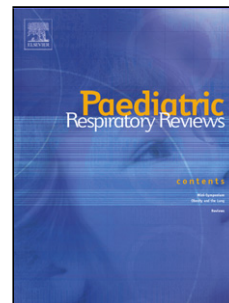


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# Interventions to improve inhaler technique and adherence to inhaled corticosteroids in children with asthma

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## Why was it important to do these Cochrane Reviews?

Asthma is a common chronic disease worldwide and affects approximately 1.1 million (1 in 11) children in the UK alone<sup>1</sup>. Inhaled drugs are often prescribed to help control asthma symptoms, improve quality of life and reduce the risk of exacerbations or flare-ups. However, evidence suggests that many children taking an asthma inhaler are either not using it correctly, or regularly miss doses<sup>2,3</sup>. Both incorrect technique and poor adherence to inhaled corticosteroids (ICS) are associated with worse clinical outcomes<sup>3,4</sup>. Suboptimal adherence was thought to contribute to one-third of the asthma deaths in the UK in one year<sup>5</sup>. International and national guidelines and initiatives highlight that assessment of inhaler technique and adherence discussions are essential components of asthma care, especially for patients with inadequate control<sup>2,6,7,8</sup>.

## What were the objectives of the reviews?

We carried out two separate reviews of randomised controlled trials (RCTs), including adults and children with asthma, investigating:

1. interventions to improve inhaler technique<sup>9</sup>
2. interventions to improve adherence to inhaled corticosteroids<sup>10</sup>

We will summarise the findings for children here. Our main aim was to find out whether interventions had an impact on inhaler technique and adherence and whether this resulted in better clinical outcomes. We were particularly interested in whether the interventions led to fewer exacerbations and better asthma control (our primary outcomes).

## What was the evidence base of these reviews?

### Inhaler technique

We found 10 RCTs testing interventions aimed at improving inhaler technique in children (n=700). Three studies trialed enhanced face-to-face inhaler training, three used a training device to help participants refine their technique (e.g. the Flo-Vu or Trainhaler), three tested video- or computer-delivered training, and one study used a spacer device adapted to give audible feedback. Follow-up ranged from two to 26 weeks.

## Adherence

We found 18 RCTs including children or children and adolescents testing interventions aimed at improving adherence to ICS (n=3,369). Eight studies investigated enhanced face-to-face adherence education, seven used electronic reminders or trackers (one three-arm study contributed to both the preceding groups), three studies assessed the benefit of giving ICS at school, and one study investigated a simplified medicine regimen. Follow-up ranged from two months to two years.

## What were the findings of the reviews?

### Inhaler technique

Technique was measured either with a checklist at baseline and follow-up, or with peak inspiratory flow rate. As different measures were used and the checklist data were skewed we were unable to perform many meta-analyses. The overall picture suggests that all three types of intervention may improve technique but the small number of studies and children involved mean we are very unsure of the findings.

Regarding asthma control, two studies investigating feedback devices used the Asthma Control Questionnaire (ACQ) and found no between group-difference, with the confidence interval excluding the minimally important clinical difference (MCID) of 0.5 (mean difference (MD) -0.02; 95% CI -0.35 to 0.32; studies = 2, participants = 98; **Figure 1**). A similar finding was observed in one trial investigating the use of an inhaler technique video and measuring control using the Asthma Control Test (ACT), which has an MCID of 3 (MD 0.73; 95% CI -0.99 to 2.45; studies = 1; participants = 91).

We did not find any data about exacerbations.

### Adherence

Enhanced education increased percentage adherence in children compared with control, but the confidence interval included no difference and the results were very inconsistent (MD 8%; 95% CI -5 to 21; studies = 4; participants = 1241;  $I^2 = 93\%$ ; **Figure 2**). We were not able to extract data on exacerbations or asthma control for any of the child studies in this group.

Electronic reminders also increased percentage adherence in children (MD 17%; 95% CI 8 to 26; studies = 3, participants = 314;  $I^2 = 46\%$ ). Two studies in this group reported exacerbations, but results were inconclusive (odds ratio (OR) 1.05; 95% CI 0.52 to 2.13). Three studies reported asthma control using either the Asthma Control Test (ACT) or the Asthma Control Questionnaire (ACQ), showing inconsistent and inconclusive results.

One small study investigating simplified regimens found that use of combined inhalers over separate inhalers increased percent adherence, but confidence intervals included no difference (MD 9%; 95% CI -3 to 21; studies = 1, participants = 103). The same study did not find any between-group difference on the ACQ score (MD -0.03; 95% CI -0.34 to 0.28). We found no data on exacerbations in this group.

Studies of school-based therapy did not report adherence as this would not be a meaningful comparison. Two studies reported hospitalisations (for any cause) and found a benefit of school-based therapy but the result is too imprecise to draw any conclusion (OR 0.58; 95% CI 0.16 to 2.05, studies = 2, participants = 279).

## What are the implications of these reviews for practice and research?

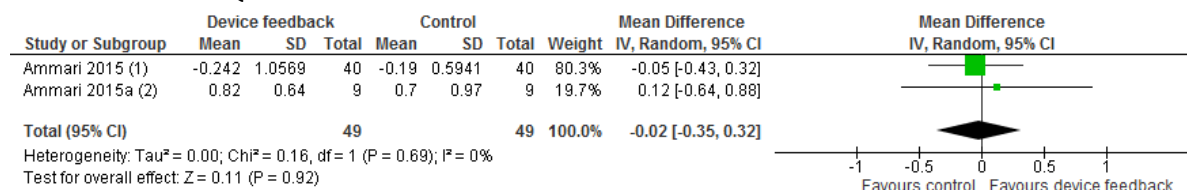
Although a substantial number of children (> 4,000) have participated in RCTs investigating interventions to improve adherence and inhaler technique, we can draw relatively few conclusions. It appears that both technique and adherence can be improved, at least for the duration of follow-

up, but we have little clear information about whether these improvements translate into meaningful clinical benefits. Trials did not consistently report our pre-specified primary clinical outcomes of asthma control and exacerbations, or reported them in such a way that meant we could not perform meta-analyses (e.g. they used composite or non-validated scales). Trials of this type are difficult to effectively blind and risk of bias further reduced our confidence in the findings.

Clinical guidelines call for both correct inhaler technique and adherence to be reinforced regularly to improve clinical outcomes, and our findings do not undermine this recommendation; what is less clear is what specific interventions are most beneficial in children once a problem with either technique or adherence has been identified.

Future trialists might consider interventions that aim to improve both technique and adherence as not confronting both together may curtail the possible clinical benefits. Consistent reporting of 'core' asthma outcomes, such as exacerbations and asthma control (using validated scales) would also facilitate meta-analysis and forming conclusions. Trial follow-up needs to be sufficiently long (at least 6 months) to detect benefits as well as possible harms. Some of the interventions tested are likely to be expensive; targeting children with poorly controlled asthma may make best use of scarce resources.

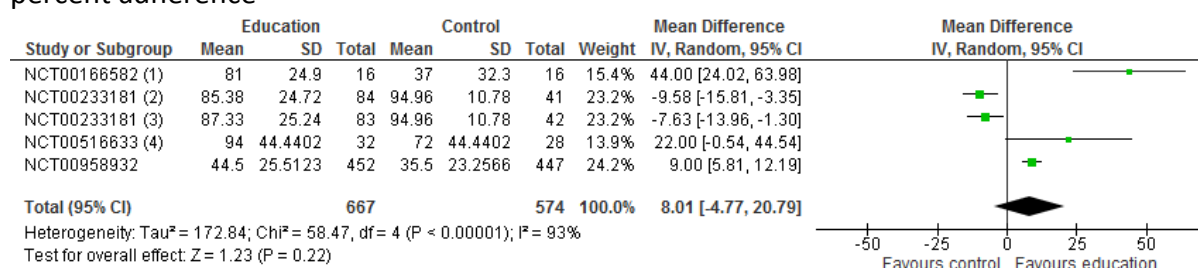
Figure 1: Forest plot: Inhaler technique feedback device versus control/usual care, outcome: Asthma Control Questionnaire



#### Footnotes

- (1) ACQ. 12 weeks. Change from baseline  
(2) ACQ. 6-8 weeks

Figure 2: Forest plot: Enhanced adherence education versus control/usual care, outcome: percent adherence



#### Footnotes

- (1) Entered teamwork vs control. Non-adherence education group not used.  
(2) Self-reported adherence ABC group vs control  
(3) Self-reported adherence AMF group vs control  
(4) Variance estimated from p-value for the difference. Adherence verified from canister weight.

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