td>
</tr>
<tr>
<td>DESCRIBED AS RANDOMIZED: yes</td>
<td></td>
</tr>
<tr>
<td>METHOD OF RANDOMISATION WELL DESCRIBED/APPROPRIATE: not described.</td>
<td></td>
</tr>
<tr>
<td>DESCRIPTION OF WITHDRAWALS/DROPOUTS: 10 out of 40 in the control group and 5 out of 40 in the intervention group did not return responded to the questionnaire</td>
<td></td>
</tr>
<tr>
<td>TYPE OF ANALYSIS (AVAILABLE CASE/TREATMENT RECEIVED/ITT): Intention-to-treat analysis</td>
<td></td>
</tr>
<tr>
<td>COMPLIANCE: Not assessed</td>
<td></td>
</tr>
<tr>
<td>CONFOUNDERS: Not mentioned</td>
<td></td>
</tr>
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</table>

<table>
<thead>
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<th>Participants</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N SCREENED:</td>
<td>80</td>
</tr>
<tr>
<td>N RANDOMISED:</td>
<td>80</td>
</tr>
<tr>
<td>N COMPLETED:</td>
<td>(at 6 months): 65</td>
</tr>
<tr>
<td>M = 53</td>
<td></td>
</tr>
<tr>
<td>F = 27</td>
<td></td>
</tr>
</tbody>
</table>
### Characteristics of included studies (Continued)

**MEAN AGE:** 36.1 years  
**CHARACTERISTICS:** Prior use of ICS at 1 mg: 47.5%  
**INCLUSION CRITERIA:** admitted on the general medical take to a large teaching hospital with a documented primary diagnosis of acute asthma  
**EXCLUSION CRITERIA:** chronic obstructive respiratory disease, previously participated in an educational programme from a hospital-based asthma nurse, unable or unwilling to complete a series of follow-up questionnaires

#### Interventions

**Education group:** subsequent visits of the asthma nurse until discharge from hospital. A minimum of 2 sessions of 30 minutes each; 1) discussion about mechanisms, triggers and booklet 2) summary of first session, self-management plan peak flow meter + instructions and Sheffield Asthma Card with emergency phone numbers and, 3) last visit where patients were encouraged to express fears or anxieties related to their home management  
**Control group:** usual care  
Both groups: seen by the asthma nurse as a single interviewer with 48 hours of admission

**FOLLOW-UP PERIOD:** 18 months

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Preferred action taken on worsening of asthma symptoms (GP urgent visits, GP call-outs, accident and emergency visits, re-admissions); withdrawal/loss to follow up</th>
</tr>
</thead>
</table>

#### Notes

**Allocation concealment**  
**B – Unclear**

### Study

**Osman 2002**

#### Methods

**STUDY DESIGN:** Parallel group trial. Independent assessor blinded to patient assignment collected data on readmission within 12 months from hospital records.  
**LOCATION, NUMBER OF CENTRES:**  
**DURATION OF STUDY:** 12 months  
**CONCEALMENT OF ALLOCATION:** sealed envelopes  
**DESCRIBED AS RANDOMISED:** Yes  
**METHOD OF RANDOMISATION WELL DESCRIBED/APPROPRIATE:** random numbers held in sealed envelopes  
**COCHRANE QUALITY SCORE:** A  
**DESCRIPTION OF WITHDRAWALS/DROPOUTS:** Data collected from patient notes (follow-up at clinic only for initial admission; questionnaires returned by post)  
**TYPE OF ANALYSIS (AVAILABLE CASE/TREATMENT RECEIVED/ITT):** Available case (based on questionnaire at one month post-discharge)  
**COMPLIANCE:** Assessed via questionnaire report (81% returned at 1 month). 97% patients contributed to primary outcome (readmission information)  
**CONFOUNDERS:** At 12 months the differences between the 2 groups of patients remained greater for those for whom this had been a first admission. At one month return of questionnaire may be motivated by satisfaction with treatment.

#### Participants

**N SCREENED not reported (study population represented 60% of all eligible patients over the study period)**  
**N RANDOMISED:** 280  
**N COMPLETED:** 226 questionnaires returned at one month (data on readmission at 12 months collected from patient records)  
M = 94  
F = 186  
**CHARACTERISTICS:** 22-43 years old, 43% current smokers, 79% treated with ICS prior to admission, 23% outpatient appointment at chest clinic outpatient in previous 12 months  
**INCLUSION CRITERIA:** 14-64 years old and admitted to the hospital with acute asthma  
**EXCLUSION CRITERIA:** Not reported

#### Interventions

**Education group:** Self-management programme (SMP) in 2 visits of 30 minutes each by a trained respiratory nurse. Discussion about asthma, booklet, self-management plan (symptom and peak flow based).
### Characteristics of included studies (Continued)

Control group: Usual care. Only one visit by the respiratory nurse, two questionnaires sent after they leave hospital.

All participants received a postal questionnaire

**FOLLOW-UP PERIOD:** 12 months

**Outcomes**

- Re-admission for acute asthma within 12 months; readmission 1 month after discharge; patient satisfaction with asthma explanation; written management plan; management at discharge

**Notes**

- Allocation concealment: A – Adequate

**Study**

- **Perneger 2002**

**Methods**

- STUDY DESIGN: Parallel group trial.
- DURATION OF STUDY: 6 months
- CONCEALMENT OF ALLOCATION: sealed numbered envelopes
- COCHRANE QUALITY SCORE: A
- DESCRIBED AS RANDOMIZED: yes
- METHOD OF RANDOMIZATION WELL DESCRIBED/APPROPRIATE: computer-generated list of random block of numbers
- DESCRIPTION OF WITHDRAWALS/DROPOUTS: 8 were lost to follow-up and 1 died in the immediate education group (14% of randomized); 7 were lost-to-follow-up in the delayed education group (11%)
- TYPE OF ANALYSIS (AVAILABLE CASE/TREATMENT RECEIVED/ITT): All comparisons were performed on an intention-to-treat basis.
- COMPLIANCE: 50% of randomized attended the 3 sessions, 15% attended 2 sessions, 9% attended only one session, and 12% attended no session at all in the immediate education group. 48% of randomized attended the 3 sessions, 9% attended 2 sessions, 6% attended only 1 session, and 26% attended no session at all in the delayed education group.
- CONFOUNDERS: Comparison of baseline characteristics was used to determine the effectiveness of randomisation.

**Participants**

- N SCREENED: 311
- N ELIGIBLE: 253
- N RANDOMISED: 131
- N COMPLETED: 115
- M = 36
- F = 79

- BASELINE CHARACTERISTICS: Age-groups: < 30 years: 31; 30-44 years: 40; 45-59 years: 37; 60+ years: 23; Severity of asthma attack: 9% Stage 1: PaO2 75 to 95 mm Hg, PaCO2 < 36 mmHg; 16% Stage 2: PaO2 < 75 mm Hg, PaCO2 < 36 mmHg; 31% Stage 3: PaO2 < 75 mm Hg, PaCO2 36 to 44 mmHg; 18% Stage 4: PaO2 < 75 mm Hg, PaCO2 > 44 mmHg; 64% Swiss nationality, 69% had asthma for more than 10 years, 11% first attack, 70% had other respiratory problems, 38% smokers.
- INCLUSION CRITERIA: adult patients hospitalized for asthma between January 1996 and June 1998 at he Geneva University Hospital, seen in the emergency ward, or who received asthma medications while they were hospitalized for something else
- EXCLUSION CRITERIA: inability to understand French, residence outside the canton of Geneva, inability to fill out questionnaire, unstable asthma

**Interventions**

- Education group: 3 group sessions of 75 min/each conducted by 2 respiratory physicians and a physiotherapist; session #1) recognize and assess symptoms, triggers listed. Learning the use of peak flow meter session #2) illustrated information, classification and proper use of asthma drugs session #3) self-management plan and proper actions depending on PEFR.
- Control group: waiting list control

**FOLLOW-UP PERIOD:** 6 months
Characteristics of included studies (Continued)

Outcomes Improvement in health and functional status measured by validated French translations of the Short-Form 36-Item (SF-36) Health survey and ASQOL, number of days missed, smoking status, other physical or emotional problems caused by asthma, level of confidence in treatment, division of responsibility for treatment between patient and physician, number of physician visits, ER visits, hospitalisation and regular use of asthma drugs

Notes

Allocation concealment A – Adequate

Study Smith 2005

Methods STUDY DESIGN: Parallel group trial DURATION OF STUDY: 4 months CONCEALMENT OF ALLOCATION: Not clear DESCRIBED AS RANDOMIZED: yes METHOD OF RANDOMISATION WELL DESCRIBED/APPROPRIATE: Not clear COCHRANE QUALITY SCORE: B DESCRIPTION OF WITHDRAWALS/DROPOUTS: Not reported TYPE OF ANALYSIS (AVAILABLE CASE/TREATMENT RECEIVED/ ITT): Not reported COMPLIANCE: Not reported CONFOUNDERS: Not clear

Participants N SCREENED: Not reported N RANDOMISED: 146 N COMPLETED: Not reported M = 64 F = 82 MEAN AGE: 34 years CHARACTERISTICS: Mean age of 34 (SD 13.8 years), groups did not differ in age, education, gender, income, and previous ED attendances, however the PCE group was more likely to have seen a GP in previous 7 days. Improvement in Peak flow monitoring (post intervention). Reduction of re-attendance at 4 months post (PCE group had fewer re-attendance) INCLUSION CRITERIA: Not clear EXCLUSION CRITERIA: Not clear

Interventions Education group: Patient-centered education (PCE) utilizing an Asthma Foundation Leaflet and comprising a commonly used standard education curriculum for both groups. Control group: Usual care. FOLLOW-UP PERIOD: 4 months

Outcomes Re-attendance; re-admission

Notes Study reported as conference abstract.

Allocation concealment B – Unclear

Study Yoon 1993

Methods STUDY DESIGN: Parallel group trial DURATION OF STUDY: 10 months CONCEALMENT OF ALLOCATION: unclear DESCRIBED AS RANDOMIZED: yes METHOD OF RANDOMISATION WELL DESCRIBED/APPROPRIATE: unclear COCHRANE QUALITY SCORE: B DESCRIPTION OF WITHDRAWALS/DROPOUTS: 11 not followed-up at 10 months TYPE OF ANALYSIS (AVAILABLE CASE/TREATMENT RECEIVED/ ITT): Available case. COMPLIANCE: 74% attended 10 months follow-up visit CONFOUNDERS: Imbalance at baseline between groups in terms of prior asthma education and peak flow metre training in favour of the control group (see Participants).

Participants N SCREENED: 185 N RANDOMISED: 76 N COMPLETED: 56 M = 20 F = 56 CHARACTERISTICS: Past smokers: 17 in intervention group and 16 in control group; current smokers: 3 in the intervention group and 2 in the control group; Peak flow meter training: 12 in the intervention group and 26 in the control group; previous asthma education: 2 in the intervention group and 9 in the control group; up to 10 years primary and secondary education: 14 in the intervention group and 13 in the control group; matriculation or tertiary training or both: 23 in the intervention group and 23 in the control group. Mean age: 30 for intervention group and 34 for control.
INCLUSION CRITERIA: Adults admitted to the respiratory ward of a university teaching hospital in Sydney between April 1987 and April 1989. 16-65 years, literacy in English, able to attend the education, centre diagnosis of asthma confirmed by history and document, reversibility of airflow obstruction (at least 15% predicted).

EXCLUSION CRITERIA: irreversible airflow obstruction, for example due to smoking, or other concurrent disease.

Interventions

Education group: Single education session of 2.5-3 hours which groups of 5 to 8 adults learnt asthma management skills including: a) 40 min. interactive lecture, b) 20 min. videotape discussing actions and side effects of asthma treatments and information on delivery of inhaled drugs, c) individual training in use of PFM, asthma diaries, and inhaler techniques d) 14 min. videotape of questions and misconceptions about asthma, and e) final practice session in the use of a treatment plan.

Control group: Usual care.

FOLLOW-UP PERIOD: 10 months

Outcomes Hospital admission; lung function (PEF); questionnaires measuring a) psychosocial disturbance; b) asthma symptoms; c) knowledge about asthma; d) aspects of self-management behaviour measurement of airway functions

Notes Allocation concealment B – Unclear

ED: emergency department; ER: emergency room; F: female; ICS: inhaled corticosteroids; M: male; PEFR: Peak expiratory flow rate; SABA: short-acting beta-agonist

Characteristics of excluded studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Reason for exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdulwadud 1997</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Abdulwadud 1999</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Adams 2001</td>
<td>Different management plans compared</td>
</tr>
<tr>
<td>Allen 1995</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Anonymous 1994</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Bailey 1990</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Bailey 1999</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Baldwin 1997</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Berg 1997</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Choy 1999</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Cote 2001</td>
<td>Randomisation between two active treatment groups. First 45 participants recruited to the control group</td>
</tr>
<tr>
<td>Cowie 1997</td>
<td>Participants identified from records going back 12 months.</td>
</tr>
<tr>
<td>Cowie 2002</td>
<td>Age range below that of review entry criteria</td>
</tr>
<tr>
<td>D’Souza 1996</td>
<td>Before and after study</td>
</tr>
<tr>
<td>Demiralay 2004</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Emond 1999</td>
<td>Before and after study</td>
</tr>
<tr>
<td>Janson 2003</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Kaupinnen 1998</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Khan 2004</td>
<td>Paediatric study</td>
</tr>
<tr>
<td>Klein 2001</td>
<td>Recruitment from outpatient clinic</td>
</tr>
</tbody>
</table>
Characteristics of excluded studies (Continued)

<table>
<thead>
<tr>
<th>Study</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lahdensuo 1996</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Magar 2005</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Marabini 2002</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Martín Olmedo 2001</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>McDonald 1998</td>
<td>Comparison of different types of education in order to determine whether different modes of delivery education achieve the same effect</td>
</tr>
<tr>
<td>Mulloy 1996</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Osman 1994</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Ringsberg 1990</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Segura 2001</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Singh 2001</td>
<td>Paediatric study</td>
</tr>
<tr>
<td>Smith 2005a</td>
<td>Participants randomised to intervention remote from an acute event</td>
</tr>
<tr>
<td>Stiegler 2005</td>
<td>Before and after study</td>
</tr>
<tr>
<td>Sundberg 2005</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>Wang 2004</td>
<td>Both groups given education. Self-management plan given as treatment</td>
</tr>
<tr>
<td>Worth 2002</td>
<td>COPD</td>
</tr>
<tr>
<td>Yilmaz 2002</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>de Oliveira 1997</td>
<td>Recruitment from outpatient clinic</td>
</tr>
<tr>
<td>de Oliveira 1999</td>
<td>Recruitment from outpatient clinic</td>
</tr>
</tbody>
</table>

COPD: chronic obstructive pulmonary disease

ADDITIONAL TABLES

Table 01. Control group re-admission rate

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>% re-admitted</th>
<th>NNT(benefit)</th>
<th>Follow up (w)</th>
</tr>
</thead>
<tbody>
<tr>
<td>George 1999</td>
<td>20</td>
<td>60</td>
<td>4 (3 to 19)</td>
<td>24</td>
</tr>
<tr>
<td>Morice 2001</td>
<td>40</td>
<td>28</td>
<td>8 (5 to 40)</td>
<td>72</td>
</tr>
<tr>
<td>Osman 2002</td>
<td>140</td>
<td>27</td>
<td>8 (6 to 42)</td>
<td>52</td>
</tr>
<tr>
<td>Perneger 2002</td>
<td>58</td>
<td>10</td>
<td>20 (14 to 112)</td>
<td>24</td>
</tr>
<tr>
<td>Yoon 1993</td>
<td>28</td>
<td>25</td>
<td>8 (6 to 45)</td>
<td>40</td>
</tr>
</tbody>
</table>

ANALYSES

Comparison 01. Education versus usual care

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Hospital admission/re-admission (end of follow up)</td>
<td>5</td>
<td>572</td>
<td>Relative Risk (Random) 95% CI</td>
<td>0.50 [0.27, 0.91]</td>
</tr>
<tr>
<td>02 Hospitalisations for asthma per 100 persons at 12 months</td>
<td></td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
<tr>
<td>03 Length of hospital stay (days)</td>
<td></td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
<tr>
<td>04 Presentation at emergency department (end of follow up)</td>
<td>7</td>
<td>800</td>
<td>Relative Risk (Random) 95% CI</td>
<td>0.69 [0.40, 1.21]</td>
</tr>
</tbody>
</table>
05 Mean emergency department visits/100 persons
06 Severe episodes of asthma
07 Primary care physician urgent visits
08 Physician visits per 100 persons
09 Primary care physician call outs
10 Scheduled clinic attendance
11 Satisfied with explanation of asthma
12 Missed school/work due to asthma (end of follow up)
13 Days of limited activity due to asthma per 100 asthma at 12 months
14 Study withdrawal/loss to follow up
15 Quality of life (SGRQ)
16 PEF
17 Cost ($) 
18 Asthma caused physical limitations
19 Asthma caused sleep problems
20 Asthma caused emotional problems
21 Asthma caused social difficulties
22 Self-management techniques
23 Mean work days missed
24 Adequate self-management techniques
25 Mean number of physician visits

Comparison 02. Sensitivity analysis (study quality - Grade A concealment)

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital admission/readmission (end of follow-up)</td>
<td>2</td>
<td>386</td>
<td>Relative Risk (Random) 95% CI</td>
<td>0.63 [0.40, 0.97]</td>
</tr>
</tbody>
</table>

 COVER SHEET

Title
Education interventions for adults who attend the emergency room for acute asthma

Authors
Tapp S, Lasserson TJ, Rowe BH

Contribution of author(s)
ST: Lead author on review; question formulation; study assessment, data extraction; draft of ‘Discussion’
TL: Study assessment; data extraction; data entry; analysis; results write-up
BR: Guide on draft of review; revision of review manuscript

Issue protocol first published
2001/2

Review first published
2007/3
Figure 01. Graph to demonstrate that for every 100 people who undergo an educational intervention having presented with an acute asthma exacerbation, around 9 would have to be treated in order that one person would not be admitted to hospital.
Analysis 01.01. Comparison 01 Education versus usual care, Outcome 01 Hospital admission/re-admission
(end of follow up)

Review: Education interventions for adults who attend the emergency room for acute asthma
Comparison: 01 Education versus usual care
Outcome: 01 Hospital admission/re-admission (end of follow up)

<table>
<thead>
<tr>
<th>Study</th>
<th>Education</th>
<th>Control</th>
<th>Relative Risk (Random)</th>
<th>Weight</th>
<th>Relative Risk (Random)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>95% CI</td>
<td>(%)</td>
<td>95% CI</td>
</tr>
<tr>
<td>George 1999</td>
<td>3/30</td>
<td>12/20</td>
<td>17.0</td>
<td>0.17</td>
<td>[0.05, 0.52]</td>
</tr>
<tr>
<td>Morice 2001</td>
<td>10/40</td>
<td>11/40</td>
<td>26.1</td>
<td>0.91</td>
<td>[0.44, 1.90]</td>
</tr>
<tr>
<td>Osman 2002</td>
<td>22/131</td>
<td>38/140</td>
<td>34.0</td>
<td>0.62</td>
<td>[0.39, 0.99]</td>
</tr>
<tr>
<td>Perneger 2002</td>
<td>4/57</td>
<td>6/58</td>
<td>15.6</td>
<td>0.68</td>
<td>[0.20, 2.28]</td>
</tr>
<tr>
<td>Yoon 1993</td>
<td>1/28</td>
<td>7/28</td>
<td>7.3</td>
<td>0.14</td>
<td>[0.02, 1.09]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>286</td>
<td>286</td>
<td>100.0</td>
<td>0.50</td>
<td>[0.27, 0.91]</td>
</tr>
</tbody>
</table>

Test for heterogeneity chi-square=8.22 df=4 p=0.08 I² =51.3%
Test for overall effect z=2.27 p=0.02

Analysis 01.02. Comparison 01 Education versus usual care, Outcome 02 Hospitalisations for asthma per 100 persons at 12 months

Review: Education interventions for adults who attend the emergency room for acute asthma
Comparison: 01 Education versus usual care
Outcome: 02 Hospitalisations for asthma per 100 persons at 12 months

<table>
<thead>
<tr>
<th>Study</th>
<th>Education</th>
<th>Control</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N Mean(SD)</td>
<td>N Mean(SD)</td>
<td>95% CI</td>
<td>95% CI</td>
</tr>
<tr>
<td>Bolton 1991</td>
<td>106  7.00 (20.00)</td>
<td>118  10.00 (20.00)</td>
<td>-3.00 [-8.25, 2.25]</td>
<td></td>
</tr>
</tbody>
</table>

-10.0 -5.0 0 5.0 10.0
Favours education  Favours control
Analysis 01.03. Comparison 01 Education versus usual care, Outcome 03 Length of hospital stay (days)

Review: Education interventions for adults who attend the emergency room for acute asthma
Comparison: 01 Education versus usual care
Outcome: 03 Length of hospital stay (days)

<table>
<thead>
<tr>
<th>Study</th>
<th>Weighted Mean Difference (Fixed)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Bolton 1991</td>
<td>44</td>
</tr>
</tbody>
</table>

Analysis 01.04. Comparison 01 Education versus usual care, Outcome 04 Presentation at emergency department (end of follow up)

Review: Education interventions for adults who attend the emergency room for acute asthma
Comparison: 01 Education versus usual care
Outcome: 04 Presentation at emergency department (end of follow up)

<table>
<thead>
<tr>
<th>Study</th>
<th>Relative Risk (Random)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
</tr>
<tr>
<td>Baren 2001</td>
<td>3/95</td>
</tr>
<tr>
<td>Brown 2006</td>
<td>12/51</td>
</tr>
<tr>
<td>George 1999</td>
<td>3/30</td>
</tr>
<tr>
<td>Levy 2000</td>
<td>36/103</td>
</tr>
<tr>
<td>Morice 2001</td>
<td>2/40</td>
</tr>
<tr>
<td>Perneger 2002</td>
<td>7/57</td>
</tr>
<tr>
<td>Yoon 1993</td>
<td>3/28</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>404</td>
</tr>
</tbody>
</table>

Total events: 66 (Education), 86 (Control)
Test for heterogeneity chi-square = 14.23 df=6 p=0.03 I² = 57.8%
Test for overall effect z=1.29  p=0.2
Analysis 01.05. Comparison 01 Education versus usual care, Outcome 05 Mean emergency department visits/100 persons

Review: Education interventions for adults who attend the emergency room for acute asthma
Comparison: 01 Education versus usual care
Outcome: 05 Mean emergency department visits/100 persons

<table>
<thead>
<tr>
<th>Study</th>
<th>Education</th>
<th>Control</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N Mean(SD)</td>
<td>N Mean(SD)</td>
<td>95% CI</td>
<td>95% CI</td>
</tr>
<tr>
<td>Bolton 1991</td>
<td>106 16.00 (20.00)</td>
<td>118 39.00 (70.00)</td>
<td></td>
<td>-23.00 [-36.19, -9.81]</td>
</tr>
</tbody>
</table>

Favours education  Favours control

Analysis 01.06. Comparison 01 Education versus usual care, Outcome 06 Severe episodes of asthma

Review: Education interventions for adults who attend the emergency room for acute asthma
Comparison: 01 Education versus usual care
Outcome: 06 Severe episodes of asthma

<table>
<thead>
<tr>
<th>Study</th>
<th>Education</th>
<th>Control</th>
<th>Odds Ratio (Fixed)</th>
<th>Odds Ratio (Fixed)</th>
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<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>95% CI</td>
<td>95% CI</td>
</tr>
<tr>
<td>Levy 2000</td>
<td>35/103</td>
<td>45/108</td>
<td>0.72 [0.41, 1.26]</td>
<td></td>
</tr>
</tbody>
</table>

Favours education  Favours control

Analysis 01.07. Comparison 01 Education versus usual care, Outcome 07 Primary care physician urgent visits

Review: Education interventions for adults who attend the emergency room for acute asthma
Comparison: 01 Education versus usual care
Outcome: 07 Primary care physician urgent visits

<table>
<thead>
<tr>
<th>Study</th>
<th>Education</th>
<th>Control</th>
<th>Relative Risk (Fixed)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>95% CI</td>
<td>95% CI</td>
</tr>
<tr>
<td>Morice 2001</td>
<td>11/40</td>
<td>9/40</td>
<td>1.22 [0.57, 2.62]</td>
<td></td>
</tr>
</tbody>
</table>

Favours education  Favours control
### Analysis 01.08. Comparison 01 Education versus usual care, Outcome 08 Physician visits per 100 persons

#### Review: Education interventions for adults who attend the emergency room for acute asthma

#### Comparison: 01 Education versus usual care

#### Outcome: 08 Physician visits per 100 persons

<table>
<thead>
<tr>
<th>Study</th>
<th>Education</th>
<th>Control</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
<td>95% CI</td>
</tr>
<tr>
<td>Bolton 1991</td>
<td>106 46.00 (70.00)</td>
<td>118 58.00 (80.00)</td>
<td>-12.00 [-31.65, 7.65]</td>
<td></td>
</tr>
</tbody>
</table>

Favours education

Favours control

### Analysis 01.09. Comparison 01 Education versus usual care, Outcome 09 Primary care physician call outs

#### Review: Education interventions for adults who attend the emergency room for acute asthma

#### Comparison: 01 Education versus usual care

#### Outcome: 09 Primary care physician call outs

<table>
<thead>
<tr>
<th>Study</th>
<th>Education</th>
<th>Control</th>
<th>Relative Risk (Fixed)</th>
<th>Weight Relative Risk (Fixed)</th>
</tr>
</thead>
</table>
| n/N    | n/N       | 95% CI  | 95% CI                 | (%)
| Morice 2001 | 2/40 | 5/40 | 0.40 [0.08, 1.94] |

Favours education

Favours control

### Analysis 01.10. Comparison 01 Education versus usual care, Outcome 10 Scheduled clinic attendance

#### Review: Education interventions for adults who attend the emergency room for acute asthma

#### Comparison: 01 Education versus usual care

#### Outcome: 10 Scheduled clinic attendance

<table>
<thead>
<tr>
<th>Study</th>
<th>Education</th>
<th>Control</th>
<th>Relative Risk (Fixed)</th>
<th>Weight</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n/N</td>
<td>n/N</td>
<td></td>
<td>95% CI</td>
<td>(%)</td>
<td>95% CI</td>
</tr>
<tr>
<td>Baren 2001</td>
<td>44/95</td>
<td>24/83</td>
<td>1.60 [1.07, 2.39]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Godoy 1998</td>
<td>5/10</td>
<td>1/10</td>
<td>5.00 [0.70, 35.50]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>105</td>
<td>93</td>
<td>1.73 [1.17, 2.56]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total events: 49 (Education), 25 (Control)

Test for heterogeneity chi-square=1.27 df=1 p=0.26 I² =21.1%

Test for overall effect z=2.74 p=0.006

Favours control

Favours education
### Analysis 01.11. Comparison 01 Education versus usual care, Outcome 11 Satisfied with explanation of asthma

Review: Education interventions for adults who attend the emergency room for acute asthma  
Comparison: 01 Education versus usual care  
Outcome: 11 Satisfied with explanation of asthma

<table>
<thead>
<tr>
<th>Study</th>
<th>Education n/N</th>
<th>Control n/N</th>
<th>Relative Risk (Fixed)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osman 2002</td>
<td>108/108</td>
<td>89/118</td>
<td>1.33 [ 1.20, 1.47 ]</td>
<td></td>
</tr>
</tbody>
</table>

Test for heterogeneity chi-square=0.49 df=1 p=0.48 I² =0.0%

### Analysis 01.12. Comparison 01 Education versus usual care, Outcome 12 Missed school/work due to asthma (end of follow up)

Review: Education interventions for adults who attend the emergency room for acute asthma  
Comparison: 01 Education versus usual care  
Outcome: 12 Missed school/work due to asthma (end of follow up)

<table>
<thead>
<tr>
<th>Study</th>
<th>Education n/N</th>
<th>Control n/N</th>
<th>Relative Risk (Fixed)</th>
<th>Weight (%)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perneger 2002</td>
<td>8/57</td>
<td>11/58</td>
<td>73.2</td>
<td>0.74 [ 0.32, 1.70 ]</td>
<td></td>
</tr>
<tr>
<td>Yoon 1993</td>
<td>5/28</td>
<td>4/28</td>
<td>26.8</td>
<td>1.25 [ 0.37, 4.17 ]</td>
<td></td>
</tr>
</tbody>
</table>

Total (95% CI) 85 86 100.0 0.88 [ 0.44, 1.73 ]

Total events: 13 (Education), 15 (Control)
Test for heterogeneity chi-square=0.49 df=1 p=0.48 I² =0.0%
Test for overall effect z=0.38  p=0.7

### Analysis 01.13. Comparison 01 Education versus usual care, Outcome 13 Days of limited activity due to asthma per 100 asthma at 12 months

Review: Education interventions for adults who attend the emergency room for acute asthma  
Comparison: 01 Education versus usual care  
Outcome: 13 Days of limited activity due to asthma per 100 asthma at 12 months

<table>
<thead>
<tr>
<th>Study</th>
<th>Education N</th>
<th>Education Mean(SD)</th>
<th>Control N</th>
<th>Control Mean(SD)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolton 1991</td>
<td>106</td>
<td>161.00 (330.00)</td>
<td>118</td>
<td>246.00 (460.00)</td>
<td>-85.00 [-189.09, 19.09]</td>
</tr>
</tbody>
</table>

Test for heterogeneity chi-square=0.49 df=1 p=0.48 I² =0.0%
### Analysis 01.14. Comparison 01 Education versus usual care, Outcome 14 Study withdrawal/loss to follow up

**Review:** Education interventions for adults who attend the emergency room for acute asthma  
**Comparison:** 01 Education versus usual care  
**Outcome:** 14 Study withdrawal/loss to follow up

<table>
<thead>
<tr>
<th>Study</th>
<th>Education</th>
<th>Control</th>
<th>Relative Risk (Random)</th>
<th>Weight (%)</th>
<th>95% CI</th>
<th>Relative Risk (Random)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baren 2001</td>
<td>3/98</td>
<td>11/94</td>
<td>4.5</td>
<td>4.5</td>
<td>0.26</td>
<td>0.08, 0.91</td>
</tr>
<tr>
<td>Bolton 1991</td>
<td>26/119</td>
<td>30/122</td>
<td>25.8</td>
<td>25.8</td>
<td>0.89</td>
<td>0.56, 1.41</td>
</tr>
<tr>
<td>Brown 2006</td>
<td>17/51</td>
<td>13/59</td>
<td>16.1</td>
<td>16.1</td>
<td>1.51</td>
<td>0.82, 2.80</td>
</tr>
<tr>
<td>George 1999</td>
<td>14/44</td>
<td>13/33</td>
<td>16.7</td>
<td>16.7</td>
<td>0.81</td>
<td>0.44, 1.48</td>
</tr>
<tr>
<td>Levy 2000</td>
<td>17/103</td>
<td>13/108</td>
<td>14.0</td>
<td>14.0</td>
<td>1.37</td>
<td>0.70, 2.68</td>
</tr>
<tr>
<td>Osman 2002</td>
<td>4/135</td>
<td>5/145</td>
<td>4.2</td>
<td>4.2</td>
<td>0.86</td>
<td>0.24, 3.13</td>
</tr>
<tr>
<td>Perneger 2002</td>
<td>8/66</td>
<td>7/58</td>
<td>7.4</td>
<td>7.4</td>
<td>1.00</td>
<td>0.39, 2.60</td>
</tr>
<tr>
<td>Yoon 1993</td>
<td>9/37</td>
<td>11/39</td>
<td>11.3</td>
<td>11.3</td>
<td>0.86</td>
<td>0.40, 1.84</td>
</tr>
</tbody>
</table>

Total events: 98 (Education), 103 (Control)  
Test for heterogeneity chi-square=7.93 df=7 p=0.34 I² =11.7%  
Test for overall effect z=0.28  p=0.8

### Analysis 01.15. Comparison 01 Education versus usual care, Outcome 15 Quality of life (SGRQ)

**Review:** Education interventions for adults who attend the emergency room for acute asthma  
**Comparison:** 01 Education versus usual care  
**Outcome:** 15 Quality of life (SGRQ)

<table>
<thead>
<tr>
<th>Study</th>
<th>Education</th>
<th>Control</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
<td>01 Total scores</td>
<td></td>
<td></td>
<td>95% CI</td>
<td>95% CI</td>
</tr>
<tr>
<td>Levy 2000</td>
<td>99</td>
<td>30.25 (17.51)</td>
<td>28.73 (17.91)</td>
<td>1.52 [ -3.43, 6.47 ]</td>
</tr>
<tr>
<td>02 Symptoms</td>
<td>Levy 2000</td>
<td>99</td>
<td>45.67 (22.86)</td>
<td>38.12 (21.98)</td>
</tr>
<tr>
<td>03 Activity</td>
<td>Levy 2000</td>
<td>99</td>
<td>32.29 (23.18)</td>
<td>32.07 (26.76)</td>
</tr>
<tr>
<td>04 Limitations</td>
<td>Levy 2000</td>
<td>99</td>
<td>24.27 (20.59)</td>
<td>23.88 (17.89)</td>
</tr>
</tbody>
</table>
Analysis 01.16. Comparison 01 Education versus usual care, Outcome 16 PEF

Review: Education interventions for adults who attend the emergency room for acute asthma
Comparison: 01 Education versus usual care
Outcome: 16 PEF

Study | Education | Control | L/min (SE) | L/min (Random) | Weight | L/min (Random) |
--- | --- | --- | --- | --- | --- | --- |
Levy 2000 | 99 | 98 | 20.05 (9.89) | 61.2 | 20.05 [0.67, 39.43] |
Perneger 2002 | 57 | 58 | -18.00 (20.56) | 38.8 | -18.00 [-58.30, 22.30] |
Total (95% CI) | | | | 100.0 | 5.29 [-31.04, 41.63] |

Test for heterogeneity chi-square=2.78 df=1 p=0.10 I² =64.0%
Test for overall effect z=0.29 p=0.8

Analysis 01.17. Comparison 01 Education versus usual care, Outcome 17 Cost ($)

Review: Education interventions for adults who attend the emergency room for acute asthma
Comparison: 01 Education versus usual care
Outcome: 17 Cost ($)

Study | Education | Control | Weighted Mean Difference (Fixed) | Weighted Mean Difference (Fixed) |
--- | --- | --- | --- | --- |
01 ER visits per person per year | 106 | 408.00 (537.00) | 118 | 1036.00 (1889.00) | -628.00 [-983.83, -272.17] |
02 Physician visits per person per year | 106 | 281.00 (399.00) | 118 | 351.00 (492.00) | -70.00 [-186.83, 46.83] |
03 hospital admissions for asthma per person per year | 106 | 2250.00 (5591.00) | 118 | 3461.00 (7926.00) | -1211.00 [-2993.69, 571.69] |
04 Cost ($) - total | 106 | 2936.00 (6068.00) | 118 | 4849.00 (9812.00) | -1913.00 [-4026.91, 2009.91] |
### Analysis 01.20. Comparison 01 Education versus usual care, Outcome 20 Asthma caused physical limitations

Review: Education interventions for adults who attend the emergency room for acute asthma
Comparison: 01 Education versus usual care
Outcome: 20 Asthma caused physical limitations

<table>
<thead>
<tr>
<th>Study</th>
<th>Education n/N</th>
<th>Control n/N</th>
<th>Relative Risk (Fixed)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perneger 2002</td>
<td>27/57</td>
<td>29/58</td>
<td>0.95</td>
<td>[0.65, 1.38]</td>
</tr>
</tbody>
</table>

### Analysis 01.21. Comparison 01 Education versus usual care, Outcome 21 Asthma caused sleep problems

Review: Education interventions for adults who attend the emergency room for acute asthma
Comparison: 01 Education versus usual care
Outcome: 21 Asthma caused sleep problems

<table>
<thead>
<tr>
<th>Study</th>
<th>Education n/N</th>
<th>Control n/N</th>
<th>Relative Risk (Fixed)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perneger 2002</td>
<td>12/57</td>
<td>10/58</td>
<td>1.22</td>
<td>[0.57, 2.60]</td>
</tr>
</tbody>
</table>

### Analysis 01.22. Comparison 01 Education versus usual care, Outcome 22 Asthma caused emotional problems

Review: Education interventions for adults who attend the emergency room for acute asthma
Comparison: 01 Education versus usual care
Outcome: 22 Asthma caused emotional problems

<table>
<thead>
<tr>
<th>Study</th>
<th>Education n/N</th>
<th>Control n/N</th>
<th>Relative Risk (Fixed)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perneger 2002</td>
<td>15/57</td>
<td>21/58</td>
<td>0.73</td>
<td>[0.42, 1.26]</td>
</tr>
</tbody>
</table>
**Analysis 01.23. Comparison 01 Education versus usual care, Outcome 23 Asthma caused social difficulties**

Review: Education interventions for adults who attend the emergency room for acute asthma

Comparison: 01 Education versus usual care

Outcome: 23 Asthma caused social difficulties

<table>
<thead>
<tr>
<th>Study</th>
<th>Education</th>
<th>Control</th>
<th>Relative Risk (Fixed)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perneger 2002</td>
<td>13/57</td>
<td>16/58</td>
<td>0.83 [0.44, 1.56]</td>
<td>0.83 [0.44, 1.56]</td>
</tr>
</tbody>
</table>

**Analysis 01.24. Comparison 01 Education versus usual care, Outcome 24 Self-management techniques**

Review: Education interventions for adults who attend the emergency room for acute asthma

Comparison: 01 Education versus usual care

Outcome: 24 Self-management techniques

<table>
<thead>
<tr>
<th>Study</th>
<th>Education</th>
<th>Control</th>
<th>Relative Risk (Fixed)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Adequate inhalation technique</td>
<td>Perneger 2002</td>
<td>27/57</td>
<td>14/58</td>
<td>1.96 [1.15, 3.34]</td>
</tr>
<tr>
<td>02 Knows peak flow reading</td>
<td>Perneger 2002</td>
<td>36/57</td>
<td>21/58</td>
<td>1.74 [1.18, 2.59]</td>
</tr>
</tbody>
</table>

**Analysis 01.25. Comparison 01 Education versus usual care, Outcome 25 Mean work days missed**

Review: Education interventions for adults who attend the emergency room for acute asthma

Comparison: 01 Education versus usual care

Outcome: 25 Mean work days missed

<table>
<thead>
<tr>
<th>Study</th>
<th>Education</th>
<th>Control</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perneger 2002</td>
<td>57</td>
<td>3.80 (19.40)</td>
<td>58</td>
<td>5.10 (20.50)</td>
</tr>
</tbody>
</table>
### Analysis 01.26. Comparison 01 Education versus usual care, Outcome 26 Adequate self-management techniques

Review: Education interventions for adults who attend the emergency room for acute asthma  
Comparison: 01 Education versus usual care  
Outcome: 26 Adequate self-management techniques

<table>
<thead>
<tr>
<th>Study</th>
<th>Education</th>
<th>Control</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
<td>01</td>
<td>57</td>
<td>1.70 (0.70)</td>
<td>58</td>
<td>1.30 (0.60)</td>
</tr>
<tr>
<td>02</td>
<td>57</td>
<td>6.60 (0.70)</td>
<td>58</td>
<td>6.40 (0.80)</td>
</tr>
<tr>
<td>03</td>
<td>57</td>
<td>84.00 (17.00)</td>
<td>58</td>
<td>79.00 (15.00)</td>
</tr>
<tr>
<td>04</td>
<td>57</td>
<td>16.00 (26.00)</td>
<td>58</td>
<td>15.00 (25.00)</td>
</tr>
</tbody>
</table>

### Analysis 01.27. Comparison 01 Education versus usual care, Outcome 27 Mean number of physician visits

Review: Education interventions for adults who attend the emergency room for acute asthma  
Comparison: 01 Education versus usual care  
Outcome: 27 Mean number of physician visits

<table>
<thead>
<tr>
<th>Study</th>
<th>Education</th>
<th>Control</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
<td>Perneger 2002</td>
<td>57</td>
<td>2.70 (2.50)</td>
<td>58</td>
<td>3.50 (4.50)</td>
</tr>
</tbody>
</table>
**Analysis 02.01. Comparison 02 Sensitivity analysis (study quality - Grade A concealment), Outcome 01 Hospital admission/readmission (end of follow-up)**

Review: Education interventions for adults who attend the emergency room for acute asthma

Comparison: 02 Sensitivity analysis (study quality - Grade A concealment)

Outcome: 01 Hospital admission/readmission (end of follow-up)

<table>
<thead>
<tr>
<th>Study</th>
<th>Education</th>
<th>Control</th>
<th>Relative Risk (Random)</th>
<th>Weight</th>
<th>Relative Risk (Random)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>95% CI</td>
<td>(%)</td>
<td>95% CI</td>
</tr>
<tr>
<td>Osman 2002</td>
<td>22/131</td>
<td>38/140</td>
<td></td>
<td>87.0</td>
<td>0.62 [ 0.39, 0.99 ]</td>
</tr>
<tr>
<td>Perneger 2002</td>
<td>4/57</td>
<td>6/58</td>
<td></td>
<td>13.0</td>
<td>0.68 [ 0.20, 2.28 ]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>188</td>
<td>198</td>
<td></td>
<td>100.0</td>
<td>0.63 [ 0.40, 0.97 ]</td>
</tr>
</tbody>
</table>

Total events: 26 (Education), 44 (Control)

Test for heterogeneity chi-square=0.02 df=1 p=0.89 I² =0.0%

Test for overall effect z=2.10 p=0.04

Favours education

Favours control