

## Effects of educational interventions for self management of asthma in children and adolescents: systematic review and meta-analysis

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### Abstract

**Objectives** To determine the effectiveness of educational programmes for the self management of asthma in children and adolescents.

**Data sources** Databases of the Cochrane Airways Group, PsychINFO, reference lists of review papers, and eligible studies.

**Review methods** Eligible studies were published randomised controlled trials or controlled clinical trials of educational programmes for the self management of asthma in children and adolescents that reported lung function, morbidity, self perception of asthma control, or utilisation of healthcare services. Eligible studies were abstracted, assessed for methodological quality, and pooled with fixed effects and random effects models.

**Results** 32 of 45 identified trials were eligible, totalling 3706 patients aged 2 to 18 years. Education in asthma was associated with improved lung function (standardised mean difference 0.50, 95% confidence interval 0.25 to 0.75) and self efficacy (0.36, 0.15 to 0.57) and reduced absenteeism from school (-0.14, -0.23 to -0.04), number of days of restricted activity (-0.29, -0.33 to -0.09), and number of visits to an emergency department (-0.21, -0.33 to -0.09). When pooled by the fixed effects model but not by the random effects model, education was also associated with a reduced number of nights disturbed by asthma. The effect on morbidity was greatest among programmes with strategies based on peak flow, interventions targeted at the individual, and participants with severe asthma.

**Conclusions** Educational programmes for the self management of asthma in children and adolescents improve lung function and feelings of self control, reduce absenteeism from school, number of days with restricted activity, number of visits to an emergency department, and possibly number of disturbed nights. Educational programmes should be considered a part of the routine care of young people with asthma.

### Introduction

Educational programmes for the self management of asthma in children have been developed to improve healthcare practices, reduce morbidity, and lower the

costs of care.<sup>1,2</sup> Experts have recommended that programmes be based on sound theoretical understandings of change in behaviour and that they employ strategies designed to improve knowledge, skills, and feelings of self control.<sup>3</sup> Many programmes, however, are an ad hoc set of messages and skills incorporated into didactic lectures by clinicians.<sup>4</sup>

Programmes aimed at adults with asthma do seem to reduce morbidity and the use of healthcare resources, but a meta-analysis of self management in children found no such association.<sup>5,6</sup> The meta-analysis was limited to trials published before 1992, and several rigorous evaluations have been subsequently completed. We aimed to estimate the effectiveness of educational programmes in self management on clinical outcomes in children and adolescents with asthma by incorporating more recent studies.

### Participants and methods

We searched the Cochrane Airways Group's special register of controlled trials and hand searched airways related journals. PsychINFO (to 1998) was also searched to identify trials published in the educational or behavioural science literature. The reference lists from relevant review articles and all eligible studies were also hand searched.<sup>5,6,7</sup>

### Selection and data abstraction

Studies published in any language were eligible if they fulfilled the following criteria: were randomised controlled trials or controlled clinical trials; included children aged 2 to 18 years with asthma; incorporated educational interventions in self management related to prevention of asthma, management of asthma attacks, or development of social skills; reported outcomes of interest.

Non-English language articles were translated into English. Two investigators independently assessed each article for eligibility, and authors were contacted if further information was needed.

### Validity assessment and study characteristics

Study quality was based on whether assignment of intervention was concealed before enrolment.<sup>8</sup> Trials were categorised as adequate, unclear, or clearly inadequate. In addition, we judged whether systematic

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differences in care, withdrawals, or outcome assessment were evident between treatment and control groups.<sup>8 9</sup>

Outcomes of interest were forced expiratory volume in one second (FEV<sub>1</sub>) and peak expiratory flow rate as measures of lung function, number of days absent from school, number of days of restricted activity, number of disturbed nights, self efficacy scales (including coping scores or health locus of control scales), symptom scores, number of visits to an emergency department, and hospitalisations. The severity of asthma was assessed from trial self report, examination of mean baseline FEV<sub>1</sub> or peak expiratory flow rate, or chronicity of asthma symptoms at baseline.<sup>10 11</sup> Studies were categorised as moderate-severe if participants had severe asthma, mild-moderate if participants had mild or moderate asthma, or unclear if severity was not reported and could not be deduced.

**Quantitative data synthesis**

Because measures were reported with different scales or time intervals, we used the standardised weighted mean difference to estimate a pooled effect size for each outcome of interest. Data were pooled with both fixed effects and random effects models.<sup>12 13</sup> Homogeneity of effect sizes and publication bias were assessed. Subgroups were analysed to estimate the magnitude of the effect of study quality and programme components on outcome measures. See bmj.com for details.

**Results**

A total of 32 trials totalling 3706 children and adolescents with asthma were included (see table A on bmj.com). Most were relatively small randomised controlled trials and enrolled children with severe asthma. Fifteen trials enrolled adolescents aged 13 to 18 years, and 12 enrolled children aged 2 to 5 years; no study stratified data on age. The educational programmes were diverse and targeted children, parents, or both. Most had programmes with multiple sessions and symptom based strategies. Methodological quality on the basis of concealment of allocation was adequate in

only 12 (38%) studies, but many studies contained insufficient information to determine study quality (see table B on bmj.com). Few studies had systematic differences in care or withdrawal.

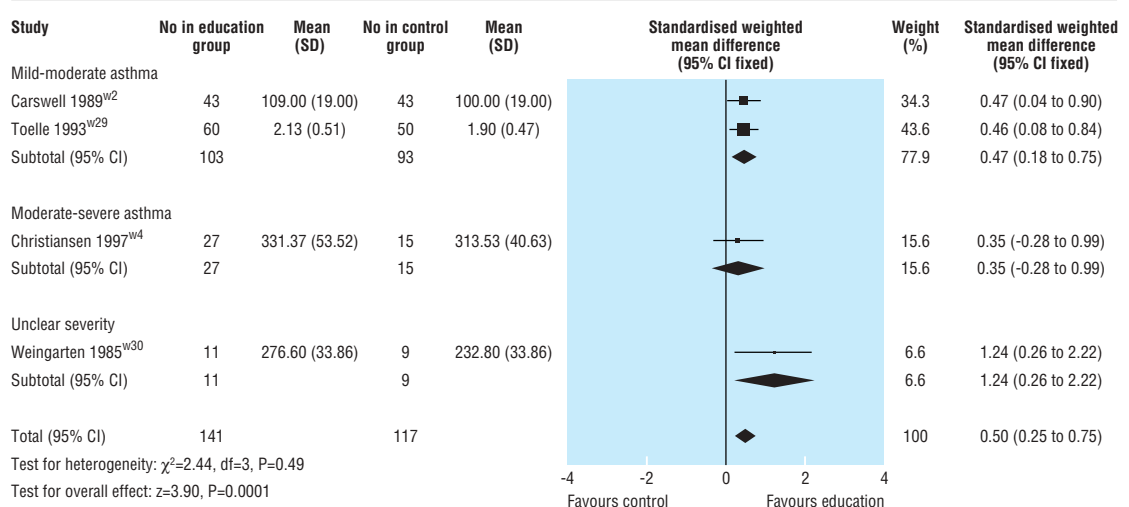
**Quantitative data synthesis**

Four trials (258 patients) had complete data on measures of lung function (fig 1). Education was associated with moderate improvement on a combined measure of lung function (standardised mean difference 0.50, 95% confidence interval 0.25 to 0.75) and on individual measures of FEV<sub>1</sub> (0.46, 0.08 to 0.84) and peak expiratory flow rate (0.53, 0.19 to 0.86). This translated into a 0.24 litre increase in FEV<sub>1</sub> and a 9.5% increase in percentage predicted peak expiratory flow rate associated with education.

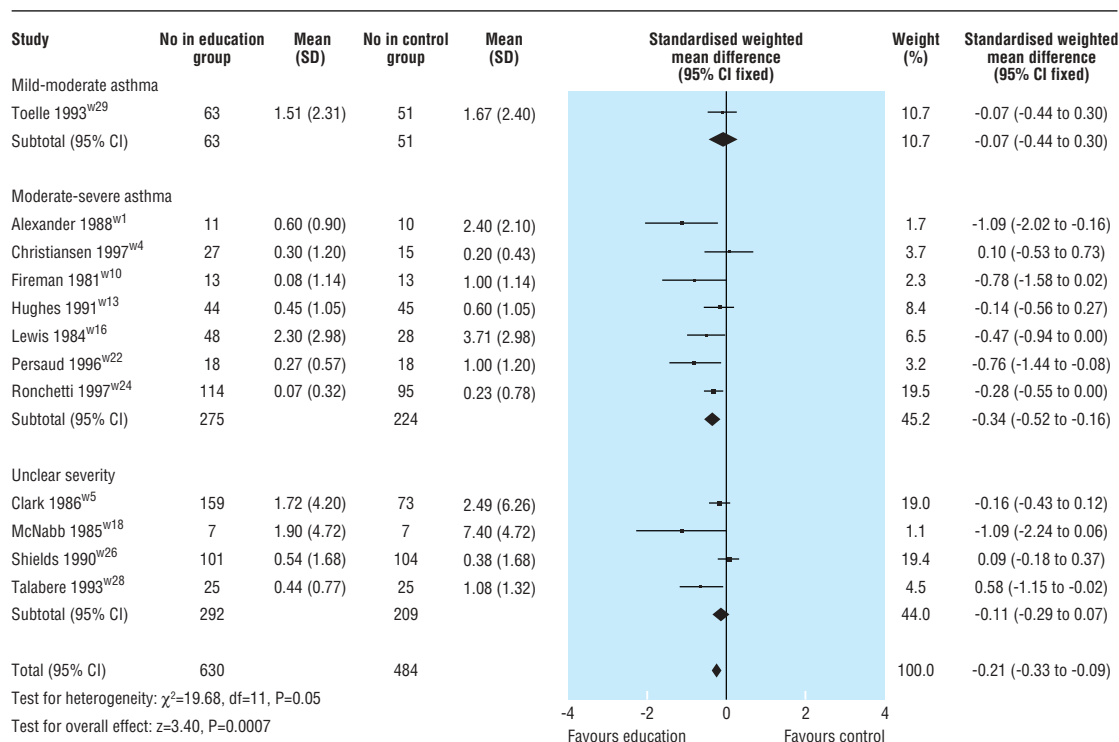
Eighteen trials (1649 patients) had complete data on measures of morbidity. Education was associated with a modest reduction in absenteeism from school (-0.14, -0.23 to -0.04). Education was also associated with a reduction in number of days of restricted activity (-0.29, -0.49 to -0.08) and number of disturbed nights (-0.34, -0.62 to -0.05). Heterogeneity was found among trials pooled for number of nights disturbed by asthma ( $\chi^2=11.2$ ,  $df=2$ ,  $P=0.004$ ) but not for other morbidity outcomes. The pooled estimate from the random effects model for number of disturbed nights was not significant (-0.39, -1.07 to 0.28). Outcomes were generally stronger among trials of moderate-severe asthma than among those of mild-moderate asthma.

Nine trials (522 patients) reported complete data on measures of self perception of asthma control. We found a moderate improvement in self efficacy (0.36, 0.15 to 0.57). Education had no effect on symptom scores. No statistical heterogeneity was found for self efficacy, but it was found for symptom scores ( $\chi^2=6.7$ ,  $df=3$ ,  $P=0.08$ ). Results were, however, consistent across both models.

Eighteen trials (1899 patients) reported complete data on measures of utilisation of healthcare services. Education was associated with a modest reduction in number of visits to an emergency department (-0.21, -0.33 to -0.09; fig 2). Education had no effect on hos-



**Fig 1** Effect of educational programmes in self management of asthma on lung function. Lung function was reported as changes in absolute forced expiratory volume in one second or peak expiratory flow rate or as changes in percentage predicted peak flow expiratory flow rate



**Fig 2** Effect of educational programmes in self management of asthma on number of visits to an emergency department. Visits refers to hospital emergency departments, reported as mean number of visits every three months, four months, or year

pitalisations. Utilisation outcomes were stronger among trials of moderate-severe asthma than among those of mild-moderate asthma. Possible publication bias was found for hospitalisations (intercept  $-3.0$ ,  $-4.7$  to  $-1.3$ ) but not for visits to an emergency department.

### Subgroup analyses

When analyses were restricted to studies of higher quality we found similar estimates for lung function, self efficacy, morbidity, and utilisation of healthcare services. When we stratified analyses to assess different programme characteristics we found that those based on peak flow had the greatest improvement in lung function and the greatest reductions in morbidity measures. Programmes targeted at the individual had the greatest reductions in morbidity measures, whereas programmes targeted at a group had the greatest reduction in hospitalisations. Finally programmes comprising single sessions had the greatest reductions in morbidity measures, whereas those comprising multiple sessions had the greatest improvement in self efficacy and the greatest reduction in number of visits to an emergency department. No studies involved direct comparisons between different educational components.

## Discussion

Educational programmes for the self management of asthma in children and adolescents were associated with modest to moderate improvement in many outcome measures, including lung function, self efficacy, absenteeism from school, number of days of restricted activity, number of visits to an emergency department, and possibly number of nights disturbed by asthma. Education seemed to be as effective among studies of mild-moderate asthma as among those of

moderate-severe asthma; for many morbidity outcomes, however, effects of education were strongest in studies enrolling patients with more severe asthma. Programmes with strategies based on peak flow showed the strongest effects on morbidity measures, as did programmes with interventions aimed at the individual. These results should be interpreted cautiously given the lack of direct comparisons in primary studies. The results obtained among studies considered to be of higher quality generally supported the main findings.

Our results differed from a previously published meta-analysis of asthma education in children.<sup>6</sup> In this review, involving 11 trials published between 1981 and 1991, the authors were only able to pool between three and five studies for any one outcome. This may have limited their statistical power to identify small effects. Our review included these 11 trials and an additional 21 trials, nine of which were published between 1980 and 1991 and either were not identified or were excluded by these authors. We were also able to evaluate a wider range of outcomes and to provide tentative estimates of important comparisons between subgroups.

Our study has several limitations. Firstly, the effect of education on most morbidity measures was limited by the paucity of studies reporting these outcomes. For instance, quality of life—considered an important outcome in asthma—was not reported by any eligible trial. Secondly, many studies did not adequately report methods and results. This limited our ability to estimate the effects of study quality or to pool data. Thirdly, we may not have identified all relevant trials of asthma education; formal tests showed publication bias only for hospitalisations, a non-significant outcome. Fourthly, there were insufficient studies and a lack of

### What is already known on this topic

Evidence on the effectiveness of educating children about their asthma has been conflicting

A meta-analysis found no evidence of reduction in morbidity or utilisation of healthcare resources associated with educational programmes

### What this study adds

Educational programmes in the self management of asthma improve lung function and self efficacy and reduce morbidity and utilisation of healthcare resources

Such programmes should be part of the routine care of young people with asthma

direct comparisons to reliably estimate subgroup effects. Our subgroup analyses should therefore be interpreted with caution.

Our study has important implications for practice and research. Incorporating educational programmes for self management into the routine care of children with asthma may significantly improve outcomes. Priority should be given to patients with severe asthma, and education should be provided long term to account for changing needs.

A detailed version of this systematic review is published in the Cochrane database of systematic reviews ([www.update-software.com/abstracts/ab000326.htm](http://www.update-software.com/abstracts/ab000326.htm)). We thank the

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